Intergovernmental Oceanographic Commission

Annual Report 2005

Intergovernmental Oceanographic Commission (IOC)

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Purpose and Role of the Intergovernmental Oceanographic Commission of UNESCO

The purpose of the Commission is to promote international cooperation and to coordinate programmes in research, services, and capacity building, in order to learn about the nature and resources of the ocean and coastal areas and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making processes of its Member States.

The Commission will collaborate with international organizations concerned with the work of the Commission, and especially with those organizations of the United Nations system which are willing and prepared to contribute to the purpose and functions of the Commission and/or to seek advice and cooperation in the field of ocean and coastal area scientific research, related services, and capacity building.

FROM THE CHAIR

From the beginning, 2005 was an exceptional year for our Commission. The immediate and urgent responses to the December 2004 tsunami in the Indian Ocean have gradually been replaced by longer-term considerations, and by the establishment of procedures for setting up permanent warning systems. Our Executive Secretary, Patricio Bernal, and his colleagues have worked hard to ensure that the contribution of the IOC to this progression has been substantial and effective: I want here to thank them on behalf of our Member States for their diligence and professionalism. This Report tells of what has been achieved so far. It cannot, however, fully reflect the detailed and often difficult political negotiations that were part of the governmental responses to the tsunami; nor can it describe the guidance and the leadership that Patricio Bernal gave to move the process forward.

Our Assembly in June 2005 established arrangements for a tsunami warning system in the Indian Ocean and introduced plans for warning systems in the Mediterranean, Atlantic Ocean, and Caribbean, to add to the existing system in the Pacific. And the Assembly looked further ahead: it agreed to work towards a global ocean system for all marine hazards that includes tsunami and storm flooding at one extreme, and pollution and sea level rise at the other. Of course this is not a task for the IOC alone. We will work with partners in other organizations, both within and outside the United Nations system. A recent meeting in Argentina between the Officers of the IOC and the Bureau of the World Meteorological Organization is an example of how that cooperation can be fostered; so too is our Joint Commission with the WMO for marine observations.

Through 2005 we have received strong support from elsewhere in UNESCO, particularly in the tsunami work, and we are grateful for that. However, UNESCO, in common with many United Nations agencies, is an organization under acute financial pressures. Despite the acknowledged importance of the oceans for the future of Planet Earth and of the IOC role, our budget from UNESCO for 2006-2007 has been significantly reduced. This evident paradox is a result of the different Member State priorities as expressed in the different Governing Bodies. It is for the Representatives at the IOC to convince people elsewhere within their governments that we have an essential long-term responsibility to discharge on their behalf. For the tsunami work the Member State responses in some cases have been magnificent, with most of the funding coming in the form of substantial direct contributions; but it is still necessary to point out that our long-term tsunami programme depends on short-term funding. As a model for funding future initiatives this response is encouraging, but not entirely satisfactory. Our Medium Term Plan being developed under the leadership of Captain Valladares, one of our Vice-Chairs, will seek to address the issue of long-term funding stability.

Although 2005 has been dominated by tsunami-related activities, elsewhere in this Report you will read of progress and achievements in many other areas of IOC activity, including science, the Global Ocean Observing System (GOOS) and capacity-building. I am confident that you will be impressed by the work being done at the interface between science and governments by the IOC of UNESCO, on behalf of our Member States. Scientists need resources from governments to do their work, and governments need science to plan a sustainable future. Together we can make it happen.

Dr David Pugh
Chair
Intergovernmental Oceanographic Commission
of UNESCO

FROM THE EXECUTIVE SECRETARY

Nations working together to advance understanding

Though rather forgotten now, two hundred and fifty-five years ago in 1755, an 8.9 magnitude earthquake caused one of the greatest disasters in human history. A series of tsunamis that followed caused chaos and destruction and claimed the lives of over 100,000 people along the Iberian Peninsula. Lisbon, one of the wealthiest trading cities at that time, was devastated.

We are still in shock from the images of last year's Indian Ocean tsunami that inflicted massive damage in many countries, killed over 240,000 people, and caused millions more to lose their homes and livelihoods.

How will we and our Planet continue to survive if one day we lose the memory of this tragedy too? Are we willing to suffer the price of only responding to crises as they arise with little forethought to the future? The Intergovernmental Oceanographic Commission of UNESCO is convinced that the science and technology we have today can and should protect the lives and property of all people living around the oceans of the world. This Annual Report will describe how we are working towards this goal by updating you on just a few of our activities during the past year.

A year of building consensus

Since 1965 the IOC of UNESCO has been supporting the Tsunami Warning System in the Pacific. It is one of the most successful international programmes ever undertaken, operating with the full cooperation and trust of others, and implemented in a totally transparent and accountable way. Twenty-six Member States participate in the direct responsibility of mitigating the effects of tsunamis, saving lives and preserving property in the region. Based on this unequalled experience, the IOC of UNESCO was called on by the international community early this year to play the lead role on behalf of the UN system in coordinating efforts to establish a tsunami warning system for the Indian Ocean.

We have been addressing this formidable task with great energy and enthusiasm, driven by the conviction that people should never again be caught unprepared for this rare but high-impact disaster.

In response, the IOC organized and coordinated an intensive series of high profile, international intergovernmental meetings that resulted in the unprecedented commitment and unified, rapid action of our Member States towards the establishment of an Indian Ocean Tsunami Warning and Mitigation System (IOTWS). In particular, two major intergovernmental meetings advanced the process and created several important initiatives. The First International Coordination Meeting, held in Paris in early March, resulted in the agreement of the twenty-seven countries of the Indian Ocean rim to work within the framework offered by the IOC through an Intergovernmental Coordination Group (ICG). A second successful coordination meeting was held in April in Mauritius that further reinforced the Paris consensus and vested the IOC with extensive responsibilities, especially in the areas of needs assessment and capacity-building required for the establishment of the national warning systems forming the backbone of the IOTWS. The Twenty-third Session of the IOC Assembly subsequently unanimously approved Resolution XXIII-12 formally establishing the ICG, responsible for the technical design of the System and the observational networks to be deployed in the Indian Ocean.

The IOC Secretariat with the UN/International Strategy for Disaster Reduction (ISDR), submitted a joint proposal within the framework of the Tsunami Flash Appeal (6 January 2005), requesting US$3.5 million for the establishment, by the IOC, of the early-warning component of the IOTWS. By 1 April, an interim warning system was in place and operating in the Indian Ocean region, consisting of a network of National Tsunami Focal Points receiving advisory information on tsunamis from the Pacific Tsunami Warning Center (PTWC) and the Japan Meteorological Agency (JMA). This solution is being further enhanced with a US$0.5 million project component to install and/or upgrade sea level gauges in affected countries to cover the immediate sea level observation gaps in the Indian Ocean. An initial system will be in operation by 1 July 2006 and a nearly completed system should be operational by the end of December 2007.

The ICG of the IOTWS is being supported from Perth, Australia, by a Secretariat composed of two new professionals. At IOC headquarters in France, we are finalizing the formation of a Tsunami Unit, providing technical support to the Secretariats in Perth and Hawaii, and the rest of the world, with a newly hired Head of Unit and four professionals.

Tsunami risks exist in all ocean basins

We face, however, a somewhat paradoxical situation. Europe, which already possesses most of the elements to operate a tsunami warning system, still does not have such a system. A stronger commitment from national authorities is needed to identify the responsible agencies that will act as national operational tsunami centres and sustain the medium to long-term awareness and preparedness that is needed to build tsunami-safe communities all along the Mediterranean and North East Atlantic coast.

UNESCO through the IOC has proposed a global strategy to establish early warning systems to all regions at risk and we have already made much progress by creating two other new ICGs: one for the Caribbean and Adjacent Regions; and a second for the North-Eastern Atlantic, the Mediterranean and Connected Seas. In November in Rome, Italy, we had the first meeting of the latter and agreed in principle to have an initial system in the region operating by the end of 2007. It is a big challenge.

Multipurpose ocean observing systems

The best way of ensuring that tsunami and other ocean-related hazard early warning systems remain fully operational for decades to come is to integrate them into a broader, multi-purpose ocean observation system. In this way, we optimize their effectiveness and the investment of resources needed for their maintenance.

For the past ten years, the IOC has been pursuing the establishment of a permanent Global Ocean Observing System (GOOS). GOOS provides an important contribution to science and serves many needs beyond climate and weather forecasting, including public health, fisheries, coastal pollution, ocean engineering, shipping and environmental protection. The new IOC-World Meteorological Organization Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM) has been created to help integrate plans for the implementation of ocean observations.

Global coordination/ partnerships

Observing a global ocean is far too enormous a task for one organization, or even one country, to undertake alone. The best way to develop this effort is by using a coordinated approach of international partners working together. The full and open sharing of data between nations therefore becomes essential, a big incentive to those participating, and must be acknowledged as a founding principle for all national, regional and global systems.

The International Oceanographic Data and Information Exchange (IODE) Committee, established in 1961, was one of the first subsidiary bodies of the IOC. It provides valuable oceanographic data and information services free of charge to governments, industry, scientists and the general public alike. IODE is adapting to the new era of real-time data and products and we are grateful to the Government of Flanders for hosting the new IODE Project Office jointly with the Flanders Marine Institute in Oostende, Belgium, and supporting the further development of the solid results achieved thus far.

Capacity Building

Not all countries have the capacity, such as communications infrastructures, access to information and observing technologies, and adequate numbers of trained scientists and technicians to acquire such data. One of the most crucial concerns of the IOC is to advance the development of this capacity in Member States that demand it. The Thirty-seventh Session of the IOC Executive Council last June adopted Resolution EC-XXX-VII.9 to develop an implementation plan for capacity-development, based on regional inputs from an Expert Workshop and to undertake an assessment of the capacity-building programmes that have been carried out by IOC over the last five years. The implementation plan that the IOC has just launched is an ambitious programme involving marine scientists in developing countries and is designed to fulfill a critical mission to provide science for the sustainable use of coastal and marine resources.

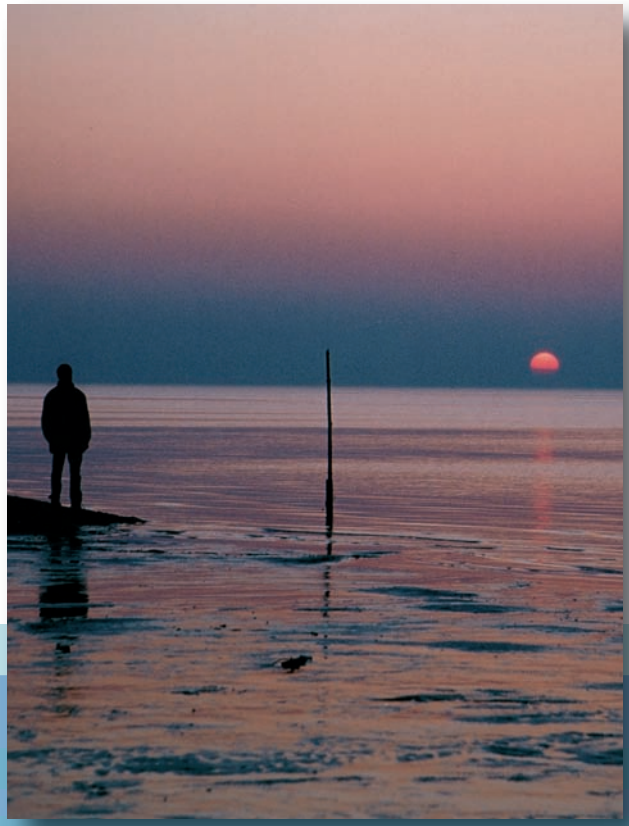
Refusing to forget the past

Catastrophic tsunamis are infrequent and their return time can be measured in decades, even centuries. Geologists studying tsunami deposits from the 1755 Lisbon event are now convinced that the rocky shorelines of the Iberian peninsula may well preserve the imprints of other, earlier tsunami waves of very similar strength to the two historical tsunami events identified and dated so far in the region (Scheffers, 2005).

With the passing of several generations, society loses the knowledge, the collective memory fades away and awareness disappears. In the long run, the ultimate challenge is therefore to put in place and constantly nurture a culture that can counteract this inexorable fact of life.

Dr Patricio A. Bernal
Assistant Director-General, UNESCO
Executive Secretary, IOC

Public Awareness



Courtesy of kirsten.i.achenbach@gmx.de

The Gulf Stream and the Climate

BRUNO VOITURIEZ is a physical oceanographer. His interest concerns both climate and the physical processes controlling its biological production. He was in charge of the physical and space oceanography research programmes of Ifremer (Institut Français de Recherche pour l'Exploitation de la Mer). He was coordinator of the French contribution to the international programmes, Tropical Ocean-Global Atmosphere observing system (TOGA) and the World Ocean Circulation Experiment (WOCE) in the framework of the World Climate Research Programme (WCRP) and President of the French National Committee for the IOC. In 1999 he co-authored with Guy Jacques *El Niño: Fact and Fiction*.[1] In 2003 he published *The Changing Ocean: Its Effects on Climate and Living Resources*.[2] His latest book, *The Gulf Stream*[3] appears in 2006.

The IOC is pleased to present a new title, appearing in 2006, in the IOC Ocean Forum Series, *The Gulf Stream*, which presents the history of the discovery of the Gulf Stream and its scientific reality. In the following article adapted from this new book, author Bruno Voituriez discusses the unique roles of the Gulf Stream and the thermohaline circulation in the climate system, along with possible global warming scenarios.

The oceans largely control the rhythm of climate change. The IOC collaborates with the Intergovernmental Panel on Climate Change (IPCC) for the purpose of ameliorating the associated effects of climate change on society and the environment.

1. Myths about the Gulf Stream

No other marine current is quite as well known as the Gulf Stream. It acquired mythical status when M.F. Maury, Superintendent of the U.S. Navy Hydrographical Office, described it in these terms in his book *The Physical Geography of the Sea*, published in 1855: 'There is a river in the ocean. In the severest droughts, it never fails, and in the mightiest floods, it never overflows. Its banks and its bottoms are of cold water, while its currents are warm. The Gulf of Mexico is its fountain and its mouth is in the Arctic Seas. It is the Gulf Stream. There is in the world no other such majestic flow of waters. Its current is more rapid than the Mississippi or the Amazon.' It was also Maury who made the comparison to a central heating system, in which the Gulf of Mexico acts as the boiler and the Gulf Stream as the hot water channel that warms the climate of western Europe. There are Gulf Stream hotels on the coasts of Brittany, in the far west of France. It has inspired painters (Fig. 1) and now has a media and even a Hollywood reputation that makes it a sort of

Fig. 1. The Gulf Stream, as seen by Winslow Homer (1836–1910) in 1899. (Metropolitan Museum of Art, New York)

1 Voituriez, B. and Jacques, G. 2000. *El Niño: Fact and Fiction*. UNESCO Publishing. (IOC Ocean Forum Series.) Available in English, French and Spanish.
2 Voituriez, B. 2003. *The Changing Ocean: Its Effects on Climate and Living Resources*. Paris, UNESCO Publishing. (IOC Ocean Forum Series) Available in English, French and Spanish.
3 Voituriez, B. 2006. *The Gulf Stream*. Paris, UNESCO Publishing. 213 pp. (IOC Ocean Forum Series, 6) ISBN 92-3-103995-4, French version: ISBN 92-3-203995-8, Spanish version: ISBN 92-3-303995-1.

conductor of climate change with the alarming question: could it shut down and, despite global warming due to the greenhouse effect, bring about near glacial climate conditions?

So, Could the Gulf Stream stop flowing?

It is a question often asked by journalists but it makes scientists uneasy, because if they answer 'no', they are stating a scientific truth without responding to what the question really means. It actually concerns a phenomenon in which the Gulf Stream does take part but which in no way determines its existence: the famous 'conveyor belt', which is a result of what is known as 'thermohaline circulation', or THC. If they answer 'yes', they are satisfying the journalists' curiosity but reinforcing the mythic status of the Gulf Stream by maintaining the fiction of a Gulf Stream river as described by Maury – 'The Gulf of Mexico is its fountain and its mouth in the Arctic Seas' – and lumping together the Gulf Stream and the thermohaline circulation, with the corollary that the latter could only collapse if the Gulf Stream itself shuts down. Which is not the case at all.

2. What drives the Gulf Stream?

So what causes the Gulf Stream? The wind does, the wind associated with the Azores anticyclone, blowing clockwise around it: the movement of winds from the west to the north of the Azores anticyclone and the north-east trade winds on its eastern and southern flanks (Fig. 2). This major atmospheric anticyclonic circulation generates, in the ocean, an equivalent major anticyclonic conveyor made up, among other things, of the Canary Current to the east, the North Equatorial Current to the south and the Gulf Stream to the west (Fig. 3). More generally, the wind-driven ocean currents generate zones of high oceanic pressure (super-elevation of the sea level) and oceanic lows (under-elevation). These currents move around in the same way as winds move around anticyclones and depressions. These variations in sea level are mapped by altimeter satellites and we can deduce currents from them, just as we can deduce the wind from differences in atmospheric pressure (Fig. 4). The Gulf Stream is thus the 'only' current on the western boundary of the oceanic anticyclonic circulation generated by the Azores anticyclone, just as the Canary Current is its eastern boundary current. The Gulf Stream has its counterparts in other ocean basins: the Brazil Current in the South Atlantic associated with the Saint Helena anticyclone, the Kuroshio Current in the North Pacific, and the Agulhas Current in the southern Indian Ocean. They are known as 'western boundary currents' and are particularly distinctive and intense owing to the rotation of the Earth and the necessary conservation of vortex energy. At its peak, the flow rate of the Gulf Stream reaches 140 million cubic metres per second (by comparison, the Amazon's peak flow rate is only 300,000 cubic metres and the total flow rate of all rivers is of the order of one million cubic metres per second). All these currents transport heat from the equator to the poles and are thus vital forces in the weather machine. It would not be a misleading over-simplification to state that for the Gulf Stream to shut down, the Azores anticyclone itself would have to vanish, thereby bringing an end to heat transfer through the atmosphere from the equator to the poles. In other words, the equator would no longer be where it is now. In order for that to happen, there would have to be a substantial modification of the parameters of the Earth's rotation on its own axis and around the sun, a disruption far more significant than the increase in atmospheric greenhouse gas concentration. Paleoclimatic studies have moreover shown that in Florida, where it is best channelled, the Gulf Stream has never been interrupted during past glacial stages.

Thus defined by the cause that generated it, the Gulf Stream, although it

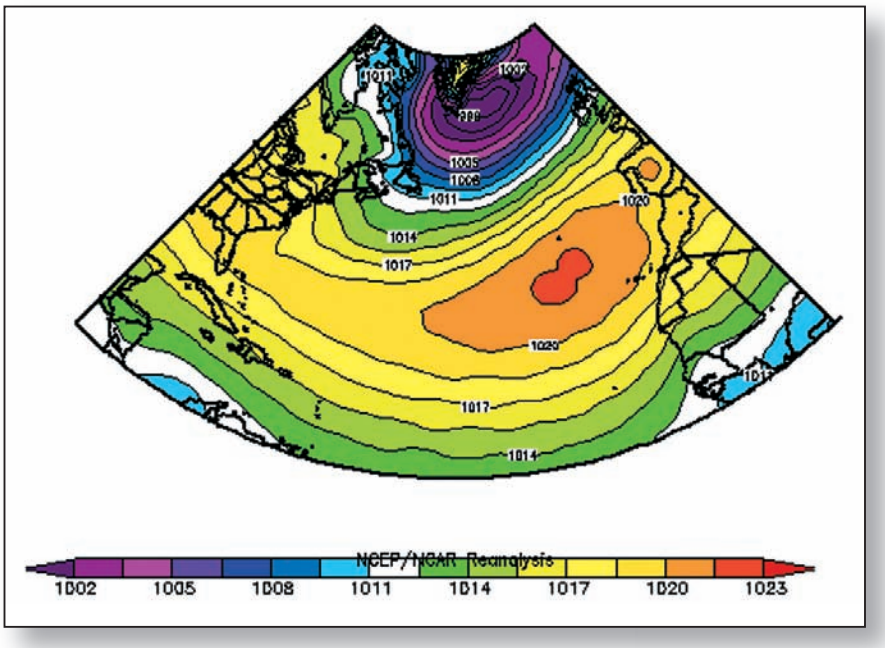


Fig. 2. The average atmospheric pressure field at sea level in the Atlantic. The centre of the Azores anticyclone (in red); the Iceland low pressure area (in purple). The wind blows clockwise around the anticyclone and anti-clockwise around the low pressure area. (NOAA–Cires/Climate Diagnostic Center)

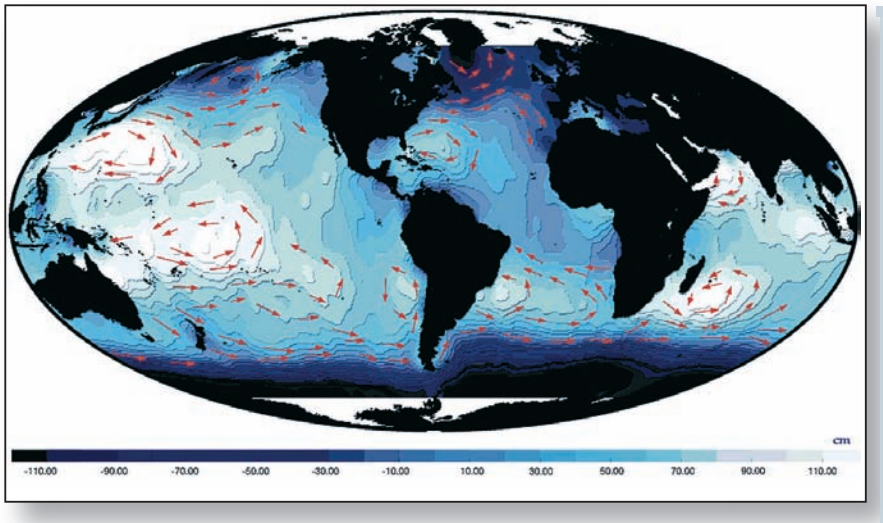


Fig. 3. General oceanic surface circulation in the Atlantic. Around the Azores anticyclone: the Gulf Stream, the Canary Current and the North Equatorial Current. Associated with the Iceland Depression, the North Atlantic Drift and the Labrador Current.

*(*Ocean Circulation*. The Open University, Pergamon Press, 1989)*

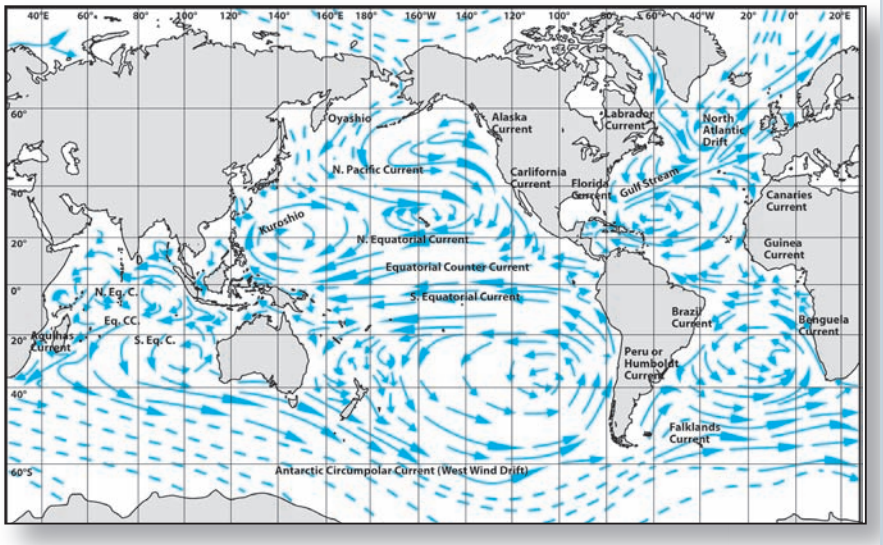


Fig. 4. Topography of the ocean surface based on altimeter satellite measurements (Topex/Poseidon). This map shows the 'anomalies' in the ocean level in relation to what it would be in the absence of a current. The positive anomalies range from medium blue to white; the negative anomalies from medium blue to dark blue. The subtropical anticyclonic circulation appears in the North Atlantic and, to the north, the cyclonic circulation associated with the Iceland low.

(CLS–Satellite Oceanography Division)

does originate in the Gulf of Mexico, does not flow into the Arctic, as Maury maintained. Dynamically, as the western boundary current of the Azores anticyclone, the Gulf Stream ends its journey when the current, following the anticyclonic movement, moves away from the continental slope and heads east, the unchanging direction of the planet's vortex. It can be said then that, dynamically, the Gulf Stream ends its journey at about 40 ºN and 50 ºW at the top of the anticyclonic loop. Of course, this does not mean that the current stops and speed falls to zero at that point. There is a continual flow and the warm, saline waters transported there by the Gulf Stream continue on their way north in the North Atlantic Current and the Norwegian Current. They stay in the same carriage but change locomotive, because while the main engine of the currents is still the wind, it is no longer the Azores anticyclone that dominates but the system of the Icelandic low around which the wind turns anticlockwise, driving the marine currents in the same direction. The coldwater Labrador Current is the 'western boundary current' of this low system.

3. The thermohaline circulation and the conveyor belt: a bonus for the Gulf Stream

The combined movements of the ocean and the atmosphere and the energy they exchange, in particular in the processes of evaporation and precipitation, amount to exchanges of density between different oceanic regions. Evaporation (transfer of freshwater from the ocean to the atmosphere) increases the salinity and thus the density of seawater. The atmosphere will return some of that freshwater to the ocean in the form of precipitation, leading to a drop in salinity and therefore in density. It is the variations in density arising from these exchanges that produce the 'thermohaline' circulation (from *thermos*, meaning heat, and *alos*, meaning salt, the two parameters determining the density of seawater). When surface water becomes denser than the water below it, it sinks to the depth corresponding to its hydrostatic balance. It is this phenomenon of convection that can be observed in the Greenland Sea in the North Atlantic, where the surface waters sink to a depth of about 3,500 metres: it is North Atlantic Deep Water (NADW) that spreads throughout the ocean and gradually rises to the surface, in the North Pacific for instance, to return to its starting point in the Greenland Sea via the straits of Indonesia, the Agul-

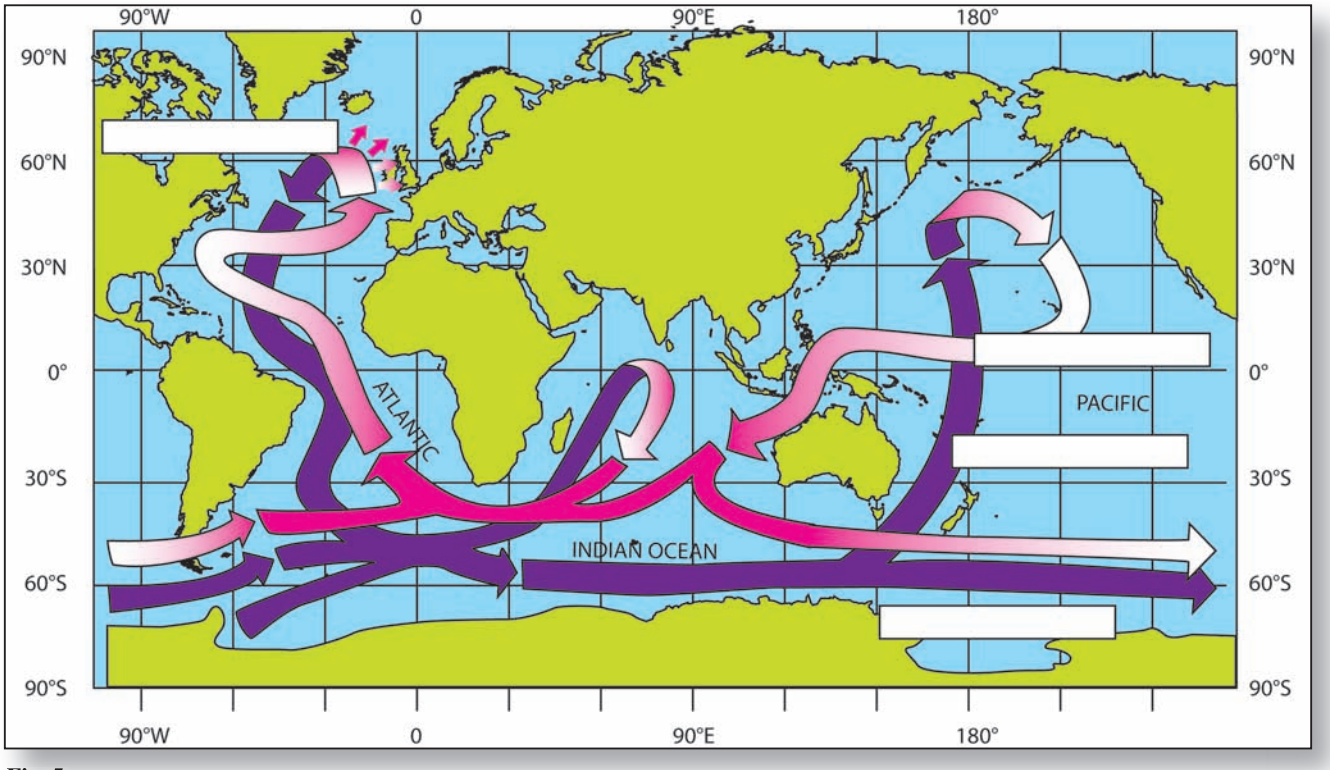


Fig. 5. The conveyor belt of the thermohaline circulation. In blue, deep circulation. In pink and mauve, the return to the surface by the cold route through the Drake Passage between South America and the Antarctic, and the warm route from the North Pacific through the Indonesian Straits.

(E. Maier-Reimer [Max Planck Institute für Meteorology, Hamburg, Germany] adapted from Broecker et al., 1985, Nature *315)*

has Current, the Benguela Current, the South Equatorial System, the Gulf Stream, the North Atlantic Drift and lastly the Norwegian Current. This is the famous conveyor belt (Fig. 5).

The thermohaline circulation plays a very important role in the climate: it is this, and not the Gulf Stream that controls the transport of heat by the oceans towards the high latitudes in the North Atlantic. Convection in the Greenland Sea creates what is in fact a 'water intake' whose flow rate is some 15 million cubic metres per second, increasing by as much the flow rates of the Norwegian Current, the North Atlantic Drift and the Gulf Stream, and thus the amount of heat they transport to the high latitudes (Fig. 6). If convection in the Greenland Sea and the thermohaline circulation were to slow down considerably or even collapse, as it seems was the case in glacial periods, then the flow of heat equivalent to those

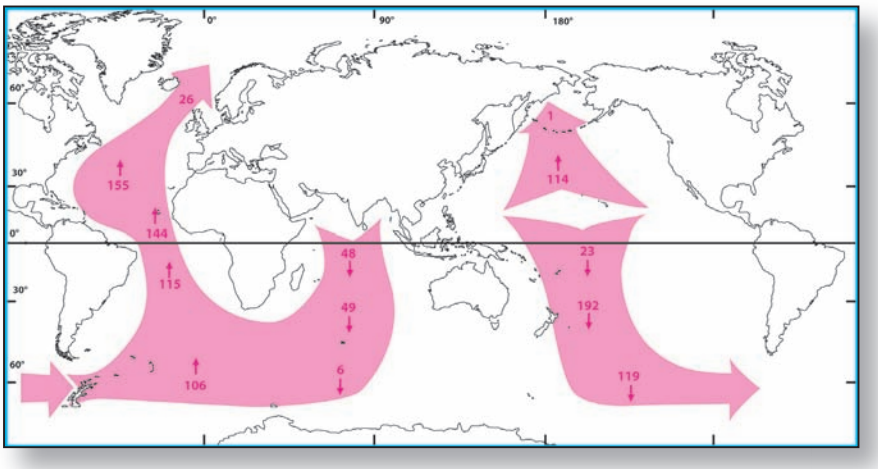


Fig. 6. The heat flows transported by the ocean in 1013W. Whilst in the Pacific Ocean heat transport is roughly symmetrical towards the north and towards the south in relation to the equator, in the Atlantic the transport is only towards the north. At 60 ºN, the flow transported is 26 in the Atlantic compared to only 1 in the Pacific: this is the direct result of the formation of deep water in the North Atlantic, which has no equivalent in the Pacific.

(Ocean Circulation. *The Open University, Pergamon Press, 1989)*

15 million cubic metres per second would be lost for the North Atlantic, which, given the thermal deficit, would raise the possibility of significant cooling in these regions rather than the warming suggested by the increase in the greenhouse effect. Should this happen though, the Gulf Stream, whose flow rate exceeds 100 million cubic metres per second

at Cape Hatteras, would continue its route on the western boundary of the Azores anticyclone. The real question that arises, which is a legitimate question when one wonders whether the Gulf Stream could shut down, is the following: could global warming lead to a slow-down, or even the collapse of the thermohaline circulation and thus the oceanic transport of the corresponding heat to high latitudes in the North Atlantic?

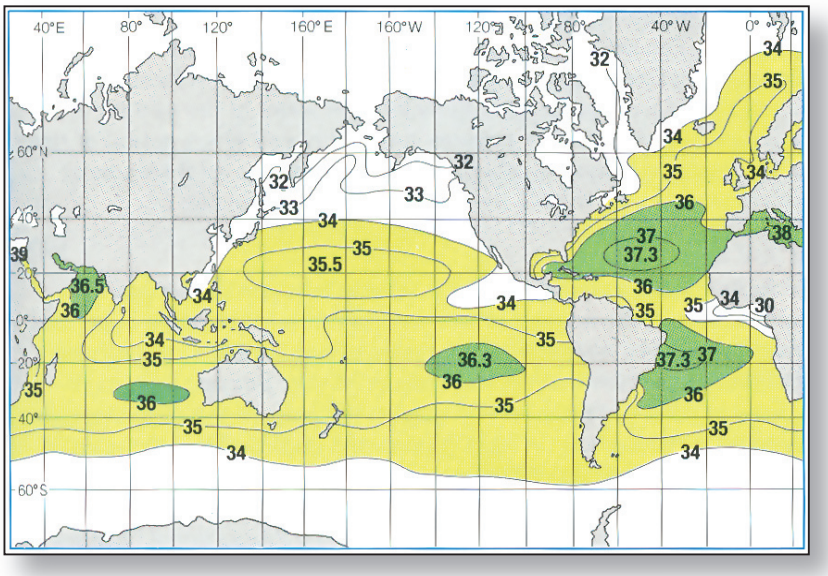


Fig. 7. Salinity of the world's ocean surface. The highest levels of salinity are in the northern tropical Atlantic. It is the transport of this saline water by the Gulf Stream and then the North Atlantic Drift to the Norwegian Sea and the Greenland Sea that triggers the conveyor belt.

(Ocean Circulation. *The Open University, Pergamon Press, 1989)*

4. Why the Atlantic?

There are other convection zones where deep water is formed in the Antarctic, but there are none in the North Pacific. What accounts for this difference between the Atlantic and the Pacific, whereby the oceanic transport of heat to the north is greater in the former than the latter? It is because the result of 'exchanges in density' through evaporation and precipitation make the Atlantic, and in particular the northern subtropical Atlantic, the most saline ocean region. It is far more saline than the northern subtropical Pacific. So the Gulf Stream conveys warm, very saline water to the middle latitudes of the North Atlantic, and it is then taken up by the northern branch of the North Atlantic Drift and the Norwegian Current which make up the southern and eastern boundaries of the circulation, cyclonic this time (anticlockwise), associated with the Labrador low system (Fig. 7). In the course of its epic journey, this saline water cools down significantly but remains hypersaline so that in the Greenland Sea it reaches very high density levels that are greater than those of the water below it and are increased still more in winter by the formation of ice which, by taking up freshwater, increases still further the salinity and density of the surface water. In the Pacific, despite a pattern of oceanic circulation (Kuroshio + Aleutians cyclonic circulation) that is analogous to that of the Atlantic (Gulf Stream + Labrador cyclonic circulation), there is no deep convection owing to a lack of salt, something which does not prevent the Kuroshio from flowing, just as the Gulf Stream would if such a mishap occurred in the Atlantic.

5. The right question: could the thermohaline circulation stop?

As in the case of the Gulf Stream, we have to look back to the causes in order to answer this question and, in this case, it is variations in the density of seawater. A rise in the temperature of the ocean and a fall in its salt content would both contribute to a reduction in the density of the seawater and the possible shutdown of the formation of deep water. These two phenomena are possible in global warming scenarios. We can already observe continued rises in ocean surface temperatures. We can also observe a constant shrinking of the ice cap and can anticipate a steep increase in rainfall and a significant increase in freshwater runoff from rivers flowing into the Arctic. All of these elements make the models used by the Intergovernmental Panel on Climate Change (IPCC), except for one, converge on a reduction in the thermohaline circulation by the year 2100. Although the simulations produced with some models do predict a complete shutdown of the thermohaline circulation for a global increase in temperature from 3.7 to 7.4 ºC, none of the simulations arising from the IPCC's combined ocean/atmosphere models point to such an eventuality by the year 2100. At that date, everything indicates a continued increase in temperature in Europe, even those that announce the sharpest reduction in the thermohaline circulation. Such an event could occur subsequently, but an earlier shutdown cannot be ruled out, due in particular to possible 'threshold effects' or points of no return which, at a critical value of a parameter of the system, make it pass suddenly from one state to another. The IPCC, aware of the uncertainty

surrounding these thresholds which are not fully taken into account in the models, does not rule it out: 'None of the current projections with coupled models exhibits a complete shutdown of the THC by the year 2100'. However, they do not exclude the possibility of threshold phenomena within the range of projected climate changes. In addition, since the natural variability of the climate system is not fully predictable, there are necessarily limitations inherent in the climate system itself to the prediction of threshold and transition phases. In other words, it is an event that is improbable but not impossible.

6. Conclusion: the Gulf Stream, the thermohaline circulation and the climate

So in the end what remains of the unique role of the Gulf Stream in the climate system? It is not so much that it transports warm water north. The Kuroshio Current does that too in the Pacific. It is rather that the water is very saline, an indispensable condition for the formation of deep water in the Greenland Sea, the thermohaline circulation, the conveyor belt and the particularly high flows of heat in the North Atlantic. It is thanks to the salt it transports that the flow rate of the Gulf Stream and the quantities of heat it conveys are higher than those of the Kuroshio. If climate warming ends the formation of deep water in the Greenland Sea, not because of lower salinity of the Gulf Stream but because of an excess of freshwater in Arctic regions, the situation in the Atlantic would be comparable to the current situation in the Pacific.

In glorifying the positive role of the Gulf Stream on the western European climate Maury was wrong to compare it to the Labrador Current. An analogous contrast exists at the same latitudes on either side of the Pacific, between the coasts of North America and Siberia. Nobody in Seattle or Vancouver thanks the Kuroshio for the temperate climate they enjoy whilst on the other side the Sea of Okhotsk is iced over, like the Labrador coasts. If this contrast exists between the two shores of the oceans, it is due to the rotation of the Earth which ensures that at temperate latitudes the eastern shores of the oceans benefit from an oceanic climate: they are under the influence of westerly winds which arise between subtropical anticyclones and low pressure areas (Iceland, the Aleutians) and which in their ocean journey draw on heat and humidity. Conversely, the western shores are subject, on the western boundary of low pressure areas, to north-westerly winds originating in the polar regions. We must compare what can be compared, which in this case means differences in climate between western Europe and the west coasts of the American continent. Average temperatures in Europe are unquestionably higher than in America. At the same latitude, the average annual temperatures in Norway are

"The Gulf Stream plays a part as a 'transporter', it is not the engine."

10 ºC higher than those of Alaska. This is the direct result of the heat surplus transported by the currents in the North Atlantic, but while the Gulf Stream plays a part as a 'transporter', it is not the engine: the cause is the formation of deep water in the Greenland Sea. We can presume that in the event of this process failing, Norway would experience the same climate as Alaska, and Brest, in the far west of France, would have the same climate as Vancouver, which is at the same latitude.

