

International Workshop for GODAR-WESTPAC
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Scientific Needs from the Climate Change Study in the Ocean

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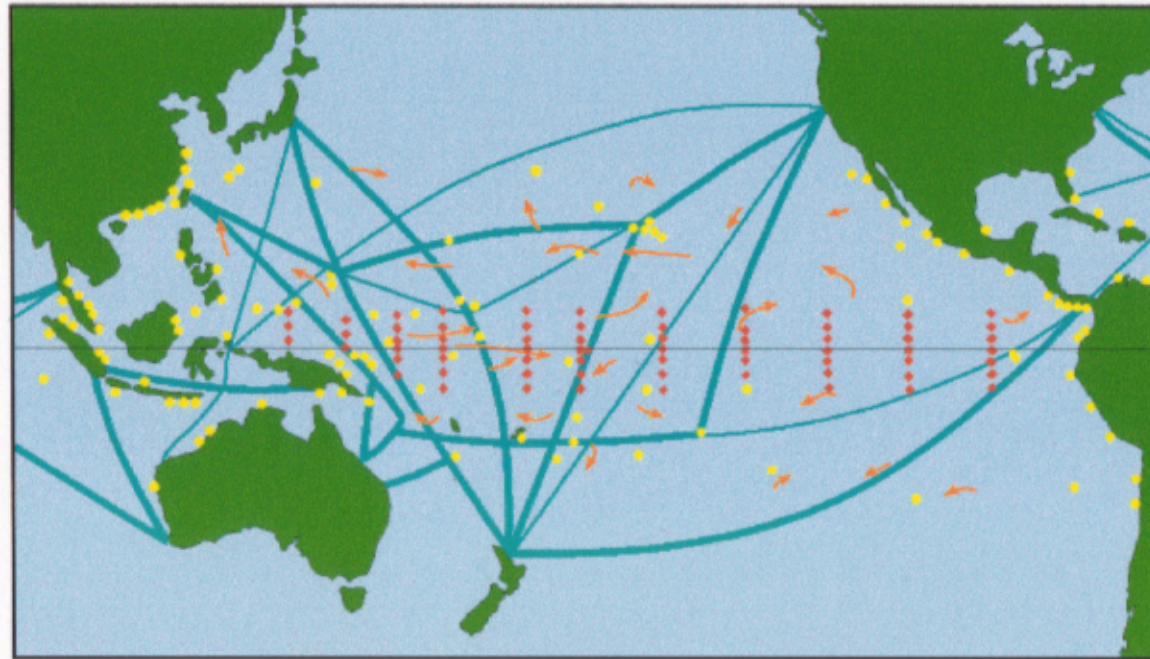
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Outline

- How does understanding of the ocean's role in the climate system through observations improve climate predictability? —ENSO prediction is a good example
- Importance of and difficulty in understanding decadal/interdecadal variability
- We need both the global ocean observing system and GODAR type projects
- An example of decadal/interdecadal phenomena related to the WESTPAC region
- Desired data types and quality

