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# CONTINUITY OF HIGH ACCURACY SATELLITE ALTIMETRY THROUGH JASON-1 AND JASON-2

As part of the presentation on GOOS during the 33rd session of the IOC Executive Council (June 2000), attention will be drawn to the plans of the space agencies to address the need for continuity of certain ocean observations.

This information document spells out the plans for the high accuracy radar altimeter missions needed to continuously observe the global ocean and to understand short- to long-term changes to ocean circulation. Long-term continuation of ocean measurements is essential to produce times series over several decades. These measurements are now considered as essential components of GOOS, which will integrate them with other satellite and *in situ* data into models to produce a wide range of products tailored to user requirements. Whilst the future looks secure for the next five years with Jason-1, a firm decision is needed in the very short term to secure continuity through Jason-2 measurements in the GODAE timeframe. To this end CNES, NASA, NOAA and EUMETSAT are discussing a cooperative approach for transitioning to a fully operational satellite service starting with Jason-2. The Executive Council will be asked to note and endorse the plans of CNES, NASA, NOAA and EUMETSAT to ensure the long-term continuity of precision altimetry observations through the Jason programme.

## Introduction

High accurate radar altimeter missions are necessary to globally and continuously observe the ocean and to understand the short- to long-term changes to ocean circulation. They are now considered as essential components of future global ocean observations systems. These systems will integrate altimeter and other satellite and *in situ* data into models and will require long-term continuation of ocean measurements to produce time series over several decades.

## Background

An operational global ocean observing system remains to be implemented, and satellites are an indispensable component of such a system, which will materialize based on the successful transitioning from research to operational programmes. This represents a significant additional investment with respect to the current operational meteorological systems, and will only be justified by the integration of requirements and the combined benefits to the various user communities and application areas. In this respect, oceanography is fortunate in that most space-based measurements of ocean surface parameters, if available in real time, are now at the crossroads of oceanography, marine meteorology and climate monitoring. On the one hand, the real time assimilation of wind and wave data in NWP and sea state models has a demonstrated impact on operational forecasts. On the other hand, the increasing interest of operational entities in coupled modelling systems aimed at improving ENSO and seasonal prediction is closing the gap which has so far prevailed between numerical weather prediction, oceanography and climate research.

One key aspect of an operational oceanographic system is altimetry. Altimeter missions provide co-located measurements of significant wave height, wind speed and sea surface topography. These observations are now being assimilated by global ocean circulation, sea state and coupled numerical models like those operated at ECMWF[1] and used to support a variety of applications including seasonal prediction, climate monitoring, marine meteorology and climatology, support to fisheries and ship routing. The increasingly long observational series collected from GEOSAT, ERS, Topex/Poseidon and soon from Jason-1 offers potential for the computation of ocean wave statistics, including probability of occurrence of extreme events, in any part of the global ocean.

## Precision Altimetry: Topex/Poseidon and Jason

Topex/Poseidon (and ERS[2]) has demonstrated that satellite altimetry may be utilized in a wide range of ocean research and applications topics, such as planetary waves, tides and global sea level change, seasonal and interannual climate prediction, and commercial marine applications. In the past eight years the user community has had access to an experimental, multi-satellite system, with unprecedented space-time sampling and coverage of the global ocean, including the polar regions, and pre-operational, near real time data services.

The accuracy and spatial and temporal needs vary but the long-term need is for continuity of a high-precision mission (*e.g.*, Jason series) to complement a polar-orbiting altimeter to enhance temporal/spatial coverage of the global ocean (*e.g.*, ERS, ENVISAT).

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[1] ECMWF: European Centre for Medium-Range Weather Forecasts
[2] ERS: Earth Resources satellite

In this respect the major focus of the Jason-1 mission, planned for launch in late 2000, will be to pursue the unique accuracy, continuity and coverage of the Topex/Poseidon mission for describing and understanding the ocean circulation, its variability on all scales, and its influence on climate. Only such very accurate, *i.e.* within 1cm at basin scale, global and homogeneous sea level measurements allow to determine precisely the ocean currents, and associated climate variations. Moreover Jason-1 will be a key element for GODAE[3] which requires global, near real time, high accuracy and high-resolution observation of sea surface topography.

Acquisition of ocean topography data from Jason-1 will help develop operational activities, including:

- marine meteorology for a better prediction of sea-state;
- seasonal and interannual climate prediction;
- operational oceanography to predict ocean circulation for marine applications, and for boundary conditions to extend predictability of coastal and regional subsystems.

**The future**

Continuity of space-based measurements of ocean topography cannot be taken for granted beyond the scientific and pre-operational success of the current satellite missions, without timely, convergent and coordinated initiatives from the development and operational agencies.

Whilst the future looks secure for the next five years with Jason-1, a firm decision is needed in the very short term to secure continuity through Jason-2 measurements in the GODAE timeframe. To this end CNES[4], NASA[5], NOAA[6] and EUMETSAT[7] are discussing a cooperative approach for transitioning to a fully operational satellite service starting with Jason-2. These discussions are at an early stage with NOAA and EUMETSAT examining whether such a service fits within their respective responsibilities and conventions, and if so what frameworks are available for funding opportunities.

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[3] GODAE: Global Ocean Data Assimilation Experiment (GOOS)
[4] CNES: Centre national d'études spatiales (France)
[5] NASA: National Aeronautics and Space Administration (USA)
[6] NOAA: National Oceanic and Atmospheric Administration (USA)
[7] EUMETSAT: European Organization for the Exploitation of Meteorological Satellites