Although the Gulf Stream has nothing to do with the possible interruption of the thermohaline circulation, its persistence should reassure us, since it is the guarantee that at some time or another it might resume as it always has done on a regular basis over the past 600,000 years throughout the many vicissitudes that have marked glacial and interglacial periods.

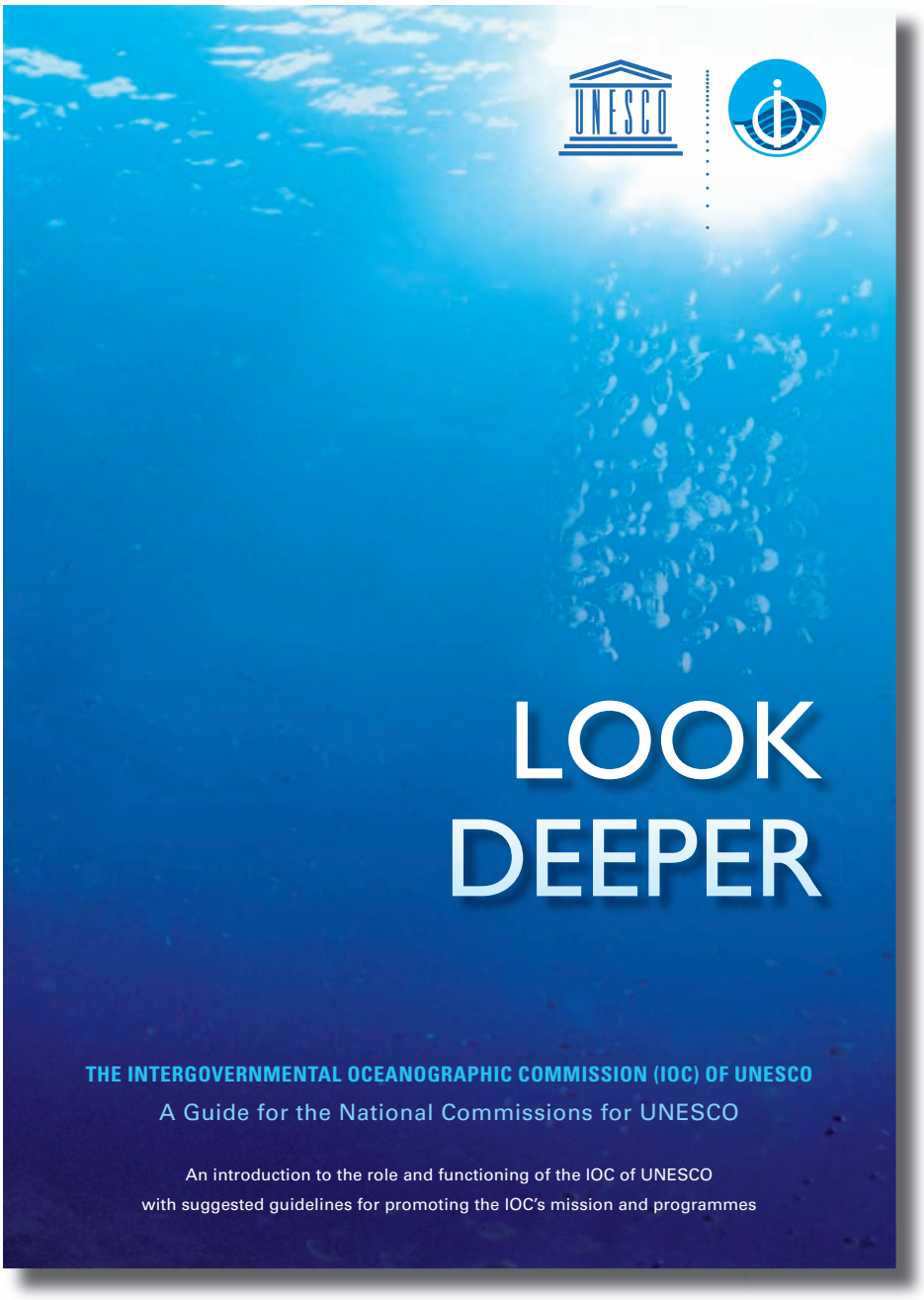
Two new brochures that introduce you to the work of the IOC

Look Deeper

A new twelve-page brochure titled 'Look Deeper' provides a clear, general overview of the Intergovernmental Oceanographic Commission of UNESCO's mission and programmes. Although the brochure is primarily intended as a guide for the National Commissions for UNESCO, other readers interested in the IOC's role and functions may find it useful too.

The National Commissions represent an important link in the IOC's strategy towards ensuring an adequate understanding of the issues and the respective responsibilities of national agencies and individuals dealing with ocean and coastal affairs by crafting better communication between science, governments and civil society.

'Look Deeper' was officially released on the occasion of the Thirty-third General Conference of UNESCO (3-21 October 2005) during a round table session on 'Promoting cooperation between National Commissions for UNESCO and the National Committees of the Intergovernmental Scientific Programmes'. The session gathered the chairpersons of the five scientific programmes of UNESCO: the International Geoscience Programme (IGCP), the Programme on Man and the Biosphere (MAB), the Interactive Basic Sciences Programme (IBSP), the International Hydrological Programme (IHP) and the IOC.



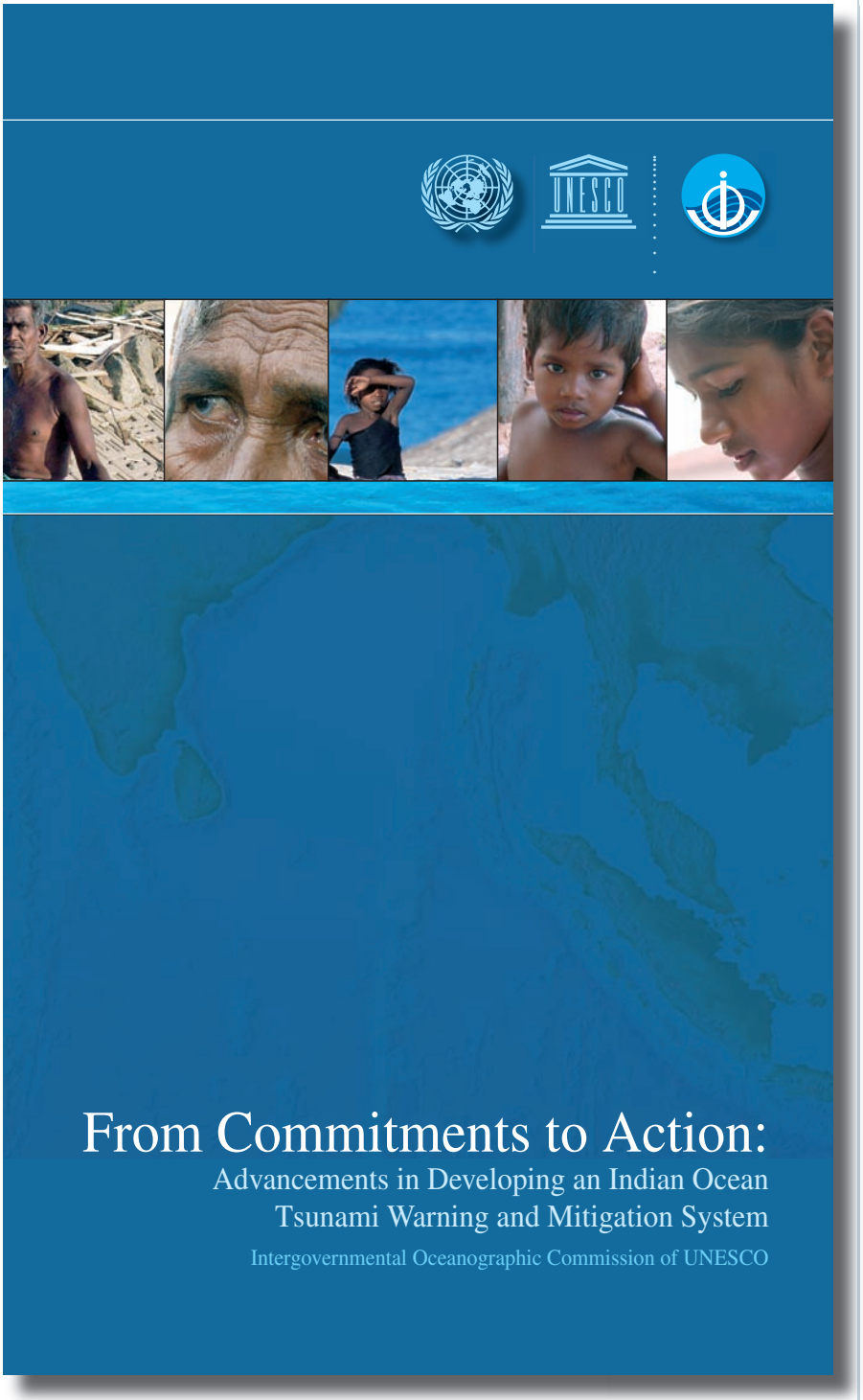
From Commitments to Action

The tsunami's death toll could have been drastically reduced if the systems needed to warn people had been in place. A recently published 27-page brochure guides the reader through IOC's coordination activities for the immediate implementation of a complete end-to-end Tsunami Warning and Mitigation System in the Indian Ocean following the catastrophe of December 2004.

The brochure offers a comprehensive summary of the coordination efforts that IOC is leading with its partners and the public sector on behalf of the UN system. 'We can now confirm the presence of tsunami in the Indian Ocean' said IOC's Executive Secretary, Patricio Bernal, following the implementation of an initial interim warning system in the region in April 2005, just four months after the disaster.

The Indian Ocean Tsunami Warning and Mitigation System should be operational by the end of December 2007. Similar systems are underway for the Mediterranean, the Northeast Atlantic, and the Caribbean and Adjacent Regions as part of an integrated global multi-hazard warning system designed to protect all regions of the world at risk.

'From Commitments to Action' examines the enormous challenge of putting such a warning system in place, the design of its core elements, and the unprecedented international cooperation and agreement that have provided the building blocks for its establishment.



Policy

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Estuarine Coastal and Shelf Science: Invited ViewPoint[1]

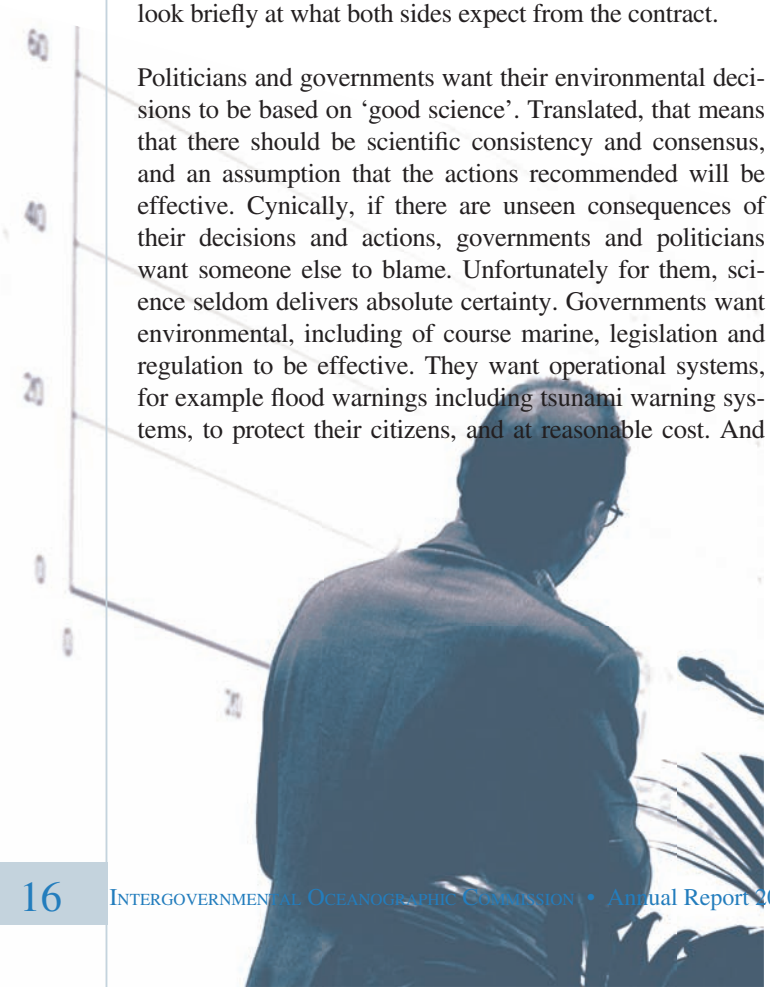
GOVERNMENT POLICIES AND SCIENTIFIC POSSIBILITIES

By David Pugh
Chair, Intergovernmental Oceanographic Commission of UNESCO

Once, at a sea level conference, I met a dentist from a small Caribbean island State. In his retirement he was representing his country as a diplomat and politician at the United Nations. He explained that his dental experience had ideally qualified him for his new role: all his life he had been paid for causing people pain.

Few scientists, and I suspect fewer politicians would admit so openly their power to impact on other people's lives, and neither would easily acknowledge the unwritten alliance through which these impacts may occur. Yet there are close links between government policies and scientific possibilities. As scientists we make different futures possible. Governments help to make selected futures happen. In marine science we may advise on ocean management possibilities, and governments may choose to take that advice. Or they may not, choosing in the face of uncertainty to do something different, or nothing at all. This symbiosis between governments and science is often taken for granted on both sides, without closer examination of the mutual expectations. These expectations are often very different, and it may be useful to look briefly at what both sides expect from the contract.

Politicians and governments want their environmental decisions to be based on 'good science'. Translated, that means that there should be scientific consistency and consensus, and an assumption that the actions recommended will be effective. Cynically, if there are unseen consequences of their decisions and actions, governments and politicians want someone else to blame. Unfortunately for them, science seldom delivers absolute certainty. Governments want environmental, including of course marine, legislation and regulation to be effective. They want operational systems, for example flood warnings including tsunami warning systems, to protect their citizens, and at reasonable cost. And inevitably they want wealth-creating businesses to continue to the maximum extent possible: this means jobs, individual prosperity and national economic success.



Scientists have a different agenda. First we want money to do our work. Governments worldwide fund most marine science either directly, or indirectly. But once they have the money scientists want the freedom to apply their professional skills without interference; and they want their conclusions to be independent of the supposed expectations of the funding sources. Wise governments appreciate the long-term dangers of buying the wanted conclusions when setting up the funding arrangements; but the temptations to buy, and deliver, a policy-favourable result are always there, on both sides. Scientists also expect that their conclusions and recommendations will be taken seriously, and not dismissed because they are politically difficult. And above all, scientists want politicians to accept and acknowledge publicly that scientific assessments are inevitably expressed in terms of probabilities. If a hypothesis is not proved at the 95 percent level, that is very far from saying that the reverse hypothesis has been proved. Not every politician appreciates that.

Which brings me briefly to the *Precautionary Principle*. At one extreme it could be interpreted 'undertake no action until it is certain no harm will result'; at the other extreme it could mean 'actions are acceptable if it cannot be proved that harm will occur'. As marine scientists, the often huge gap between these extremes is a measure of the limits of our scientific knowledge. Our challenge is to reduce the gap. But in the end scientific forecasts will inevitably include elements of probability. Scientists should not be afraid to express their conclusions in terms of probability and risk. Politicians, and the public at large should get used to the inevitable uncertainties inherent in marine science and its prognostications. Usefully, UNESCO has just published a general review of the interpretation and application of the *precautionary principle*.

Here, to end, are some predictions with probabilities attached. There will *probably* be future marine disasters and environmental degradation. I believe it *very probable* that these could be reduced and in some cases avoided if scientists and governments understood their respective roles and limitations better. And of this I am *certain*: regular checks keep your teeth healthy. I know that because the dentist told me.

[1]. Reproduced with the kind permission of Elsevier from *Estuarine, Coastal and Shelf Science*, Volume 65, Issue 3, November 2005, Pages 383-384

The Intergovernmental Oceanographic Commission of UNESCO

MANDATE AND SUMMARY OF 2005 GLOBAL RESULTS AND ACHIEVEMENTS

1. Addressing scientific uncertainties for the management of marine environment and climate change

COORDINATING INTERNATIONAL SCIENCE PROGRAMMES

Carbon in the Ocean

The International Ocean Carbon Coordination Pilot Project (IOCCP), coordinated by the IOC, addresses scientific uncertainties associated with carbon in the ocean. Carbon plays a critical role in climate change. The IOCCP was recently requested by the Scientific Committee on Oceanic Research (SCOR) and the International Geosphere-Biosphere Programme (IGBP) to serve as an international communications and coordination centre for ocean carbon research and observations.

IOCCP activities in 2005 included:

- Publication of a special issue of the *Journal of Geophysical Research* (September) highlighting research from the international symposium 'The Oceans in a High CO_2 World'.
- Co-hosting the 'International repeat hydrography and carbon workshop' (November) where it was decided to develop a sustained programme to carry out decadal global surveys of hydrographic parameters and carbon measurements.

The IOC-SCOR Panel on CO_2 finalized the *Guide on Best Practices for Oceanic pCO_2 Measurement and Data Reporting*.

TRANSLATING SCIENCE INTO ACTIVITIES THAT BENEFIT CIVIL SOCIETY

Scientific management of coastal areas and coral reefs:

The IOC Science and Communication Centres in Copenhagen (Denmark) and Vigo (Spain), provided individual Harmful Algal Bloom (HAB) training and study opportunities to more than one hundred scientists through international and regional training workshops in Brazil, Germany, Italy, Kuwait, Philippines, South Africa and Vietnam.

A Letter of Agreement was signed with the North Pacific Marine Science Organization (PICES). for recording harmful algal events and establishing a common IOC-ICES-PICES database (HAEDAT).

The IOC's Integrated Coastal Area Management (ICAM) released a 'Beta Version' of the *Handbook on the Application of Indicators for Integrated Coastal Area* (May) for a year's testing by coastal managers in twelve ICAM projects around the world before final publication.

UNESCO/IOC is the Executing Agency for the GEF Project 'Adaptation to Climate Change - Responding to Shoreline Change and its human dimensions in West Africa through integrated coastal area management' involving the development of strategies, policies and measures, based on technical/scientific information and appropriate policy instruments. Three newsletters and an African Ocean Portal have been developed by the New Partnership for Africa's Development Coastal and Marine Unit-COSMAR (hosted by Kenya) through the support provided by IOC and ODINAFRICA.

The Global Coral Reef Monitoring Network (GCRMN) report on the state of coral reefs worldwide, including suggested remedial action, was published and widely publicized to stakeholders.

POLICY AND CAPACITY DEVELOPMENT ACTIVITIES

The Global Forum on Oceans, Coasts and Islands, with IOC as a lead partner, organized the Ocean Policy Summit in October 2005 in Lisbon, where two hundred and fifty participants discussed national and regional ocean policy guidance, as well as capacity-building needs for Small Island Developing States (SIDS).

Financial support was provided to participants from developing countries to attend the Land-Ocean Interaction in the Coastal Zone (LOICZ) Open Science Conference 'Coasts and Coastal People - Scenarios of Change and Responses'.

The Fourth Inter-calibration experiment on Submarine Groundwater Discharges in the Coastal Zones was organized together with the International Atomic Energy Agency (IAEA) and UNESCO-International Hydrological Programme (IHP) in Mauritius in April and attended by a team of international scientists.

In December, the Fourth Session of the IOC Regional Committee for the Central Indian Ocean was held in Colombo, Sri Lanka. Ten countries participated and agreed to priority actions for the region in terms of ocean science, services and observation, including capacity-building activities to strengthen the participation of countries in the Indian Ocean Tsunami Warning System.

2. Developing monitoring and forecasting capabilities for the management and sustainable development of the open and coastal ocean

The Global Ocean Data Assimilation Experiment (GODAE) modelling was successfully implemented and the Argo float programme is continuing to progress with 1,926 operating floats (by 5 July 2005) representing 64 percent of the target 3,000 float array. By the end of the biennium 2,000 Argo floats are expected to be operational.

The Second Session of the IOC-WMO Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), was held in September 2005, in Halifax, achieving thereby the brokering of national contributions to the JCOMM programme. The number and quality of Global Ocean Observing System (GOOS) components have expanded in a manner fully consistent with adopted plans and open ocean time series stations now exist as a component of JCOMM. The JCOMM Observing Platform Support Centre (JCOMMOPS) improved technical support tools for operational oceanography and marine meteorology through their website and developed a web application dedicated to the collection of metadata from drifting and moored buoys.

In 2005 the requirements for open ocean and coastal ocean observations were fully refined in the Global Climate Observing System (GCOS) and Coastal Ocean Observations Panel (COOP) strategy and implementation plans.

An Indian Ocean tsunami warning system is now operational using real-time tide gauges that are part of GOOS. This is a major achievement that the IOC of UNESCO has been primarily and directly responsible for, through extra-budgetary funding.

3. Developing and strengthening a global mechanism to ensure full and open access to ocean data and information for all

A new IOC Project Office for International Oceanographic Data and Information Exchange (IODE) was inaugurated in Oostende, Belgium on 25 April 2005 with the financial and administrative support provided by the Government of Flanders through the Flanders Marine Institute (VLIZ). The new office provides a creative environment facilitating the further development and maintenance of IODE projects, services and products. A prototype integration server has been established and is maintained at the IODE Project Office, demonstrating the full range of processes including data discovery, access, and visualization.

Providing data and information products and expanding the scope of data sources

OceanExpert was re-engineered to emphasize its main purpose of being an authoritative and user-friendly portal providing information on ocean professionals.

OceanPortal now contains close to 4,700 links to ocean related websites. Over one hundred poster requests were handled. OceanPortal tracked over 129,000 visitors to its site - a 13 percent increase compared to 2004.

A project 'System of Industry met-ocean data for the Offshore and Research Communities (SIMORC)' was initiated in July. SIMROC will stimulate and support wider application and exchange of the large met-ocean datasets collected by the oil and gas industry, being useful to both the scientific and industrial communities.

The ODINAFRICA III Project organized a training course on website development (December) attended by eleven countries. These websites will include data and information for all relevant stakeholders. New websites will be developed and maintained in the African Member States, but hosted by the IODE Project Office.

The ODINAFRICA III-linked project 'Development of an African repository for electronic publications' that aims at easing access to African research publications by African researchers and the decision-making community,

is being monitored as a prototype for subsequent implementation in other developing regions.

The Ocean Mapping programme established the new Global Regional Digital Bathymetric Data Base (GRDBD) that will benefit more than fifty countries in improving their knowledge on the topography of the World Ocean floor and skill in compilation and management of bathymetric data. Ocean Mapping published full sets of the International Bathymetric Charts of the Caribbean Sea and Gulf of Mexico; the International Digital Bathymetric Data Base of the North Atlantic; and Sheets NN 9,10,12 of the International Bathymetric Chart of the Western Indian Ocean. The Second Edition of the International Bathymetric Chart of the Mediterranean Sea and its dissemination together with the GEBCO Digital Atlas will significantly improve the quality of tsunami modelling and prediction.

4. Developing the capacities and effectiveness of Member States in Marine Scientific Research, and in the management and sustainable development of the open and coastal ocean

In June, the IOC Assembly approved a Strategy for Capacity-Building that emphasizes the importance of self-drive in accelerating capacity development. This strategy has a three-phase approach to its mission of safe lives and sustainable livelihoods from healthy ocean and coasts: (i) strengthening scientific, legal and institutional structures; (ii) raising awareness of decision-makers and communities; (iii) enrolling communities at many levels for good governance.

The Assembly also approved an initial implementation plan of leadership, team-building and proposal-writing workshops. In this context, the Kingdom of Sweden recently granted financial support for 'Empowering Developing Countries for the Sustainable Use of their Coastal Resources'. This programme, to be implemented over three years, will focus on reducing dependence on external funding and developing scientific capacity focused on issues of priority in the nation and/or region ('self-driven' capacity development). The first leadership workshop was held in October-November for twenty-six directors/senior scientists of marine science institutes. This initial success is being followed up by field visits to assess the impact of the workshop for further emulation in other IOC regions.

The Italian Government signed a contract with the IOC of UNESCO for the ADRIatic sea integrated COastal areaS and river basin Management-EXT project, a joint research and observation effort implemented by the IOC, in collaboration with the Institute Nazionale di Geofisica e Vulcanologia, Ravenna, Italy. The project involves twenty-three leading research institutes in Albania, Bosnia-Herzegovina, Croatia, Italy, Serbia and Montenegro, and Slovenia. The project seeks to extend the experience and knowledge-base generated by the original ADRICOSM network to other Adriatic Countries to continue the implementation of a state-of-the-art monitoring and forecasting system for the marine coastal areas and their adjacent river catchments around the Adriatic Sea. This project is conducted in close coordination with GOOS.

The IOC's traditional capacity-building activities:

Chairs at universities

Links with the four established IOC Chairs were strengthened through:

- Building capacity to assemble and service a satellite transmitter for oceanographic data (Maputo, Mozambique);
- Organization of Summer School on Oceanography and Remote Sensing (Concepción, Chile);
- Organization of an Advanced Leadership Development Workshop in close coordination with the IOC Chair in Maputo (Maputo, Mozambique);
- Participation of four Moscow State University scientists in a field trip to coastal Morocco–Rif region, analysis of data and participation in post-excursion conference.

Travel and research grants were focused on issues concerning the coastal zone, a priority indicated by developing regions, whilst the open ocean training was conducted in collaboration with partners from the Partnership for Observation of the Global Oceans (POGO). A total of twenty-four travel, research and fellowships were awarded: seven individual travel grants for participation in major scientific events: seven research fellowships in partnership with POGO and the Scientific Committee on Oceanic Research (SCOR); seven travel grants to attend the COSPAR capacity-building workshop on satellite oceanography; and three research grants enabling young scientists from developing countries to pursue their careers at leading research institutes.

The Ocean Sciences Training Through Research Programme (TTR) addresses topical cutting-edge science, rooted firmly in developing capacity in young researchers. It is presently investigating geosphere-biosphere coupling processes in relation to the protection of the high seas marine environment, and was successful in securing funds from the Belgian Government and the

European Union project 'Hermes'. The TTR, providing the most direct research experiences for oceanographers, was extended to the Asian region with French and Australian assistance, and coordinated by the University of Sydney. The cruise during 2005 delivered precious training to eight Asian and ten Australian students. Plans are scheduled to site the on-board cruise experience within a longer-term educational post-graduate degree programme.

5. UNESCO/IOC regional ocean sub-portals as part of the UNESCO knowledge portal

The IOC of UNESCO ocean sub-portals for Africa, Latin America and South-East Asia, as part of UNESCO's knowledge portal, aim to facilitate access to information and data on all aspects of ocean/coastal research and management. This is achieved using collaborative websites and distance learning technologies, which form part of UNESCO's knowledge portal efforts. The project will consolidate the foundation laid during its first phase during the preceding biennium, by: (i) increasing the number of content providers to better cover the information needs of all focus audiences; (ii) increasing the ability of partners to communicate their expertise to a non-academic audience; (iii) facilitating access to portal and its information (both on the internet and in other forms); and (iv) improving scientific capacity by e-learning activities.

6. The IOC of UNESCO's Tsunami Programme

UNESCO is actively participating in the international effort to assess the impact of December 2004's tsunami and identify priority needs in the recovery and reconstruction process. UNESCO is focusing in particular on environmental, cultural and educational damage assessment and rehabilitation. The IOC of UNESCO received the mandate to help Member States of the Indian Ocean rim establish a Tsunami Early Warning System. UNESCO's immediate response includes an interim tsunami advisory information system in place under the aegis of the IOC of UNESCO, in cooperation with the Pacific Tsunami Warning Center (PTWC) from the USA and the Japan Meteorological Agency (JMA) from Japan, as of 1 April 2005.

Between May and September 2005, national assessments of sixteen countries in the Indian Ocean were conducted to identify capacity-building needs and support requirements for developing an Indian Ocean Tsunami Warning System (IOTWS). Missions were conducted to each country to meet with national experts from government agencies and non-governmental organizations involved in tsunami or natural disaster management to complete a questionnaire covering all aspects of the tsunami warning and mitigation system. Mission teams were composed of international experts from the IOC of UNESCO, the UN International Strategy for Disaster Reduction/Platform for the Promotion of Early Warning (UN-ISDR/PPEW), the World Meteorological Organization (WMO), and the Asian Disaster Reduction Center (ADRC) and subject matter experts from Australia, China, Finland, France, and the USA. Country teams that participated in the mission discussions included national experts from academic institutions, government agencies, and nongovernmental organizations from each participating country.

The overall regional summary indicates that most countries have established or strengthened their disaster management laws, national platforms, and national and local coordination mechanisms to guide all-hazard disaster risk reduction and to establish clearer responsibilities for end-to-end early warning systems. Not all, however, have specifically addressed the tsunami coordination aspect.

All participating countries receive international tsunami warnings from the Pacific Tsunami Warning Center (PTWC) and the Japan Meteorological Agency (JMA) except Somalia, and most countries receive these warnings at facilities with back-up systems for receiving warning messages that operate 24 hours a day, 7 days a week.

The Twenty-third Session of the IOC Assembly (Paris, 21-30 June 2005) created regional early warning systems for tsunamis in the Indian Ocean, the North-Eastern Atlantic, the Mediterranean and Connected Seas, and the Caribbean Sea and Adjacent Regions. Intergovernmental Coordination Groups are regularly meeting and establishing implementation working plans in the Indian Ocean (ICG/IOTWS), the Caribbean and Adjacent Regions (ICG/CARTWS), the North-Eastern Atlantic, and the Mediterranean and Connected Seas (ICG/NEAMTWS). These are joining the Pacific system (ICG/PTWS, formerly ITSU) established by IOC in 1965.

A year of international cooperation and political will

A global overview of the IOC's advancements in developing Tsunami Warning and Mitigation Systems

DR ULI WOLF
IOC Programme Specialist
Tsunami Unit

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http://ioc3.unesco.org/indotsunami

The Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean (From left to right): Dr Patricio A. Bernal, Executive Secretary, IOC; Hon. Paul Raymond Bérenger, Prime Minister of Mauritius; Hon. R.A. Bhagwan, Minister of Environment and National Development Unit; Mr Salvano Briceño, Director, UN/ISDR.

A call to action

Triggered by an undersea earthquake on 26 December 2004, the strongest tsunami in living memory caused the tragic death of more than 280,000 people. UNESCO, through its Intergovernmental Oceanographic Commission (IOC), took the lead in coordinating activities and immediate action to establish a Tsunami Warning System (TWS) in the Indian Ocean. The response included an interim tsunami advisory information system that is in place under the aegis of IOC's International Tsunami Information Centre (ITIC), which has been cooperating with the Pacific Tsunami Warning Center (PTWC) in Hawaii and the Japan Meteorological Agency (JMA) since April 2005.

The IOC General Assembly XXIII in Paris, 21-30 June, confirmed this initiative by adopting resolutions to create three additional regional Intergovernmental Coordination Groups (ICG) as subsidiary bodies of IOC. Together with the existing International Coordination Group for Tsunami Warning in the Pacific and other relevant UN bodies they are intended to form a global Working Group on tsunami and other ocean hazard related early warning systems.

Planning for effective and durable systems

Between May and September 2005, national assessments of sixteen countries in the vicinity of the Indian Ocean were conducted to identify capacity-building needs and support requirements for the establishment of an Indian Ocean Tsunami Warning and Mitigation System (IOTWS). Several three-day missions were undertaken to each country to meet with national representatives from government agencies and NGOs involved in tsunami or natural disaster management.

During the meetings a questionnaire covering all aspects of a tsunami warning and mitigation system was completed. Mission teams were composed of experts from UNESCO-IOC, the UN-ISDR Platform for the Promotion of Early Warning (UNISDR/PPEW), the World Meteorological Organization (WMO), the Asian Disaster Reduction Center (ADRC) as well as subject matter experts from Australia, China, Finland, France, and the USA. The summary of the regional assessment of the sixteen countries indicates that:

- Most countries have established or strengthened their disaster management laws, national platforms, and national and local coordination mechanisms to guide all-hazard disaster risk reduction and to establish clearer responsibilities for an end-to-end early warning system. Not all of them have specifically

addressed the aspects of tsunami mitigation coordination.

- All participating countries (except Somalia) receive international tsunami warnings from the Pacific Tsunami Warning Center (PTWC) and the Japan Meteorological Agency (JMA). Most countries receive these warnings at facilities with back-up systems for receiving warning messages that operate 24 hours a day, 7 days a week. Few countries operate a national tsunami warning centre or have the capacity to receive or provide real-time seismic or sea level data.
- Few participating countries have developed tsunami emergency and evacuation plans and signage or tested response procedures for tsunamis or earthquakes. There is an urgent need to collect information and data needed to develop these procedures and plans, such as post-event surveys and inundation modelling as well as tsunami hazard and vulnerability assessment.
- Many participating countries have assessed local government capacity for disaster preparedness and emergency response but not community preparedness. Community education and outreach programmes are being developed but are largely not yet in place in most of the countries.
- Most countries have made progress in developing policies, assessing technological needs and establishing coordination mechanisms at a national level for tsunami warning and mitigation. In the majority of cases, local planning and preparedness activities are being carried out first in a small number of selected target areas, or cities and towns, rather than as comprehensive national programmes.

TSUNAMI BULLETIN NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 0404Z 08 OCT 2005

THIS BULLETIN IS FOR ALL AREAS OF THE INDIAN OCEAN.
... TSUNAMI INFORMATION BULLETIN ...
THIS MESSAGE IS FOR INFORMATION ONLY.
AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 0351Z 08 OCT 2005
COORDINATES - 34.8 NORTH 73.7 EAST
LOCATION - PAKISTAN
MAGNITUDE - 7.5

EVALUATION
A DESTRUCTIVE TSUNAMI WAS NOT GENERATED BASED ON EARTHQUAKE AND HISTORICAL TSUNAMI DATA. THIS EARTHQUAKE IS LOCATED TOO FAR INLAND TO GENERATE A TSUNAMI IN THE INDIAN OCEAN.

THIS WILL BE THE ONLY BULLETIN ISSUED BY THE PACIFIC TSUNAMI WARNING CENTER FOR THIS EVENT UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE.
THE JAPAN METEOROLOGICAL AGENCY MAY ISSUE ADDITIONAL INFORMATION FOR THIS EVENT

Tsunami warning bulletins with predicted tsunami travel and arrival times at selected coastal communities alert all participating countries' Designated Warning Centres.

Moving towards completion

A recent evaluation by ISDR and IOC within the UN agencies Flash Appeal projects to strengthen early warning systems in countries affected by the December 2004 tsunami summarizes the following results:

- Excellent progress has been made to establish the core technical elements of a regional tsunami early warning system. This system is on track for initial completion by July 2006.
- Significant progress in awareness raising and capacity-building has been achieved, but much work remains to build the long-term capacities of countries for effective early warning and risk management.
- The ICG/IOTWS provides an inspiring example of an integrating vehicle for supporting the implementation of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disaster.

The ICG/IOTWS stated during its second session in Hyderabad, India, that 28 additional tide gauges and 25 seismic stations will be in place by July 2006. By that date, together with the first 3 out of 60 planned open ocean (DART) buoys and updated communication facilities for data and warning exchange, an initial system will be operating. Neverthe-

less, the complete system, including all the intended instrumentation updates, the installation of all national warning centres, as well as ensuring the effective communication of all warnings to the potentially affected population along the coasts (at the last mile) will not be in place before the turn of the decade. For more information on IOC's Indian Ocean activities see http://ioc.unesco.org/indotsunami.

Courtesy of GFZ Potsdam

Several countries in the region are working on the deployment of deep-ocean tsunami detection instruments – known as DART buoys.

Protecting other regions at risk

In the **Pacific Ocean**, where tsunamis are much more frequent, IOC has been active for more than forty years in ensuring that people living on the ocean's rim receive prompt forecasts and warnings of impending tsunamis through the Pacific Tsunami Warning Centre in Hawaii (PTWC) and the Japan Meteorological Agency (JMA). This fully operational system has proven itself to be effective for many years. Nonetheless, some small islands in the southern Pacific are still not part of the TWS and there is a great need to optimize the sea level system in the southeast Pacific. For more information see http://ioc3.unesco.org/itic.

The first meeting between Member States to establish the ICG for the **North-Eastern Atlantic, the Mediterranean and Connected Seas Tsunami Warning and Mitigation System** took place in Rome, 21-22 November 2005. The meeting confirmed that a European-North African TWS is urgently needed as the Atlantic Ocean, including the Mediterranean, is the second largest source of tsunamis around the globe. Given the short geographical distances between possible sources and coastal target regions of an impact (i.e. in the Mediterranean), a regional TWS for Europe has to rely on a dense net of seismic stations to provide timely forecasts and warnings. The ICG decided to have an initial system in place by end of 2007 and to develop a draft action plan during its next meeting in May 2006 in Paris. See http://ioc3.unesco.org/neamtws for details.

The ICG for the **Caribbean and Adjacent Regions** was established on 10-12 January 2006 in Bridgetown, Barbados. In contrast to other regions the ICG decided to extend the regional TWS into a multi-marine hazard warning system, which should include forecasts on storm surges and even hurricanes. The meeting endorsed the offer made by Puerto Rico to establish the Coastal Hazard Center of the University of Puerto Rico as the interim regional warning centre, which was strongly supported by the PTWC in Hawaii.

For further information see http://ioc3.unesco.org/cartws.

Working towards community preparedness

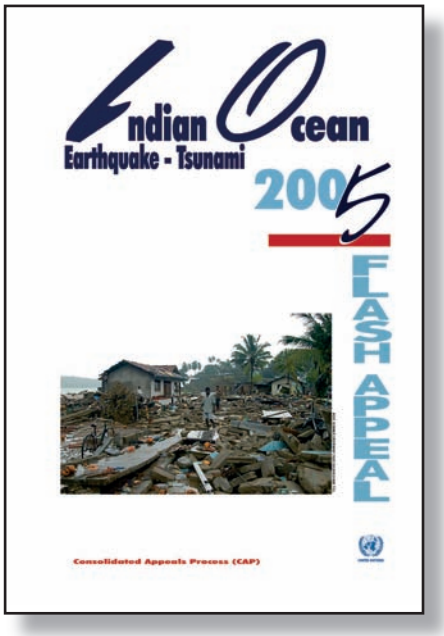
Besides the need for technical equipment and national warning centres, the December 2004 tragedy also highlighted the imperative for ongoing education, information and capacity-building of potentially affected populations on tsunami issues. Schools need to ensure that children are aware of protective measures to be utilized should a tsunami alert be issued. Government authorities need to be endued with appropriate organizational structures to handle potential tsunami situations. The general public needs to recognize the signs of an impending tsunami and to know how to take shelter. Thus IOC's International Tsunami Warning Center in Hawaii, in cooperation with regional NGOs (and last year also in close cooperation with ISDR), has been continuously providing educational material and undertaking training courses for technical staff and the public.

Photo by Dan Caldwell

Schools need to ensure that children are aware of protective measures to be utilized should a tsunami alert be issued.

The IOC achieved the political and technical concensus for building the regional Tsunami Warning and Mitigation Systems described in this report through an intensive series of high profile, international intergovernmental meetings held throughout the past year. For a full summary of these meetings please see page 88.

Nature at its worst; humanity at its best



A provision for the establishment of an early warning system for the Indian Ocean region was included within the UN-launched Flash Appeal, 6 January 2005. Contributions totaling US$11 million were received shortly thereafter. The IOC of UNESCO made a complementary request to the Flash Appeal Mid-Term Review for US$12 million to fast-track the warning system's implementation, which was positively received.