Observations which have improved ENSO predictability

ENSO Observing System

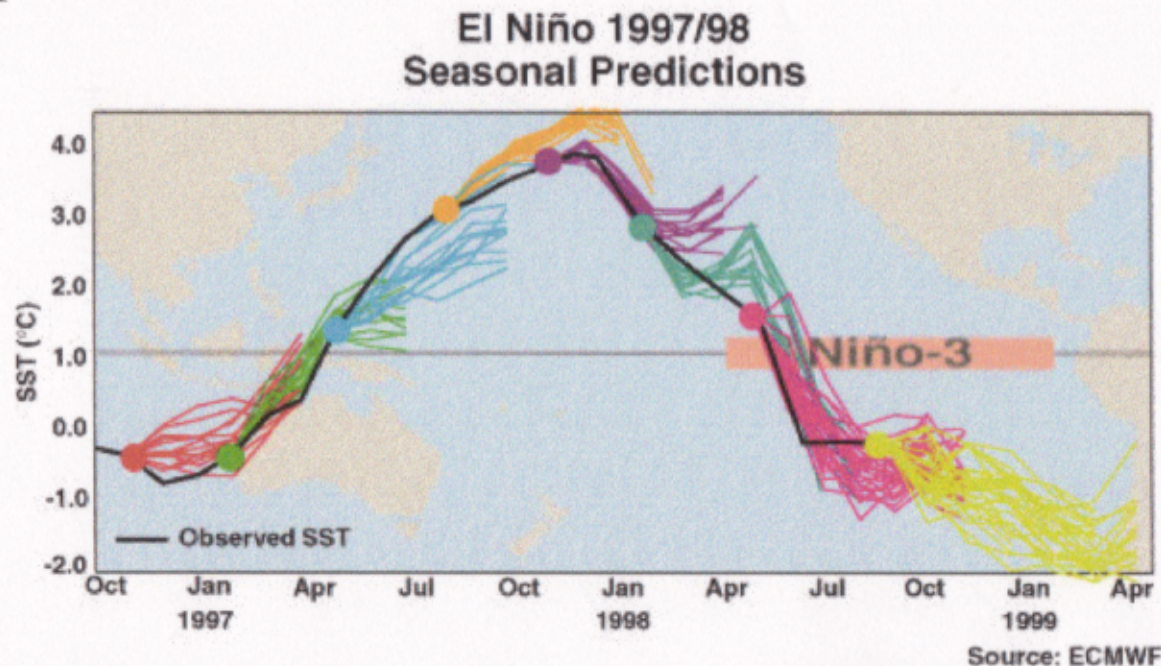


(from NOAA web site)

Progress in ENSO Prediction

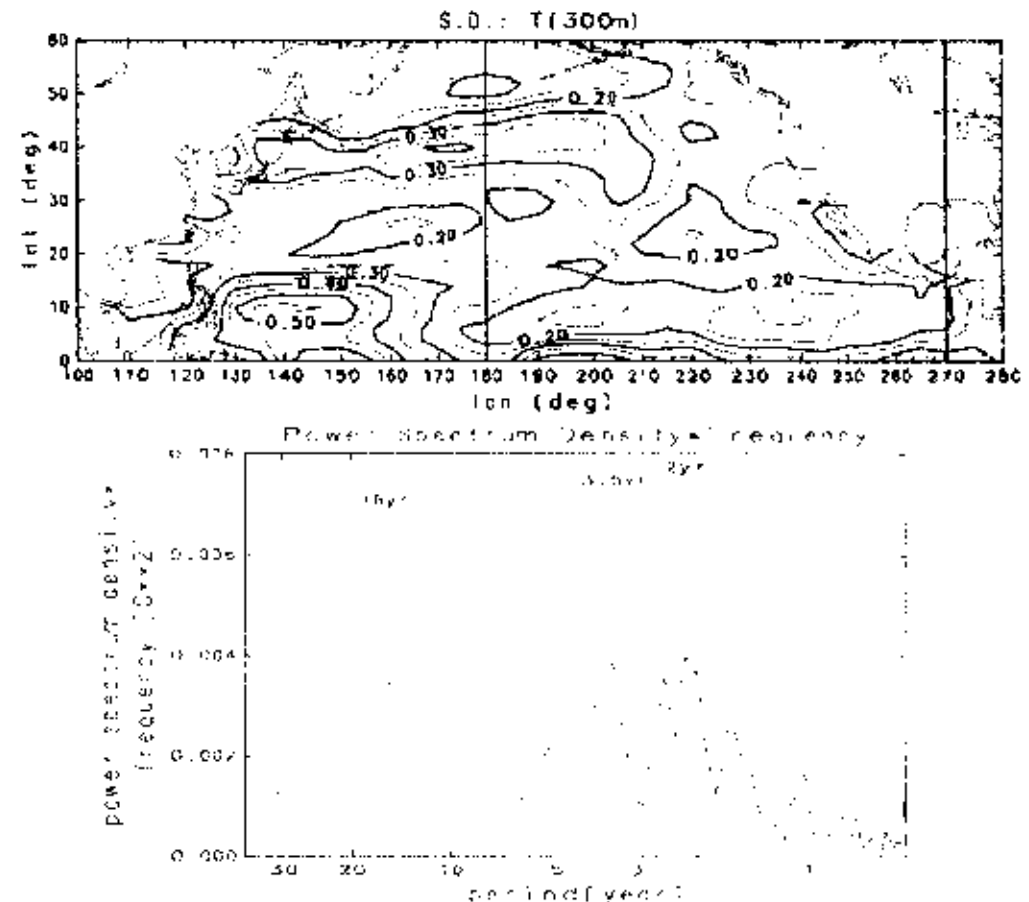
Observations

- Understanding of physical processes
- Coupled ocean-atmosphere model development
- Assimilation
- Prediction on time scales of seasons to a year improved