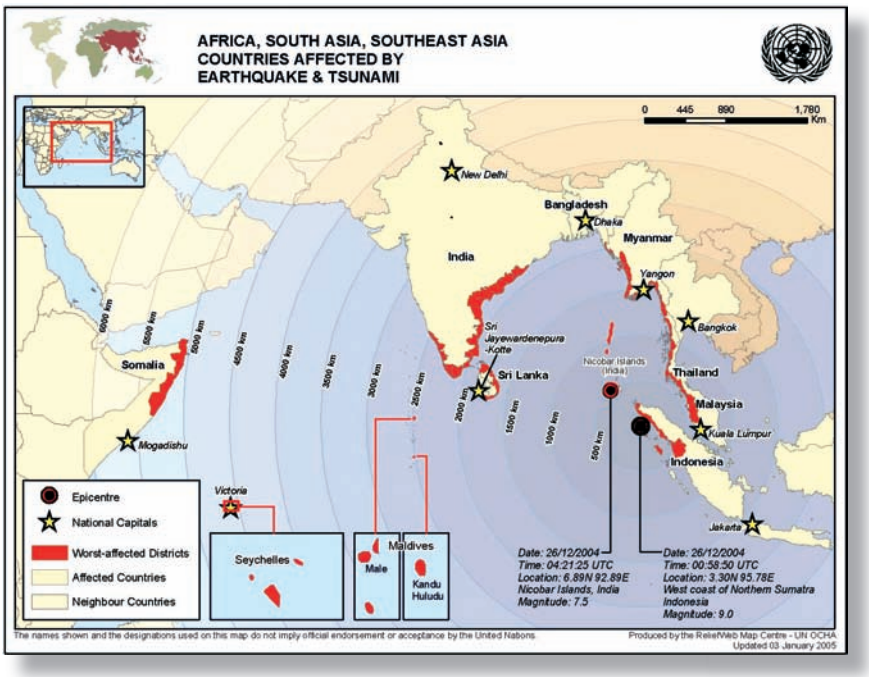
An early warning system for the Indian Ocean

The Indian Ocean earthquake-tsunami, which struck on 26 December 2004, was one of the most devastating natural disasters ever. The response, from every quarter, was swift and extraordinarily generous.

Recognizing the urgency to mobilize efforts and resources towards establishing an early warning system, the **Intergovernmental Oceanographic Commission (IOC) of UNESCO** was invited to take the lead responsibility for the multinational, multi-partner effort to develop the Indian Ocean's regional warning capabilities. During the past year, the IOC has been using its intergovernmental mechanisms and technical networks to mobilize national and regional agreement and action in order to design and build the core elements of an Indian Ocean Tsunami Warning and Mitigation System (IOTWS).

The IOTWS addresses all stages of early warning from initial hazard detection and warning to the final communication of the message to coastal communities at risk and will build up the human and institutional infrastructure to make sure these systems are interoperable and sustainable for years to come.

An interim early warning system is now in place in the Indian Ocean, an



'We must be able to say that we did everything humanly possible to build resilient societies.'

UN Secretary-General Kofi Annan

initial system will be in operation by 1 July 2006 and a nearly completed system should be operational by the end of December 2007.

An outpouring of goodwill and aid

Although the original January 2005 Flash Appeal, 'Evaluation and Strengthening of Early Warning Systems in countries affected by the 26 December 2004 Tsunami' was confined to a sub-set of affected countries, there is now general agreement among most parties, including donors, that an effective early warning and mitigation system needs to involve all countries in the Indian Ocean Region. The Early Warning Strengthening Project therefore will endeavour to encompass all countries, as appropriate to their needs, capacities and risks faced.

The Early Warning Strengthening Project was well received by donors. Substantial resources are being provided by the countries of the region, bilateral donors and many other organizations. These include:

- Generous contributions, amounting to several tens of millions of dollars to support core system development from the governments of:


Australia


Belgium


The European Commission


Finland


France


Germany


Ireland


Israel


Italy


Japan


The Netherlands


Norway


Sweden


The United States of America (coordinated by the U.S. Agency for International Development [USAID]).

- A commitment by the government of India of approximately US$30 million to develop its national system.
- An offer by the government of Thailand of US$10 million to support a multi-partner regional early warning system fund.
- A commitment from the United Nations Environment Programme (UNEP) of US$1 million to support environmental assessments and related activities.
- Through the Early Warning Strengthening Project, channeled by the UN International Strategy for Disaster Reduction (UN-ISDR), financial resources up to US$3,550,000 were provided to the IOC of UNESCO to support early warning related activities.

These activities include, among others, the upgrading of the Indian Ocean sea level gauge network, national assessments and coordination meetings, technical training, information product generation, and the major coordination meetings organized by the IOC of UNESCO in Paris, France, 3-8 March and Grand Baie, Mauritius, 14-16 April. These two coordination meetings were instrumental in laying the foundations for developing the technical specifications and establishing the regional intergovernmental framework for an Indian Ocean Tsunami Warning and Mitigation System.


© Till Mayer/IFRC

A united effort

Developing the Indian Ocean Tsunami Warning and Mitigation System is a challenge of unprecedented proportions, characterized by a spirit of teamwork, inspiration and goodwill, and involving UN agencies, regional and national organizations, NGOs, research institutes, partners in the private sector, and local communities.

The UN Flash Appeal Indian Ocean Earthquake–Tsunami 2005 project 'Evaluation and Strengthening of Early Warning Systems in Countries Affected by the 26 December 2004 Tsunami' involves various key partners:

Key partners

Asian Disaster Preparedness Center (ADPC) Regional organization with regional networks active in disaster preparedness coordination, training, and education.

Asian Disaster Reduction Center (ADRC) Nationally supported by the Japanese Government; responsible for international advocacy and dissemination of information on risk reduction.

The Bureau of Meteorology Australian Tsunami Alert System (BoM of ATAS) Provides regional Tsunami warning services for Australia, based on information from the PTWC and the JMA and Geoscience Australia.

The Preparatory Commission for the Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO) The IOTWS uses the Global Seismic Network and CTBTO stations to locate and size earthquakes and to issue tsunami information to designated national tsunami focal points within 10-20 minutes of the earthquake occurrence.

The International Federation of Digital Seismographic Networks (FDSN) Providing real-time seismic data from more than 150 stations around the world for incorporation into the IOTWS.

International Federation of Red Cross and Red Crescent Societies (IFRC) Coordination and support of national Red Cross and Red Crescent societies; advocating and organizing preparedness activities on national and local level.

The International Maritime Organization (IMO) UN specialized agency responsible for ports, navigational aids and global distress communication management to facilitate the medium and long-term recovery of the affected areas.

Japan Meteorology Agency (JMA) Continuously monitors all seismic activity in Japan and elsewhere 24 hours a day, and issues timely information concerning earthquakes and tsunamis. In 2005, the JMA began operations of the Northwest Pacific Tsunami Advisory Center (NWPTAC), providing supplementary tsunami information for events in and around Japan and the northwest Pacific in close coordination with the PTWC. As of 1 April 2005, the PTWC and JMA began providing interim advisory services to the Indian Ocean.

The Richard H. Hagemeyer **Pacific Tsunami Warning Center (PTWC)** Serves as the regional Tsunami Warning Center for Hawaii and as a national/international warning center for tsunamis that pose a Pacific-wide threat. The PTWC continuously monitors seismic activity and sea levels in the region to determine if tsunamis have been generated, and provides timely warnings to national authorities. As of 1 April 2005, the PTWC and JMA began providing interim advisory services to the Indian Ocean.

United Nations Development Programme (UNDP) Active in development coordination, country project management and promoting the integration of disaster risk planning and preparation into national and regional development programmes.

United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP) UN organization operating on regional level, supporting and coordinating economic and social development issues.

United Nations Environmental Programme (UNEP) UN organization coordinating environmental issues and activities, and establishing technical networks and support of warning systems.

United Nations International Strategy for Disaster Reduction/Platform for the Promotion of Early Warning (UN-ISDR/PPEW) Coordinating disaster risk reduction and early warning activities with the IOC of UNESCO by providing an overall integrated framework for strengthening core system implementation, integrated risk management, public awareness and education and community-based approaches.

United Nations Office for the Coordination of Humanitarian Affairs (UN/OCHA) UN organization operating in several aspects of humanitarian and emergency relief coordination.

United Nations University (UNU) Research and development on issues of concern to the United Nations, with expertise in project design and evaluation of community-based early warning systems.

United Nations Volunteers (UNV) UNV serves as an operational partner in development cooperation at the request of UN Member States, mainly operating on local, community-based and national levels.

The U.S. Agency for International Development (USAID) Leading the U.S. effort, USAID works closely with each of its U.S. agency partners in a number of technical areas, including assessing needs and capabilities in the region, supporting technical training, educational exchanges, and the sharing of best practices.

The U.S. Geological Survey (USGS) USGS is supporting seismic technology transfer to the Indian Ocean region, capacity-building for data analysis, and associated earthquake hazard mapping and modelling related to tsunami hazards.

The U.S. National Oceanic and Atmospheric Administration (NOAA) NOAA is supporting the deployment of detection buoys and related technologies in the Indian Ocean and contribute to designing and developing the regional warning system with the IOC.

Courtesy: NOAA

The Pacific Tsunami Warning Center (PTWC) and the West Coast and Alaska Tsunami Warning Center (WC/ATWC) are operated by the U.S. National Oceanic and Atmospheric Administration National Weather Service.

The West Coast and Alaska Tsunami Warning Center (WC/ATWC) Provides regional Tsunami Warning Center services to the Gulf of Mexico and Atlantic coasts of the USA, and to the west and east coasts of Canada.

The World Meteorological Organization (WMO) UN specialized agency for meteorology ensuring Global Telecommunications System (GTS) support for the IOTWS, in particular for the interim arrangements. In the framework of IOTWS, the GTS is widely used for the real-time transmission of tsunami advisory information and warnings.

IOC's experts

Under the auspices of the IOC itself, numerous tsunami experts, innovative scientists and talented technicians have offered their skills to assist countries in establishing national Tsunami Warning and Mitigation Systems and protect populations from future risks.

Immediately following the disaster, international interdisciplinary teams of scientists, technicians, engineers, and geologists were dispatched throughout the Indian Ocean region to conduct comprehensive field surveys assessing conditions of the areas affected by the tsunami. Some of these teams were funded by UNESCO/IOC. These teams traveled thousands of kilometres to investigate the damage, record interviews with eyewitnesses and gather key scientific information and data. Their findings have been essential in improving our overall analysis and understanding of the tsunami's impact.

The IOC created a tsunami team within the Secretariat in early 2005. This team included Dr Thorkild Aarup (GOOS Project Office), Mr Bernardo Aliaga (ADG Office), Dr Keith Alverson (GOOS Project Office), Dr Laura Kong (ITIC, Hawai) and Mr Peter Pissierssens (Ocean Services). In addition, France kindly made Dr François Schindelé (Chair, ITSU) available as a technical expert for a period of six months (February-July 2005) and Japan provided significant time from the Head of JMA's Tsunami Unit, Mr Masahiro Yamamoto, detailed to IOC as of 30 September 2005. Germany sent Dr Uli Wolf as secondment to the IOC as of 1 November 2005. This team was able to respond rapidly to the considerable demands on UNESCO and its IOC.

Reducing the vulnerability of communities to future disasters

The coordination efforts that the IOC is leading with its partners and the public sector on behalf of the UN system have achieved the political consensus and technical specifications for establishing the regional intergovernmental framework for an Indian Ocean Tsunami Warning and Mitigation System.

By the year 2025 the UN estimates that three-quarters of the world's population will be living in coastal areas. The IOC is coordinating an expanded tsunami network that is just the first step in building a global tsunami warning system to monitor oceans and seas everywhere, designed with the goal of protecting lives, property, livelihoods and ultimately, the long-term stability and development of our society.

Information about the continuing development of the IOTWS is available at http://ioc.unesco.org/indotsunami/

Photo by Agustinus Wibowo

IOC Programme Sections

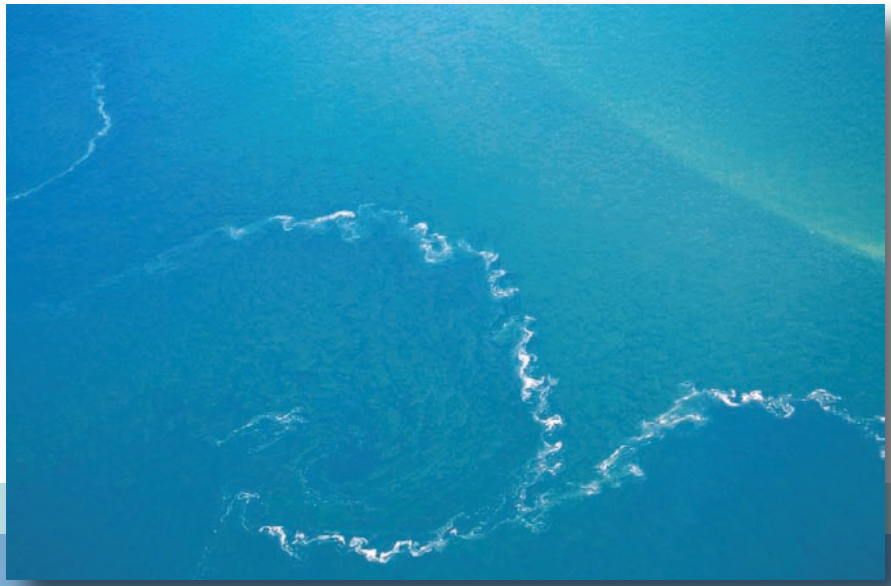


Photo courtesy of kirsten.i.achenbach@gmx.de

ocean science
Programmes Overview

By Umit Unluata, Head of Section

Courtesy of Dr Masao Fukasawa, JAMSTEC

IOCCP Chair Dr Chris Sabine opens the IOCCP-CLIVAR International Repeat Hydrography and Carbon Workshop, Shonan Village, Japan.

The **International Ocean Carbon Coordination Pilot Project (IOCCP),** co-sponsored by the Intergovernmental Oceanographic Commission (IOC) of UNESCO and the Scientific Committee on Oceanic Research (SCOR), and coordinated by the IOC, provides technical coordination to create a global coordinated network of ocean carbon observations required to quantify and understand the ocean's role in the global carbon cycle. The IOCCP was requested in 2005 by national, regional, and global research programmes to expand its remit to include ocean carbon research coordination (not just observations coordination) and also to include the full suite of carbon system parameters (not just CO_2). The Terms of Reference for this expanded project were reviewed and approved by the IOC Assembly in June 2005. In October 2005, the IOCCP held its first meeting of the eight-person Scientific Steering Group (SSG). In conjunction with the first SSG meeting, the IOCCP hosted an International Ocean Carbon Open House meeting at the Seventh International Carbon Dioxide Conference. The Open House brought together seventy participants and ten national, regional, and global programme representatives to share information about major activities and to discuss potential collaborations and coordination needs. In November 2005, the IOCCP co-hosted the 'International Repeat Hydrography and Carbon Workshop' along with the Climate Variability and Predictability programme (CLIVAR) and Japan's Marine Science and Technology Centre (JAMSTEC), where plans were made to develop an international programme for hydrography and carbon measurements based on large-scale integrated science questions and

Taking water samples from a CTD rosette sampler on-board the U.S. research vessel *Thomas G. Thompson* during the P16S hydrographic section from Tahiti to Hawaii. The IOCCP provides an international coordination forum for planning, standardization, and data synthesis for carbon measurements made on-board these hydrographic cruises.

Photo courtesy of Dr Chris Sabine, NOAA Pacific Marine Environmental Laboratory

drawing on all ocean interior measurements and platforms, combining ship-based hydrographic data with data from programmes such as Argo and time series measurements. This meeting also developed plans for the first North Atlantic Synthesis workshop, to be held in June 2006, and established a pilot project, called 'Friends of Oxygen on Argo', to develop a small-scale proof-of-concept array of Argo floats with O_2 sensors. In September 2005, the IOC and SCOR followed up the 2004 international symposium 'The Ocean in a High CO_2 World' with publication of a special issue of the *Journal of Geophysical Research* (Oceans), which contains seventeen peer-reviewed articles presented at the symposium.

The IOC Science and Communication Centres in Copenhagen (Denmark) and Vigo (Spain), through international and regional training workshops in Brazil, Germany, Italy, Kuwait, South Africa and Vietnam, provided individual training and study opportunities to more than a hundred scientists on **Harmful Algal Blooms (HABs)**. A Letter of Agreement was signed with the North Pacific Marine Science Organization (PICES), to establish a partnership in systematically compiling, storing and presenting records on harmful algal events online. PICES has thus joined the nineteen-year-old partnership between IOC and the International Council for the Exploration of the Sea (ICES) on a common database on harmful algal events (HAEDAT). The implementation of the joint IOC-SCOR science programme on the global ecology and oceanography of harmful algal blooms (GEOHAB) came closer to field implementation through two open science meetings on HABs in eutrophic systems (Maryland, USA, March 2005) and in stratified systems (Paris, France, December 2005) respectively. An important activity in 2005 was the Joint ICES/IOC Intercomparison Workshop on New and Classic Techniques for Numerical Abundance and Biovolume of HAB Species – Evaluation of the Cost, Time Efficiency, and Intercalibration methods.

The Global Environment Facility (GEF)/World Bank '**Global Coral Reef Targeted Research and Capacity Building Project (CRTR)**', with the University of Queensland, Australia and the IOC acting as the executing agencies, became operational in late April 2005. This project is a high priority global initiative that will accelerate and refine the science related to the resilience and vulnerability of coral reef ecosystems. It is bringing together over eighty of the world's leading scientists within six working groups. These working groups will focus on four international Centers of Excellence based at four leading international research institutes: the University of Dar Es Salaam, Tanzania; the Universidad Nacional Autónoma de México;

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Bleached coral on reefs off Great Keppel Island in May 2002

the University of the Philippines; the University of Queensland, Australia.

The work of the Bleaching Working Group of the CRTR Project is coordinated by IOC's Ocean Science Programmes. A range of interconnected projects addressing a number of ecological to molecular issues are planned over a period of five years. This will cover a range of activities in the four focal regions, each of these having both research and capacity building objectives.

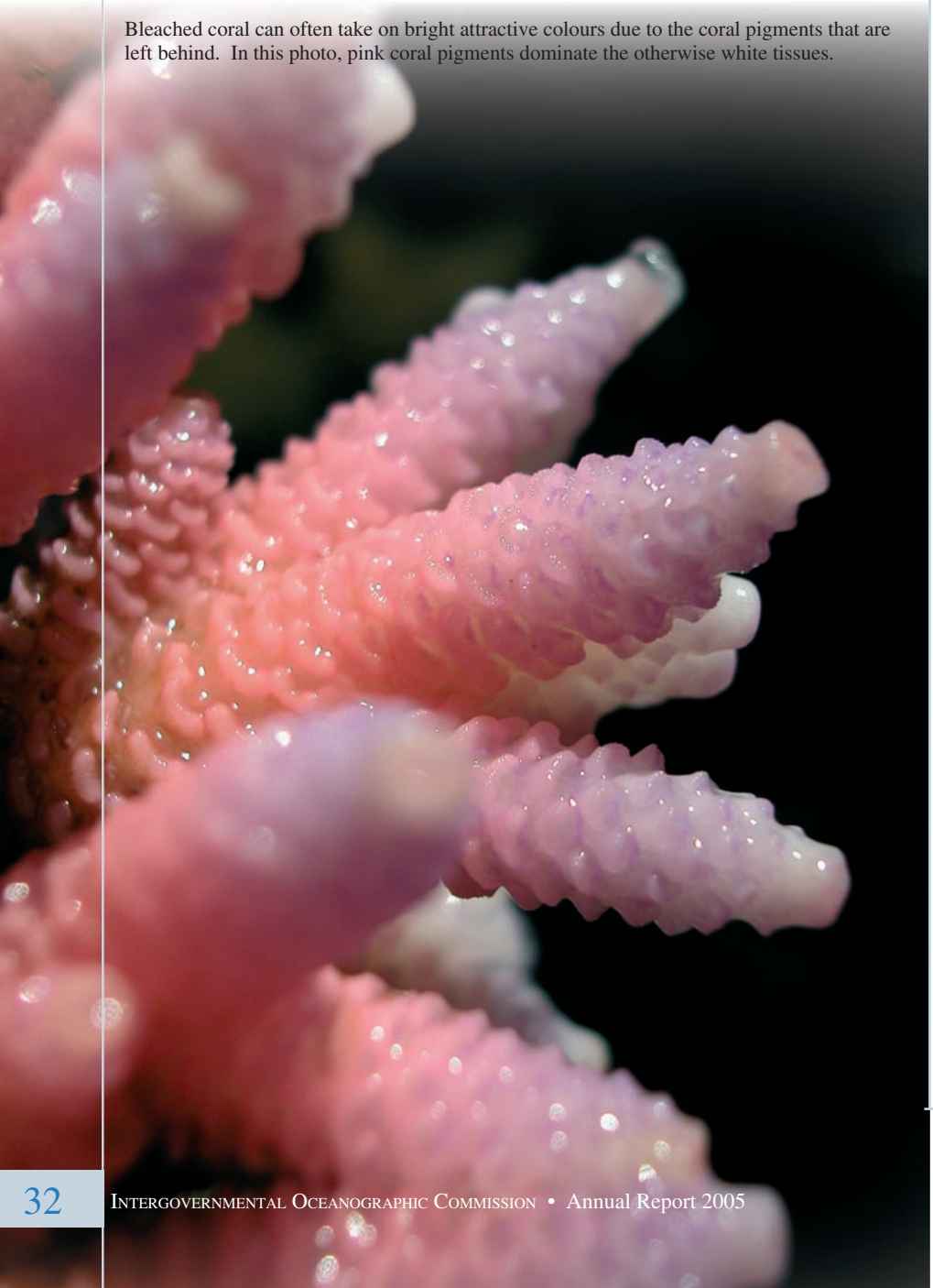
The first regional workshop of CRTR Project took place in May-June 2005 at the Mexican Centre of Excellence in Puerto Morelos. Over sixty leading experts and graduate students participated in discussions, research presentations and experimental work aiming to resolve key aspects of the coral bleaching problem. Topics discussed were the significance of bacterial versus environmental bleaching, the Adaptive Bleaching Hypothesis, new techniques for monitoring physiological change in coral populations, genomic approaches to understanding stress and the efficiency of remote sensing in reef management.

Another Bleaching Group workshop took place at the Australasian Centre of Excellence, Heron Island, in November/December 2005. This workshop focused on scientific exchange on a series of collaborative scientific studies covering ecological consequences of coral bleaching, as well as coral bleaching caused by microbial organisms.

In July/August 2005 the IOC's Ocean Science Programmes supported a three-week specialized training workshop on 'Stress biology of coral reefs' for five Indonesian students from Demarang University at the University of Queensland's Centre for Marine Studies. This activity is expected to facilitate a strong linkage between the two universities.

A 'Beta Version' of the ***Handbook on the Application of Indicators for Integrated Coastal Area Management*** (ICAM) was released in May 2005 for a year's testing by coastal managers in twelve ICAM projects around the world before it is published.

In 2005 the IOC of UNESCO became the Executing Agency for the GEF Project ***'Adaptation to Climate Change - Responding to Shoreline Change and its human dimensions in West Africa through integrated coastal area management'***. Participating countries (Cape Verde, Gambia, Guinea Bissau, Mauritania and Senegal) will develop and implement pilot adaptation activities in response to shoreline involving the development of strategies, policies and measures, based on technical/scientific information and appropriate policy instruments.



Bleached coral can often take on bright attractive colours due to the coral pigments that are left behind. In this photo, pink coral pigments dominate the otherwise white tissues.

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Students examining a core sample during the TTR 15 cruise on-board the R/V *Professor Logachev*.
© DFG-Research Center Ocean Margins

The fifteenth **Training Through Research (TTR 15) cruise** (6 June-5 August) carried out on-board the R/V *Professor Logachev* (Russia) focused on geological processes in the Black and Mediterranean Seas and North Atlantic and on their influence on benthic biodiversity. A new field of carbonate mounds was mapped off Morocco. Many mud volcanoes that form specific ecosystems were studied in both the Black Sea and the Gulf of Cadiz.

The Global Forum on Oceans, Coasts and Islands, with the IOC as a lead partner, organized the **Ocean Policy Summit** in October 2005 in Lisbon, attended by 250 participants. Delegates gathered to discuss the development of national and regional ocean policy guidance as well as capacity-building needs for Small Island Developing States (SIDS).

In 2005 the **Advisory Group for the IOC's Ocean Science Programmes** was formed as a result of discussions at the Twenty-second Assembly and follow-up discussions at the Twenty-third Assembly of the IOC. The Advisory Group is regarded as an ongoing mechanism for providing advice on ocean science activities and specifically to develop advice for the Head of the Ocean Sciences Section on the Ocean Sciences Programme of the IOC. It had its first meeting 9-10 November 2005 at UNESCO Headquarters in Paris.

The Group expressed general satisfaction with the existing elements of the Ocean Sciences Programme and Ocean Sciences Section and noted the overwhelming constraint provided by resources for IOC activities.

The Advisory Group recommended that a restatement of the functions of the Ocean Sciences Section in a form that provides guiding principles for adoption of work and responsibility within the Programme should be developed. The general weakness of the internal and external communication activities and the urgent need to improve communication channels to Member States were noted. The structure of the Programme should be modified so that it clearly shows both the leading strategic objectives and more explicitly reflects the relevance of IOC's mandate and needs of its Member States.

The Advisory Group strongly suggested the incorporation of several new aspects and/or raising the priority of existing actions, including: the impacts of climate variability and climate change in the marine environment and on its living resources and ecosystems; explicit recognition of coastal research as a primary element, including climate impacts; direct anthropogenic influences, integrated coastal management, natural marine hazards and coastal prediction; early introduction of marine assessment as a primary element (subprogramme), with emphasis on the science that will underpin the Global Marine Assessment and its assessment of assessments; and introduction of an underpinning, cross-cutting element in marine modelling.

The Executive Council at its Thirty-ninth Session will be invited to consider the guidance provided by the Advisory group with a view to its utilization in the preparation of the IOC Draft Medium-Term Strategy (2008-2013).

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Many mud volcanoes that form specific ecosystems were studied in both the Black Sea and the Gulf of Cadiz during TTR 15.

The Comparative 'Systems' Approach to Harmful Algal Blooms (HAB) Research[1]

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HAB Programme Coordinator
Ocean Science Programmes

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The Intergovernmental Oceanographic Commission of UNESCO's Harmful Algal Bloom (HAB) Programme aims to understand, predict and mitigate the effects of HAB occurrences. Such events have been associated with fish and shellfish kills, human health impacts and ecosystem damage throughout the world. The IOC publishes the newsletter *Harmful Algae News*, and maintains a number of HAB-related databases.

For further information:
http://www.geohab.info

What are Harmful Algal Blooms?

Marine and fresh waters team with life, much of it microscopic and most of it harmless. In fact, it is this microscopic life on which all aquatic life ultimately depends for food. Microscopic algae also play an important role in regulating atmospheric carbon dioxide (CO_2) by sequestering it during production and transporting it to deeper waters. Yet some of these microscopic 'algae' cause problems when they accumulate in sufficient numbers, due either to their production of endogenous toxins, their sheer biomass, or even their physical shape. These are known as the harmful algae or, when in sufficient numbers, harmful algal blooms (HABs). As with all plankton blooms, their proliferation results from a combination of physical, chemical, and biological mechanisms and their interactions with other components of the food web that are for the most part poorly understood.

HABs have one unique feature in common: they cause harm, either due to their production of toxins or the manner in which the cells' physical structure or accumulated biomass affect co-occurring organisms and alter food web dynamics. Dangerous conditions can also occur when the water is clear with very low cell concentrations if a highly toxic HAB species is present. The term 'HAB' also applies to some non-toxic micro- or macroalgae (seaweeds) that can grow out of control and cause major ecological impacts such as the displacement of indigenous species, habitat alteration, or oxygen depletion in the bottom waters. Most HABs are dinoflagellates, cyanobacteria, or diatoms, or other organisms traditionally referred to as 'algae', but also include other groups of protists that obtain their nutrition by grazing and not by photosynthesis. Thus, the term 'HAB' is operational and not technical, but this distinction is irrelevant in terms of their human health and economic impacts.

The occurrence of certain microalgae is associated with fish and shellfish kills, human health impacts and ecosystem damage throughout the world. The occurrences of these microalgae are collectively referred to as harmful algal blooms (HAB).

The range of toxins produced by HABs is quite extensive, including: brevetoxins, the cause of neurotoxic shellfish poisoning; saxitoxins, the cause of paralytic shellfish poisoning; okadaic acid, the cause of diarrhetic shellfish poisoning; domoic acid, the cause of amnesic shellfish poisoning; azaspirazid, the cause of azazpiracid shellfish poisoning; ciguatoxin, the cause of ciguatera fish poisoning, and numerous others. There are no known antidotes for poison-

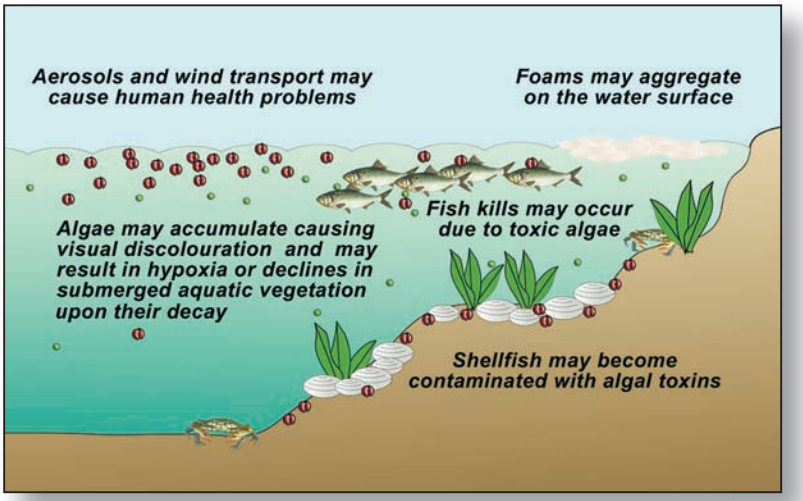


Fig. 1. The impacts of HABs are numerous, and the effects may be felt by many components of the ecosystem.

> Experimental and comparative methods have been referred to as the 'two great methods of science' (Mayer, 1982). To reach valid scientific conclusions, the process of interest should be studied through repeated investigations, preferably over a range of differing conditions. The most direct way to accomplish this is the experimental method, wherein controls are imposed that allow the scientist to systematically vary conditions of interest while holding other factors constant. Marine ecosystems, however, are not amenable to experimental control. One way to address this shortcoming is through the comparative method (Mayer, 1982), which allows the process of interest to be examined on repeated occasions using naturally occurring temporal and spatial variations in existing conditions and phenomena. In this case, the range of natural variability in conditions and mechanisms substitute for controlled experimental treatments.

ings caused by HAB toxins. Illness and death are the direct impacts of HABs on humans, but effects on wildlife are also important. Some fish kills due to HABs can be spectacular in size, with millions of fish and millions of dollars lost to local economies. In addition HABs impact aquaculture industries, and losses can be staggering as the impacted organisms are typically in confined areas and rapidly succumb to toxins or to excessive accumulation of cells. In other areas, tourism, general water quality or drinking water is impacted leading to losses to local or national economies.

The range of factors influencing HABs

Varying forcing functions, including physical dynamics, climate change, nutrient loading, and other anthropogenic influences such as reductions or changes in the grazing community through fishing or aquaculture select for different groups of algae – including HABs – in several distinct oceanographic systems (Figure 2, following pages). This selection and the resulting bloom and population dynamics of those groups are a consequence of these factors and physiological, behavioural, and trophodynamic interactions of HABs with the environment. Once a bloom is initiated, physical processes controlling bloom transport are of paramount importance. Coastal current driven by wind, buoyancy, or other factors can transport blooms hundreds or even thousands of kilometres along the coast, often from one management area to another. Understanding the physical dynamics underlying these transport pathways is essential to effective management and mitigation of HAB effects. A population's range and biomass are affected by physical controls such as long-distance transport, accumulation of biomass in response to water flows and swimming behaviour, and the maintenance of suitable environmental conditions (including temperature and salinity, stratification, irradiance, and nutrient supply). Thus, physical forcings, nutrient supply, and the behaviour of organisms all interact to determine the timing, location, and ultimate biomass achieved by a bloom, as well as its impacts.

The comparative approach

Harmful algal bloom (HAB) research has had a long history in many countries, and further advances in understanding HABs are likely to benefit from international,

> The Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Programme is an international activity aimed at fostering and promoting cooperative research directed toward improving the prediction of harmful algal bloom events. The GEOHAB Programme has been endorsed by the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, and is intended to be of at least 10 years' duration. Scientists working in physical, chemical and/or biological disciplines, or other fields related to harmful algal research, including the development of relevant instrumentation and models, are encouraged to contribute to this programme. Active participation by the widest international representation of the research community will be essential to ensure the success of GEOHAB. See: www.geohab.info

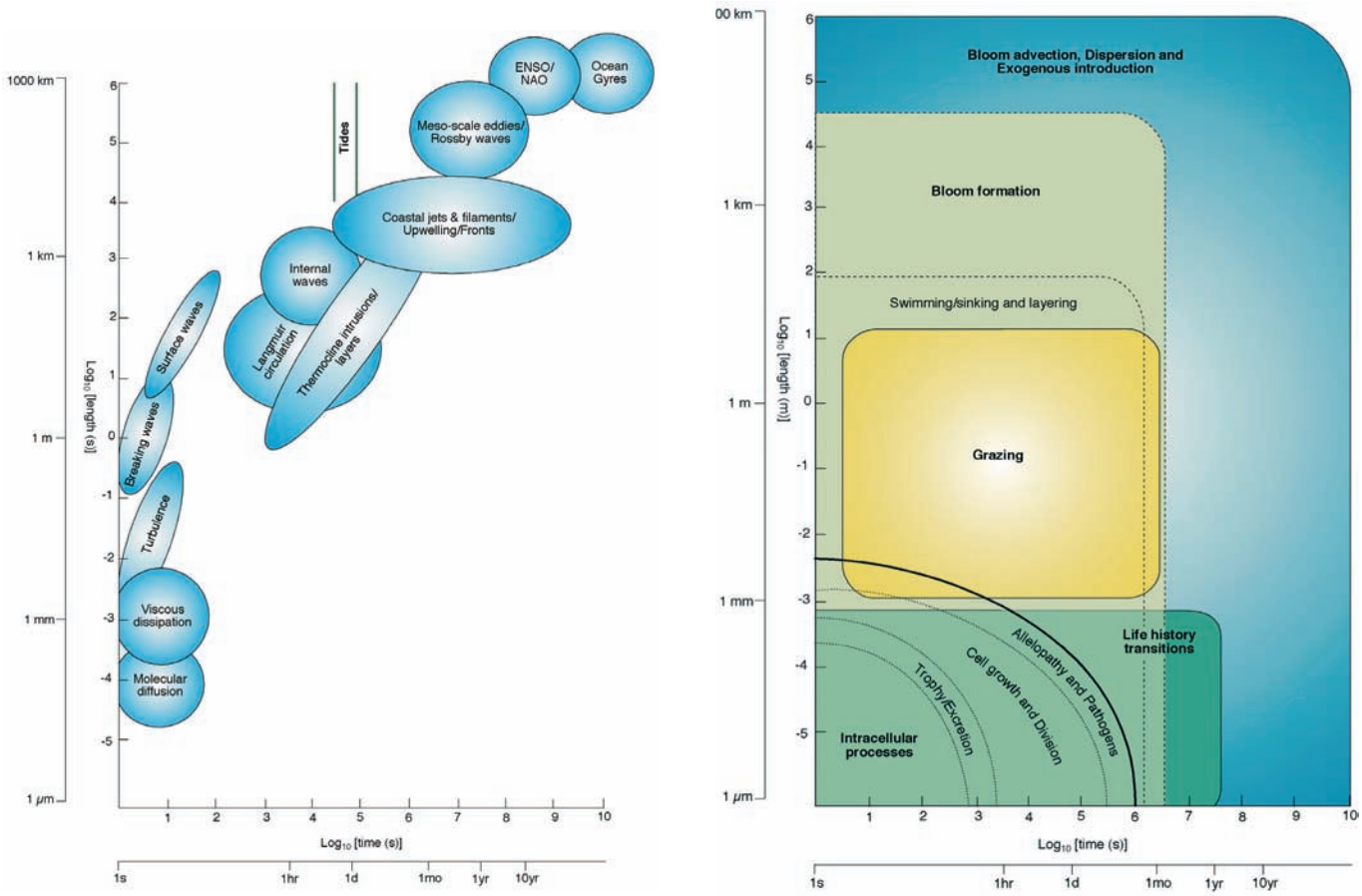


Fig. 2. For some HABs, the physical-biological interactions are dominated by physical processes such as largescale advection and transport phenomena in coastal ecosystems. In other cases, biological factors such as swimming and aggregation behaviour are the dominant processes affecting the distribution of a HAB species. For these reasons, physical and biological processes must be considered from a multi-disciplinary perspective and not in isolation.

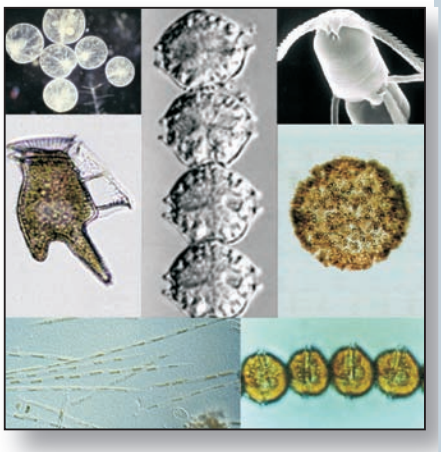


Fig. 3. Many morphological and physiological characteristics of HAB species may be adaptive strategies. Examples shown in this panel include: buoyancy/sinking regulation through adjustment of ion balance, gas vacuoles, colony formation, and spine production, and the use of external wings/rudders and chain formation to optimize swimming capacity.

collaborative efforts that will allow for the assembly and comparison of data collected in different systems. A comparative approach will allow us to generalize previously obtained results and to establish the existence of recurrent patterns. By analysing the response of particular HAB species from similarly functioning ecosystems distributed around the world, it should be possible to tease out significant trends from the noise within any single system. Likewise, similar HAB species can occur in geographically separated and environmentally distinct regions and as a result, may differ in their growth dynamics and expression of harmful attributes. Comparison can reveal fundamental processes governing population development and toxin production.

Furthermore, major anthropogenic and/or natural forcings, such as nutrient loading and climate variability, appear to have differing impacts on HABs in different regions, so understanding this gradient of response may lead to better insight and better management of HAB events.

Harmful algal bloom (HAB) research has had a long history in many countries and further advances in understanding HABs are likely to benefit from international, collaborative efforts that will allow for the assembly and comparison of data collected in different systems

There are, of course, disadvantages to the comparative approach that must be considered when setting up programmes of this type. For example, costs can be high as separate teams of investigators are often required, each with their own equipment and support

needs. Nevertheless, the rationale for comparative studies of harmful algal taxa, functional groups, and the ecosystem in which they occur is compelling and is the approach taken by GEOHAB.

By analysing the response of particular HAB species from similarly functioning ecosystems distributed around the world, it should be possible to tease out significant trends from the noise within any single system.

Central to the implementation of GEOHAB is the establishment of Core Research Projects, which comprise oceanographic field studies in comparable ecosystems through identification of relevant organisms, and measurements of the physical, chemical and biological processes that control their population dynamics. A major objective of Core Research is the integration achieved by the application of models to HAB dynamics in geographically distinct ecosystems. Examples of ecosystem types that could be defined on the basis of hydrographic regimes include:

- Upwelling systems associated with eastern-bound current systems such as the California Current, the Humbolt Current, the Canary Current and the Iberian Coastal System and the Benguela Current;
- Fjords, e.g. in Alaska, Canada, Chile and Scandinavia;
- Coastal embayment systems, found in most coastal countries;
- Thin-layer-producing systems along most coasts, including the Atlantic coast of France, Sweden, California and Washington (USA);
- Systems strongly influenced by eutrophication, such as the Black Sea, Baltic Sea, Adriatic Sea, Seta Inland Sea, and the waters near Hong Kong, and the Mid-Atlantic region of the USA;
- Brackish systems, such as the Baltic Sea or portions of the Chesapeake Bay or the St. Lawrence.

Comparative studies need not be limited to ecosystems. It is also possible to conduct studies on taxonomic groups, or species with common life histories or survival strategies:

- Cyst-forming dinoflagellates, haptophytes, and cyanobacteria that are heavily reliant on the germination of dormant stages for bloom initiation;
- Mixotrophic species (i.e. those that obtain part of their nutrition through consumption of other organisms and compounds).

The above examples are not intended to be comprehensive or exclusive; they demonstrate the latitude that can be followed in comparative studies. During 2004-2005, GEOHAB conducted four major open science meetings where the scientific community was invited to take part in the planning and implementation of GEOHAB Core Research Projects.

Expected advances in understanding

The comparative approach should lead to a number of important contributions to our understanding of HAB dynamics. A few of the benefits from this approach include:

- Identification of the physical oceanographic forcings that play a significant role in bloom dynamics and are specific to particular ecosystem types;
- Models of HAB transport and dynamics in key hydrographic systems that can be used at multiple locales, leading to bloom forecasts and predictions;
- Models of HAB species or functional groups that can be modified for use with other species or groups, and that can be incorporated into physical circulation models for bloom forecasts and predictions;
- An understanding of the dynamics of particular organisms or groups of organisms that can be used in the design and implementation of mitigation strategies.

This comparative ecosystem approach compels the HAB research community to synthesize knowledge and data in order to group HABs into categories based on behaviour, physiology, life history characteristics, or simply an ability to flourish under a particular set of conditions. Since it is not feasible to study all HAB phenomena at all locations, a series of studies targeting comparable ecosystem types, taxa, or functional groups is clearly an efficient use of limited scientific and financial resources.

Moving forward

The HAB problem is significant and growing worldwide and poses a major threat to public health, ecosystem health, as well as to fisheries and economic development. The HAB problem is as diverse as are the underlying mechanisms controlling the blooms. A full understanding of the many biological, chemical, and physical processes that underlie HABs will continue to be a challenge, given the many different species and hydrographic systems involved. Addressing the HAB problem requires the interplay of all oceanographic disciplines, as well as others such as public health and management. Only through recognition of the diversity of these interactions will progress be made towards our goal of scientifically based management of HAB-threatened resources. The development of multi-lateral international programmes such as GEOHAB are bringing scientists together from different countries and disciplines in a concerted attack on this complex and multi-faceted issue.

1 Abridged from 'Special Issue on Harmful Algal Blooms', edited by P. Glibert and G. Pitcher, *Oceanography*, Vol. 18, No. 2, June 2005 and the *Global Ecology and Oceanography of Harmful Algal Blooms*, Science Plan. (2001) P. Glibert and G. Pitcher (eds). SCOR and IOC, Baltimore and Paris. 87 pp.

GOOS operational observing systems Overview

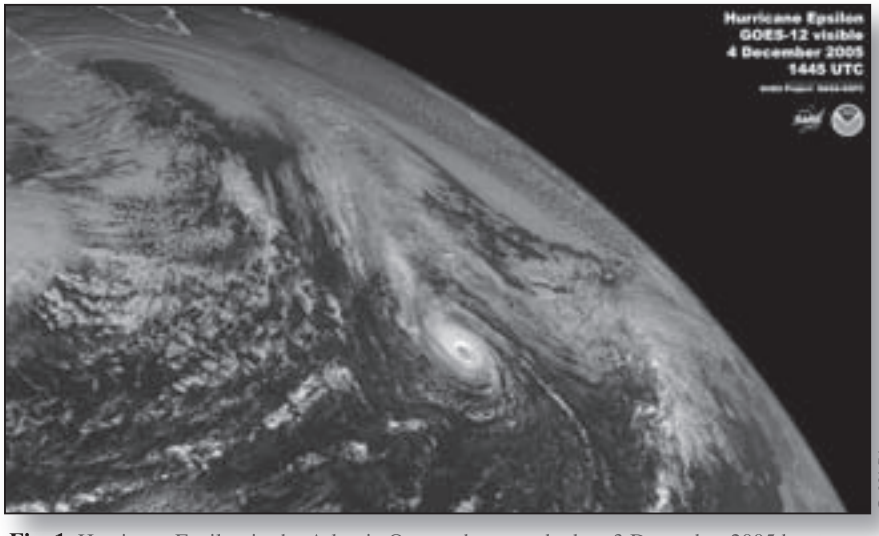
By Keith Alverson, Head of Section

'GOOS is the ocean component of GEOSS'

Vice Admiral Conrad C. Lautenbacher Jr, U.S. Under Secretary of Commerce for Oceans and Atmosphere and GEOSS co-chair, speaking to the 130 Member States of the IOC at their biennial Assembly, 2005

'Ultimately, GEOSS must make the case for, and oversee, an upgrading of systems such as GCOS and GOOS'

Nature, *Editorial, 24 February 2005*



© NASA

Fig. 1. Hurricane Epsilon in the Atlantic Ocean photographed on 3 December 2005 by a crewmember aboard the International Space Station.

The year 2005 was again a remarkable one for operational oceanographers. Just as evidence suggesting a climatic slowdown of the Atlantic meridional overturning was published (Bryden et al., *Nature* 238, 2005) hurricane Epsilon (figure 1) was simultaneously etching its Greek-letter-name into the record books. These events were respectively predicted and diagnosed as a result of the availability of ocean observations, but the prediction of an above normal hurricane season was operational and the suggested slowing of the Atlantic overturning circulation was research. To be effective, the Global Ocean Observing System (GOOS) needs to break down the often cited, but unhelpful, distinction between research and operations. A comprehensive ocean observing system simply cannot exist without the full engagement of the oceanographic research community.

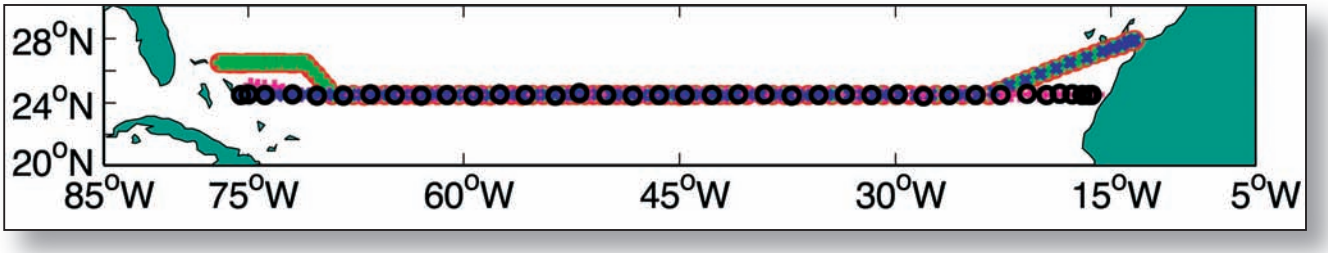


Fig. 2. Station positions for transatlantic hydrographic sections taken in 1957, 1981, 1992, 1998 and 2004. The 1957 and 1992 sections each went zonally along 24.58N from the African coast to the Bahama Islands. Because of diplomatic clearance issues, the 1981, 1998 and 2004 sections angled southwestward from the African coast at about 288N to join the 24.58N section at about 238W. The 1998 and 2004 sections angled northwestward at about 738Wto finish the section along 26.58 N.
Reprinted with permission from Nature. *Bryden, H.L. et al. 2005. Slowing of the Atlantic meridional overturning circulation at 25°N.* Nature, *Vol. 438, pp. 655-657.*

On 2 August 2005 the U.S. National Weather Service called for a '95 percent to 100 percent chance of an above normal 2005 Atlantic hurricane season.' This was the highest confidence they had ever expressed in predicting an above normal season. True to the prediction, the season was indeed far above normal, with a record four Category 5 storms (Emily, Katrina, Rita and Wilma) including the most intense hurricane ever recorded in the Atlantic (Wilma, 882 millibars). The season also included the largest total number of tropical storms on record (27) and the latest ever dissipation of the final tropical storm of the season (Zeta, 6 January 2006). Given the veracity of these predictions, there can be no doubt that climate related hazard predictions based on operational ocean observations are providing substantial and tangible societal benefits.

The reported slowdown of the Atlantic meridional overturning makes an interesting counterpoint. This report was based on five transatlantic hydrographic sections at 25°N carried out by research cruises over the period 1957 to 2004 (figure 2), which appear to show a slowing, by about 30 percent. Along with widespread publicity in the mainstream press, this study drew rather critical comments from some scientists for its dramatic conclusions about a system that is poorly understood, based on five data points, at a single location, spread over five decades. The short and easy answer to such criticisms is no doubt to acknowledge their validity, but also assert that these are the best data at our disposal and thus our best guess as to what is going on.

A more forward looking answer would be to ensure that the ocean observing system we are building will monitor large-scale ocean changes occurring on decadal timescales. Realistically, the scientific research community is, and for many years will continue to be, both the primary provider and primary user of climate related ocean data. Thus, incorporating the research community products in the observing system, and simultaneously designing the system to help address research community hypotheses, will be absolutely critical in ensuring that we can monitor climate change in the oceans. A case in point is the Bryden et al. study. These five hydrographic sections were brought together by a small research team to address a specific hypothesis. This kind of research would surely be a lot easier, and the conclusions substantially more robust, if research vessel tracks and data were seamlessly included in the observing system. The observing system would be a lot richer as well. Research vessels travel far from traditional ship of opportunity routes and take a large number of the highest quality temperature and salinity data available from any source (figure 3). They provide the

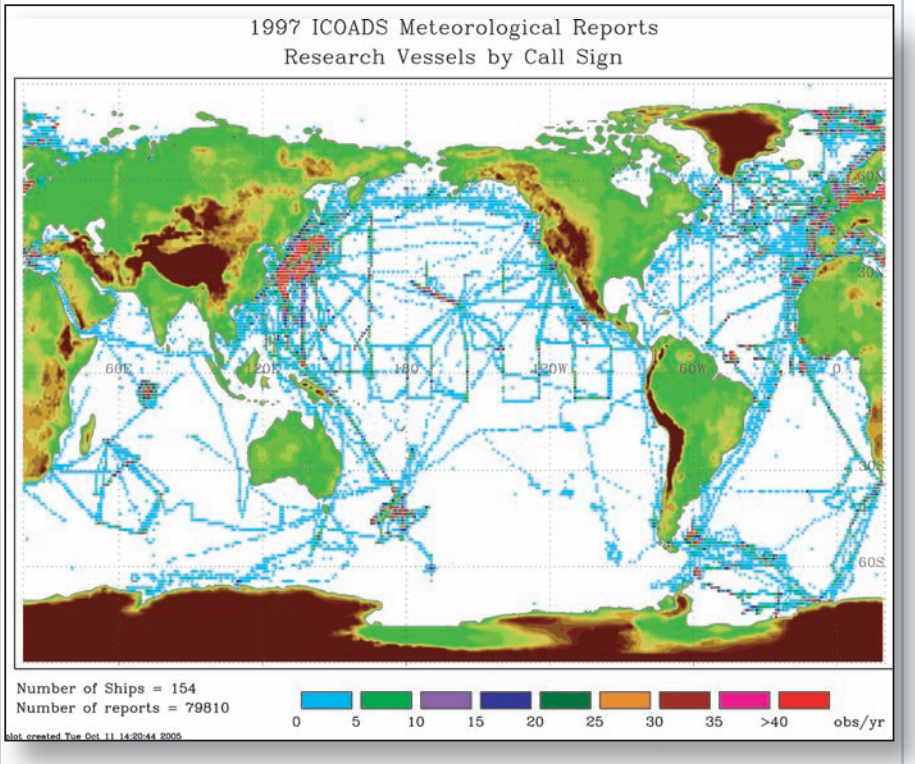


Fig. 3. Number of marine reports from 154 research vessels in the International Comprehensive Ocean-Atmosphere Data Set in one degree bins during 1997.
(Reproduced by permission of the American Geophysical Union, and John Gould, National Oceanography Centre, Southampton, UK. 'Research Vessels: Underutilized Assets for Climate Observations.' EOS, *Vol. 87, No. 22, 30 May 2006)*

only high quality dataset for calibrating Argo floats – now the dominant source of ocean salinity data. The call to enhance the contribution of research vessels to GOOS (Gould and Smith, *EOS*, 30 May 2006) is simply one example of the need to break down the fallacious research-operational divide. But it is a clear one, and one we cannot afford to ignore.

Publications

The Secretariat was active in publicizing the work of GOOS and JCOMM in 2005. Outreach publications included:

Alverson, K. and A. Fischer. The Global Ocean Observing System (GOOS). *IGBP Global Change News*, 61, 12-14, 2005.

Alverson, K. Watching over the world's oceans. *Nature*, 434, 19-20, 2005.

Fischer A. Watching the oceans for signs of climate change. *A World of Science*, 4:1, 2-8.

The Secretariat also published a number of reports in the past year. Highlights included:

Progress with the initial ocean climate observing system: A report to the UNFCCC, GOOS Report 146, 2005.

An Implementation Strategy for the Coastal Module of GOOS. GOOS Report 148, 2005.

Coastal Theme Report of the Integrated Global Observing Strategy (IGOS), 2006.

A full list of publications is available on the GOOS and JCOMM websites: http://ioc.unesco.org/goos and http://ioc.unesco.org/jcomm

Meetings

A number of meetings were organized within the Operational Observing Systems Section in 2005. Highlights included:

- Eighth meeting of the GOOS Scientific and Technical Committee (GSSC), 21-28 February, Australian Bureau of Meteorology, Melbourne, Australia;
- Seventh meeting of the Intergovernmental Committee for GOOS (I-GOOS), 4-7 April, UNESCO/IOC headquarters, Paris, France;
- Tenth Session of the Ocean Observations Panel for Climate (OOPC) 9-12 May, WMO Headquarters, Geneva, Switzerland;
- Second Session of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology, 19-27 September, Halifax, Canada.

Reports from these and all other meetings coordinated by, or participated in by, the Operational Observing Systems Section are available on the GOOS and JCOMM websites: http://ioc.unesco.org/goos and http://ioc.unesco.org/jcomm

Links with Partner Programmes

The Operational Observing Systems Section continues to participate actively in joint activities with a number of partner organizations. Highlights from 2005 included:

GOOS took on the role of co-leading (with NASA/Jet Propulsion Laboratory) a review and update of the Integrated Global Observing Strategy Partners (IGOS-P) ocean theme.

GOOS and JCOMM have been active as oceanic contributions to the Global Earth Observing System of Systems (GEOSS).

JCOMM, and in particular the JCOMM-II Session (see meetings), continues to constitute an important cooperation with the World Meteorological Organization (WMO).

A sea of changes for GOOS

By Keith Alverson, Director of GOOS Project Office.

In June 2005, by Resolution XXIII-5, the Twenty-third IOC Assembly adopted new terms of reference governing the GOOS Scientific Steering Committee (GSSC) and the Intergovernmental Committee for GOOS (I-GOOS). Through this Resolution, substantial clarity in the governance and guidance of GOOS was achieved. I-GOOS was given the overall responsibility for promotion, planning and coordination of GOOS, while the GSSC has the responsibility for providing scientific and technical advice to I-GOOS. Finally, the I-GOOS Board was set up, consisting of the chair and vice-chairs of IGOOS and the chair of the GSSC, to provide guidance and advice on the implementation of the decisions of I-GOOS during the inter-sessional period. The newly formed I-GOOS board (figure 1) has quickly and effectively established a clear executive guidance and leadership for GOOS.

GOOS can point to three major accomplishments in 2005. First, the open ocean observing system for climate is now more than 50 percent complete. Second, the coastal ocean observing system strategy and implementation plans were endorsed and published. Finally, and most importantly, relevant components of the observing system, specifically tide gauges, are now providing data in real time to operational hazard warning centers, a tangible societal benefit from GOOS.

For the coming year GOOS has a number of challenges to face. *Nature*, among others, has called for enhanced support for GOOS calling the system 'chronically underfunded' (*Nature* 433, 785; 2005). *Nature* also specifically called for the need for 'global' and 'sustained' monitoring of the ocean in a second editorial entitled 'the circulation challenge' (*Nature* 439, 244; 2006). Heeding these calls will require three future successes. First and foremost that the Member States of IOC support the development of I-GOOS as a robust commitments mechanism to efficiently take stock of individual national efforts and increase resources available for coordination. Second, GOOS will need to vastly increase its efforts to reach out to, and build capacity for, a much wider range of potential contributors and users of the system than have heretofore been identified. This biennium, for the first time, the Secretariat has allocated a small budget for outreach and communication. Finally, the GOOS Regional Alliances will need to be developed as implementation bodies for coastal GOOS including clarifying a global coordination mechanism amongst them.

These future challenges have been quantified as two 'expected results' with associated 'performance indicators', 'means of verification', and 'benchmarks' within the UNESCO Performance Based Management System as follows:

- **Expected Result 1**: Increased Member State contributions to operational open ocean observing systems.
- **Performance Indicator**: 20 percent increase in national commitments to GOOS and its Ocean Observing Panel for Climate (OOPC).
- **Benchmark**: Initial GOOS commitments meeting report, June 1999.
- **Means of verification**: I-GOOS VIII report in 2007.

- **Expected Result 2**: Establishment of clear principles and guidelines for GOOS Regional Alliances (GRAs) as the primary implementation bodies for coastal GOOS.
- **Performance Indicator**: Functionality of GRAs as a synergistic global implementation mechanism.
- **Benchmark**: Somewhere very close to zero.
- **Means of verification:** Outcome, outputs and level of follow-up to GOOS regional forum to be held in November 2006 and degree to which COOP plan is implemented by GRAs.

Fig. 1. Members of the new I-GOOS Board. From left to right: Mary Altalo (USA), Keith Alverson (Secretariat), Francois Gérard (France), John Field (South Africa), Kouadio Affian (Ivory Coast), Lin Shaohua (China).

THE INTERGOVERNMENTAL GROUP ON EARTH OBSERVATIONS (GEO):

Ocean community contributions to and benefits from GEO

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The Intergovernmental Group on Earth Observations (GEO) is compiling worldwide efforts of Earth observations to build a Global Earth Observation System of Systems (GEOSS) over the next ten years, to 'realize a future wherein decisions and actions for the benefit of humankind are informed via coordinated, comprehensive, and sustained Earth observations'. The purpose of GEOSS is 'to improve monitoring of the state of the Earth, increase understanding of Earth processes, and enhance prediction of the behaviour of the Earth system.' (GEOSS 10-Year Implementation Plan). GEOSS will work with and build upon existing national, regional, and international systems to provide comprehensive, coordinated Earth observations from thousands of instruments globally, transforming the data they collect into vital information for society.

In 2006, GEO is to start putting the GEOSS 10-Year Implementation Plan into effect by means of the Annual Work Plan. It addresses primarily the two-year targets of the 10-Year Plan with the understanding that many of these two-year targets were designed as first steps in support of the subsequent six-year and ten-year targets.

GEO programme activities will cover all nine societal benefit areas and five transverse areas identified in the 10-Year Plan. Nine societal benefit areas were identified in the following areas of:

(1) Disasters
(2) Human health
(3) Energy resources
(4) Climate variability and change
(5) Water-resource management
(6) Weather
(7) Ecosystems
(8) Agriculture and combating desertification
(9) Biodiversity.

Transverse activities are those 'cross-cutting' activities that make up the technical approach of GEOSS across societal benefit areas, comprising:

(1) User engagement
(2) Architecture
(3) Data management
(4) Capacity-building
(5) Outreach.

GEO members and participating organizations are engaged at the local, national, and regional level to realize the vision and deliver the benefits of comprehensive and coordinated Earth observations.

By Resolution XXIII-1, the Intergovernmental Oceanographic Commission (IOC) of UNESCO recognized the relevance to GEOSS of IOC's programmes, experience and expertise, and the roles and responsibilities of other intergovernmental organizations. It also recognizes the systems and programmes for ocean observations under the leadership of the IOC, and in particular, the Global Ocean Observing System (GOOS) as a crucial component of the 'system of systems'.

In cooperation with the scientific community concerned and other ocean-related organizations, the IOC provided expert advice in the drafting of the 10-Year Implementation Plan and the 2006 Work Plan, focusing on enhancing the capacity of existing ocean observation systems. The ocean community felt a need for strong representation of the ocean aspects in GEO and better coordination in the interaction of ocean-related international bodies with GEO. During the second meeting of GEO (GEO II, Geneva, Switzerland, 13-15 December) the representatives of GOOS, the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM0, the Partnership for Observation of the Global Oceans (POGO) and IOC decided that IOC should formally be the 'ocean voice' in GEO. It was also

decided, for better coordination of the input to the GEOSS implementation, to set up a discussion group of experts and representatives of organizations/programmes with an ocean mandate (named as the Ocean-United forum) to share information and continue online discussion about ongoing issues. Participants in Ocean-United were to:

(i) Share information on GEO-related activities and plans within their programmes
(ii) Contribute to GEO through consolidated and integrated input, under the coordination of IOC
(iii) Provide a direct link to each programme/organization, so as to concretize activities within the GEO framework.

More than fifteen major programmes committed to ocean observations are now participating in this forum.

In the development of the 2006 Work Plan, the Ocean-United forum provided the GEO with two proposals: (i) to undertake a 'gap analysis' of GEOSS vis-à-vis GOOS (as proposed at the Ninth Session of the Global Ocean Observing System Scientific Steering Committee (GSSC) 6-8 March, Paris, France), and; (ii) a proposal on a pilot project by the GOOS Coastal Panel, on chlorophyll observation through satellite ocean colour observations. POGO and GOOS have expressed their willingness to take the lead of these initiatives, within the framework of the GEOSS Architecture and Data, and Capacity-building and Outreach activities, respectively. These proposals would be contributions to GEO from the ocean community, and at the same time, possible areas of activity in which GEO could contribute to ongoing/planned ocean observations.

Report on the Second Session of the WMO/IOC

Joint Commission for Oceanography and Marine Meteorology (JCOMM)

CANDYCE CLARK
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The Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) coordinates, regulates and manages a fully integrated marine observing, data management and services system that uses state-of-the-art technologies and capabilities. It is responsive to the evolving needs of all users of marine data and products, and includes an outreach programme to enhance the national capacity of all maritime countries. It works closely with partners including: the International Oceanographic Data and Information Exchange (IODE), the Global Ocean Observing System (GOOS), and the Global Climate Observing System (GCOS).

For more information:

http://ioc.unesco.org/jcomm/

JCOMM-II

The Second Session of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) took place in Halifax, Nova Scotia, Canada, 19-27 September 2005, hosted by the Canadian Government. It was preceded by a scientific conference – Operational Oceanography and Marine Meteorology in the Twenty-first Century.

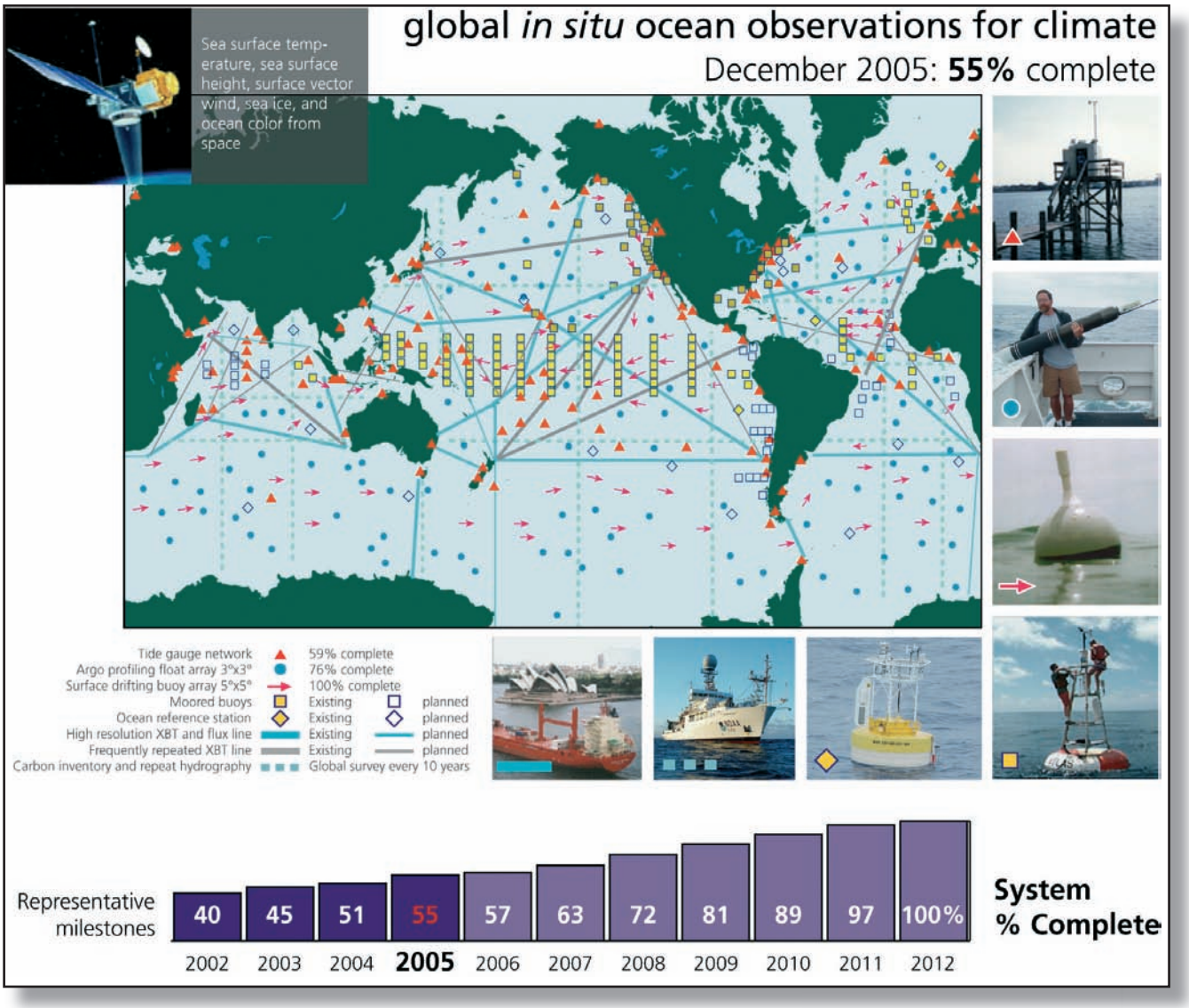
Overall, the Conference was a great success, with very positive support for the concept, role and future development of JCOMM.

The conference was followed by the deployment of surface drifter no. 1250 on 18 September 2005 from the Tall Ship Silva near Halifax, with a special ceremony to commemorate this significant milestone. With this deployment, the global drifting buoy array achieved its design goal of 1250 data buoys in sustained service, becoming the first GOOS component to be fully implemented.

Above: The Data Buoy Cooperation Panel (DBCP) deployed Global Drifter 1250 near Halifax Harbour from the vessel, Tall Ship Silva. A special ceremony and celebration was held in association with JCOMM-II to commemorate this historic event. With this deployment, the global drifting buoy array achieved its design goal of 1250 buoys in sustained service, and thus completed the first component of the initial Global Ocean Observing System (GOOS). It has taken ten years to reach this milestone since the international community began implementation of GOOS in 1995.

Below: A special ceremony for a milestone buoy. (From left to right) Dr Peter Niiler (Director, Joint Institute for Marine Observations, Scripps Institution of Oceanography), Mr Mike Johnson (Coordinator, JCOMM Observations Programme Area), Dr Worth Nowlin (Chair, former Ocean Observing System Development Panel), Mr Michel Jarraud (Secretary-General, World Meteorological Organization), Dr Patricio Bernal (Executive Secretary, Intergovernmental Oceanographic Commission), Dr Savi Narayanan (Co-President JCOMM), Mr Larry Murray (Deputy Minister, Department of Fisheries and Oceans), Canada.

Photos courtesy of Philippe Dandin



Status of the global *in situ* ocean observations for climate in December 2005. The global climate component of GOOS comprises a composite network of satellite and *in situ* measurements of surface and subsurface parameters. The *in situ* network was 55 percent complete at the end of 2005, and will require substantial investment to reach its goal of 100 percent by 2012.

Courtesy JCOMM OPS

JCOMM-II General Session

Participation in the Session was very similar to that at JCOMM-I in Iceland – around 125 participants from forty-two Members/Member States and a number of international organizations and programmes. However, it was noticeable that the overall level of and participation in the discussions was significantly enhanced from JCOMM-I, which indicates a growing understanding of and involvement with the JCOMM concept. At the conclusion of the opening ceremony, JCOMM Outstanding Service Certificates were awarded to Mr Val Swail, Canada, and Dr Neville Smith, Australia.

Scientific Input and External Interactions

The relationship and interactions between JCOMM and both GOOS and the Global Climate Observing System (GCOS) (and the Ocean Observations Panel for Climate, OOPC) in deep ocean physical oceanography and climate are now well-established and effective, with the ocean component of the GCOS Implementation Plan (GCOS 92) having been adopted by JCOMM as the scientific basis for its operational ocean observing system. The interaction of JCOMM with the non-physical and coastal components of GOOS, however, is less clear. While it was generally agreed that JCOMM can and should take on the implementation of the major physical components of the GOOS Coastal Implementation Plan, when the requirements for these are clearly defined and established (e.g. through pilot projects), the same is not necessarily true for non-physical elements, which may be better suited to implementation through the GOOS Regional Alliances (GRAs).

Two very topical issues, which engendered substantial discussion, were natural

disaster prevention and mitigation, specifically related to tsunami and other marine multi-hazard warning systems, and the Global Earth Observation System of Systems (GEOSS). It was recognized that the existing JCOMM expertise in services (e.g. storm surges and waves), observing systems (sea level, ocean data buoys), and warning dissemination mechanisms (marine meteorological warning services) could best be utilized in the context of a comprehensive marine multi-hazard warning system.

While JCOMM has already achieved some recognition within GEOSS, in the context of being an implementation mechanism specified in the GCOS Implementation Plan, the Commission felt the need to enhance this recognition, both in the Group on Earth Observations (GEO) and at the national level. There was an understanding that GEOSS holds potential benefits for JCOMM and its programme for resources but more importantly in standardization, coordination and data exchange; however to gain these benefits JCOMM will need to have a higher profile in the process.

Programme Areas

The core business of JCOMM takes place within the Programme Areas and there was a clear recognition that the work is progressing well, with broad satisfaction with past achievements and ongoing activities. Highlights included:

(i) The surface buoy network is now essentially complete. Overall, the ocean *in situ* observing system is some 55 percent implemented, with the JCOMM plan driving to full implementation, in principle by 2010;

(ii) There is close ongoing interaction with pilot projects and experimental systems such as Argo, OceanSITES, International Ocean Carbon Coordination Project, etc;

(iii) A successful integration of ship-based observations (the Voluntary Observing Ships programme, VOS; the Automated Shipboard Aerological Programme, ASAP; the Ship Of Opportunity Programme, SOOP) is taking place under the new Ship Observations Team;

(iv) JCOMM has agreed to a re-engagement with the concept of bulk purchase of consumables for ocean observations, initially expendable Bathythermographs (XBTs), but with possible extensions to other types;

(v) The value and further development of JCOMMOPS as a major technical information and support portal for *in situ* ocean observing systems is clearly recognized;

(vi) The practical coordination and cooperation between JCOMM and IODE is now almost seamless. Similarly, interaction with the World Meteorological Organization Information Systems (WIS) is developing well;

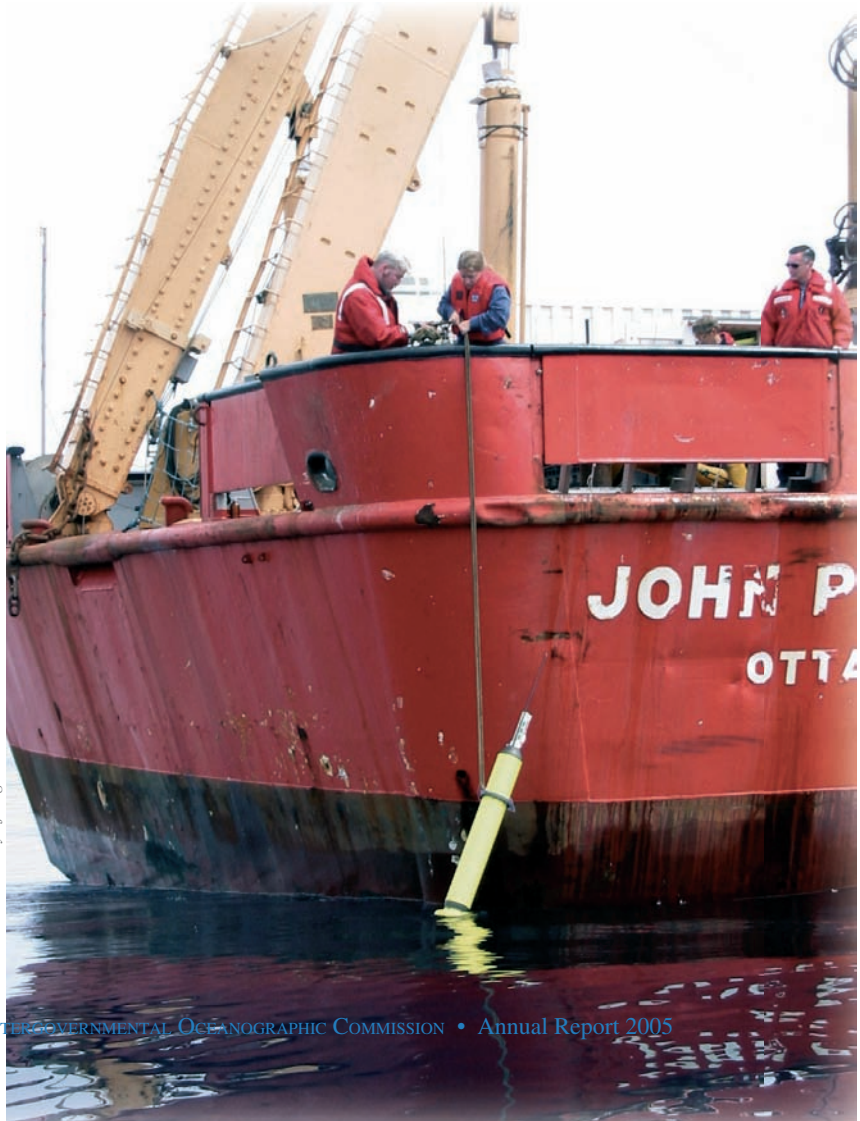
(vii) The SEACAMP Project is finally operational;

(viii) The Sea Ice Team is preparing a substantial input to the International Polar Year (IPY);

(ix) The Global Maritime Distress and Safety System (GMDSS) is operating smoothly, with the new website increasingly utilized. There are some ongoing technical issues, including in particular the possible transmission of graphics over Inmarsat, as a part of the GMDSS services;

(x) The Marine Pollution Emergency Response Support System (MPERSS) is now operational, a new standing Expert Team established, and an embryo website developed;

JCOMM interacts with international projects such as Argo, a major component of the oceans observing system, deploying approximately 3,000 profiling floats around the world.



Courtesy of Argo-Canada

(xi) Outline of a guide to storm surge forecasting has been prepared. The finalization of this guide is a priority for the new intersessional period.

A major new area of work for JCOMM in the next intersessional period, which was the subject of considerable effort and discussion in the lead up to and during the Session, relates to operational oceanographic products and services. JCOMM adopted a recommendation that proposes a number of specific issues and topics for the Commission to work with the ocean modelling and research community, in particular the Global Ocean Data Assimilation Experiment (GODAE), to help transition from pilot projects to true operational oceanography. These include standardized formats, protocols, procedures and nomenclature for the operational delivery of ocean data, products and services, as well as, more generally, the building of the business case for operational oceanography.

JCOMM Development

The Commission approved, with some amendments, the draft JCOMM Strategy Document, and agreed strongly on the need for the preparation of an accompanying Implementation Plan. The Commission also agreed on the need for the preparation and implementation of a JCOMM Communications Plan, to provide a coherent and directed approach to communications and outreach.

The observations programme area has already developed extensive observing system performance monitoring, with the results available through JCOMMOPS. The Session agreed that JCOMM should now implement a full system-wide performance monitoring, based on the Implementation Plan, with clear objectives, milestones, timelines, performance indicators, etc. This will be valuable in a number of ways, including for WMO and IOC Secretariat programme performance monitoring and for the full internal review of JCOMM, planned to take place prior to JCOMM-III.

Structure and Nominations

Two new Co-Presidents were elected at the session. Peter Dexter (Australia) is now Co-President for meteorology, to replace Johannes Guddal, while Jean-Louis Fellous (France) has become the Co-President for oceanography, replacing Savi Narayanan. The new Programme Area Coordinators are Craig Donlon (UK), Services, Mike Johnson (USA), Observations, and Robert Keeley (Canada), Data Management. There is no longer a separate Programme Area for Capacity Building, with this work now to be undertaken by a cross-cutting team comprised of specialist rapporteurs within each of the other Programme Areas. It is hoped that this will allow the JCOMM capacity building activities to be more directly related to the technical work areas of the Commission. There is also a new, cross-cutting task team of experts on satellite data requirements. As with the capacity building rapporteurs, members of this satellite team will also work directly with the three programme areas.

Closing

The Commission noted with appreciation the formal offer by Morocco to host JCOMM-III in 2009. During the closing ceremony, there were many tributes paid to the outgoing Co-Presidents. Johannes Guddal has been with the former Commission for Marine Meteorology (CMM), and subsequently JCOMM, for more than twenty years, and has made significant contributions to the marine community throughout that time. Savi Narayanan made an enormous positive impact during her four years with JCOMM, but sadly her new senior position in Canada made it difficult for her to find the time required to devote to a second term as Co-President.

Coming Intersessional Period

The coming intersessional period promises to be a very busy one, with great expectations for it to be very productive. Priority issues for the next four years include:

(i) The further development of oceanographic products and services, and the transition to operational oceanography;
(ii) An enhanced involvement in and support for natural disaster prevention and mitigation and marine multi-hazard warning systems;
(iii) Full implementation of the ocean observing system and its long-term maintenance on an operational basis, including existing pilot projects such as Argo and the key ocean satellite missions;
(iv) An active engagement with the GOOS community in the implementation of the GOOS Coastal Implementation Plan;
(v) Substantial enhancement of JCOMM data management and its integration with IODE and WIS;
(vi) A greater involvement of smaller maritime countries, in particular, in the work of the Commission;
(vii) An engagement with the private sector in support of the implementation of the JCOMM work programme and of operational oceanography in general.

As is the case everywhere, this work will only be accomplished through the investment of resources, both financial and human. A certain amount of such resources is available through the Secretariat, but this is by no means sufficient to achieve everything we hope and plan for. The Commission is therefore looking to all its members, and their home institutions and countries, to contribute to the realization of its ambitious but vitally important role in support of IOC and WMO and their programmes.

JCOMM Co-Presidents, past and present, Halifax 2005 (from left to right: Dr Peter Dexter, Dr Savi Narayanan, Mr Johannes Guddal, Dr Jean-Louis Fellous).

THE IOC COORDINATED INDIAN OCEAN TSUNAMI WARNING SYSTEM:
Upgrading GLOSS stations in the Indian Ocean

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The Intergovernmental Oceanographic Commission (IOC) of UNESCO is coordinating the upgrade of the Global Sea Level Observing System (GLOSS) network of tide gauges in the Indian Ocean. The upgrade is taking place through national concerted actions and under bilateral or multilateral arrangements (Figures 1a and b). In addition to the GLOSS network upgrades, some nations are upgrading their denser national sea level station networks to enhancing national early warning systems.

IOC contributes directly to the sea level station upgrade work in three ways: First, through a contract with the University of Hawaii Sea Level Center (UHSLC) to upgrade seventeen gauges in the Eastern and Central Indian Ocean; Second, through the ODINAFRICA programme that has targeted five stations in the Eastern Indian Ocean for upgrade; and third, through direct provision of equipment from the GLOSS programme to Mozambique, Pakistan and South Africa.

UHSLC is currently working to install, upgrade, and maintain multiple-use tide gauge stations for tsunami warning in the Indian Ocean on behalf of the IOC. During 2006, seventeen GLOSS stations will be upgraded. The UHSLC is also working with the Asian Disaster Preparedness Center (ADPC) and the U.S. agency, the National Oceanic and Atmospheric Administration (NOAA) to install an additional twelve stations in the region. Following a one-year installation phase, the UHSLC will remain involved with local technicians with the ongoing maintenance of the stations.