Importance of Understanding Decadal/Interdecadal Variability

- Large variability
—energy peak at
periods longer than
ENSO time scale
- Any human-
induced changes in
climate will likely
be superimposed
on natural
variations of these
time scales
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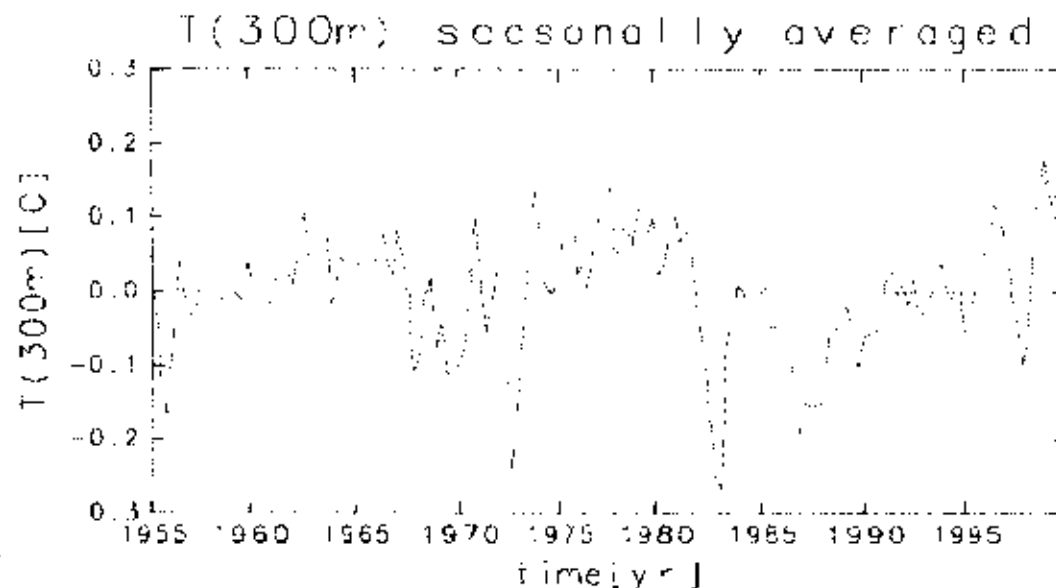


Variability of temperature averaged vertically
over 0-300m, or T(300m), based on White's
(1995) dataset (Hasegawa, 2001)

Difficulty in Understanding Decadal/Interdecadal Variability

Available long-term instrumental climate
record is not long enough

“A 40-year long record would be sufficient to
understand variability with a 2-year period but
not with a 20-year period”



Time series of T(300m)
averaged over the North
Pacific

(Ihasegawa, 2001)

Ongoing Research Programme

- **CLIVAR:**
a sub-programme of WCRP
a study of Climate Variability and Predictability
- **CLIVAR-DecCen:**
a sub-programme of CLIVAR
a study of Decadal-to-Centennial Climate
variability and predictability
 - > Initial effort is made to explore the
role of the ocean in determining
climate variability