The value of the GLOSS stations for tsunami warning was demonstrated during the December 2004 tsunami. The GLOSS stations in operation were among the few measurement platforms in the Indian Ocean capable of providing near real-time observations of the devastating event. Although most of these stations employed float gauges designed for sea level monitoring, all successfully recorded the arrival of the first tsunami wave, and only two failed to collect data for the duration of the event due to sensor malfunction. A typical time series from a tide station in the Maldives (Figure 2) shows the dramatic increase in water level with the arrival of the first wave, followed by progressively weaker oscillations of an approximately 40-minute period. The tsunami arrival coincided with low or mid-tidal height at this location. The impact of the tsunami would have been even greater had it arrived at peak high tide. GLOSS stations also suc-

Fig. 1. Left) Map showing the timeline for Indian Ocean sea level station installations. Right) Map showing which organization has taken responsibility for upgrading the Indian Ocean sea level network; *All images courtesy of Mark Merrifield, UHSLC*

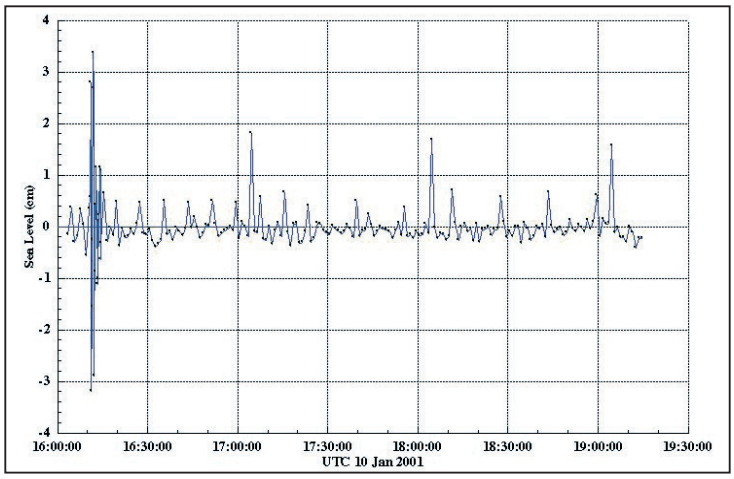

Fig. 2. December 2004 tsunami observed at the Male, Maldives tide gauge station.

Fig. 3. The GLOSS tide gauge station at Padang, Indonesia, maintained by Indonesia's National Coordinating Agency for Surveys and Mapping, BAKOSURTANAL, and the University of Hawaii Sea Level Center (UHSLC).

cessfully monitored the smaller Indian Ocean tsunami in March 2005.

While the GLOSS stations proved reliable and durable during the 2004 extreme event, they were not designed with tsunami warning in mind and so there are a number of station design elements that needed to be improved for monitoring tsunamis. First, only eleven of the fifty-three GLOSS stations in the region were capable of providing data in near-real time, and of these stations the fastest transmission period was one hour. Second, many of the stations closest to the tsunami generation region relied on chart recorders that require post-processing to obtain digital water level values. Third, float gauges in stilling wells are susceptible to spurious data jumps in an event of this magnitude. The most glaring deficiency was that even if the stations were up to tsunami warning specifications, there was no warning center that downloaded and inspected the data on a routine basis. On the positive side, many of the working stations relied on batteries and solar panels instead of on local power, and the data were transmitted via satellite rather than over phone lines. These stations therefore were immune to local utility failures.

To address the issue of data access, the new stations will transmit one-minute samples at fifteen-minute intervals. For stations close to a tsunami generation zone (within one hour travel time or 1,000 kms distance), the plan is to shorten the transmission interval even further to between one and five minutes. Initially, the Pacific Tsunami Warning Center (PTWC) and the Japan Meteorological Agency (JMA) will receive the tide gauge station data via the European Space Agency, Meteosat and the JMA's Geostationary Meteorological Satellites (GMS). The sea level data messages are forwarded immediately from downlink sites to the PTWC and the JMA using the World Meteorological Organization's (WMO) Global Telecommunications System (GTS). The sea level messages are used by these centers to confirm the existence of a major tsunami and to cancel a tsunami watch or warning.

The new station design satisfies both long-term sea level monitoring and tsunami requirements. The stations are being outfitted with multiple water level sensors, including typically a radar, shaft encoder, and pressure transducer. Also included are a data acquisition platform, solar panels, satellite antenna, water level switches, and a tide staff. UHSLC technicians conduct a field visit in coordination with local technical staff, install the equipment, conduct a leveling survey to tide gauge benchmarks, and provide basic information on the operation of the station. Figure 3 shows the newly outfitted GLOSS station at Padang, Indonesia.

To supplement routine maintenance activities, UHSLC technicians will visit each site at roughly one-and-a-half year intervals, or as needed should the station cease to operate. During these visits, the technicians will replace any defective parts, conduct a level survey to local benchmarks, and conduct training sessions with local technicians. The long-term goal is to have local agencies assume full operation and maintenance responsibilities for the stations after the five-year period. UHSLC data analysts will assess data quality with daily inspections of the time series. Any discrepancies or problems with the station will be identified, and UHSLC technicians will work with local partners to solve the problem.

A reliance on multiple-use water level stations maximizes the likelihood of ongoing maintenance and the continuous realization of the sea level measurement network. Because the sea level data acquired through these sites are used in climate, oceanographic, and coastal sea level research, we consider these stations to be more sustainable than sole purpose coastal tsunami stations. The establishment of the eastern Indian Ocean real-time GLOSS sites in conjunction with the upgrade of the existing central and western Indian Ocean real-time GLOSS sites will enable PTWC and JMA to provide interim basic basin-wide tsunami monitoring and warning to the Indian Ocean nations. This service will be an essential part of the effort that enables the nations affected by the December 2004 tsunami to normalize the lives of their citizens.

Acknowledgements

The IOC would like to acknowledge the financial and in-kind support from the Government of Finland/Ministry of Foreign Affairs, the Government of Flanders and the International Strategy for Disaster Reduction, the Asia Disaster Preparedness Center and Vaisala. Thanks are also due to the many national tide gauge agencies that have provided local support to the sea level station upgrade work - notably BAKOSURTANAL (Indonesia), the National Hydrographic Office of Oman, the Meteorological Service of Mauritius, and the National Aquatic Resources Research and Development Agency (NARA) of Sri Lanka.

Global ocean observations benefiting local coastal communities

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The Intergovernmental Oceanographic Commission (IOC) of UNESCO and its flagship programme, the Global Ocean Observing System (GOOS), make up the UN arm responsible for sustained global ocean observations. An IOC group of experts, the Ocean Observations Panel for Climate (OOPC), helps to define the standards and goals of the global climate component of GOOS and the tools to monitor and evaluate the system.

The IOC and the World Meteorological Organization (WMO) are partners in actively coordinating these global networks through the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM). JCOMM's *in situ* (in the water) platform support centre (JCOMMOPS), located in Toulouse, France, continually monitors the thousands of floats, ships and moorings transmitting oceanographic data and provides technical assistance to operators.

An observing system is more than just satellite and *in situ* measurements. It comprises a data transmission and delivery system, and analysis and forecast systems. This last link in the chain is critical in interpreting incoming information about the ocean, allowing the creation of products that are of value to a large audience. The international coordination of the development of ocean data assimilation and forecast systems has been spearheaded by the OOPC and GOOS pilot project, the Global Ocean Data Assimilation Experiment (GODAE). At the end of 2005 the GODAE project office moved from its home at the Australian Bureau of Meteorology to the UK Met Office.

GODAE has created a common open international data infrastructure to incorporate ocean data in forecast models, and a collaboration resulting in the exchange of ideas and techniques, and a comparison of model forecasts contributing to their improvement. In 2005 the national and regional efforts contributing to GODAE were in their demonstration phase, with many regional and global ocean nowcast and forecast products available freely over the Web. These can be found by following the links on the GODAE website: http://godae.org.

Photo by Terry Joyce, Woods Hole Oceanographic Institution

Researchers and crew members struggle to deploy a spar buoy in rough seas in the North Atlantic. The buoy measures the exchange of heat and moisture between the atmosphere and the ocean.

ocean Services Overview

By Peter Pissierssens, Head of Section

IODE GOVERNANCE: IODE-XVIII (26-30 APRIL 2005)

The Intergovernmental Oceanographic Commission Committee on International Oceanographic Data and Information Exchange held its Eighteenth Session (IODE-XVIII) at the Kursaal, Oostende, Belgium, 26-30 April 2005. The Session was attended by fifty-nine delegates from thirty-one Member States, fifteen representatives of organizations, programmes and projects, and five observers.

The Session on 25 April 2005 was preceded by the official inauguration of the IOC Project for IODE based in Oostende, Belgium, which was attended by Mr Jean Vandecasteele, Mayor of the City of Oostende, Mrs Fientje Moerman (Vice-Minister-President of the Flemish Government and Flemish Minister for Economy, Enterprise, Science, Innovation and Foreign Trade), Dr Patricio Bernal (on behalf of Mr Koïchiro Matsuura, Director-General of UNESCO), Mr Johan Vande Lanotte, Deputy Prime Minister, Minister for the Budget and Public Enterprise and Minister of the North Sea, Mr Paul Breyne, Governor of West-Flanders and President of the Board of Directors of the Flanders Marine Institute (VLIZ), Dr Lesley Rickards, Chair of the IOC Committee on International Oceanographic Data and Information Exchange (IODE), and Mr Yves Leterme, Minister-President of the Flemish Government and Flemish Minister for Institutional Reform, Agriculture, Sea Fisheries and Rural Policy.

During its five-day Session, the IODE Committee reviewed the work of the past inter-sessional period. Considerable attention was given to the IODE Review that had taken place during the inter-sessional period. The Committee reviewed all recommendations by the Review Team and made several fundamental and structural change decisions in response to the Review. These included the recomposition of the IODE Officers, the abolishment of the Responsible National Oceanographic Data Centre (RNODC) and IODE Regional Coordinator systems, and a further review of the IODE Groups of Experts during the next inter-sessional period. Resulting from the review and implementation of its recommendation is a renewed and reinvigorated IODE. Regarding IODE's marine information management component, all IOC Member States have been invited to nominate IODE national coordinators for marine information management, to complement IODE national coordinators for marine data management.

The Committee established an inter-sessional working group on ocean data quality control, thereby re-emphasizing the important role of IODE in this area.

Building upon the success of the ODINAFRICA project, the Committee recommended the development of an Ocean Data and Information Network (ODIN) for the IOCINDIO region (ODINCINDIO) and requested to further strengthen ODINCARSA. The Committee also recommended the establishment of an ODIN for the WESTPAC region.

The Committee further welcomed the increased collaboration with other organizations, programmes and projects such as the Joint Technical Commission for Oceanography and Marine Meteorolgy (JCOMM), the Global Ocean Observing System (GOOS), the International Council for the Exploration of the Sea (ICES), the Scientific Committee on Antarctic Research (SCAR), the Carbon Dioxide Information Analysis Center (CDIAC), the Global Change Master Directory (GCMD), the Caribbean Environment Programme (CEP), the Ocean Biogeographic Information System (OBIS), the International Association of Aquatic and Marine Science Libraries and Information Centres (IAMSLIC), the European Aquatic Science Libraries and Information Centres (EURASLIC) and others.

The Committee prepared four Resolutions and eight Recommendations, including the IODE Programme and Budget for 2005-2007.

More information on IODE is available at: http://www.iode.org

IODE CONTRIBUTION TO JCOMM: JCOMM/IODE EXPERT TEAM FOR DATA MANAGEMENT PRACTICES

During 2005 the main task of the JCOMM/IODE Expert Team for Data Management Practices (ETDMP) was to implement three Pilot Projects that were proposed at the First Session of the ETDMP (September 2003), namely:

(i) Pilot Project 1, Metadata Management;
(ii) Pilot Project 2, Data Assembly, Quality Control and Quality Assurance;
(iii) Pilot Project 3, End to End Data Management System (E2EDM) Prototype.

The most interesting and valuable results were obtained within the Pilot Project 3 - a prototype of the E2EDM technology was developed, tested, and presented at the IODE-18 and JCOMM-II meetings.

The objectives of E2EDM are:

(i) To ensure the quality, completeness and comparability of operational and delayed marine data collected from different sources, as well as of forecast, analysis and climate products generated by various organizations and groups;
(ii) To organize the full and continuous marine data and information cycle from data collection to product generation;
(iii) To provide the timely delivery of marine data and products to meet scientific, forecasting, industrial and environmental needs.

E2EDM should not replace, but build on the existing infrastructure of marine data acquisition and management, e.g. the infrastructure developed under major national and international programmes and agencies as IOC, WMO, ICSU, GOOS, etc. The E2EDM technology is based as well on existing technologies/systems (GiGIR OBIS, OPeNDAP, WMO WIS Metadata Profile, etc.).

To be a member of the E2EDM system the data centres install the Data Provider software so that local data can serve as a data source for the Integration Server services and be updated according to the commitments of the centre. The data sources are intended to provide the definite marine service (or a number of services that are close to the application domain) and can form the data source federation.

The appointed data centre (data centre-coordinator of the E2EDM data sources federation) installs the Integration Server software and provides the management of system metadata, control of the relevance of distributed data sources and ensures the information interaction with distributed data sources on request of the external end-user applications. The end-user application can be web-based client accessible via the web browser or software for data processing/modelling on local computers connected to the internet (the last version is under development). The E2EDM technology provides the interaction interface (rules and metadata structures) to link the external end-user application with the E2EDM system via Integration Server.

A user can enter the E2EDM system via the web browser (http://data.meteo.ru/e2edm/) to start the application and request data of single or multiple types from distributed data sources specifying parameters, space, time and other criteria. The appropriate data, at the user's request, are automatically sourced from wherever they reside and returned to the requesting application providing value-added services.

The E2EDM technology prototype was tested with different types of data including marine meteorological data (air temperature, sea surface temperature, pressure, wave height and wave direction, wind speed and wind direction) and oceanographic data (temperature, salinity, oxygen, and some nutrients).

These data sources were involved in the E2EDM prototype: historical marine meteorological data (Met Office, UK), ocean cruise data (VLIZ, Belgium, RIHMI-WDC, Russia); real-time GTS marine meteorological (SHIP) and ocean (BATHY and TESAC) data (RIHMI-WDC, Russia); real-time GTS ocean (TESAC/ARGO) data (IFREMER, France); monthly climatic fields of ocean parameters in the form of images (RIHMI-WDC, Russia); marine

weather charts, as well in the form of images (RIHMI-WDC, Russia).

The following data centres were involved in the prototype system (with installation of Data Providers software): the Russian National Oceanographic Data Centre (NODC), Ifremer (France), Metoffice (UK), VLIZ (Belgium/Flanders). The Integration Servers were put in the Russian NODC and VLIZ/IODE Project Office. The E2EDM prototype system was demonstrated at the IODE-18 and JCOMM-II meetings and it was well received by the meeting participants.

IODE and interoperability: development of Marine XML

MarineXML is an initiative of the IOC/IODE of UNESCO to improve marine data exchange within the marine community. The European Commission has provided a funding contribution to this initiative as part of its Fifth Framework Programme to undertake a 'pre-standardization' task of identifying the approaches the marine community should adopt regarding XML technology to achieve improved data exchange. This project (MarineXML EC) ran from February 2003 to January 2005. Other projects that have contributed to MarineXML in this timeframe include the Study Group on XML (SGXML) of ICES/IOC, the UK NERC Data Grid Project and the UKHO S-57 GML project. All these projects worked closely together to reach consensus on using XML for marine data exchange. We believe that they have been successful in providing a level of pre-standardization to form a route-map towards an extensible framework of standardization for data exchange in the marine community based on the adoption of ISO and OGC standards.

The MarineXML website (http://www.iode.org/marinexml/) was developed and hosted by the IODE Project Office as a focal point for MarineXML activities. This website contains all the results obtained within the IOC/ICES study group on XML and the MarineXML EU project including the online ontology tool on the marine data exchange standards created within the MarineXML project, as well as other documents related to MarineXML development.

The work on the MarineXML has been fully supported by IODE-18 and to ensure the continuation of this work, a MarineXML Steering Group was established with the following terms of reference:

(i) Establish a Pilot Project to set up an ISO 19100 series of standards compliant standards register, with possible collaboration with IHO, to be hosted by the IODE Project Office;
(ii) Monitor and assist XML development activities in other IODE/JCOMM groups, such as ETDMP, GEBICH and SGMEDI.

On 1 September 2005, the Marine Overlays on Topography for Annex II Valuation and Exploitation Project (MOTIIVE) was started. This project is funded by the European Union's Sixth Framework Research and Technology Development Programme in relation to the joint European Commission and European Space Agency programme, Global Monitoring for Environment and Security (GMES). The project began under the coordination provided by HR Wallingford, UK and continues some direction of the work started within the MarineXML project. IOC/IODE provides a technical secretariat for this project and will be a custodian of the project results.

More information is available at http://www.marinexml.net

Casting a bigger data net: IODE's participation in the EU project 'System of Industry Metocean data for the Offshore and Research Communities' (SIMORC)

A very substantial volume of metocean *in situ* data is collected by or under contract to major oil and gas companies. This is done all over the world and over many years a large volume of data sets has been acquired, often at substantial cost. These data are currently managed by the metocean departments of the oil and gas companies and stored in various formats. They are exchanged on a limited scale between the oil and gas companies. Despite various industry cooperative joint projects, there is not yet a common awareness of available data sets and no systematic indexing and archival of these data sets within the industry. Furthermore there is only limited reporting about and access to these data sets and results of field studies for other parties, in particular the scientific community. Opening up these data sets will provide favourable conditions for creating highly valuable extra knowledge of both local and regional ocean and marine systems.

To stimulate and support a wider application of these industry metocean datasets a System of Industry Metocean data for the Offshore and Research Communities (SIMORC) is being established. This will consist of an index meta-database and a database of actual data sets, which together will be accessible through the internet. The index meta-database will be public domain, while access to data will be regulated by a dedicated SIMORC Data Protocol. This will contain rules for access and use of data sets by scientific users, by oil and gas companies, and by third parties. In this project, all metocean data sets in the database will undergo quality control and conversion to unified formats, resulting in consistent, high quality harmonized data sets.

SIMORC is a unique and challenging development, undertaken by major ocean data management specialists: the Marine Information Service (MARIS), the British Oceanographic Data Centre (BODC) and IOC-IODE, and the International Association of Oil and Gas Producers (OGP). It involves the participation of major oil and gas companies, including Shell, Total, BP Amoco, ChevronTexaco, Statoil, Norske Hydro, that will bring in their substantial data sets.

The objectives of the SIMORC project are therefore:

- To create a central index and database of metocean data sets, collected by the oil and gas industry at various sites on the globe in the past and continuing at present;
- To facilitate harmonization in quality and formats, storing and retrieving of these industry metocean datasets for use by industry partners and scientific users;
- To define and establish arrangements for use, updating and long-term operation of the SIMORC facility beyond the project period;
- To promote and disseminate the SIMORC facility in both the oil and gas industry and scientific communities to achieve an increasing number of contributing parties and users.

A dedicated website with full project information is available at http://www.simorc.org.

IODE is one of the lead project contractors (together with the Mariene Informatie Service (MARIS), the British Oceanographic Data Centre (BODC), and NOAA's Office of Global Programs (OGP) and it is responsible for the project's promotion, dissemination and exploitation activities.

IODE's capacity-building programme: building ODINs

Following the success of ODINAFRICA (Ocean Data and Information Network for Africa) and ODINCARSA (Ocean Data and Information Network for the Caribbean and South America) the coverage of ODIN networks was further expanded in 2005 by the formal establishment (by IODE-XVIII) of the Ocean Data and Information Network for the IOCINDIO region (ODINCINDIO). In addition, strong interest has been shown in the WESTPAC region to establish an ODINWESTPAC.

Ocean Data and Information Network for Africa (ODINAFRICA)

Progress was made in implementation of all the work packages of ODINAFRICA.

A survey of the current status of the African sea level network revealed the existence of at least forty operational stations spread unevenly along the African coastline and island States. The most common model of installed tide gauge was the OTT float gauge, followed by Handar encoders. ODINAFRICA will install/upgrade twelve sea level stations in Cameroon, Comoros, Congo, Djibouti, Egypt, Ghana, Madagascar, Mauritania, Morocco, Senegal and Tunisia. An additional eighteen stations will be installed or upgraded by other partners as follows:

- The Indian Ocean Tsunami Warning System (IOTWS)/Global Sea Level Observing System (GLOSS): Nine stations in Kenya, Mauritius, Seychelles, South Africa, and Tanzania;
- The Benguela Current Large Marine Ecosystem (BCLME) Programme: Five stations in Angola and South Africa;
- The French Naval Hydrographic and Oceanographic Service (SHOM): Three stations in La Réunion, Mayotte, and Madagascar).

Several countries participating in ODINAFRICA also have plans to procure and install tide gauges.

Equipment and software were provided to newly established National Oceanographic Data Centres in Algeria, Angola, Egypt and Namibia. Training was also provided on a variety of topics for both the newly established and existing data and information centres. These included:

- Data management training course (IODE Project Office, Oostende, Belgium, 14-29 April)
- Marine information management (IODE Project Office, Oostende, Belgium, 14 August-3 September)
- Marine biodiversity data management courses (IODE Project Office, Oostende, Belgium, 18-22 April, and Grand Baie, Mauritius 22-26 August)
- ODINAFRICA websites improvement course (IODE Project Office, Oostende, Belgium, 5-9 December).

The meta-databases and library catalogues developed by the institutions participating in ODINAFRICA were quality controlled and availed through the internet.

National consultations were undertaken on data and information products necessary for Integrated Coastal Area Management (ICAM). The priority themes that were identified in many of the countries included: Shoreline changes, critical habitats, storm surges and coastal flooding, and biodiversity.

The objectives of the SIMORC project are therefore:

Coastal flooding was a priority theme during national consultations on data and information products

- To create a central index and database of metocean data sets, collected by the oil and gas industry at various sites on the globe in the past and continuing at present;
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IODE's capacity-building programme: building ODINs

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These are very similar to those that are required for the core themes of the Africa Process. ODINAFRICA will focus on two products to address these themes: (i) Regional marine atlases, and (ii) Marine biodiversity databases. Three regional marine atlases will be prepared for: (i) the Western Indian Ocean (Agulhas, Somali Large Marine Ecosystems [LMEs] and the Mascarenhas); (ii) the Western Atlantic (Guinea Current and Benguela Current LMEs); and (iii) the Canary LME and Mediterranean Sea. These atlases will incorporate existing georeferenced datasets available in the public domain (but tailored to meet specific scope requirements) and also data products created from national and international marine data collections by scientists participating in the ODINAFRICA programme of capacity-building projects. The marine biodiversity databases will focus on five taxonomic groups of commercial importance: mollusks, polychates, echinoderms, sponges, and stony corals.

Ocean Data and Information Network for the IOCARIBE and South America regions (ODINCARSA)

During 2005, two virtual meetings were held to review the progress of ODINCARSA activities. The first was held in Spanish with Latin American members of ODINCARSA and the second with Caribbean countries. Participating countries included Barbados, Brazil, Chile, Colombia, Ecuador, Jamaica, Mexico, Peru, Saint Lucia, and Trinidad and Tobago. Some of the main issues discussed in these meetings were the difficulties encountered during the implementation of the ODINCARSA Action Plan, the achievements of the Latin American Group on Marine Information Management, the translation to Spanish of Ocean Teacher materials, the progress with the Regional Marine Metadata Catalogue, and the need to adjust and refine the capability assessment in the Caribbean. Through these meetings it was demonstrated that virtual meetings are a cost-effective means of communication that will be continued.

The **Third ODINCARSA Training Course in Data Management** was held at the IOC Project Office for IODE in Oostende, Belgium, 7-18 November, with the participation of fourteen students from: Argentina, Barbados, Brazil, Chile, Colombia, Cuba, Dominica, Dominican Republic, Ecuador, Panama, Peru, St. Lucia, Venezuela and three students from Morocco.

The **Second ODINCARSA Training Course in Marine Information Management** was held at the IODE Project Office for IODE in Oostende, Belgium, 9-19 November, with participants from eight countries: Argentina, Chile, Colombia, Cuba, Ecuador, Mexico, Trinidad and Tobago, Uruguay and Venezuela. The course included theoretical lectures on Information Management, some planning issues on the marine information component of ODINCARSA, and a report on activities of the Regional International Association of Aquatic and Marine Science Libraries and Information Centres (IAMSLIC) Latin American Group. One of the main outcomes of the training was the agreement of the group to start drafting a project document for an ODINCARSA Marine Sciences Digital Repository.

The **First ODINCARSA Advanced Course in Ocean Data Management** workshop was held at the IOC Project Office for IODE in Oostende, Belgium, 21-26 November, with participants from Argentina, Brazil, Colom-

bia, Ecuador, Mozambique and Peru. This group is now part of the regional trainers team for ODINCARSA.

The Latin American Regional Group launched the **Latin American Regional Union List of Serials** that includes more than 8,350 holding records from seventeen libraries in nine Latin American countries (Argentina, Chile, Colombia, Cuba, Ecuador, Mexico, Panama, Peru and Venezuela). The List is available on the internet at: http://library.csumb.edu/iamslic/latinoamericano/unionlist.

Support of ODINCARSA to Latin American document delivery project

With the support of IAMSLIC, the Eastern Pacific Consortium of the Inter-American Institute for Global Change Research (EPCOR-IAI), and ODINCARSA/IOC, six institutions in five countries (Colombia, Cuba, Ecuador, Panama and Venezuela) were provided with scanners and document scanning/transmission software.

Metadata records for MEDI were compiled from Colombia, Costa Rica, Ecuador, Mexico and Peru.

Improving information on the relief of the World Ocean floor

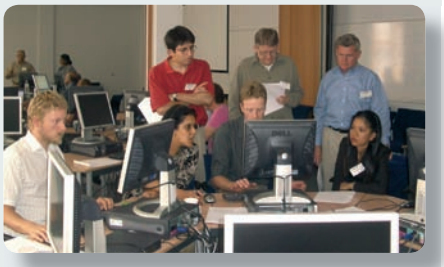
The main results in the ocean mapping framework are the updating of the Third Edition of the General Bathymetric Chart of the Oceans (GEBCO) Digital Atlas (GDA) as well as the International Bathymetric Chart of the Arctic Ocean. Ocean Mapping continued its support to all existing regional bathymetric projects focused on the compilation and declassification of bathymetric data, in particular in the regions affected by tsunami. In accordance with the joint GEBCO/Nippon Foundation Plan twelve students from nine countries graduated from a one-year training course in bathymetry at the University of New Hampshire, USA.

The Intergovernmental Oceanographic Commission of UNESCO

New Project Office for International Oceanographic Data and Information Exchange (IODE)

The host agreement between the Intergovernmental Oceanographic Commission of UNESCO and the Kingdom of Belgium for the Oostende IOC Project Office for IODE was signed in Paris at the UNESCO headquarters on 18 July 2005.
(Left) UNESCO Assistant Director-General, Executive Secretary of IOC, Dr Patricio Bernal and (right) the Ambassador of the Kingdom of Belgium to UNESCO, H. E. Mr Yves Haesendonck, sign the document determining the main objectives of the Project Office, related obligations of the Government of Belgium and UNESCO/IOC, and privileges and immunities of the Project Office.

The IODE Programme must now meet the new challenges related to ocean data and information management. The IODE community must lead the way in coordinating and facilitating access to marine data and information to support the broad needs of scientists, policy makers, marine resources managers, the commercial sector and the general public. The IODE Programme now gives attention to all ocean related data including physical, chemical, and biological oceanographic data, and to operational data streams in addition to delayed mode data. IODE now closely collaborates with, and services the needs of other IOC and related programmes such as Ocean Sciences, the Global Ocean Observing System (GOOS), the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), and the International Tsunami Warning System.



Providing an environment where ocean data and information experts and students can work, meet and discuss.

In order to respond to these challenges, an IOC Project Office for IODE was established following the decision of the IOC Assembly to establish the office and the acceptance of the offer extended by the Government of Flanders

(Belgium) and the City of Oostende, with financial and administrative support provided by the Government of Flanders through the Flanders Marine Institute (VLIZ).

The Project office has the following objectives:

(i) To establish a creative environment facilitating the further development and maintenance of IODE and partner data and information management projects, services and products with emphasis on improving the efficiency and effectiveness of the data and product/service stream between the stage of sampling and the user;
(ii) To assist in strengthening the capacity of Member States to manage oceanographic data and information and to provide ocean data and information products and services required by users.

To achieve these objectives, the IOC Project Office undertakes to:

(i) Further develop, strengthen and maintain IOC-IODE ocean data and information management training programmes and training tools;
(ii) Provide an environment ('think tank') where ocean data and information experts and students can work, meet and discuss;
(iii) Develop, host and maintain IOC-IODE's ocean information systems and related public awareness tools;
(iv) Promote collaboration between all expert levels active in ocean data (and data product) and information management, including scientists, data managers and other users;
(v) Host specialized short-term training courses in ocean data and information management;
(vi) Provide a laboratory environment for the development and beta testing of ocean data and information management technology.

The Project Office work plan for 2005 responded to the requirements identified by IODE-XVIII (Oostende, Belgium, 26-30 April), in particular its technology development and Ocean Data and Information Network (ODIN) capacity-building elements. In addition, the Project Office carried out tasks within several EU projects and undertook extensive infrastructure building within the Project Office itself (office furniture, information technology infrastructure).

The Project Office is now fully furnished, equipped and operational. The facilities include:

(i) A large conference hall accommodating up to one hundred and fifty people;
(ii) Two (air conditioned) training/meeting rooms accommodating up to twenty-four people each (these two rooms can be combined into one large room);
(iii) One small conference room for expert meetings accommodating up to fifteen people;
(iv) An open space work area for the Project office staff (four people);
(v) An open space work area for up to twelve visiting experts;
(vi) Thirty personal computers for training/visitors;
(vii) Five web/data servers;
(viii) 850 Mbit/sec broadband internet connection;
(ix) All necessary software and additional hardware (audio and video equipment, printers, etc.).

The renovation work of the Project Office building was finished in April and the official inauguration of the Project Office was held on 25 April, just before the IODE-XVIII meeting.

With the opening of its Project Office, IODE has entered a new era of capacity-building and ocean data/information services. The Project Office can provide different kinds of training ranging from general marine data and information management courses (at basic, intermediate and advanced levels) to specialized courses (Geographical Information Systems (GIS), web development, digital modelling and related data issues, etc.).

In 2005, the Project Office organized ten different training courses. One hundred and two trainees from forty-nine countries were trained during these courses. Nineteen scientific and capacity-building meetings of different regional and international projects and organizations were hosted by the Project Office. More than two hundred and fifty experts from around the world visited the Project Office to become acquainted with the Project Office objectives and plans; twenty-two of them came for medium or long-term visits (ranging from several days to several weeks).

The Project Office was involved in three European Union projects during 2005, related to marine data and information management.

Full information on the Project Office, its activities and plans, including the events calendar can be found at: http://www.iode.org/projectoffice.

All photos courtesy of the IOC Project Office for IODE

Meetings and Training Courses

1. Ocean Data Management training course for ODINAFRICA, beginner level (IOC Project Office for IODE, Oostende, Belgium, 11-29 April)
2. Biodiversity Data Management training course for ODINAFRICA, beginner level (IOC Project Office for IODE, Oostende, Belgium, 18-22 April)
3. OBIS Management Committee (IOC Project Office for IODE, Oostende, Belgium, 23-24 April)
4. IODE-XVIII (Oostende, Belgium, 26-30 April)
5. International Marine Data and Information Systems Conference (IMDIS) (Brest, France, 31 May-3 June)
6. Marine Information Management training course for ODINAFRICA, beginner level (IOC Project Office for IODE, Oostende, Belgium, 15 August-3 September 20)
7. Joint JCOMM/IODE/GOOS training courses on numerical modelling and corresponding data management, advanced level (IOC Project Office for IODE, Oostende, Belgium, 2-10 September); Region: Africa, Latin America and Caribbean, Indian Ocean
8. Ocean Data Management training course for the Indian Ocean Countries, beginner level (IOC Project Office for IODE, Oostende, Belgium, 10-22 October)
9. Autumn meeting of EurOcean (IOC Project Office for IODE, Oostende, Belgium, 26 October)
10. Ocean Data Management training course for ODINCARSA countries, beginner level (IOC Project Office for IODE, Oostende, Belgium, 7-19 November)
11. Ocean Data Management training course for ODINCARSA countries, advanced level (IOC Project Office for IODE, Oostende, Belgium, 21-26 November)
12. Marine Information Management training course for the ODINCARSA countries, beginner level (IOC Project Office for IODE, Oostende, Belgium, 9-17 November)
13. Web service development training for ODINAFRICA, beginner level (IOC Project Office for IODE, Oostende, Belgium, 5-9 December)
14. Training course on development of electronic repositories on marine related publications from Africa, beginner level (IOC Project Office for IODE, Oostende, Belgium, 5-9 December)
15. SIMORC EU Project Coordination Group/Advisory Board Meeting (IOC Project Office for IODE, Oostende, Belgium, 20 December)
16. EcoMAMA GIS training (IOC Project Office for IODE, Oostende, Belgium, 21-23 December)

Report provided by Vladimir Vladimirov, Head of IOC Project Office for IODE, Oostende, Belgium.

capacity-Development

Overview

By Ehrlich Desa, Head of Section

Tomorrow, the safety, livelihood, and well-being of millions, both in the developing and the industrialized world, will depend on the management of the ocean and coasts today. Many countries lack the scientific capacity needed to address this vast challenge. One of the most crucial remits of the IOC is to advance the development of this capacity in Member States that demand it. The IOC has begun implementing an ambitious programme of self-driven capacity-development using the talent and drive of marine scientists in developing countries to fulfil a critical mission: providing science for the sustainable use of coastal and marine resources.

Capacity-Development: creating opportunities for success in the developing world

Two major milestones were achieved in 2005 for the Intergovernmental Oceanographic Commission's Capacity-Development Section: the IOC Assembly approved the Principles and Strategy and accepted the initial Implementation Plan for IOC Capacity-building, and a proposal was successfully submitted to the Swedish International Development Agency to support the implementation. The Section began its programme of enhancing leadership skills of directors of marine institutes in the Western Indian Ocean, and an initial assessment of capacity to conduct marine sciences was conducted in this region.

The challenge: developing scientific capacity NOW to preserve the ocean and coasts

Based on discussions with experts from all regions, the decades-long experience of IOC in this domain, and reports on trial and errors in many fields of international development, a set of principles were prepared to guide capacity-development activities in the coming years, and approved by the IOC Assembly in June 2005. The key principles relate to the relevance, ownership and sustainability of capacity-development, and can be encapsulated in the concept of self-driven capacity-development.

Partnerships for solutions from within

Through self-driven capacity-development, the IOC seeks to develop the skills and mindsets such that Member States embark on programmes that they define, and develop the scientific capacity they need, for the issues they identify. Building on successful experience in developing and emerging economies, the IOC is beginning this process by focusing on three essential skills for scientific organizations: leadership, proposal writing, and teamwork. This approach has been endorsed by experts in this field, and by the Swedish International Development Agency (SIDA) through a major grant in support of its implementation.

The first leadership workshop for directors of marine institutes was conducted in Maputo, Mozambique, in October 2005 (see box, page 62). An initial assessment of existing capacity was conducted in institutes that participated to this workshop on the East African coast (see box, page 63).

A host of successful TEMA schemes were expanded, maintained or modified

Successful programmes developed within the framework of Teaching, Education and Mutual Assistance

(TEMA) were maintained or expanded in 2005, some were modified, and some were dropped. The Training Through Research programme (TTR) that provides at-sea experience for marine science students around the world was expanded. The Russian Federation provided ship time on-board R/V *Professor Logachev* for the TTR 15 cruise, while the first TTR in the Western Pacific was conducted thanks to the provision of ship time on-board R/V *Marion Dufresne* by France. IOC travel grants were focused to support coastal zone projects and thirteen young scientists from developing countries were supported to attend international scientific events. In response to the IOC Governing Bodies directives, a workshop on remote-sensing applications for African oceanographers was organized in Rabat, Morocco. The UNESCO/IOC Chairs programme was used as a platform for collaboration with other sectors of UNESCO. Chairs in Moscow and Maputo were closely involved in capacity-development activities (for TTR and the leadership workshop, respectively). Funding constrained IOC support for the Partnership for Observation of the Global Oceans (POGO)-managed Fellowship programme, and required that we drop our own small grants for coastal zone projects.

The opportunity is now here to make a difference

France, Italy, Sweden and the USA provided support for activities implementing the IOC strategy for capacity-development. In the next few years the IOC will work in developing countries with the self-drive of scientists and directors of institutes to strengthen capacity to provide science and services demanded by their communities. The IOC also plans to subsequently engage with decision-makers and enrol community-based organizations, media and societies to work together with their scientists in managing vital coastal and marine resources and preserving the global ocean heritage for future generations.

Students examine mud from a core sample.

Training-through-Research R/V *Marion Dufresne*

The University of the Sea is a ship-based training and research programme for students and young marine scientists from across the Asia-Pacific region. The first cruise took place in the Coral Sea-Arafura Sea region on-board the French research vessel R/V *Marion Dufresne*, June 24-July 8. The ship sailed from Port Moresby, Papua New Guinea to Darwin, Australia. During this two-week period, twenty students representing ten countries (Australia, the People's Republic of China, East Timor, Indonesia, Japan, Malaysia, New Zealand, Papua New Guinea, the Philippines and Sri Lanka) got 'hands on' practical experience in both marine data collection and marine research problem solving.

Training-through-Research R/V *Professor Logachev*

The Training-through-Research (TTR) programme started the year 2005 with its annual post-cruise meeting and international research conference on 'Geosphere-Biosphere coupling processes: the TTR interdisciplinary approach towards studies of the European and North African margins' (Marrakech, Morocco, 2-5 February). It was attended by nearly seventy participants from sixteen countries. The TTR15 cruise was carried out 6 June-5 August on-board the R/V *Professor Logachev* (Russia). Participants in the cruise were thirty researchers and fifty students from fourteen countries of Africa, Asia and Europe. Complementary to sea-going research, a field trip on the 'Cretaceous to Miocene Geological Formations of the Flysch Domain, N-W Alpine Rif Belt (Morocco)' was organized (12-16 November).

Photo by E. Kozlova, Moscow State University

Hands-on training with gas hydrates and oil on the TTR-15 cruise.

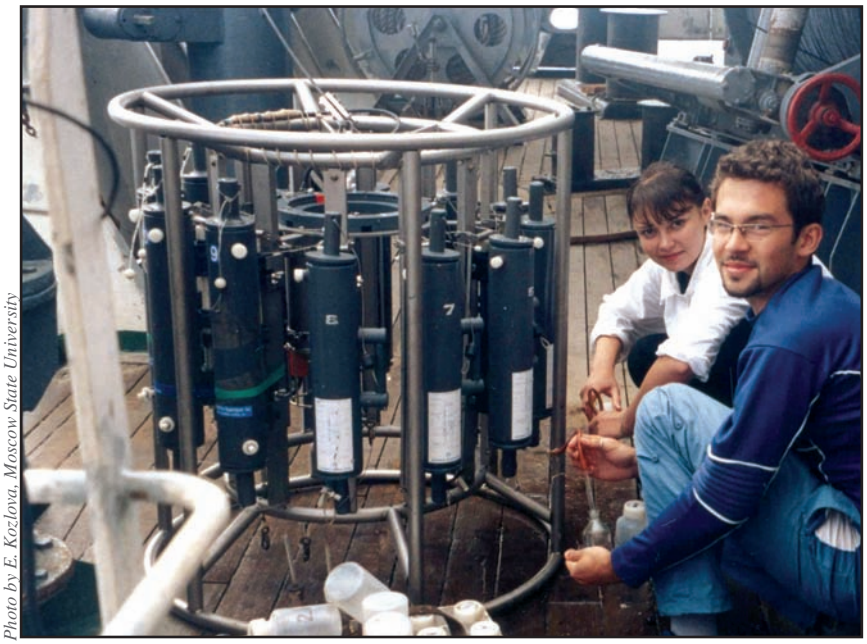


Photo by E. Kozlova, Moscow State University

Students in the BFU-2005 expedition taking rosette samples.

The Baltic Floating University (BFU)

Launched in 1993 as part of UNESCO's Floating University scheme and co-sponsored by the Helsinki Environmental Commission (HELCOM), the BFU project has been executed since 1996 as part of the Training, Education and Mutual Assistance in the Marine Sciences (TEMA) Programme and contributes with the research results to the Integrated Coastal Area Management (ICAM) programme of IOC. The Russian State Hydro-meteorological University (RSHU, St. Petersburg) acts as its leading executor. The focus of the BFU work is a combination of research undertaken from a sailing catamaran *Centaurus* in the coastal waters and from a bigger research vessel *Sibiriakov* for studying the open Baltic Sea. Six students from RSHU, professors and experts from a number of research institutions of St. Petersburg and eight students from Latvia, Lithuania, Slovakia, Spain, Ukraine and the United Kingdom took part in the BFU-2005 cruises (3-16 August). The cruises provided students with training in oceanography and environmental science through lectures, data collection, analysis and interpretation.

IOC's Advanced Leadership Workshop draws high praise

The IOC, in collaboration with the Western Indian Ocean Marine Science Association, organized the first Leadership workshop for directors of marine science institutes of the Western Indian Ocean region in November 2005 in Maputo, Mozambique. Directors and scientists from Kenya, Madagascar, Mozambique, Seychelles, South Africa and Tanzania participated in the workshop. The participants' involvement in the exercises and feedback was extremely positive, with many expressing the opinion that this type of training was long overdue in the region. The workshop generated great enthusiasm and momentum for change, as well as a regional team spirit and mutual trust between these key players for the development of marine sciences in the Western Indian Ocean.

Workshop participants walkabout in the streets of Maputo.

The IOC grant programme:
In 2005, the Capacity-Development Section continued its programme to provide support for junior scientists and students from developing countries to attend conferences, workshops and other events relating to ocean sciences and policy. The 2005 awardees were:

1. Jeremiah Lemmy, Geology Department, University of Nairobi, Kenya, to participate in the Twenty-fourth Meeting of the International Association of Sedimentologists, Sultan Qaboos University, Oman, 10-13 January.
2. Kissao Gnandi, Faculty of Sciences, University of Lome, Togo, to participate in the International Conference on Environmental Science and Technology, New Orleans, USA, 23-26 January.
3. Jose Ignacio Martinez Rodriguez, Universidad EAFIT, Department of Geology, Marine Science Group, Medellin, Colombia, to participate in the AMADEUS Scientific Cruise, exploring the continental margins of southern Columbia and northern Ecuador on-board the French research vessel *Atalante*, 4 February-10 March.
4. Luis Manual Farfan Molina, CICESE, La Paz, Baja California Sur, Mexico, to participate in the General Assembly of the European Geosciences Union, Vienna, Austria, 24-29 April.
5. Nguyen Van Quan, Hai Phong Institute of Oceanology, Hai Phong City, Viet Nam, to participate in the Seventh Indo-Pacific Fish Conference organized by the Research Center for Biodiversity, Taiwan, Howard International House, Taipei, 16-20 May.
6. Susan El Hassanein Kholeif, National Institute of Oceanography and Fisheries, Alexandria, Egypt, to participate in the Fourth European Global Ocean Observing System Conference (EuroGOOS) organized by IFREMER, Brest, France, 6-9 June.
7. Marites Magno, The Marine Science Institute, University of the Philippines, Diliman, Quezon City, the Philippines, to participate in the 2005 International Ocean Research Conference organized by The Oceanography Society (TOS), UNESCO Headquarters, Paris, France, 6-10 June.
8. Flower E. Msuya, Institute of Marine Sciences, University of Dar es Salaam, Zanzibar, Tanzania, to participate in the Seventh International Marine Biotechnology Conference, organized by the National Research Council, Canada, St. Jones, Newfoundland, Canada, 7-12 June.
9. Oersted David Mirera, Kwetu Training Centre for Sustainable Development, Mombasa, Kenya, to participate in the International Conference on 'Extension Methods for Mariculture and Coastal Management' organized by the Western Indian Ocean Science Association, Zanzibar, Tanzania, 4-9 July.
10. Mohsen Omar El-Sherbiny, Russian State Hydrometeorological University (RSHU), St Petersburg, Russia, to participate in the Ninth International Conference on Copepoda, organized by the World Association of Copepodologists, Hammamet, Tunisia, 11-15 July.
11. Evie Hadrijantie Sudjono, Marine Geological Institute, Bandung, West Java, Indonesia, to participate in the IPSI-2005 Pescara Conference on Challenges in the Internet and Interdisciplinary Research, organized by IPSI Serbia, Pescara, Italy, 27 July-1 August.
12. Antonio Babu Chetalan, Department of Atmospheric Sciences, Cochin University of Science and Technology, Cochin, India, to participate in the International Association of Meteorology and Atmospheric Sciences - IAMAS 2005 Conference, Beijing, China, 2-11 August.
13. Hazel Ouano Arceo, Marine Environment and Resources Foundation, Inc., University of the Philippines, Diliman, Quezon City, Philippines 1101, to participate in the First International Marine Protected Area Congress (IMPAC1) organized by the World Conservation Union, Geelong, Australia, 23-27 October.

View of the creek in Mombassa from the Kenya Marine and Fisheries Research Institute.

Initial assessment of scientific capacity in the Western Indian Ocean region
Following instructions by the Assembly of its Member States, the IOC began an evaluation of existing capacity for marine sciences and operational oceanography in its region. This exercise began with the visit of several marine institutes in the Western Indian Ocean region. More in-depth assessments will be conducted in the following years by professionals from the region, but in the context of developing plans to work with research institutes, on-site visits and discussions have provided crucial first-hand information on the situation on the ground. Comparison with previous surveys from the IOC showed that human scientific capacity has grown very rapidly in the region, particularly in terms of qualification of researchers, although the number of researchers has grown less rapidly. With the success of national and international training programmes, the most severe limitations now appear to be in infrastructure rather than in expertise.

Regional Activities

Photo by Agustinus Wibowo (www.avgustin.net)

The Caribbean Large Marine Ecosystem Project (CLME)

© NOAA

DR ROBIN MAHON
IOCARIBE Regional Project Coordinator

Scope and objectives of the CLME Project

The overall objective of the project is sustainable management of the shared living marine resources of the Caribbean LME and adjacent areas through an integrated management approach that will meet the World Summit on Sustainable Development (WSSD) target for sustainable fisheries.

The specific objectives of the project are:

1. To identify, analyse and agree upon major issues, root causes and actions required to achieve sustainable management of the shared living marine resources in the Caribbean Sea LME;
2. To improve the shared knowledge base for sustainable use and management of transboundary living marine resources;
3. To implement legal, policy and institutional Strategic Action Plan (SAP) reforms to achieve sustainable transboundary living marine resource management;
4. To develop an institutional and procedural approach to LME level monitoring, evaluation and reporting.

All five LME modules will be addressed in the project. However, the emphasis will be on governance of transboundary living marine resources, both exploited and non-exploited. Pollution and health aspects will receive less emphasis due to the existence of another Global Environment Facility (GEF) project in the region that focuses on Integrated Watershed and Coastal Area Management (IWCAM) that has a substantial pollution and coastal system health orientation. The global GEF Coral Reefs project is expected to contribute a substantial component of science needed for reef governance. A main thrust of the CLME project is expected to be developing a monitoring and reporting system that can integrate all these various initiatives. Owing to the governance emphasis, partnerships for science cofinancing are being actively sought by the CLME project.

The project will support the involvement of twenty-five GEF-eligible countries from the Wider Caribbean Region.[1] Four non-GEF-eligible countries[2] and associated territories will be invited to participate in the project at their own expense. The level of funding committed by the GEF for the PDF-B phase is US$700,000 to which is being added US$200,000 of cofinancing from the region. For the full project, the GEF has indicated that it will consider funding to the level of US$9M contingent on a minimum of at least a similar level of cofinancing.

The Implementing Agency for this project is the United Nations Develop-

1. Antigua and Barbuda, Bahamas, Barbados, Belize, Brazil, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, México, Nicaragua, Panama, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Venezuela.
2. France (French Guyana, Guadeloupe, Martinique, St. Barthelemy, St. Martin), the Netherlands (Aruba, Bonaire, Curacao, Saba, St. Eustatius, St. Maarten), United Kingdom (Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat, Turks and Caicos Islands), the United States of America (Puerto Rico, U.S. Virgin Islands)

ment Programme (UNDP), while the Executing Agency will be Intergovernmental Oceanographic Commission of UNESCO's Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE).

Project development

Preparation of the Caribbean Large Marine Ecosystem Project, titled 'Sustainable Management of the Shared Living Marine Resources of the Caribbean Large Marine Ecosystem (CLME) and Adjacent Regions', began with a PDF-A grant for a workshop in September 2001. The proposal underwent a series of reviews by UN agencies and was accepted into the GEF pipeline in March 2003. The proposal for funding to develop the full project (PDF-B funding) was submitted to UNDP in December 2003. It was distributed to countries for review and endorsement in May 2004. By 1 July 2005, enough country endorsements had been obtained for submission of the revised PDF-B proposal to the GEF. It was approved by the GEF on 5 August 2005. To date, twenty-two countries have endorsed the PDF-B with Colombia, Suriname and Venezuela remaining.

The PDF-B Phase

The PDF-B phase will last approximately eighteen months. Key steps in PDF-B implementation are as follows:

- Develop a draft implementation plan for national review and Steering Committee endorsement
- Establish, where necessary, national inter-ministerial committees to review the plan and subsequent PDF-B outputs
- Hold initial Steering Committee meeting
- Conduct Transboundary Diagnostic Analysis (TDA)
- Prepare Strategic Action Plan (SAP)
- Prepare Full Project Brief
- Hold final Steering Committee meeting to review and endorse the Full Project Brief
- Submit Full Project Brief.

Photo by Robin Mahon

A Belize Placencia snapper being landed at Placencia in Belize.

Preparations to implement the PDF-B have been proceeding steadily since approval was obtained. A Technical Secretariat will be located at the Centre for Resource Management and Environmental Studies (CERMES), University of the West Indies (UWI), Cave Hill Campus, Barbados, where the Regional Project Coordinator will have oversight of activities. Administrative functions will be carried out at the IOCARIBE Secretariat in Cartagena, Colombia. There are two positions in the Technical Secretariat: Project Manager and Assistant to the Manager. The position of Project Manager was advertised and a candidate was selected in November 2005. The Project Manager will take up the post on 1 April 2006. The position of Assistant was filled at the beginning of March 2006. The unanticipated need for a Memorandum of Understanding (MOU) between UNESCO and the Government of Barbados for establishment of the Technical Secretariat at UWI resulted in a delay of several months while the MOU was being reviewed and signed.

Linkages

It is important for the PDF-B phase to build on previous efforts and to forge linkages with ongoing projects and initiatives. There is a long list of these in the PDF-B proposal. Several are GEF projects such as the Integrating Watershed and Coastal Area Management in the Small Island Developing States of the Caribbean (IWCAM) and MesoAmerican Barrier Reef Projects. The Millennium Ecosystem Assessment Subregional Assessment on the Caribbean Sea (CARSEA) was recently completed and includes much valuable information. The White Water to Blue Water (WW2BW) process continues to develop and to be of relevance to the CLME Project. WW2BW is currently entering a new phase with the recent development of a 2006-08 Strategic Plan, a Council and an Executive Committee.

With a view to promoting linkages among primary intergovernmental and supporting agencies, an Interagency Consultation is planned for 3-4 April 2006 in Panama City, Panama. The consultation will be attended by UNDP/GEF, IOCARIBE, the United Nations Environment Programme (UNEP), the Food and Agriculture Organization (FAO), CARICOM Caribbean Regional Fisheries Mechanism (CRFM), the Central American Organization of the Fisheries and Aquaculture Sector (OSPESCA), the Latin American Organization for Fisheries Development (OLDEPESCA), UWI, the National Oceanic and Atmospheric Administration (NOAA) and Project Staff. Its purpose is to develop the draft plan for PDF-B implementation to be reviewed by the countries.

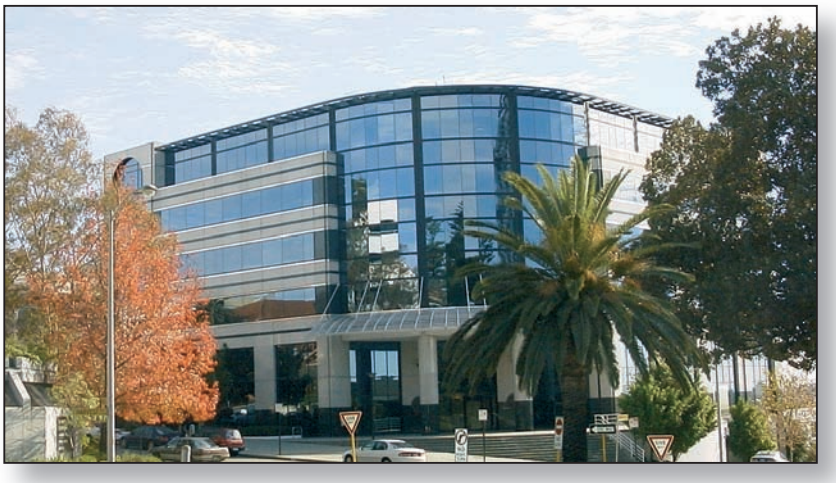
Photo by Robin Mahon

A small fishing harbour at Marigot on the east coast of Dominica.

The IOC Perth Programme Office

WILLIAM (BILL) ERB
Head of Office

The Intergovernmental Oceanographic Commission's Perth Programme Office, referred to as the Perth Office, is located in the city of Perth on the western coast of Australia. It is jointly sponsored by three partners: the Western Australian Government; the United Nations Educational, Scientific and Cultural Organization (UNESCO), through its IOC; and the Commonwealth Government, through the Bureau of Meteorology. It focuses on the balanced regional development of the Global Ocean Observing System (GOOS). In its short tenure it has helped to establish Indian Ocean GOOS (IOGOOS), Pacific Island GOOS (PI-GOOS), Western Australia GOOS (WAGOOS) and Southeast Asia GOOS (SEAGOOS). Mr William (Bill) Erb has headed the Office since its startup in 2000.



Bureau of Meteorology building, Perth Office home in West Perth.

The Intergovernmental Coordination Group for the Indian Ocean Warning System (ICG/IOTWS)

The tsunami of 26 December 2004 dramatically impacted the activities of the Perth Office during 2005. For the countries within the region, the year was devoted to assessing the damage, cleanup and restoration of communities, building warning systems and attending to human needs. The Global Ocean Observing System (GOOS) was not such a high priority.

In early 2005, the Government of Australia announced its intention to set up a regional warning system for the Indian Ocean and to contribute funds for this purpose. It indicated a desire to have the Intergovernmental Coordination Group (ICG) for the Indian Ocean Warning System (ICG/IOTWS) located as part of the existing Perth Office. It was logical in that the Office had direct links to the many Indian Ocean GOOS participants with lead roles in their countries for planning tsunami warning and mitigation. US$400,000 was provided by Australia to fund the ICG. The Perth Office was tasked with arranging the first meeting of the ICG in Perth on August 3-5 and setting up the ICG.

Initial tasks included writing protocols, deciding membership, determining objectives, agendas, working groups, etc. A second meeting was convened in Hyderabad, India in December, which was hosted by INCOIS, an Indian government agency. Also during this time, the ICG Secretariat was set up with equipment and staff. Mr Len Broadbridge, the ex-Regional Director for the Bureau of Meteorology in Western Australia, was employed to assist the Perth Office from September 2005 to January 2006. Len provided outstanding support during this time. A second person, Dr Jane Cunneen, was

First meeting of the Intergovernmental Coordination Group for the Indian Ocean Warning System (ICG/IOTWS), Perth, Western Australia.

also hired to assist the Secretariat and she attended the Hyderabad ICG meeting.

The first ICG meeting established five working groups on various aspects of tsunami planning. Most of these groups had meetings during the intersessional periods. The Perth Office managed this process, funding and logistics for the working group meetings. Databases and website postings were also needed and established.

The Global Ocean Observing System (GOOS)

Despite the time spent developing the ICG/IOTWS, progress was made in developing the GOOS programme in the various regions. The following sections describe some examples in each of the regions.

Western Australia

In Western Australia the development of GOOS continues with an emphasis on awareness building and expansion of GOOS throughout the country. The Perth Office supports Western Australia GOOS (WAGOOS) and works in partnership with it. One mechanism to accomplish the task is by sponsoring workshops and meetings that generate activities. A major conference on Indian Ocean marine science was convened at the new Perth Convention Center in cooperation with the Institute of Marine Engineering, Science and Technology (IMarEST) and the University of Western Australia. A Whale Shark Workshop and Conference was sponsored by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Perth Office, which led to a pilot project related to GOOS for the Indian Ocean region. The first meeting of the ICG for IOTWS was held in Perth and was well attended by Western Australia Government officials, many emergency management planning personnel and Commonwealth officials. The Office supported a number of other conferences and workshops in Australia.

The Western Australian GOOS (WAGOOS) organization is under the leadership of Dr Ray Steedman. WAGOOS is unique in that brings together industry, academia and government in the development of operational oceanography. WAGOOS is completing a report titled 'An Economic Analysis of the Australian Contribution to the Global Ocean Observation System', which will be published by the Australian Academy for Technology, Science and Engineering. This should help persuade government to support an Australia-wide GOOS programme. The Pacific Indonesian Throughflow project continues with a positive result being that the Woodside Petroleum Company is using a result of the study in its design plans, 'Climatic Deepening of the Timor Sea Thermocline'. Also, the Woodside Petroleum Company's extensive moored instrument data of the Timor Sea are available to enhance scientific understanding. Finally, WAGOOS is exploring cooperative activities with the new Indonesian GOOS (INAGOOS) regional alliances recently established by several cooperating Indonesian agencies.

Indian Ocean

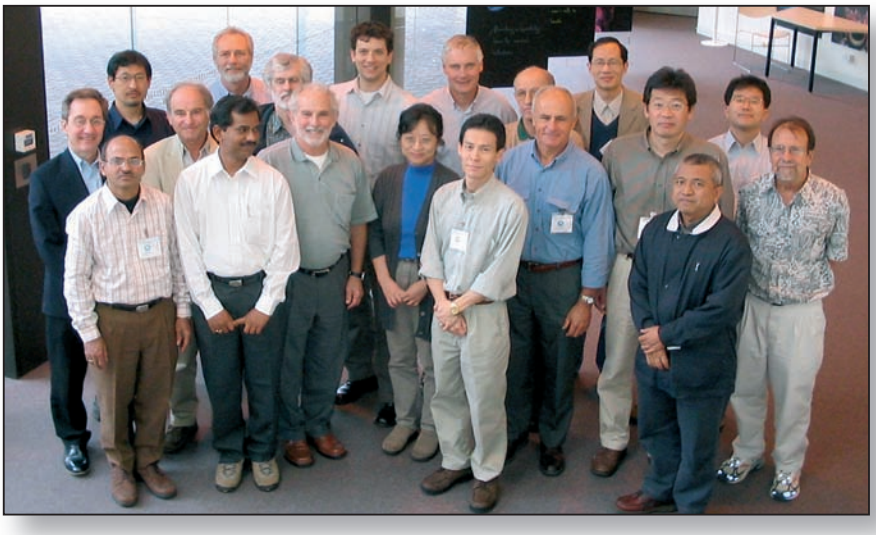
Indian Ocean GOOS (IOGOOS) is one of the larger GOOS regional alliances based on its population and geographical spread. It is comprised of twenty-two members, two associate members and eight participants. The Indian Ocean region has a diverse political, economic and cultural makeup. It has been brought together by the recent tsunami and it also suffers from many other natural disasters such as tropical cyclones, flooding and earthquakes.

Key people from the Indian Ocean countries have been tapped to oversee the ICG/ IOTWS planning processes within their countries. Despite this, progress did include the following:

The Indian Ocean Panel for Climate (IOP) was set up under IOGOOS in 2004, and has just completed an implementation plan for basin-wide sustained observations of the Indian Ocean. The Panel receives support from the Climate Variability and Predictability Programme (CLIVAR) and the Perth Office, and is chaired by Dr Gary Meyers of CSIRO in Hobart with members from around the world. The plan will guide the future deployment of oceanographic observing systems in the Indian Ocean and a number of these instruments have already been deployed.

Future work of the Panel will include designing an appropriate data management system, incorporating bio-geochemical measurement systems and addressing societal impacts of climate in the region.

At its annual meeting in Bali, IOGOOS had a special session to review its possible role in supporting tsunami activities in the region. This will require further analysis and review and it must ensure a multi-hazard approach. The report of the Bali meeting is available at the IOGOOS website: http://www.incois.gov.in/Incois/iogoos/home.jsp.



The Indian Ocean Panel for Climate (IOP) Panel In Hobart, Australia, March 2005.

Pacific Ocean

Pacific Island GOOS (PI-GOOS) was set up in response to the needs of a region that has the largest ocean in the world comprised of scattered and isolated Small Island Developing States that desperately need a coordinated effort to assist ocean observations/marine management for sustainable development. As such, its emphasis has been on awareness and capacity-building, education, coordination of marine science activities within the region conducted by countries from outside the region, and building of the GOOS infrastructure in nations. PI-GOOS is supporting the deployment of Argo in the region.

Dr Sarah Grimes is the PI-GOOS Coordinator and has been based at Scripps Orbit and Permanent Array Center (SOPAC) in Suva, Fiji since September 2004. She receives guidance from the Perth Office and is supported by funds from Perth Office, the Bureau of Meteorology (BOM) and the National Oceanic and Atmospheric Administration (NOAA). She has been particularly effective in explaining GOOS to various groups in the region and gaining support for its objectives. She is working hard at identifying products useful to the island countries and making them available to local users. She has also built good contacts with various research groups such as those involved in RIDGE 2000 and SPICE, which has, and continues to be, translated into capacity-building activities in the region. The Scientific Educational Resources and Experience Associated with the Deployment of Argo (SEREAD) project (which began several years ago) is going well with recent training sessions in the Cook Islands and Samoa. Fiji decided recently to incorporate the SEREAD teaching materials into their curriculum. A close relationship with the Argo Science Team has facilitated this work. Current activity involves raising new funds to support the work.

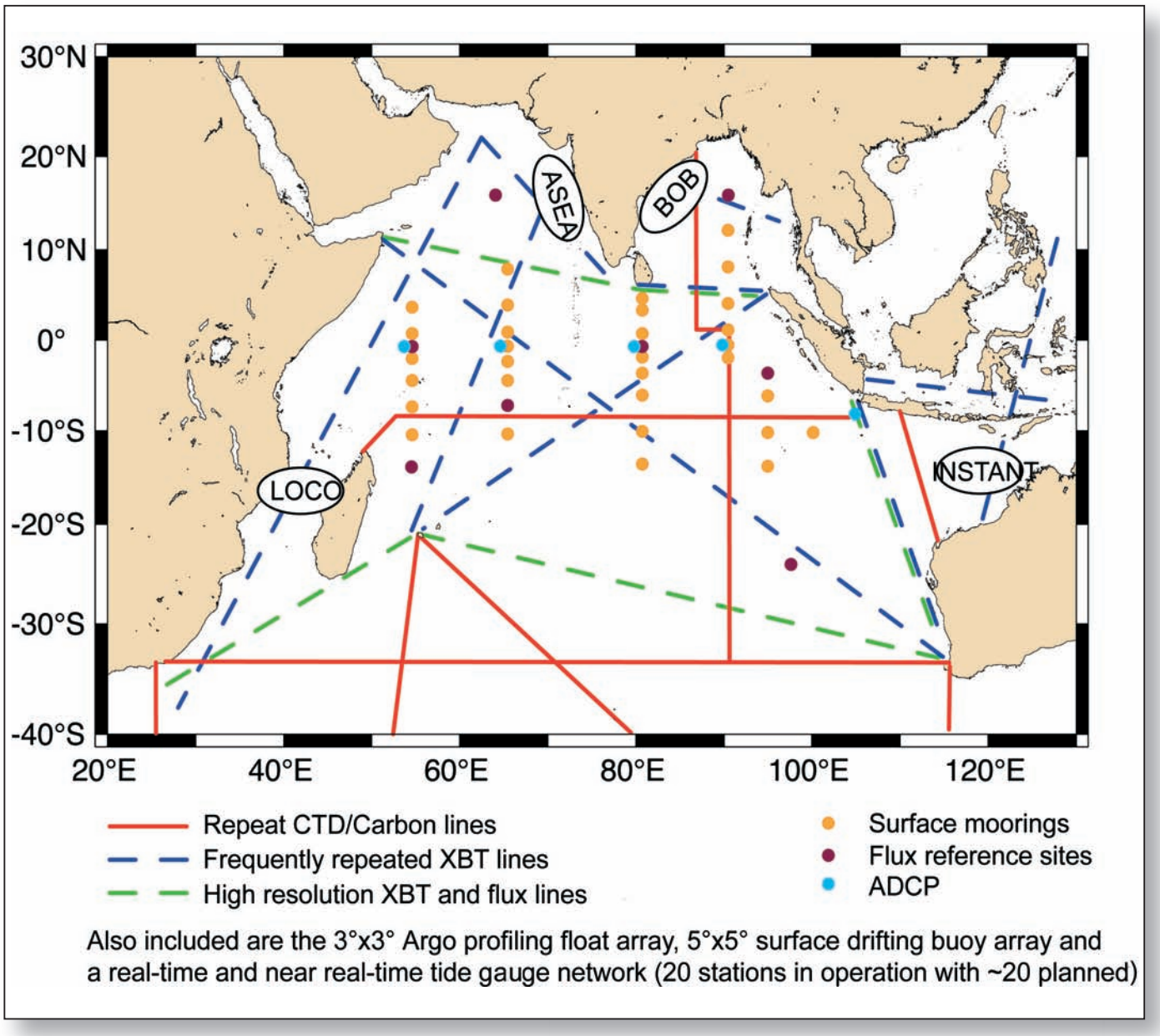
SEAGOOS

The Perth Office along with Dr Neville Smith at BOM Australia, has worked for the past few years to establish South East Asia GOOS (SEAGOOS). The politically diverse region and sensitive geographical areas have hindered the process. However, it now seems that SEAGOOS is taking shape. Thailand has agreed to support a SEAGOOS Secretariat in Thailand that is being actively led by Dr Somkiat Khokiattiwong. The management of SEAGOOS is overseen by Dr Miguel Fortes at the WESTPAC Office in Thailand. It has convened several ad hoc meetings in May at the WESTPAC meeting, August in Bali and at PaceM in Maribus in October. SEAGOOS priority projects include:

- Real-Time Sea Level Observing System for SEAGOOS Region
- Development of New Generation Sea Surface Temperature (NGSST) products in the SEAGOOS region (2005-2008)
- Development of an Expert System for Hazard and Risk Modelling in the SEAGOOS Area.

Summary

The existence of the IOC Office in Perth has resulted in the Indian Ocean becoming a priority for development of GOOS by implementing countries inside and outside the region. Secretariats for Indian Ocean GOOS, Pacific Island GOOS, Western Australia GOOS (WAGOOS) and South East Asia GOOS (SEAGOOS) have been established and are contributing to GOOS climate and coastal activities. Perth has become acknowledged as a national and international center for meetings and conferences in the marine science and technology arena. Implementation of the initial GOOS observing system has begun in the Indian and Pacific Oceans and strategic plans for the development of Indian Ocean GOOS, WAGOOS, SEAGOOS and PI-GOOS are now in place. Finally, the added dimension of the ICG for IOTWS to the Office will enhance cooperation across different disciplines and will help promote a multi-discipline approach to ocean and coastal observing.



Schematic observing system needed for the Indian Ocean: to resolve basin scale variability in oceanic structure, intense coastal boundary currents and timescales from intraseasonal to decadal, using a variety of observation-platforms. The system includes 3x3Deg Argo profiling float array, 5x5Deg surface drifting buoy array and a real-time tide gauge network, plus arrays of meteorological and deep see moorings
(courtesy of G. Meyers, Feb 2005).

Annexes

Photo by Eric Loddé

IOC Officers

Meeting of the IOC Officers at Palacio San Martín, Buenos Aires, Argentina, 20 January 2006.

Sitting left to right: Dr David Thomas Pugh (UK)[Chair]; Dr Patricio Bernal (Chile)[Executive Secretary]

Standing left to right: Prof. Su Jilan (China)[Past-Chair]; Dr Alphonse M. Dubi (Tanzania); C. de Navío Javier Armando Valladares (Argentina); Dr Alexander V. Frolov (Russia); Dr Neville Smith (Australia); [Vice-Chairs]

Not pictured: Prof. Mário Ruivo (Portugal)[Vice-Chair]

The IOC Rules of Procedure indicate that the Officers of the Commission shall consist of the Chair and five Vice-Chairs. The five Vice-Chairs shall be nationals of Member States of different electoral groups (as listed in Appendix II of the Rules of Procedure.) The IOC Officers are elected every two years for a maximum of two terms.

IOC Member States

The IOC welcomes six new Member States

The Intergovernmental Oceanographic Commission (IOC) of UNESCO would like to extend a special welcome to the six Member States that joined us during the past year:

- The Czech Republic (2005)
- The Republic of Kazakhstan (2005)
- Serbia and Montenegro (2005)
- The Democratic Republic of Timor-Leste (2005)
- The Cook Islands (2006)
- Djibouti (2006)

AFGHANISTAN	(11 March 1991)
ALBANIA	(26 January 1993)
* ALGERIA	(Jul. 1964/Nov.1965)
ANGOLA	(26 October 1982)
* ARGENTINA	(Before November 1961)
* AUSTRALIA	(Before November 1961)
AUSTRIA	(Oct. 1962/Jun. 1964)
AZERBAIJAN	527 January 1998)
BAHAMAS	(29 January 1979)
BANGLADESH	(29 October 1982)
BARBADOS	(18 December 1985)
* BELGIUM	(Before November 1961)
BELIZE	(22 September 1995)
BENIN	(23 October 1986)
* BRAZIL	(Before November 1961)
BULGARIA	(Oct. 1967/Dec. 1969)
CAMEROON	(Nov. 1971/Nov. 1973)
* CANADA	(Before November 1961)
CAPE VERDE	(20 August 1984)
* CHILE	(Before November 1961)
* CHINA	(Before November 1961)
COLOMBIA	(Oct. 1967/Dec. 1969)
COMOROS	(08 February 2000)
CONGO	(Nov. 1961/Sep. 1962)
COOK ISLANDS	(2006)
* COSTA RICA	(28 February 1975)
COTE D'IVOIRE	(Before November 1961)
CROATIA	(24 December 1992)
* CUBA	(Before November 1961)
CYPRUS	(05 December 1977)
CZECH REPUBLIC	(2005)
DENMARK	(Before November 1961)
DJIBOUTI	(2006)
DOMINICA	(21 September 1999)
DOMINICAN REP.	(Before November 1961)
* ECUADOR	(Before November 1961)
* EGYPT	(Oct. 1969/Nov. 1971)
EL SALVADOR	(16 February 1993)
ERITREA	(12 November 1993)
ESTONIA	(10 March 1992)
ETHIOPIA	(05 March 1976)
FIJI	(09 July 1974)
* FINLAND	(Before November 1961)
* FRANCE	(Before November 1961)
* GABON	(26 October 1977)
GAMBIA	(30 August 1985)
GEORGIA	(09 July 1993)
* GERMANY	(Before November 1961)
GHANA	(Before November 1961)
GREECE	(Oct. 1962/Jun. 1964)
GUATEMALA	(Dec. 1965/Oct. 1967)
GUINEA	(01 May 1982)
GUINEA-BISSAU	(26 January 1984)
GUYANA	(20 July 1977)
HAITI	(23 March 1976)
ICELAND	(Oct. 1962/Jun. 1964)
* INDIA	(Before November 1961)
* INDONESIA	(Oct. 1962/Jun. 1964)
* IRAN, Islamic Republic of	(03 June 1975)
IRAQ	(Oct. 1969/Nov. 1971)
IRELAND	(07 November 1978)
ISRAEL	(Before November 1961)
* ITALY	(Before November 1961)
* JAMAICA	(Oct. 1967/Dec. 1969)
* JAPAN	(Before November 1961)
JORDAN	(06 April 1975)
KAZAKHSTAN Republic of	(2005)
* KENYA	(Nov. 1971/Nov. 1973)
KOREA Democratic People's Republic of	(31 October 1978)
KUWAIT	(13 November 1974)
LEBANON	(Oct. 1962/Jun. 1964)
LIBYAN ARAB JAMAHIRIYA	(11 March 1974)
MADAGASCAR	(Dec. 1965/Oct. 1967)
* MALAYSIA	(Jul. 1964/Nov. 1965)
MALDIVES	(20 May 1987)
MALTA	(Oct. 1969/Nov. 1971)
MAURITANIA	(Before November 1961)
MAURITIUS	(Oct. 1969/Nov. 1971)
* MEXICO	(Before November 1961)
MONACO	(Before November 1961)
MOROCCO	(Before November 1961)
MOZAMBIQUE	(08 April 1981)
MYANMAR	(07 June 1988)
NAMIBIA	(25 April 2001)
NETHERLANDS	(Before November 1961)
NEW ZEALAND	(Nov. 1961/Sep. 1962)
NICARAGUA	(17 November 1977)
* NIGERIA	(Nov. 1971/Nov. 1973)
NORWAY	(Before November 1961)
OMAN	(16 November 1982)
PAKISTAN	(Before November 1961)
PANAMA	(Oct. 1967/Sep. 1969)
* PERU	(Dec. 1965/Oct. 1967)
* PHILIPPINES	(Oct. 62/Jun. 1964)
POLAND	(Before November 1961)
* PORTUGAL	(Oct. 1969/Nov. 1971)
QATAR	(20 July 1976)
* REPUBLIC OF KOREA	(Before November 1961)
ROMANIA	(Before November 1961)
* RUSSIAN FEDERATION	(Before Nov. 1961)
SAINT LUCIA	(14 September 1992)
SAMOA	(10 April 1978)
SAUDI ARABIA	(14 June 1978)
* SENEGAL	(Oct. 1967/Sep. 1969)
SERBIA AND MONTENEGRO	(2005)
SEYCHELLES	(27 February 1979)
SIERRA LEONE	(19 April 1974)
SINGAPORE	(Dec. 1965/Oct. 1967)
SLOVENIA	(16 June 1994)
SOLOMON ISLANDS	(11 May 1982)
SOMALIA	(10 July 1974)
* SOUTH AFRICA	(Oct. 1967/Sep. 1969)
* SPAIN	(Before Nov.1961)
SRI LANKA	(Jun. 76/Jan. 1977)
SUDAN	(26 August 1974)
SURINAM	(21 January 1977)
SWEDEN	(Jul. 1964/Nov. 1965)
SWITZERLAND	(Before Nov. 1961)
SYRIAN ARAB REP.	(Oct.1969/Nov. 1971)
THAILAND	(Before Nov. 1961)
TIMOR-LESTE Democratic Republic of	(2005)
TOGO	(22 October 1975)
TONGA	(03 January 1974)
TRINIDAD & TOBAGO	(Oct. 1967/Sep. 1969)
* TUNISIA	(Before Nov. 1961)
* TURKEY	(Nov. 1961/Sep. 1962)
* UKRAINE	(Nov. 1961/Sep. 1962)
UNITED ARAB EMIRATES	(02 June 1976)
* UNITED KINGDOM OF GREAT BRITAIN & NORTHERN IRELAND	(Before Nov. 1961)
* UNITED REPUBLIC OF TANZANIA	(Oct. 1967/Sep. 1969)
* UNITED STATES OF AMERICA	(Before Nov. 1961)
URUGUAY	(Before Nov. 1961)
VENEZUELA	(Oct. 1962/Jun. 1964)
VIET NAM	(Before Nov. 1961)
YEMEN	(22 May 1960)

* Members of the Executive Council

IOC Structure

ASSEMBLY
EXECUTIVE COUNCIL
EXECUTIVE SECRETARY
SECRETARIAT

Ocean Sciences

- Oceans and Climate (WCRP, JGOFS, CLIVAR, El Niño, SCOR-IOC Advisory Panel on Ocean CO_2)
- Science for Ocean Ecosystems and Marine Environmental Protection (HAB, Indicators for Ecosystem Health, Nutrient Enrichment, LME, Biosphere-Geosphere Coupling)
- Marine Science for Integrated Coastal Area Management (COASTS, LOICZ-Basins, ICAM Indicators, Global Web-Service, Coastal Megacities, ICAM Methodological Manual)
- United Nations Convention on the Law of the Sea (IOC/ABE-LOS, ABLOS, Special Arbitration)

Operational Observing Systems

- Global Ocean Observing System (GOOS)
- GOOS Modules, Regional Bodies and Pilot Projects (OOPC, COOP, GODAE, Argo)
- Integrated Global Observing Strategy (IGOS)
- Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) (DBCP, SOOP, TIP, GLOSS)
- Global Climate Observing System (GCOS)

Ocean Services

- International Oceanographic Data and Information Exchange (IODE) (GODAR, MIM, GTSPP, MEDI, ASFA, GETADE, GEBCDMEP, GEMIM, Ocean Teacher, OceanPortal, OceanExpert, MarineXML)
- IODE regional projects (ODINAFRICA, ODINCARSA, Regional Ocean Portals, MEDAR/MEDATLAS)
- IDNDR-Related Activities Pacific Tsunami Warning System (PTWS, former ITSU)
- Ocean Mapping (GEBCO, GAPA, IBCM)
- Public Information (IOC website, newsletters, other publications, posters, brochures and leaflets, public events)

Tsunami coordination Unit

- Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)
- Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS)
- Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connecting Seas (ICG/NEAMTWS)
- Intergovernmental Coordination Group for Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS)

CAPACITY BUILDING
TEMA • POGO • FELLOWSHIPS • TTR

REGIONS

2 Regional Subcommissions, 4 Committees and 8 Programme/Project offices

IOCARIBE Cartagena, Colombia	IOCINDIO	HAB Office, Copenhagen, Denmark	GOOS Office, Perth, Australia	ITIC Honolulu,Hawaii
WESTPAC Bangkok, Thailand	IOCWIO	HAB Office, Vigo, Spain	GOOS Office, Rio de Janeiro, Brazil	ICG/IOTWS Secretariat Perth, Australia
	IOCEA	DBCP/Argo Office, Toulouse, France	IOCWIO Project office, Nairobi, Kenya	
	Black Sea			

Organization of Secretariat Staff

- Permanent Staff/Fixed-Term
- Temporary Posts
- ALDs
- Supernumerary
- Consultants *(unless otherwise specified)*

ADG/IOC
Executive Secretary
Patricio Bernal

OFFICE OF THE ADG

ASSISTANT OF THE ADG
- B. Aliaga

UNCLOS CONSULTANT
- A. Mateos

ADMINISTRATIVE ASSISTANT
- K. Yvinec

SECRETARIES
- R. Hervé-Smadja
- S.Sermeno

DOCUMENTALISTS
- P. Boned
- C. Pontes

REGIONAL PROJECT OFFICES/SUBCOMMISSIONS
Professional Staff
- **M. Fortes,** *WESTPAC, Bangkok, Thailand*
- **C. Toro,** *IOCARIBE, Cartagena, Colombia*
- **W. Erb,** *Perth Office, Australia*
- **J. Trotte,** *Rio Office (part-time), Brazil*
- **M. Odido,** *IOCWIO Office, Nairobi, Kenya*

General Services Staff
- W. Velez, *IOCARIBE, Cartagena, Colombia*
- **N.Saransunth,** *(local post), WESTPAC, Bangkok, Thailand*

HEAD OF SECTION Ocean Sciences
U. Unluata

PROFESSIONALS
- J. Barbière
- M. Hood
- H. Enevoldsen *(Copenhagen)*
- S. Belfiore
- C. Wild
- R. Dargaville

SECRETARIAT
- C. Le Conan
- V. Bonnet
- N. Sadi

HEAD OF SECTION Operational Observing Systems, GOOS
K. Alverson

PROFESSIONALS
- T. Aarup
- B. Lee
- A. Fisher
- C. Clark *(NOAA Secondment)*
- Y. Tréglos
- **J. Ahanhanzo** *(part-time)*
- E. Charpentier *(Toulouse)*
- M. Bélbéoch *(Toulouse)*

SECRETARIAT
- I. Gazagne
- H. H. Lam
- C. Whelan
- P. Coughlan *(part-time)*
- L. Ferry

HEAD OF SECTION Ocean Services/IODE
P. Pissierssens

PROFESSIONALS
- D. Travin
- V. Vladymyrov
- R.B. Gelfeld *(NOAA Secondment)*
- B. Sims
- **J. Perce** *(part-time)*

SECRETARIAT
- F. Schiller-Ricotou
- A. Vannier

HEAD OF SECTION Capacity-Building
E. Desa

PROFESSIONALS
- J. Berque

SECRETARIAT
- S. Guiraud

IOC Personnel

Headquarters personnel shown in the photo (left to right):

Front row: Miguel Fortes, Laura Kong, Maria Hood, Aurora Mateos, Boram Lee, Cigié Pontes, Albert Fischer, Cesar Toro, Patricio Bernal, Laurence Ferry, Umit Unluata, Vladimir Vladymyrov, Sonia Guiraud, Ksenia Yvinec, Rejane Hervé-Smadja

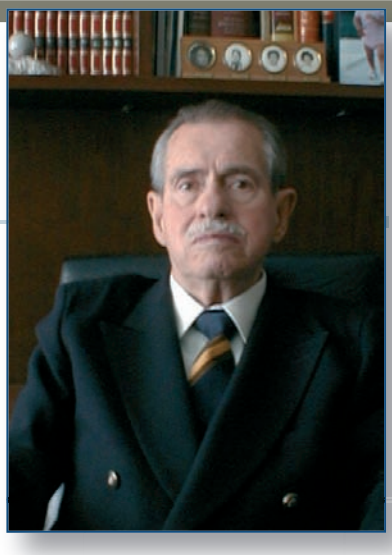
Back row

Ben Sims, Mika Odido, Candyce Clark, Peter Pissierssens, Adrien Vannier, Bill Erb, Joannes Berque, Justin Ahanhanzo, Ehrlich Desa, Bernardo Aliaga, Keith Alverson, Thorkild Aarup, Patrice Boned

In Memoriam

Dr Agustín Ayala-Castañares

former Chair of the IOC and pioneer of international cooperation in the marine sciences



Courtesy of Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México

Dr Agustín Ayala-Castañares, a leading figure in ocean sciences in Mexico, died on November 24 at age 80 following a long illness. He was Chair of the Intergovernmental Oceanographic Commission of UNESCO from 1977-1982, in which capacity he led the IOC's participation in the international conferences that resulted in the UN Convention on the Law of the Sea (UNCLOS).