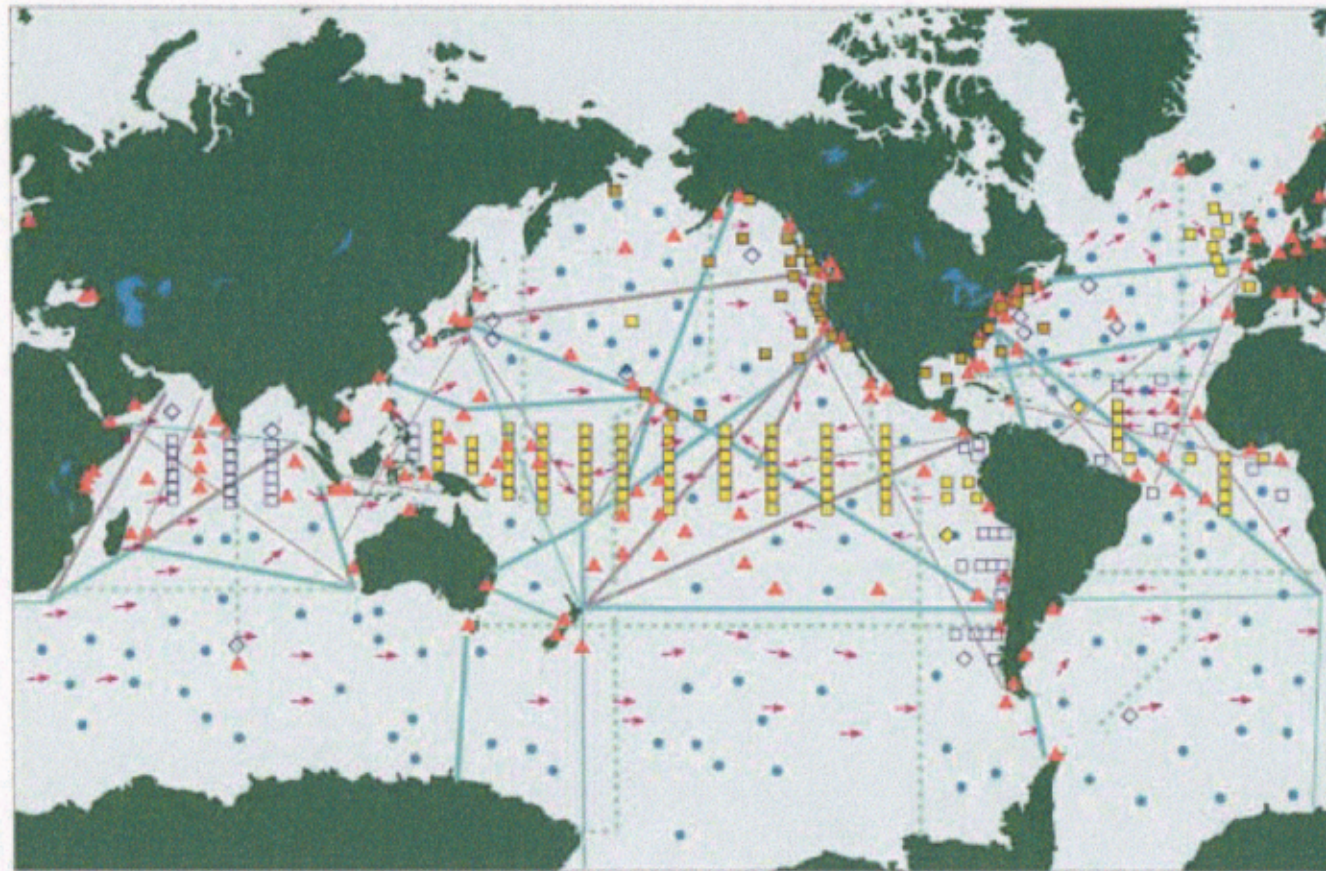


We need a global ocean observing system

Global Ocean Observing System

- The key word for the observing system in support of CLIVAR research is
“sustained observations on fully global basis”
- The WESTPAC region is
one of the most important parts of the
ocean for climate research
- The observing system is being rapidly developed and the WESTPAC region will be covered by various components of the observing system including Argo, XBT network, tropical mooring array, etc.

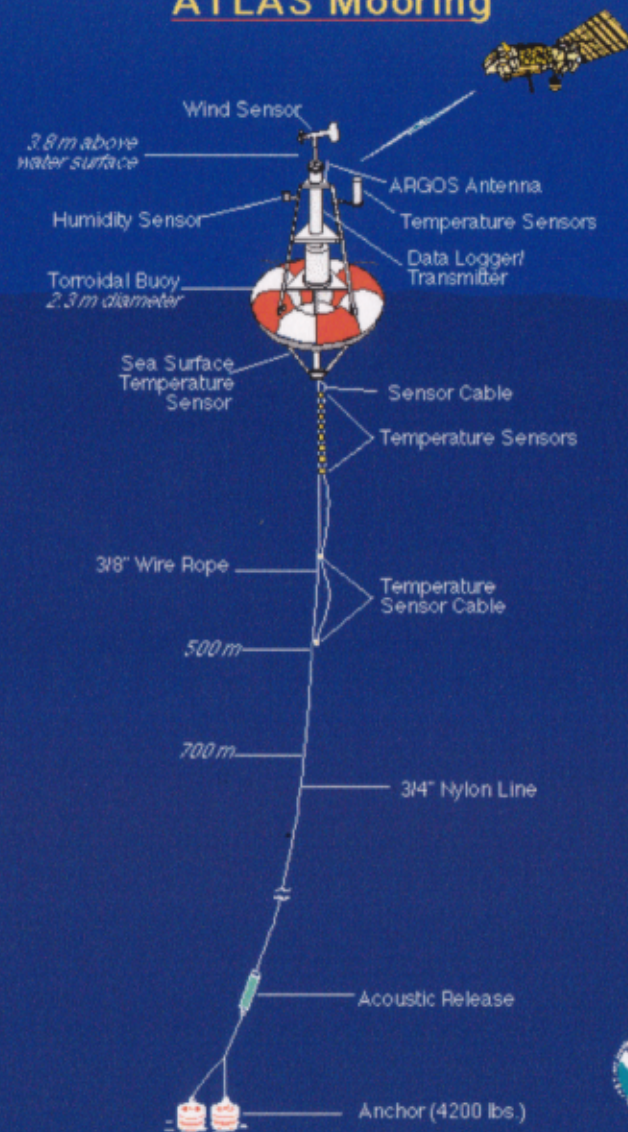
Global Ocean Observing System for Climate and Marine Services