Dr Ayala-Castañares was a major contributor to the development of the IOC, in particular in Latin America. He was dedicated to the promotion of international cooperation in the marine sciences and his outstanding commitment to this principle brought about the participation of his Latin American colleagues in the IOC's regional programmes.

During his years as Chair, he propelled the diversification of the Commission's programmes, the qualification of human resources from developing countries within the framework of Training, Education and Mutual Assistance (TEMA) and facilitated the development of operational oceanography.

His undergraduate and doctoral degrees (biology) from the National Autonomous University of Mexico (UNAM) bracketed his MS degree (geology) from Stanford University, USA. He became an associate investigator at Scripps Institution of Oceanography in California 1968, an outgrowth of his collaboration with the late F.B. Phleger on studies of Mexican coastal lagoons.

Dr Ayala-Castanñres became a member of the Mexican Academy of Sciences (AMC) in 1964, serving as its Vice-President 1974-75. He led the growth of the Institute of Marine and Limnological Sciences (ICMyL) at UNAM and was its Director from 1981-87, during which time he worked devotedly to stimulate the development of new human resources for research programmes in Mexico.

A personal tribute to Dr Agustín Ayala-Castañares, a man of vision and leadership

By Prof. Mário Ruivo, Vice-Chair, IOC

It is with great emotion that I recall Dr Agustín Ayala-Castañares, with whom I shared more than a quarter of a century of profound friendship and fraternity, built upon our common view of the opportunities offered by the ocean to promote international cooperation for the common good of humanity, and the role of the scientific community and civil society, as a whole, in that endeavour.

We met for the first time in the seventies when I attended, as a representative of the Fisheries Resources Division of the Food and Agriculture Organization, a meeting of Investigaciones Cooperativas del Caribe y Regiones Adyacentes, sponsored by the Cooperative Institute for Climate Applications and Research (CICAR), which marked the future intense involvement of Dr Ayala-Castañares in the IOC and his impressive contribution to international cooperation in oceanography and incorporating Mexico in this process.

His strong personality, persistence and skills as a negotiator contributed to the consolidation of the Intergovernmental Oceanographic Commission within the United Nations System, as an organization with 'functional autonomy' within the framework of UNESCO. Dr Agustín Ayala-Castañares' efforts were highly recognized and appreciated by all. After being Vice-Chair of the Commission from 1973 to 1977, he was elected President, a post he held from 1977 to 1982. As Head of the Portuguese Delegation to the IOC and, later, as Secretary of the Com-

mission, I maintained a very close professional and personal relationship with Dr Ayala-Castañares.

In these high functions, Dr Ayala-Castañares' vision played a decisive role in sensitizing States and international agencies to the importance of reinforcing national capacities in Marine Science and Technology as a key element for the acquisition of knowledge about the ocean and the rational use and management of marine resources and the environment. In this, as well as in other circumstances, Dr Ayala-Castañares demonstrated an intelligent and balanced combination of pragmatism and values, always keeping in mind the objective of narrowing the North-South gap and the common interest of overcoming the traditional dichotomy between developed and underdeveloped countries (as was the concept and terminology of that period). In this sense, he was instrumental in establishing the IOC Training, Education and Mutual Assistance in the marine sciences (TEMA) programme aiming at promoting the creation of favourable conditions for partnership between Member States through the contribution of funds and other means for training and education of qualified human resources.

As I had the opportunity to state, along with Manuel Murillo and Ulf Lie, in the tribute we paid to Dr Ayala-Castañares at the Universidad Nacional Autónoma de México (UNAM) in 1993, he devoted special attention to stimulating regional cooperation and promoting the association of his Mexican colleagues in the programmes and activities of the IOC and other international organizations, always keeping in mind that national capacity building in Marine Sciences was a decisive step for the achievement of national objectives in ocean affairs and global cooperation. In this context, I wish to emphasize the personal contribution of Dr Ayala-Castañares to the process of negotiation that led to the signature of the United Nations Convention on the Law of the Sea (UNCLOS) and, in particular, to Part XIII, which deals with Marine Scientific Research. In his address, as Chair of the IOC, to the Twelfth Session of the Assembly (12 November 1982), he stated:

'The Third United Nations Conference on the Law of the Sea is coming to an end. Next month, in December, the corresponding Convention will be signed; this will be the culmination of unprecedented efforts in the field of international law and will mark the conclusion of a whole phase in marine affairs at the global level. Because of this Conference and the importance that the international community attaches to the oceans, the marine sciences are now being recognized as an essential factor in development at the highest governmental level. Advantage should be taken of this particularly favourable situation so that the Commission may be assigned the importance that is its due and its own prestige and that of UNESCO enhanced. The huge potential of ocean resources – largely located in areas corresponding to exclusive economic zones and on the continental shelf – is seen to be an obvious means of helping to solve many of the serious social and economic problems oppressing Mankind. For this reason, a large number of countries view the new ocean order as an essential supporting structure for the new international economic order'.

I quote this paragraph as an indicator of Dr Ayala-Castañares' vision and leadership, which should inspire us all to pursue these goals. This is the best tribute we can pay to his memory, as well as to all the other inspired founders of the IOC.

Lisbon, 8 June 2006

Courtesy of Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México

Dr Agustín Ayala-Castañares during his term as Chair of the IOC, 1977-1982.

Publications and Public Awareness

IOC Publications

Each year the IOC publishes numerous documents and other publications. These publications support its programme activities and communicate the scientific and organizational information resulting from the various conferences, meetings, training courses and other activities that have benefited from IOC's support. Many of these publications are available on the internet; certain titles are also available in print where the internet is not an option.

IOC TECHNICAL SERIES

Kenyon, N.H., Ivanov, M.K., Akhmetzhanov, A.M., Kozlova, E.V. and Mazzini, A. (eds). 2005. *Interdisciplinary Studies of North Atlantic and Labrador Sea Margin Architecture and Sedimentary Processes. (TTR-13 Cruise of R/V 'Professor Logachev', July–September, 2003)*. (Technical Series, 68) (English)

IOC WORKSHOP REPORTS

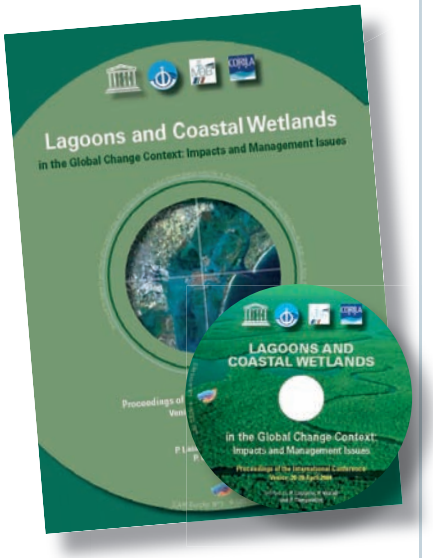
Magni, P., Hyland, J., Manzella, G., Rumhor, H., Viaroli, P., Zenetos, A. (eds). 2005. *Indicators of Stress in the Marine Benthos: Proceedings of an international workshop on the promotion and use of benthic tools for assessing the health of coastal marine ecosystems, Torregrande-Oristano, Italy 8–9 October 2004*. (Workshop Reports, 195) 50 pp. (English)

International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean within a Global Framework, Paris, France, 3–8 March 2005. 2005. 104 pp. (Workshop Reports, 196) (English)

Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean, Grand Baie, Mauritius, 14–16 April 2005. 2005. 66 pp. (Workshop Reports, 198) (English)

International Conference for the Establishment of a Tsunami and Coastal Hazards Warning System for the Caribbean and Adjacent Regions, Mexico, 1–3 June 2005. 2005. 47 pp. (Workshop Reports, 199) (English)

Lagoons and Coastal Wetlands in the Global Change Context: Impacts and Management Issues – Proceedings of the International Conference, Venice, 26–28 April 2004. 2005. (ICAM Dossier No 3; booklet and CD-ROM). (Workshop Reports, 200) (English)



TRAINING COURSE REPORTS

First ODINCINDIO Training Course in Ocean Data Management, Oostende, Belgium, 10–21 October 2005. 2005. (Training Course Reports, 78) (English, electronic copy only)

First ODINAFRICA-III Training Course in Marine Data Management, Oostende, Belgium, 11–29 April 2005. 2005. (Training Course Reports, 79) (English, electronic copy only)

HELCOM/BSRP/ICES and IOC/IODE Training Workshop: Baltic Sea Data Collection – Management, Analysis and Synthesis, Vilnius, Lithuania, 24–28 October 2005. 2005. (Training Course Reports, 80) (English, electronic copy only)

First ODINCARSA-II Data Management Training Workshop, Oostende, Belgium, 7–18 November 2005. 2005. (Training Course Reports, 81) (English, electronic copy only)

Second ODINCARSA Training Course in Marine Information Management, Oostende, Belgium, 9 November –19 November 2005. 2005. (Training Course Reports, 82) (English, electronic copy only)

Web Service Development Training for ODINAFRICA, Oostende, Belgium, 5–9 December 2005. 2005. (Training Course Reports, 83) (English, electronic copy only)

ODINAFRICA Training Course on Development of Electronic Repositories on Marine Related Publications from Africa, Oostende, Belgium, 5–9 December 2005. 2005. (Training Course Reports, 84) (English, electronic copy only)

Third ODINCARSA-I Marine Data Management Training Workshop, Oostende, Belgium, 21–26 November, 2005. 2005. (Training Course Reports, 85) (English, electronic copy only)

IODE/GOOS/JCOMM Combined Modelling and Data Management Training Workshop ('Jamboree'), Oostende, Belgium, 5–10 September 2005. 2005. (Training Course Reports, 86) (English, electronic copy only)

INFORMATION DOCUMENTS

IOC/INF-1203. *IOC Criteria and Guidelines on the Transfer of Marine Technology (CGTMT).* 2005. 33 pp. (English, French)

IOC/INF-1204. *Audit Report on the Intergovernmental Oceanographic Commission (IOC): Special Account and Controls Generally (Summary).* 2005. 9 pp. (English)

IOC/INF-1205. *GEOSS Ten-Year Implementation Plan; EOS III Resolution; and Communiqué Relating to Support for Tsunami and Multi-Hazard Warning Systems*. 2005. 15 pp. (English)

IOC/INF-1206. *IOC Ocean Sciences Section: Overview and Expected Results*. 2005. 10 pp. (English)

IOC/INF-1207. *Background, Progress, and Future Directions for the WMO-IOC-ICSU World Climate Research Programme (WCRP).* 2005. 6 pp. (English)

IOC/INF-1208. *Progress Report and Proposed Terms of Reference for the International Ocean Carbon Coordination Project.* 2005. 4 pp. (English)

IOC/INF-1209. *Joint IOC-WMO Technical Commission for Oceanography and Marine Meteorology (JCOMM); Report by JCOMM Co-Presidents on Recent Activities, 2005*. 2005. 9 pp. (English, French)

IOC/INF-1210. *Report of the First Inter-Agency Meeting of UN-Oceans, 25–26 January 2005.* 2005. 11 pp. (English)

IOC/INF-1211. *IOC Principles and Strategy for Capacity-Building.* 2005. 44 pp. (English)

IOC/INF-1212. *Implementation Plan for IOC Capacity-Building*. 2005. 63 pp. (English)

IOC/INF-1213. *Progress and Further Requirements for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean.* 2005. 75 pp. (English)

IOC/INF-1214. Progress with the Initial Ocean Climate Observing System: A report to the UNFCCC, April 2005. 2005. 7 pp. (English)

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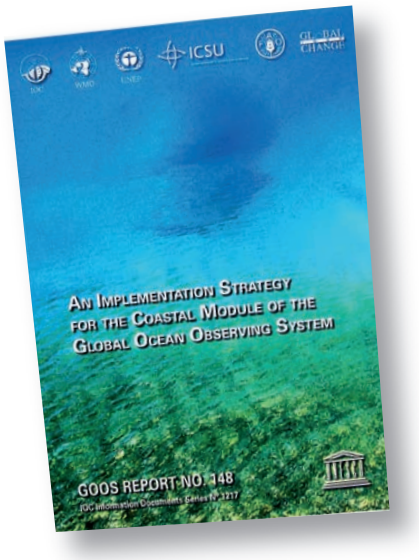

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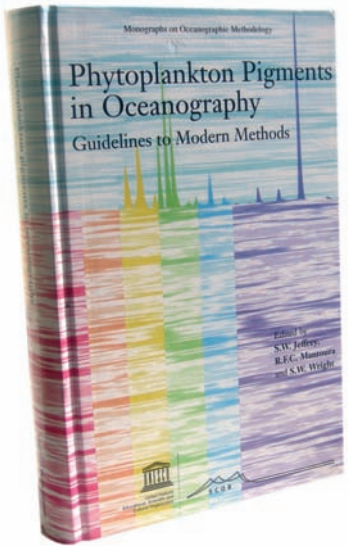

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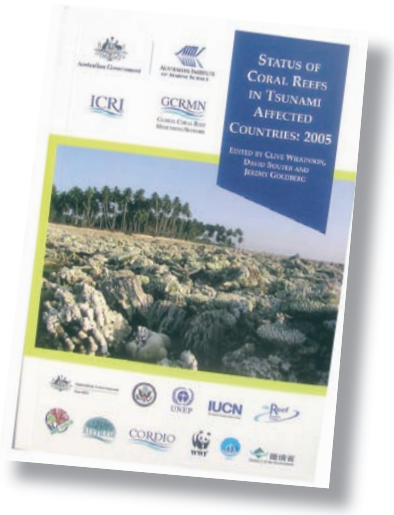

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Further information is available at: http://ioc.unesco.org

Enquiries or requests for any of the above titles may be addressed to the IOC Documentalist: Patrice Boned p.boned@unesco.org Fax: +33 1 45 68 58 10

IOC Meetings in 2005

Event	Date	Venue	IOC Department
UN-Oceans Interagency Meeting	25-26 January	Paris, France	Ocean Sciences
Training Workshop on Development of Electronic Repositories	7-11 February	Limburg, Belgium	Ocean Services
JCOMM Management Committee, Fourth Session (MAN-IV)	9-12 February	Paris, France	Operational Observing Systems
Eighth Session of the GOOS Steering Committee (GSC-VIII)	21-23 February	Melbourne, Australia	Operational Observing Systems
IOC Training Course on Qualitative and Quantitative Determination of Algal Toxins	22 February-3 March	Sylt, Germany	Ocean Sciences
Ninth Session of the IOC Group of Experts on GLOSS	24-25 February	Paris, France	Ocean Sciences
Second Session of the IOCARIBE-GOOS Steering Committee Meeting	March	Panama City, Panama	IOCARIBE
GRASP II Meeting	March	Guayaquil, Ecuador	IOCARIBE
International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System in the Indian Ocean within a Global Framework	3-8 March	Paris, France	Secretariat
GEOHAB Open Science Meeting on Harmful Algal Blooms and Eutrophication	7-11 March	Maryland, USA	Ocean Sciences
Capacity-Building Strategy Experts Meeting	9-11 March	Paris, France	Capacity-Development
Seventh Session of the IOC Intergovernmental Panel on Harmful Algal Blooms*	16-18 March	Paris, France	Ocean Sciences
GOOS Regional Alliances Network Development Project (GRAND) Workshop	29 March-2 April	Genoa, Italy	Operational Observing Systems
ICAM Planning Meetings	April	Cartagena de Indias, Colombia	IOCARIBE
Meeting of the IOCARIBE Board of Officers	April	Cartagena de Indias, Colombia	IOCARIBE
Seventh Session of the IOC-WMO-UNEP Intergovernmental Committee for the Global Ocean Observing System (I-GOOS-VII)*	4-7 April	Paris, France	Operational Observing Systems
ICES-IOC Working Group on the Dynamics of Harmful Algal Blooms	4-8 April	Flodevigen, Norway	Ocean Sciences
ICES-IOC-SCOR Study Group on GEOHAB Implementation in the Baltic	7-9 April	Flodevigen, Norway	Ocean Sciences
ODINAFRICA Data Management Training Course	10-30 April	Oostende, Belgium	IOCWIO
Fifth Open-ended Informal Consultative Process on Oceans and the Law of the Sea (ABE-LOS V)	11-15 April	Buenos Aires, Argentina	Secretariat
Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean	14-16 April	Grand Baie, Mauritius	Secretariat
Marine Biodiversity Data Management Training Course	18-23 April	Oostende, Belgium	IOCWIO
Inauguration IODE Project Office	25 April	Oostende, Belgium	Ocean Services
Eighteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE-XVIII)*	26-30 April	Oostende, Belgium	Ocean Services
Second Session of the JCOMM Observations Programme Area Coordination Group (OCG)	29-30 April	Silver Spring, USA	Operational Observing Systems

Meeting on Regional Network in Marine Science and Technology for the Caribbean	May 2005	Cartagena de Indias, Colombia	IOCARIBE
Tenth Session of the Ocean Observations Panel for Climate (OOPC)	9-12 May	Geneva, Switzerland	Operational Observing Systems
IOC Food and Nutrition Science Alliance (FANSA) Training Course on Identification of Harmful Microalgae	15-27 May	São Paulo, Brazil	Ocean Sciences
Sixth IOC Sub-Commission for the Western Pacific (WESTPAC-VI)	23-27 May	Nha Trang, Vietnam	WESTPAC
International Conference for the Establishment of a Tsunami and Coastal Hazards Warning System for the Caribbean and Adjacent Regions	1-3 June	Mexico City, Mexico	IOCARIBE
UN OCEANS	2-3 June	UN Headquarters, New York, USA	Ocean Sciences
UN Informal Consultative Process	6-10 June	UN Headquarters, New York, USA	Secretariat
IOC Oceanography Society Meeting	6-10 June	Paris, France	Ocean Sciences
Global Marine Assessments	13-16 June	UN Headquarters, New York, USA	Ocean Sciences
The Global Carbon Project, Ninth Scientific Steering Committee	14-17 June	Paris, France	Ocean Sciences
Thirty-eighth Session of Executive Council*	20 June	Paris, France	Secretariat
Twenty-third Session of the Assembly*	21-30 June	Paris, France	Secretariat
Second ODINAFRICA Project Management Meeting	29 June-2 July	Paris, France	IOCWIO
Second ODINAFRICA Steering Committee Meeting	4-6 July	Paris, France	IOCWIO
Large Marine Ecosystems Consultative Meeting.	5-6 July	Paris, France	Ocean Sciences
Ad Hoc Meeting for the International Bathymetric Chart of the East South Pacific	10-12 July	Guayaquil, Ecuador	Ocean Services
ICAM Indicators Meeting	11-13 July	Paris, France	Ocean Sciences
First Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS)	3-5 August	Perth, Australia	Perth Programme Office
ODINAFRICA/ODINCINDIO Information Management Training Course	15 August-1 September	Oostende, Belgium	IOCWIO
IOC-ICES Inter-comparison Workshop on New and Classic Techniques for the Determination of Numerical Abundance and Biovolume of HAB-species	22-26 August	Kristineberg, Sweden	Ocean Sciences
Second ODINAFRICA Marine Biodiversity Training Course	22-28 August	Mauritius	IOCWIO
Eleventh Session of the IOC-WMO-CPPS Joint Working Group on the Investigations of El Niño	Second Semester		IOCARIBE
First IODE/GOOS/JCOMM Modelling and Data Management Training Workshop	5-13 September	Oostende, Belgium	Ocean Services
Second Session of JCOMM*	19-27 September	Halifax, Canada	Operational Observing Systems
Seventh International CO_2 Conference (co-sponsored by IOC/ UNESCO)	26-30 September	Broomfield, Colorado	Ocean Sciences
IOCCP Ocean Carbon Open House	28 September	Broomfield, Colorado	Ocean Sciences
IOCCP Scientific Steering Group, First Session	1 October	Broomfield, Colorado	Ocean Sciences
International Coordination Group for the Tsunami Warning System in the Pacific, Twentieth Session (ITSU-XX)	3-8 October	Valparaiso, Chile	Ocean Services

Marine Information Management Training Course for the Indian Ocean Countries	10-22 October	Oostende, Belgium	Ocean Services
Ocean Data Management Training Course for the Indian Ocean Countries	10-22 October	Oostende, Belgium	Ocean Services
CLIVAR-OOPC South Pacific Workshop	11-14 October	Concepción, Chile	Operational Observing Systems
Twenty-first Session of the Data Buoy Co-operation Panel	17-21 October	Buenos Aires, Argentina	Operational Observing Systems
Twenty-fifth Meeting on the Argos Joint Tariff Agreement	24-26 October	Buenos Aires, Argentina	Operational Observing Systems
IOC Leadership Development Workshop for Directors/Senior Role Players	29 October-2 November	Maputo, Mozambique	Capacity-Development
Sixth Session of IOC Regional Committee for the Western Indian Ocean*	1-5 November	Maputo, Mozambique	IOCWIO
Ocean Data Management Training Course for ODINCARSA Countries (Basic Level)	7-19 November	Oostende, Belgium	Ocean Services
Marine Information Management Training Course for the ODINCARSA Countries	7-18 November	Oostende, Belgium	Ocean Services
Ocean Data Management Training Course for ODINCARSA Countries (Basic Level)	7-19 November	Oostende, Belgium	Ocean Services
Marine Information Management Training Course for the ODINCARSA Countries	7-18 November	Oostende, Belgium	Ocean Services
Ocean Sciences Activity Group	9-10 November	Paris, France	Ocean Sciences
IOCCP-CLIVAR Repeat Hydrography Workshop	14-17 November	Shonan Village, Kamakura, Japan	Ocean Sciences
Ocean Data Management Training Course for ODINCARSA Countries (Advanced Level)	21-25 November	Oostende, Belgium	Ocean Services
Web Service Development Training for ODINAFRICA Countries	5-9 December	Oostende, Belgium	IOCWIO
Global Forum on Oceans, Coasts and Islands	5-9 December	Paris, France	Ocean Sciences
GEOHAB Open Science Meeting on Harmful Algal Blooms and Stratification	5-9 December	Paris, France	Ocean Sciences
Fourth Session of the IOC Regional Committee for the Central Indian Ocean (IOCINDIO)	8-12 December	Colombo, Sri Lanka	Ocean Sciences
Training Workshop on Development of Electronic Repositories	9 December	Oostende, Belgium	IOCWIO
International Workshop for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean	12-13 December	Hyderabad, India	Perth Programme Office
Second Session of the Intergovernmental Coordination Group for the Development of a Tsunami Early Warning and Mitigation System for the Indian Ocean (ICG/IOTWS)	14-16 December	Hyderabad, India	Perth Programme Office

*Intergovernmental meetings

IOC Participation in 2005 Tsunami Warning and Mitigation System Meetings

Location	Date	Host	Topic
Kobe, Japan	18-25 January	World Conference on Disaster Reduction (WCDR)	Disaster risk reduction planning for the next ten years
Phuket, Thailand	29 January	Royal Thai Government	Ministerial Meeting on Regional Cooperation on Early Warning Arrangements
Paris, France	9-12 February	Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM)	Report on status of the Intergovernmental Coordination Group for the Tsunami Warning System in the Pacific (IGC/ITSU)
Perth, Australia	16 February	Indian Ocean Marine Environmental Conference	Science, Engineering and Management in the Indian Ocean, including a special session on tsunami
Jeet Singh Marg, New Delhi	17-18 February	Technology Information, Forecasting and Assessment Council (TIFAC)	Early Warning Systems
Vienna, Austria	21 February	The Comprehensive Nuclear Test-ban Treaty Organisation (CTBTO)	Access to seismological data
Bangkok, Thailand	21-22 February	The Asian Disaster Preparedness Center (ADPC)	Experts Early Warning Systems
Barbados	21 February	The Caribbean Disaster Emergency Response Agency (CDERA)	Review of existing Early Warning System networks
Tokyo, Japan	22-24 February	International Strategy for Disaster Reduction (UN/ISDR)	High level administration Early Warning Systems
Paris, France	24-25 February	Global Sea Level Observing System (GLOSS)	GLOSS monitoring capabilities
New Delhi, India	21-26 February	World Meteorological Organization (WMO)/Economic and Social Commission for Asia and the Pacific (ESCAP) Thirty-second Session on Tropical Cyclones	Early Warning Systems in the Indian Ocean for tropical cyclone and storm surges and building a Tsunami Warning System based on a multi-hazard approach
Paris, France	3-8 March	UNESCO/IOC	Early Warning Systems
Japan	6-19 March	Japan International Cooperation Agency (JICA)	Regional Early Warning Systems seminar
Jakarta, Indonesia	14-18 March	World Meteorological Organization (WMO) Expert Meeting on the Exchange of Early Warning and Related Information Including Tsunami Warnings in the Indian Ocean	WMO Global Telecommunication System upgrades to address needs for exchange of tsunami related information and warnings to all Indian Ocean Countries
Delft, Netherlands	21-23 March	Geo-database management centre	Data management
Italy	24 March	International Centre for Theoretical Physics (ICTP)	Physics and preparedness
India	8-10 April	Institute for Sustainable Development and Research, (ISDR)	Preparedness
Mauritius	14-16 April	IOC	Early Warning Systems coordination
Ottawa, Canada	21-22 April	Institute of Population Health	Rehabilitation and reconstruction
Vienna, Austria	24-29 April	European Geosciences Union	Special session on tsunami
Managua, Nicaragua	25-28 April	Coordination Center for the Prevention of Natural Disasters in Central America (CEPREDENAC)	Early Warning Systems
Lake Tahoe, USA	27-29 April	Seismological Society of America	Special session on earthquakes and tsunami
Charleston, USA	8-11 May	American Society of Civil Engineers	Solutions to disasters conference

Brussels, Belgium	12 May	European Commission	Warning and alert technology
Jamaica	18 May	Faculty of Pure and Applied Science, University of the West Indies	Tsunami risk reduction programme
Nusa Dua, Bali, Indonesia	20-21 May	World Tourism Organization (WTO) TOURCOM, Regional Conference for Asia and the Pacific	Recovery
Nha Trang, Vietnam	23-25 May	WESTPAC	Special Tsunami Warning System in the Pacific (ITSU) session
New Orleans, USA	23-27 May	American Geophysical Union Joint Assembly Meeting	Geophysical sciences
Mexico City, Mexico	1-3 June	IOC	Early Warning System for the Caribbean
Madang Province, Papua New Guinea	6-8 June	Twelfth Pacific Disaster Management Meeting	Building the resilience of nations and communities to disasters
Honolulu, Hawaii	6-10 June	US Trade and Development Agency (USTDA)/National Oceanic and Atmospheric Administration (NOAA)	Asia Pacific All-Hazards Workshop (Partnership, Technology)
Lae, Papua New Guinea	7-9 June	South Pacific Applied Geoscience Commission	Regional disasters managers' conference
Seattle, USA	June	University of Washington	Tsunami deposits workshop
Bangkok, Thailand	13-14 June	Asia-Pacific Broadcasting Union/ International Strategy for Disaster Relief (ISDR)	Information flow
Bangkok, Thailand	15-16 June	Asia-Pacific Broadcasting Union/ International Strategy for Disaster Relief (ISDR)	Public awareness
Singapore	20-23 June	Asia-Oceania Geosciences Society	Tsunami special session
Paris, France	21-30 June	IOC	Twenty-third Session of the IOC Assembly
Bangkok, Thailand	22-24 June	UN Economic and Social Commission for the Pacific	Expert meeting on technical options for disaster management
Chania, Crete	28 June	The International Union of Geodesy and Geophysics (IUGG) Tsunami Commission	IUGG tsunami business meeting
Orleans, France	27-29 June	Integrated Global Observing Strategy (IGOS) Geohazards Workshop	IOC Tsunami Warning and Mitigation Programme and geological hazards research needs
Chania, Crete, Greece	27-29 June	The International Union of Geodesy and Geophysics (IUGG)	The Twenty-second Tsunami Symposium
Madrid, Spain	3-7 July	WAVES	Wave measurement and analysis
Toronto, Canada	10-13 July	Canadian Centre for Emergency Preparedness	Sixteenth World Conference on Disaster Management
Tokyo, Japan	11-14 July	UN/International Strategy for Disaster Relief (ISDR) and UNESCO/IOC	Japan Tsunami Warning System Study Tour
Charlotte, USA	24-30 July	UNESCO, International Society for Environmental Geotechnology (ISEG), Global Alliance for Disaster Reduction (GADR)	International Conference on Energy, Environment and Disasters (INCEED 2005): Bridging the Gaps for Global Sustainable Development
Hawaii, USA	26-29 July	UN/International Strategy for Disaster Reduction (ISDR) and UNESCO/IOC	Hawaii Tsunami Warning System Study Tour
Chennai, India	30 July-1 August	International Conference on Tsunami Disaster Management and Coastal Development, Madras Development Society	Disaster management and coastal development

Perth, Australia	3-5 August	IOC	Intergovernmental Coordination Group for an Indian Ocean Tsunami Warning System (ICG/IOTWS-I) technical aspects
Suva, Fuji	5-6 August	Scripps Orbit and Permanent Array Center (SOPAC)	Early Warning Systems Regional Planning
Christchurch, Barbados	8-9 August	Commonwealth Secretariat	Small Island Developing States (SIDS) Disaster Warning and Response Systems
Kalpakkam, India	29 August-2 September	International Atomic Energy Agency (IAEA) International Workshop	Keynote presentation on IOC Tsunami Warning and Mitigation Programme
Seowipo, Korea	4-8 September	Asian and Pacific Coasts (APAC)	Third International Conference on Asian and Pacific Coasts, with special Asia-Tsunami Session
Bangkok, Thailand	7-8 September	UN/International Strategy for Disaster Reduction	Tsunami Education and Public Awareness
New York, USA	14-16 September	UN	High level plenary meeting
Phuket, Thailand	19-23 September	Asian Disaster Preparedness Center (ADPC)	Training course in vulnerability reduction for cities
San Diego, USA	21-22 September	U.S. National Science Foundation (NSF), Oregon State, San Diego Supercomputer	Tsunami Data Preservation
Kurukshetra, India	23-25 September	UN/International Strategy for Disaster Reduction	Tsunami Rehabilitation
Santiago, Chile	29-30 September	Tsunami Warning System in the Pacific (ITSU)	Workshop 'Large Tsunamis in the Indian Ocean and other regions'
Valparaiso, Chile	3-7 October	IOC/UNESCO Tsunami Warning System in the Pacific (ITSU)	Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)
Auckland, New Zealand	5-7 October	Australian Fire Authorities	Innovation and Technology
San Francisco, USA	9-12 October	American Shore and Beach Preservation Association	Technical Section
Salt Lake City, USA	16-19 October	Geological Society of America	Tsunami Symposium
Geneva,			
Switzerland	October 17-19, 2005	World Meteorological Organization (WMO) Coordination Meeting on Global Telecommunication System Upgrade to support multi-hazard early warning systems, including Tsunami warning	Review of the reports of the telecommunication expert missions to thirteen Indian Ocean countries; development of a concrete Global Telecommunications System upgrade plan and budget; fundraising
Queensland, Australia	31 October-3 November	Peace in the Oceans	Thirty-first Pacem in Maribus with sessions on tsunamis
Bangkok, Thailand	7-25 November	Asian Disaster Preparedness Center (ADPC)	Course on disaster management
Quezon City, Philippines	7-19 November	IOC; the International Tsunami Information Centre (ITIC); the Tsunami Warning System in the Pacific (ITSU); the Working Group on Subduction Zones Located in Developing Countries (WGSZLDC)	Training Workshop on Numerical Tsunami Modelling
Gloucestershire, UK	9-10 November	International Disaster and Emergency Resilience, UK Fire Services College	Disaster preparedness conference with tsunami presentations
Jakarta, Indonesia	10-11 November	IOC	Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) First Seismic Working Group Meeting

Melbourne, Australia	14-16 November	Joint Working Commission for Disaster Reduction on the Coasts of the Indian Ocean	Hazards mapping, vulnerability, risk
Copenhagen, Denmark	16-18 November	Ministry of Foreign Affairs of Denmark	Workshop on strengthening local communities from water related natural disasters
Rome, Italy	21-22 November	IOC	Intergovernmental Coordination Group for Tsunami Warning Systems for the North Eastern Atlantic, Mediterranean and Connected Seas (ICG/NEAMTWS-I)
Singapore	21-23 November 2005	World Meteorological Organization (WMO) Workshop on Multi-Hazard Early Warning Center's Concept of Operations for the Indian Ocean Tsunami Warning System	Multi-hazard regional centres and regional and national tsunami warning centres.
Singapore	24 November	IOC	Intergovernmental Coordination Group for an Indian Ocean Tsunami Warning System (ICG/IOTWS) Interoperable Systems Working Group Meeting
Montreal, Canada	25 November	IOC	Intergovernmental Coordination Group for an Indian Ocean Tsunami Warning System (ICG/IOTWS) International DART Partnership Working Group Meeting
San Francisco, USA	5-9 December	American Geophysical Union	Tsunami Special Session
Barkatullah University, India	7-9 December	Indian Geophysical Union	Science of earthquakes and tsunamis with a goal of preparedness
Hyderabad, India	12-13 December	IOC/UNESCO	Intergovernmental Coordination Group for an Indian Ocean Tsunami Warning System (ICG/IOTWS) Tsunami Hazard Working Group - Model Intercomparison Workshop
Hyderabad, India	13 December	IOC/UNESCO	Intergovernmental Coordination Group for an Indian Ocean Tsunami Warning System (ICG/IOTWS) Second Seismic Working Group Meeting
Hyderabad, India	14-16 December	IOC/UNESCO	Second Meeting of the Intergovernmental Coordination Group for an Indian Ocean Tsunami Warning System (ICG/IOTWS)

Funding for IOC Programmes

Introduction

This Annual Report describes a wide spectrum of activities that highlight the relevance of the Intergovernmental Oceanographic Commission of UNESCO's programmes in 2005. Together with national and non-governmental initiatives, the implementation of IOC programmes and related staff costs during 2005 was financed through income from UNESCO as part of its regular programme allocation, as approved by the UNESCO General Conference, and from extra-budgetary resources, notably those provided by IOC Member States and partner organizations through their contributions to the Intergovernmental Oceanographic Commission of UNESCO Special Account and contributions for specific projects through creation of UNESCO Funds-in-Trust. This Financial Report does not consider other contributions (either direct or in kind) provided by Member States in support of the Commission's programme execution, which are rather substantial but do not enter the budgetary flow of IOC.

The Twenty-second Session of the IOC Assembly (24 June-2 July 2003) approved the programme and budget based upon anticipated resources, which for 2004-2005 were expected to amount to $12,055,900 (the regular budget allocation of $8,495,900 provided by UNESCO under the Real Growth $610M 32C/5 Scenario to finance direct programme costs [$4,743,900] and staff costs [$3,752,000 - total approved net of lapse]; and expected voluntary contributions from the Member States and international organizations were estimated at $3,560,000[1]).

The Approved Programme and Budget for UNESCO for 2004-2005 (document 32 C/5) confirmed the funding for the Intergovernmental Oceanographic Commission at the level approved by the Assembly. This amount represents approximately 1.4 percent of the total UNESCO budget.

The allocation of $4,743,900 for direct programme costs represents an increase of 46 percent (representing $1,500,000 more) compared to the previous biennium. However, the Executive Council at its Thirty-seventh Session (23-29 June 2004), while noting this increase with appreciation, expressed its concern that, 'as a result of the increasing long-term responsibilities of the IOC in global ocean issues, the resources available to IOC will fall below the level needed to sustain the work of the Commission, and that extra-budgetary contributions, although substantial cannot be expected to fill this gap'. Extrabudgetary resources largely exceeded the estimated amount, mainly due to the contributions towards the establishment of the Early Tsunami Warning System, following the tragic events of December 2004.[2]

Table 1a. Summary of IOC Income in 2005 (in US$)

Type of Funding	Programme	Personnel	Total
Regular Programme Allocation (UNESCO) Budget (according to 32 C/5, before running costs)	2,371,950	1,876,000	4,247,950
Contributions to the IOC Special Account	1,722,321	413,712	2,136,0337
Contributions to Specific Extrabudgetary Projects (including UNESCO Funds-in-Trust)	9,105,483	1,944,596	11,050,080
TOTAL	**13,199,754**	**4,234,308**	**17,434,063**

The total amount of resources available for programme implementation in 2005 was $13,199,754 of which $10,827,804 came from sources other than the UNESCO regular budget. The contribution from the regular budget towards programme implementation represents 18 percent of the total available funding.

The largest fraction of the fixed cost of the operation of the IOC is personnel, amounting to 24 percent of the total income. In 2005, IOC had the total of 50 employees (44.9 person/month): at Headquarters (38) and in the Field (12). Of these, 34 are professional staff and 16 provide administrative and secretarial assistance. UNESCO's staff allocation only covers 8 professional and 13 general services category posts.

1. Funds already received or firmly committed.
2. Extrabudgetary funding received in 2004 (both as contributions to the Special Account and to specific subsidiary accounts and Fund-in-Trust) for programme implementation amounted to $ 4,473,639.52 representing 65 percent of total programme funding; versus 81 percent in 2005.

Regular programme implementation
UNESCO's and therefore IOC's budget is implemented over a period of two years, based on the approved programme and budget for the biennium, in this case 2004 and 2005.

Table 1b. Budget Implementation Rate for 2004–2005 (in US$)[2]

Budget Code	Title	Allocation	Total Expenses	Available Allocation
MLA 1 - OCEAN SCIENCE				
22151101 IOC	World Climate Research Programme	45,000.00	45,000.00	0.00
22151102 IOC	Ocean Carbon Advisory Panel	85,000.00	85,000.00	0.00
22151103 IOC	Ocean Observations Panel for Climate	124,000.00	124,000.00	0.00
22151201 IOC	Harmful Algal Blooms	82,000.00	81,999.14	0.86
22151202 IOC	Environmental Variability and Ecosystem Change	76,000.00	76,000.00	0.00
22151203 IOC	Global Change and Large Ecosystems	83,300.00	83,300.00	0.00
22151301 IOC	Interdisciplinary Coastal/Watershed Studies	60,000.00	59,995.94	4.06
22151302 IOC	ICAM Methodologies, Information products and indicators	80,000.00	79,993.17	6.83
22151303 IOC	Support to NEPAD Coastal Component	97,850.00	97,849.26	0.74
22151304 IOC	ICAM Regional Project Development	56,000.00	56,000.00	0.00
22151305 DAK	Shoreline Protection through ICAM: Dakar Planning	9,500.00	9,479.66	20.34
22151306 NAI	NEPAD Coastal and Marine Unit (COSMAR)	23,000.00	22,999.22	0.78
Sub-total MLA 1		821,650.00	821,616.39	33.61
MLA 2 - GLOBAL OBSERVING SYSTEMS				
22152101 IOC	Overall GOOS Design and Policy	136,000.00	135,999.28	0.72
22152102 IOC	Coastal GOOS Observations and Design	74,000.00	73,933.72	66.28
22152103 IOC	Implementation of GOOS through JCOMM	420,000.00	418,241.84	1,758.16
22152201 IOC	GOOS Regional Development	255,950.00	255,867.20	82.80
22152202 IOC	Regional GOOS Offices Support	278,000.00	278,000.00	0.00
Sub-total MLA 2		1,163,950.00	1,162,042.04	1,907.96
MLA 3 - OCEAN SERVICES				
22153101 IOC	Further development of the IODE system	379,000.00	379,000.00	0.00
22153103 QUI	Implementation of ODINCARSA project	10,000.00	10,000.00	0.00
22153201 IOC	Ocean Mapping activities	141,500.00	140,422.64	1,077.36
22153301 IOC	Strengthening of responsive warning system for tsunamis	58,500.00	58,500.00	0.00
Sub-total MLA 3		589,000.00	587,922.64	1,077.36
MLA 4 - POLICY				
22154101 IOC	Governing Bodies meetings	195,585.00	195,585.00	0.00
22154102 IOC	Officers meeting	35,000.00	35,000.00	0.00
22154103 IOC	Subscriptions to SCOR and GESAMP	60,000.00	59,999.36	0.64
22154104 IOC	Assistant to ADG/IOC	91,000.00	91,000.00	0.00
22154201 IOC	ICP meetings	8,000.00	8,000.00	0.00
22154202 IOC	ABE-LOS activities	74,000.00	74,000.00	0.00
22154203 IOC	Global Marine Assessment and Forum of the Oceans	23,941.00	23,941.00	0.00
22154301 IOC	Public awareness on ocean issues	315,474.00	315,474.00	0.00

3. Based on SAP records as of 24 November 2005 (accounts were closed for programme sectors on 15 November 2005). Authoritative figures are those contained in the financial statements prepared by the UNESCO Comptroller's Office.

Sub-total MLA 4		803,000.00	802,999.36	0.64
MLA 5 – CAPACITY-BUILDING AND REGIONS				
22155101 IOC	TEMA General Grants scheme	60,000.00	59,987.43	12.57
22155102 IOC	TEMA POGO scheme	60,000.00	59,999.60	0.40
22155103 IOC	TEMA UNESCO IOC Chairs	19,000.00	19,000.00	0.00
22155104 IOC	TEMA Capacity-Building activities general pool	120,000.00	119,999.99	0.01
22155105 IOC	TEMA Training Through Research TTR scheme	40,000.00	40,000.00	0.00
22155201 IOC	WESTPAC Regional Sub-commission	197,655.00	197,654.40	0.60
22155202 IOC	IOCARIBE Regional Sub-commission	209,110.00	209,110.00	0.00
22155203 IOC	IOCEA Regional Committee	4,076.00	4,075.02	0.00
22155204 IOC	IOCINDIO Regional Committee	44,650.00	44,650.00	0.00
22155206 IOC	Black Sea, Volga-Caspian and other regions	110,964.00	110,964.00	0.00
22155207 QUI	IOCARIBE- IODE ODINCARSA	14,000.00	14,000.00	0.00
22155208 NAI	IOCWIO 2004 Project Office	41,045.00	41,044.15	0.85
22155211 NAI	IOCWIO Regional Committee meeting	37,500.00	37,499.93	0.07
Sub-total MLA 5		958,000.00	957,984.52	14.50
TOTAL IOC		4,335,600.00	4,332,564.95	3,034.07

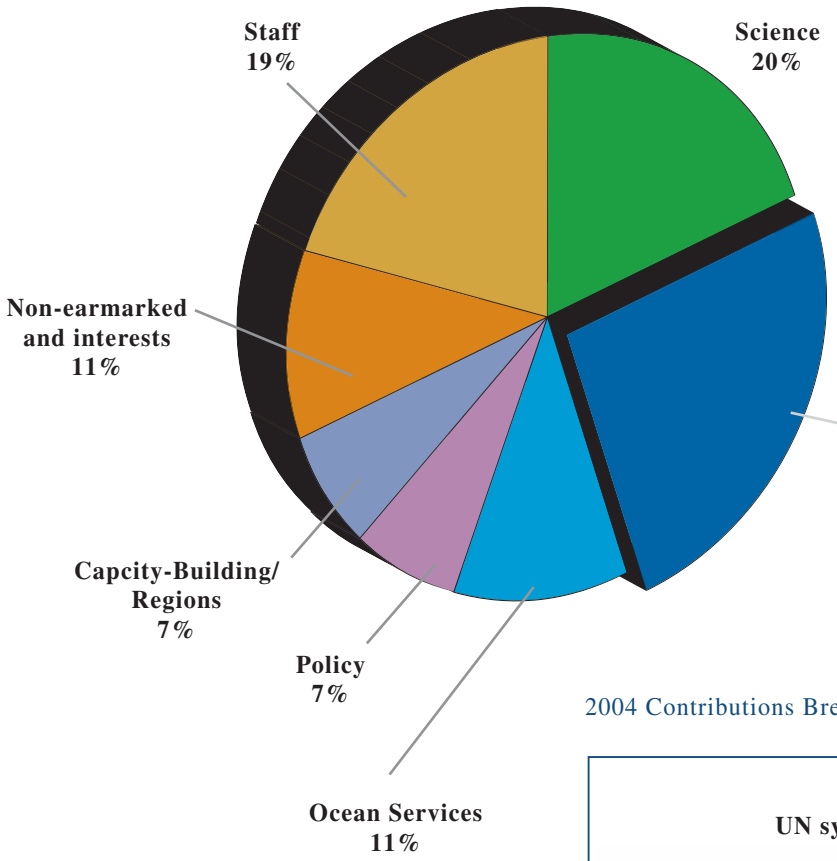
II. Contributions to the IOC Special Account

Table 2. 2005 Member States' Contributions to the IOC Special Account (in US$)

2005 CONTRIBUTIONS TO THE SPECIAL ACCOUNT		
Donor	**Amount**	**Purpose**
MLA 1 - SCIENCE		
USA	20,000.00	ICAM Indicators
Canada	35,000.00	ICAM Indicators project
UNEP	37,500.00	ICAM (Regional Seas Project)
USA	5,900.00	ICAM
UNEP (GPA)	45,000.00	ICAM/UNEP project
Spain	38,778.00	HAB (Vigo centre activities)
UNEP	7,500.00	ICRI Publication (reimbursement)
USA	20,000.00	IOC Science Fellow (Global NEWS) Final Payment
USA	10,000.00	NOAA Fisheries Funding contribution
USA	15,000.00	NOAA/NCCOS/CSCOR - Twelfth International HAB Conference
USA	24,000.00	GEOHAB
USA	10,000.00	IOC HAB Advanced Training Courses
USA	20,000.00	TOPS 2005 Lisbon, October 2005
SCOR	3,000.00	HAB Monograph
The Oceanography Society (USA)	13,164.60	IOC/SCOR symposium (reimbursement)
UNEP	2,500.00	ICRI project
Denmark	125,267.56	HAB (Copenhagen Centre, including staff component)
Sub-total	432,610.16	
MLA 2 - GOOS		
France	10,457.52	GLOSS
USA	20,000.00	GLOSS
JPL (USA)	15,000.00	GLOSS
USA	10,000.00	JCOMM
USA	15,000.00	JCOMM
USA	27,500.00	South Atlantic/Southern Ocean Argo Conference
Eurisy	7,510.86	New Space Services for Maritime Users' symposium (reimbursement)
UNEP	2,000.00	COOP
ISESCO	2,675.00	GLOSS
USA	35,000.00	GLOSS Core Network (reimbursement of 2004 used for Tsunami)
USA	50,000.00	GOOS and JCOMM communications
USA	157,000.00	GPO, I-GOOS, Argo
France	11,765.00	GOOS and JCOMM
WMO	16,564.89	GOOS
France	5,106.10	Rio Office - PIRATA
USA	30,000.00	Rio Office - Argo in South Atlantic
USA	70,000.00	RioGOOS
WAPMERR	23,775.00	SEA-GOOS meeting in conjunction with Pacem in Maribus
Sub-total	509,354.37	

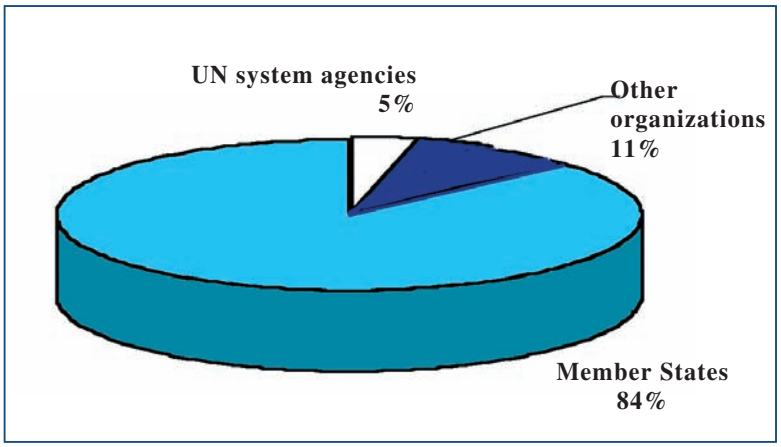
MLA 3 - SERVICES		
Belgium	66,050.00	IODE
Belgium	3,267.98	IODE
IOI	2,545.28	Alumni database
Israel	4,897.22	TWS Indian Ocean
Israel	4,897.22	TWS Mediterranean
USA	46,000.00	ITSU
Korea (Republic of)	1,000.00	ITSU
Finland	400.00	Ocean Mapping
USA/NOAA	10,000.00	GEBICH meeting
SIMORC	58,100.55	IODE Oostende Office
Internationales Landkartenhaus (Germany)	701.75	Ocean Mapping (purchase of atlases)
Wallingford	7,756.70	MarineXML
France	24,704.97	TWS
Sub-total	230,321.67	
MLA 4 - CAPACITY-BUILDING AND REGIONS		
Southampton Oceanography Centre	92,290.87	HERMES project
USA	35,000.00	Increasing awareness on Coastal Zone Management (Capacity-Building)
USA	15,000.00	IOCARIBE Secretariat support
Australia (University of Queensland)	2,412.85	Travel costs reimbursement
France	11,765.00	Capacity-building
Sub-total	156,468.72	
POLICY		
France	20,352.75	Twenty Years IOC-IFREMER Cooperation
France	11,273.21	ABE-LOS
Greece	9,247.00	ABE-LOS
Netherlands	8,408.79	ABE-LOS
Spain	31,367.75	ABE-LOS
USA	25,000.00	Global Forum
Canada	37,000.00	Global Forum
IOI	135.85	Shipment costs reimbursement
Netherlands	2,563.49	ABE-LOS
Australia (University of Queensland)	2,060.77	ADG/IOC travel reimbursement
France	11,765.00	ABE-LOS
Sub-total	159,174.61	
STAFF		
Canada	8,081.55	Argo Coordinator
France	12,970.20	Argo Coordinator
USA	120,000.00	Argo Coordinator
USA	80,000.00	Albert Fischer
USA	30,000.00	Albert Fischer
USA	115,060.00	Seconded staff (Programme Officer for the Oceans and Climate)
IBRD	5,000.00	Coral Reef project support staff (reimbursement)
USA	42,600.00	Post-doctorate position for the Science Section
Sub-total	413,711.75	
NON-EARMARKED		
France	58,365.90	UNCED follow-up

Brazil	54,249.55	Regional and capacity-building activities
Brazil	22,222.22	Regional and capacity-building activities
Sub-total	134,837.67	
INTEREST		
First quarter 2005	19,792.00	
Second quarter 2005	18,224.00	
Third quarter 2005	18,711.00	
Fourth quarter 2005	42,827.00	
Sub-total	99,554.00	
TEMPORARY ALLOCATIONS/TRANSFERS		
TRF TO 534RER2002 (ADRICOSM - Italy)	-1,184,830.00	
Sub-total	-1,184,830.00	
TOTAL	951,202.95	



2004 Contributions Breakdown by Main Programme Axes

2004 Contributions Breakdown by Type of Donor



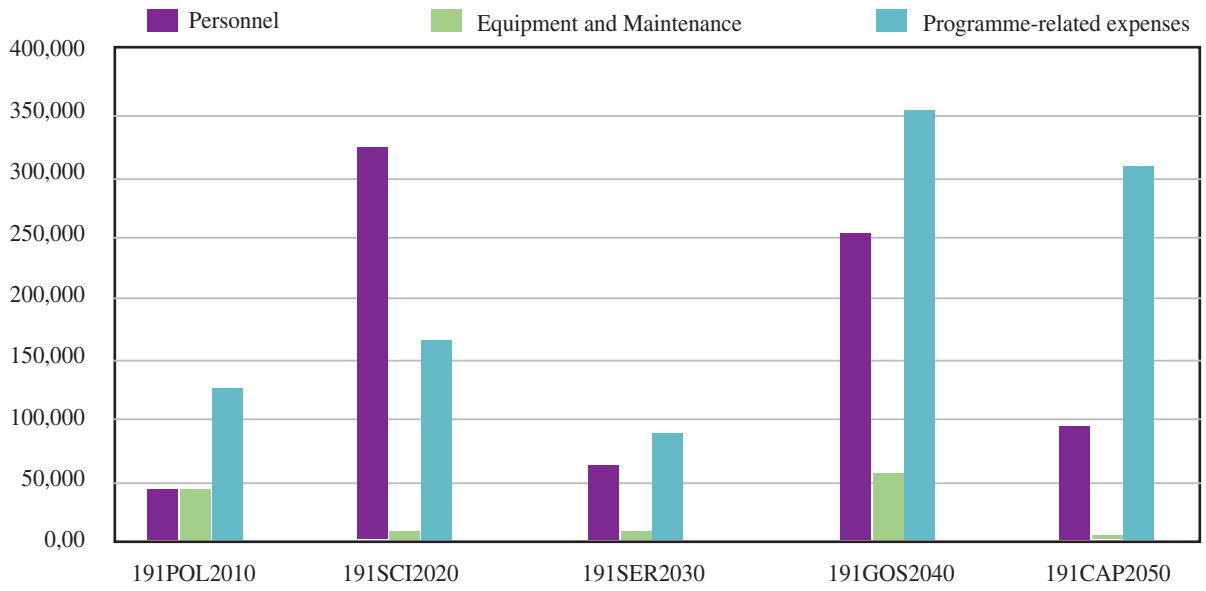
III. IOC Special Account - Expenditure

For the sake of clarity, it should be explained that voluntary contributions to the IOC Special Account are deposited into the IOC General Revenue Account (194IOC9090) from which funds are allotted to the five accounts established in accordance with the IOC programme structure. The expenditure is recorded on these operational sub-accounts:

191POL2010 – General/Policy
191SCI2020 – Ocean Science
191SER2030 – Ocean Services
191GOS2040 – Global Ocean/Coastal Observing Systems
191CAP2050 – Capacity-Building/Regional Cooperation

Table 3. Expenditure on Operational Codes under the IOC Special Account (in US$)

Type of Expenditure	191POL2010	191SCI2020	191SER2030	191GOS2040	191CAP2050
Other Personnel Cost	0	1,689.70	0	1,051.00	10,109.44
International Experts and Consultants	8,960.53	377,591.13	63,489.40	239,449.94	49,352.37
Administrative Support Personnel	21,497.77	1,920.00	0	6,430.71	32,396.20
Mission Costs	43,853.10	13,325.64	9,554.03	52,600.66	64,132.33
Sub-total for Project Personnel	**74,311.40**	**394,526.47**	**73,043.43**	**299,532.31**	**155,990.34**
Subcontracts	68,185.89	126,725.50	69,145.73	200,267.84	184,617.06
Training and Seminars/Meetings	11,517.80	20,554.87	6,393.90	29,165.08	66,933.64
Equipment and Maintenance	30,245.73	2,398.15	4,027.80	51,432.52	238.74
Miscellaneous (including sundry expenditure)	17.43	1,615.95	52.18	65,730.42	16,841.77
TOTAL	**184,278.25**	**545,820.94**	**152,663.04**	**646,128.17**	**424,621.55**



IV. Contributions for Specific Extrabudgetary Projects, including UNESCO Funds-in-Trust[4]

Table 4. 2004 Contributions for Specific Extrabudgetary Projects, including UNESCO Funds-in-Trust [4] (in US$)

Project Code	Purpose	Donor	Amount US$
	MLA 1 - OCEAN SCIENCE		
193INT2000	Ecosystem-based Approaches To Fisheries*	UNEP	454,428.00
213INT2002	Enrichment of Coastal Marine Ecosystems*	UNEP	2,418.38
213GLO2003	Fostering a Global Dialogue on Oceans*	UNEP	363,350.00
RAF0047695	Adaptation to Climate Change - ICAM	UNDP	700,000.00
Total MLA 1			1,520,196.38
	MLA 2 – GOOS		
193GLO2001	DBCP Coordinator Salary and Missions*	WMO and panel	298,075.00
Total MLA 2		members	298,075.00
	MLA 3 - OCEAN SERVICES		
513GLO2002	ODIMEX*	Government of Flanders	119,000.00
513GLO2005	IOC Ocean Forum Series “The Gulf Stream”*	Government of Flanders	10,000.00
513RAF2003	ODINAFRICA III*	Government of Flanders	1,361,743.00
513RAF2004	Development of an African Repository for Electronic Publications*	Government of Flanders	41,960.00
513RAF2005	Geosphere-Biosphere Coupling Processes*	Government of Flanders	107,500.00
513RAS2000	Biodiversity and Distribution of Megafaunal Assemblages	Government of Flanders	22,000.00
Sub-total			1,662,203.00
	TSUNAMI WARNING SYSTEM		
193INT2001	Indian Ocean Tsunami Monitoring and Warning System*	Finland	1,722,546.00
193INT2001	Indian Ocean Tsunami Monitoring and Warning System*	Germany	332,926.23
Sub-total 193INT2001		2,055,472.23	
193INT2002	Secretariat for the Indian Ocean Tsunami*	Australia	194,670.00
248INT2000	Towards the Development of an Indian Ocean Tsunami Warning System*	ISDR	1,941,865.84
534INT2002	First Session ICG for Tsunami Early Warning System*	Italy	121,065.00
561INT2000	Tsunami Early Warning System*	Ireland	600,960.00
504INT2000	Tsunami Early Warning System*	Norway	1,470,742.09
Sub-total			4,329,302.93
Total MLA 3			8,046,978.16
	MLA 5 - CAPACITY-BUILDING AND REGIONS		
534RER2002	Adriatic Sea Integrated COastal areaS and River Basin Management	Italy	1,184,830.00
Total MLA 5			1,184,830.00
TOTAL IOC			11,050,079.54

4 The above table provides information on contributions credited to specific extrabudgetary projects in 2005 as recorded in SAP. Authoritative figures are those contained in the financial statements prepared by the UNESCO Comptroller’s Office.

* projects to be continued in 2006

193-series projects are the subsidiary accounts of the IOC Special Account; the others are classic Funds-in-Trust

UNESCO

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC)

STATEMENT OF INCOME AND EXPENDITURE AND CHANGES IN RESERVES AND FUND BALANCES
FOR THE PERIOD 1 JANUARY 2004 TO 31 DECEMBER 2005

(EXPRESSED IN US DOLLARS)

	Programme Activities	Earmarked Activities	Total Biennium 2004/2005
INCOME			
Voluntary Contributions - Schedule 1.3	4,087,020.25		4,087,020.25
Other income:			
Interest	143,044.00		143,044.00
Earmarked - Schedule 1.3		3,606,645.23	3,606,645.23
Transfers	(21,828.23)	21,828.23	-
TOTAL INCOME	4,208,236.02	3,628,473.46	7,836,709.48
Cash Disbursements Schedule 1.2	3,592,855.46	871,961.21	4,464,816.67
Increase (Decrease) in balance of unliquidated obligations	14,052.93	260,209.53	274,262.46
TOTAL EXPENDITURE	3,606,908.39	1,132,170.74	4,739,079.13
EXCESS (SHORTFALL) OF INCOME OVER EXPENDITURE	601,327.63	2,496,302.72	3,097,630.35
Reserves and fund balances, beginning of the period	1,080,159.95	61,312.18	1,141,472.13
Reserves and fund balances, end of the period	1,681,487.58	2,557,614.90	4,239,102.48

Approved _____
John Haigh
Chief Accountant

UNESCO

Schedule 1.2

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC)

SCHEDULE OF DISBURSEMENTS AND UNLIQUIDATED OBLIGATIONS
FOR THE PERIOD 1 JANUARY 2004 TO 31 DECEMBER 2005

(EXPRESSED IN US DOLLARS)

	2004/2005 Disbursements	Unliquidated Obligations	Total
A. Programme Activities			
Capacity Building/ Regional Cooperation			
11 - Experts & Consultants	249,211.73	-	249,211.73
13 - Adm. Support Personnel	62,221.33	-	62,221.33
16 - Mission Costs	125,972.54	12.00	125,984.54
10' - Other Personnel Cost	15,511.44	-	15,511.44
20 - Sub-Contracts	239,607.06	12,500.00	252,107.06
32 - Training & Seminars	66,943.77	4,836.64	71,780.41
40 - Equipment & Maintenance	6,720.42	-	6,720.42
50 - Sundry Expenditure	16,876.77	-	16,876.77
Sub-Total	783,065.06	17,348.64	800,413.70
Global Ocean/Coastal Observing Systems			
11 - Experts & Consultants	422,443.44	164.97	422,608.41
13 - Adm. Support Personnel	6,430.71	-	6,430.71
16 - Mission Costs	76,909.62	5,236.13	82,145.75
10' - Other Personnel Cost	1,295.38	-	1,295.38
20 - Sub-Contracts	404,023.64	11,000.00	415,023.64
32 - Training & Seminars	165,525.72	2,553.72	168,079.44
40 - Equipment & Maintenance	59,753.58	-	59,753.58
50 - Sundry Expenditure	67,160.81	153.18	67,313.99
Sub-Total	1,203,542.90	19,108.00	1,222,650.90
General Policy			
11 - Experts & Consultants	72,815.09	-	72,815.09
13 - Adm. Support Personnel	94,774.47	174.02	94,948.49
16 - Mission Costs	67,918.46	461.53	68,379.99
10' - Other Personnel Cost	-	-	-
20 - Sub-Contracts	86,622.47	17,700.00	104,322.47
32 - Training & Seminars	69,050.07	-	69,050.07
40 - Equipment & Maintenance	34,748.25	-	34,748.25
50 - Sundry Expenditure	8,794.53	-	8,794.53
Sub-Total	434,723.34	18,335.55	453,058.89
Ocean Science			
11 - Experts & Consultants	650,682.44	40,959.43	691,641.87
13 - Adm. Support Personnel	1,933.49	-	1,933.49
16 - Mission Costs	62,578.87	7,137.14	69,716.01
10' - Other Personnel Cost	1,689.70	-	1,689.70
20 - Sub-Contracts	191,892.08	61,200.00	253,092.08
32 - Training & Seminars	23,401.56	4,543.16	27,944.72
40 - Equipment & Maintenance	21,939.22	292.59	22,231.81
50 - Sundry Expenditure	2,628.03	380.92	3,008.95
Sub-Total	956,745.39	114,513.24	1,071,258.63
Ocean Services			
11 - Experts & Consultants	65,276.40	-	65,276.40
13 - Adm. Support Personnel	-	-	-
16 - Mission Costs	19,889.42	-	19,889.42
20 - Sub-Contracts	89,717.20	9,200.00	98,917.20
32 - Training & Seminars	28,148.67	-	28,148.67
40 - Equipment & Maintenance	11,610.28	-	11,610.28
50 - Sundry Expenditure	136.80	-	136.80
Sub-Total	214,778.77	9,200.00	223,978.77
Total A.	3,592,855.46	178,505.43	3,771,360.89
B. Earmarked activities			
I.O.C. Science and Communication Centre on Harmful Agal Blooms	64,359.67	-	64,359.67
Charpentier Salary, Mission and Other Costs	355,741.09	-	355,741.09
Global Coral Reef Monitoring Network	36,964.76	-	36,964.76
Promoting Ecosystem-based Approaches to Fisheries Conservation and LMEs between UNEP and IOC	310,314.41	268,448.68	578,763.09
Indian Ocean Tsunami Monitoring and Warning System	92,362.65	3,250.43	95,613.08
Secretariat for the Indian Ocean Tsunami Monitoring and Warning System	12,218.43	45,699.67	57,918.10
Total B.	871,961.21	317,398.78	1,035,829.51
TOTAL (A + B)	4,464,816.67	495,904.21	4,807,189.70

Schedule 1.3

B. Earmarked activities

Charpentier Salary, Mission and Other Costs (193GLO2001)		
U.S.A.	207,500.00	
Canada	1,000.00	
W.M.O. contribution	290,600.00	
Bill Woodward	1,000.00	
Meteo France	1,000.00	
Sams Research	975.00	502,075.00
Promoting Ecosystem-based Approaches to Fisheries Conservation and LMEs between UNEP and IOC (193INT2000)		
UNEP contribution		854,428.00
Indian Ocean Tsunami Monitoring and Warning System (193INT2001)		
Finland	1,722,546.00	
Germany	332,926.23	2,055,472.23
Secretariat for the Indian Ocean Tsunami Monitoring and Warning System (193INT2002)		
Australia		194,670.00
SC/942(BUI):Staff Costs (193POL2001)		
Transfer from 194IOC9090		21,828.23
Total B.		**3,628,473.46**
TOTAL (A + B)		**7,836,709.48**

UNESCO

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC)

STATEMENT OF ASSETS, LIABILITIES, RESERVES AND FUND BALANCES
AS AT 31 DECEMBER 2005

(EXPRESSED IN US DOLLARS)

	31.12.2005	31.12.2003
Assets:		
Cash and term deposits	4,735,006.69	1,363,113.88
Total Assets	**4,735,006.69**	**1,363,113.88**
Liabilities:		
Accrued Payables uniliquidated obligations (see schedule 1.2)	495,904.21	221,641.75
Total liabilities	**495,904.21**	**221,641.75**
Reserves and fund balances:		
Earmarked activities	2,557,614.90	61,312.18
Operating reserves	1,681,487.58	1,080,159.95
Total reserves and fund balances	**4,239,102.48**	**1,141,472.13**
Total liabilities, reserves and fund balances	**4,735,006.69**	**1,363,113.88**

Annex

UNEP Trust Fund

193 INT 2000

Project No. GF/3010-04-06: Promoting Ecosystem-based Approaches to Fisheries Conservation and LMEs

Financial Status Report as at 31 December 2005

(Expressed in US dollars)

Income					
Funds received	May 2004			400,000.00	
	Feb 2005			454,428.00	854,428.00
Deduct					
Disbursements		Approved Budget	Cash Disbursed	Unliquid. Obligations	
10 - Personnel		19,500.00	-	-	
20 - Sub-Contracts		870,500.00	303,375.09	229,788.00	
30- Training and seminars		80,500.00	6,924.32	35,675.68	
40 - Equipment and maintenance		24,000.00	-	2,500.00	
50 - Sundry Expenditure		500.00	15.00	485.00	
		995,000.00	310,314.41	268,448.68	
Total expenditure Incurred					578,763.09
Funds Available as at 31 December 2005					**275,664.91**

534RER2002

Italy Trust Fund

ADRIATIC SEA INTEGRATED COASTAL AREAS AND RIVER BASIN MANAGEMENT SYSTEM PILOT PROJECT (ADRICOSM)

Financial Status Report as at 30 November 2005
(Expressed in US Dollars)

Income			
Transfer from General Fund	JUL 2005		1,184,830.00
	Total		1,184,830.00
Total Interest			4,027.00
TOTAL INCOME			**1,188,857.00**
Deduct			
	Approved Budget	Cash Disbursed	Unliquid. Obligations
10 Personnel	81,714.00		
Mission Costs		4,398.22	
20 Sub Contracts	817,533.00		
Sub Contracts		234,080.00	583,400.00
40 Equipment & Maintenance	213,269.00		
	1,112,516.00	238,478.22	583,400.00
Support Costs	72,314.00	15,501.09	37,921.00
	1,184,830.00	**253,979.31**	**621,321.00**
Total expenditure incurred			**875,300.31**
Funds Available as at 30 November 2005			**313,556.69**

		IMPLEMENTATION RATE	
		as % Cash Disbursement	as % Total Expenditure
Allocation	**1,184,830.00**	**21.44%**	**73.88%**

Financial statement issued by the Division of the Comptroller. The total income received and expenditure incurred are in accordance with UNESCO financial records.

213GLO2003

United Nations Environment Programme

FORESTING A GLOBAL DIALOGUE ON OCEANS,COASTS,AND SIDS,AND ON FRESHWATER-COASTAL-MARINE INTERLINKAGES

Financial Status Report as at 29 December 2005
(Provisional Accounts)
(Expressed in US Dollars)

Income		
Funds received	SEP 2005	363,350.00
	Total	363,350.00
TOTAL INCOME		**363,350.00**

Deduct

	Approved Budget	Cash Disbursed	Unliquid. Obligations
10 Personnel	99,600.00		
Mission Costs		7,601.03	534.19
20 Sub Contracts	545,000.00		
Sub Contracts		26,000.00	4,000.00
30 Training & Seminars	350,000.00		
Trainings & Seminars/Meetings		41,114.62	19,135.38
	994,600.00	74,715.65	23,669.57
	994,600.00	**74,715.65**	**23,669.57**
Total expenditure incurred			**98,385.22**
Funds Available as at 29 December 2005			**264,964.78**

		IMPLEMENTATION RATE	
		as % Cash Disbursement	as % Total Expenditure
Allocation	**994,600.00**	**7.51%**	**9.89%**

Financial statement issued by the Division of the Comptroller. The total income received and expenditure incurred are in accordance with UNESCO financial records.

Financial Statement on Income and Expenditures for the period 1 January 2005 to 31 December 2005 from Funds Allocated for the Voluntary Trust Fund for Emergency Relief Assistance

Towards the Development of an Indian Ocean Tsunami Warning and Mitigation System within a Global Framework

(248INT2000)

	Amount (USD)
I. OPERATING FUND	
Balance as of 1 January 2005	-
Add: Remittances from United Nations	1,941,865.84
Interest Income	24,480.00
Miscellaneous income (specify)	-
Subtotal	1,966,345.84
Less: Expenditures	
1. Staff and other personnel costs	138,094.96
2. Travel on official business	199,925.91
3. Contractual services	505,765.22
4. Operating expenses	15,385.20
5. Acquisitions	30,509.89
6. Fellowships, grants, other	500,379.70
Subtotal	1,390,060.88
Programme support costs (8%)	111,204.88
Total expenditure a/	1,501,265.76
Balance available 31 December 2005	465,080.08
II. STATEMENT OF UNSPENT ALLOCATIONS	
Unspent allocations 1 January 2005	-
Add: Net allocations issued for 2005	1,941,865.84
Subtotal	1,941,865.84
Less: 2005 expenditures (incl. Programme support costs)	1,501,265.76
Unspent allocations 31 December 2005	440,600.08

Notes:
a) Includes unliquidated obligations of USD 456,539.59 (incl. Programme support costs)

This is to certify that the above statement of income and expenditure is correct and that the expenditures were incurred in connexion with the approved projects for which funds have been received.

(Signature)	John Haigh, Chief Accountant (Name and Title)	16 February 2006 (Date)

504INT2000

Norway Trust Fund

TSUNAMI EARLY WARNING SYSTEM

Financial Status Report as at 31 December 2005
(Expressed in US Dollars)

Income		
Transfer from General Fund	NOV 2005	1,470,742.09
	Total	1,470,742.09
TOTAL INCOME		**1,470,742.09**

Deduct

	Approved Budget	Cash Disbursed	Unliquid. Obligations
10 Personnel	466,625.00		
20 Sub Contracts	848,500.00		
30 Training & Seminars	280,000.00		
40 Equipment & Maintenance	35,375.00		
	1,630,500.00		
Support Costs	211,965.00		
	1,842,465.00		
Total expenditure incurred			
Funds Available as at 31 December 2005			**1,470,742.09**

		IMPLEMENTATION RATE	
		as % Cash Disbursement	as % Total Expenditure
Allocation	**1,842,465.00**		

Financial statement issued by the Division of the Comptroller. The total income received and expenditure incurred are in accordance with UNESCO financial records.

561INT2000

Ireland Trust Fund

TSUNAMI EARLY WARNING SYSTEM

Financial Status Report as at 31 December 2005
(Expressed in US Dollars)

Income			
Funds received	OCT 2005	EUR 500,000.00	600,960.00
	Total		600,960.00
Total Interest			**1,422.00**
TOTAL INCOME			**602,382.00**

Deduct

	Approved Budget	Cash Disbursed	Unliquid. Obligations
10 Personnel	531,823.00		
Mission Costs		9,335.19	
	531,823.00	9,335.19	
Support Costs	69,137.00	1,213.57	
	600,960.00	**10,548.76**	
Total expenditure incurred			**10,548.76**
Funds Available as at 31 December 2005			**591,833.24**

		IMPLEMENTATION RATE	
		as % Cash Disbursement	as % Total Expenditure
Allocation	**600,960.00**	**1.76%**	**1.76%**

Financial statement issued by the Division of the Comptroller. The total income received and expenditure incurred are in accordance with UNESCO financial records.

Acronyms

ABE-LOS	Advisory Body of Experts on the Law of the Sea (IOC)
ASFA	Aquatic Sciences and Fisheries Abstracts
CLIVAR	Climate Variability and Predictability Programme (WCRP)
CLME	Caribbean Large Marine Ecosystem
COASTS	Coastal Ocean Advanced Scientific and Technical Studies
COOP	Coastal Ocean Observations Panel (GOOS)
CRTR	Global Coral Reef Targeted Research and Capacity Building Project
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DBCP	Data Buoy Cooperation Panel (WMO-IOC)
E2EDM	'End-to-End' Data Management
EU	European Union
GAPA	Geological-Geophysical Atlases of the Atlantic and Pacific Oceans
GCOS	Global Climate Observing System (WMO-ICSU-IOC-UNEP)
GEBCDMEP	Group of Experts on Biological and Chemical Data Management and Exchange Practices
GEBCO	General Bathymetric Chart of the Oceans
GEF	Global Environment Facility (World Bank-UNEP-UNDP)
GEMIM	Group of Experts on Marine Information Management
GEO	The *Ad Hoc* Group on Earth Observations
GEOHAB	Global Ecology and Oceanography of HABs (IOC-SCOR)
GEOSS	Global Earth Observation System of Systems
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (IMO-FAO-UNESCO-WMO-WHOIAEA-UN-UNEP)
GETADE	Group of Experts on Technical Aspects of Data Exchange
GLOSS	Global Sea Level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GODAR	Global Oceanographic Data Archaeology and Rescue Project (IODE)
GOOS	Global Ocean Observing System (IOC-WMO-UNEP-ICSU)
GRA	GOOS Regional Alliance
GTS	Global Telecommunications System
GTSPP	Global Temperature-Salinity Profile Programme
HAB	Harmful Algal Bloom
HAE-DAT	Metadata database on Harmful Algal Events
IBCM	International Bathymetric Chart of the Mediterranean
ICAM	Integrated Coastal Area Management (also name of IOC programme)
ICES	International Council for the Exploration of the Sea
ICG	Intergovernmental Coordination Group
ICG/CARTWS	Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the Caribbean and Adjacent Regions
ICG/ITSU	International Coordination Group for the Tsunami Warning System in the Pacific (IOC)
ICG/NEAMTWS	Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean, and Connected Seas
ICRI	International Coral Reef Initiative
IDNDR	International Decade on Natural Disaster Reduction

ICSU	International Council for Science
IGBP	International Geosphere-Biosphere Programme
IGOS	Integrated Global Observing Strategy
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOCARIBE	IOC Subcommission for the Caribbean and Adjacent Regions
IOCCP	International Ocean Carbon Coordination Project
IOCEA	IOC Regional Committee for the Central Eastern Atlantic
IOCWIO	IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IODE	International Oceanographic Data and Information Exchange (IOC)
IOGOOS	Indian Ocean GOOS
IOTWS	Indian Ocean Tsunami Warning and Mitigation System
IPCC	Intergovernmental Panel on Climate Change
ITIC	International Tsunami Information Center
JAMSTEC	Japan's Marine Science and Technology Centre
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology (WMO-IOC)
JGOFS	Joint Global Ocean Flux Study (IGBP)
JMA	Japan Meteorological Agency
LME	Large Marine Ecosystem
LOICZ	Land-Ocean Interaction in the Coastal Zone (IGBP)
MEDAR/ MEDATLAS	Mediterranean Data Archaeology and Rescue/Mediterranean (and Black Sea) Atlas
MEDI	Marine Environmental Data Information Referral Catalogue
NASA	National Aeronautics and Space Administration (USA)
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration (USA)
ODIMeX	Oceanographic Data and Information Management
ODIN	Ocean Data and Information Network
ODINAFRICA	Ocean Data and Information Network for Africa (IOC and Flanders)
ODINCARSA	Ocean Data and Information Network for the IOCARIBE and South America regions
ODINCINDIO	Ocean Data and Information Network for the Central Indian Ocean region
OOPC	Ocean Observations Panel for Climate (GCOS-GOOS-WCRP)
PICES	North Pacific Marine Science Organization
PIRATA	Pilot Research Moored Array in the Tropical Atlantic
POGO	Partnership for Observation of the Global Oceans
PTWC	Pacific Tsunami Warning Center
PTWS	Pacific Tsunami Warning and Mitigation System
R/V	Research Vessel
SCOR	Scientific Committee on Oceanic Research (member of ICSU)
SEAGOOS	South East Asia Regional GOOS
SIMORC	System of Industry Metocean data for the Offshore and Research Communities
SOOP	Ship-of-Opportunity Programme

SSG	Scientific Steering Group
TEMA	Training, Education and Mutual Assistance in the Marine Sciences (IOC cross-cutting provision/programme)
THC	Thermohaline Circulation
TIP	Tropical Atmosphere Ocean (TAO) project Implementation Panel
TOGA	Tropical Ocean and Global Atmosphere
TTR	Training-through-Research
TWS	Tsunami Warning System
UHSLC	University of Hawaii Sea Level Center
UNCED	UN Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UN-ISDR/PPEW	UN International Strategy for Disaster Reduction/Platform for the Promotion of Early Warning
VLIZ	Flanders Marine Institute (Belgium)
WAGOOS	Western Australia GOOS
WCRP	World Climate Research Programme (WMO-ICSU-IOC)
WESTPAC	IOC Subcommission for the Western Pacific
WIS	World Meteorological Organization Information Systems
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment (WCRP)

Intergovernmental Oceanographic Commission (IOC)

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