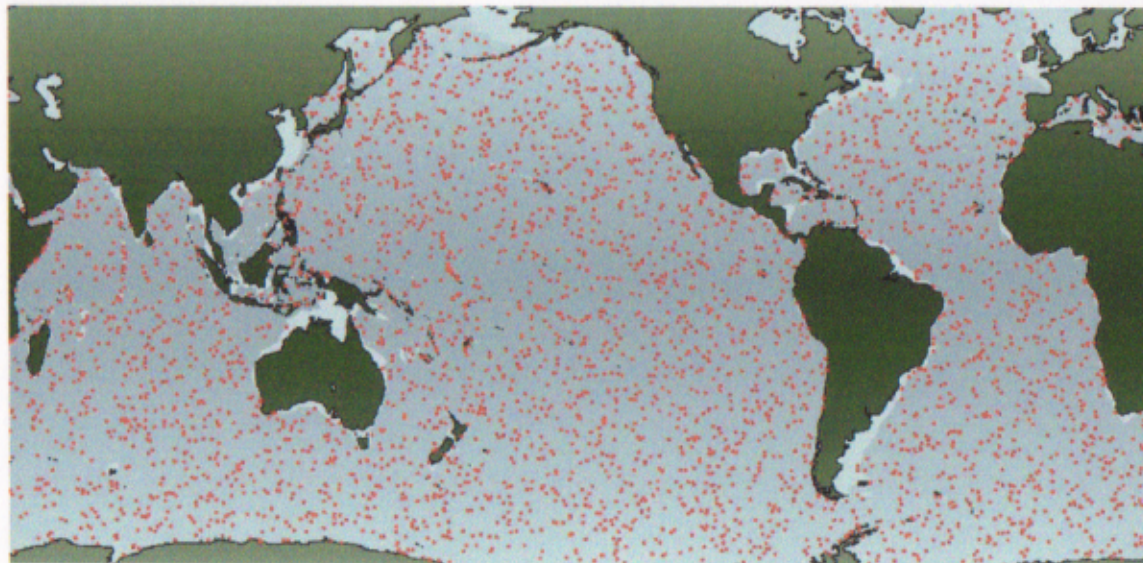
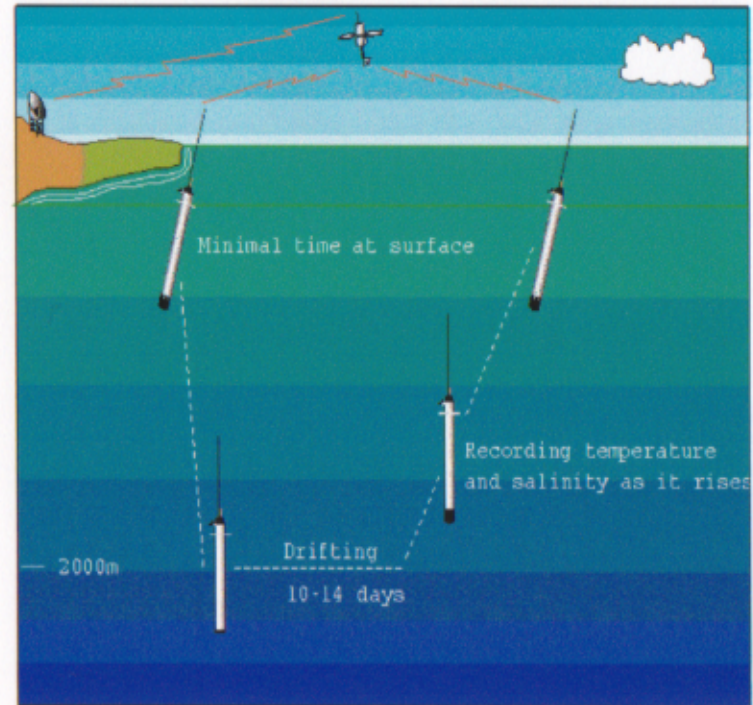
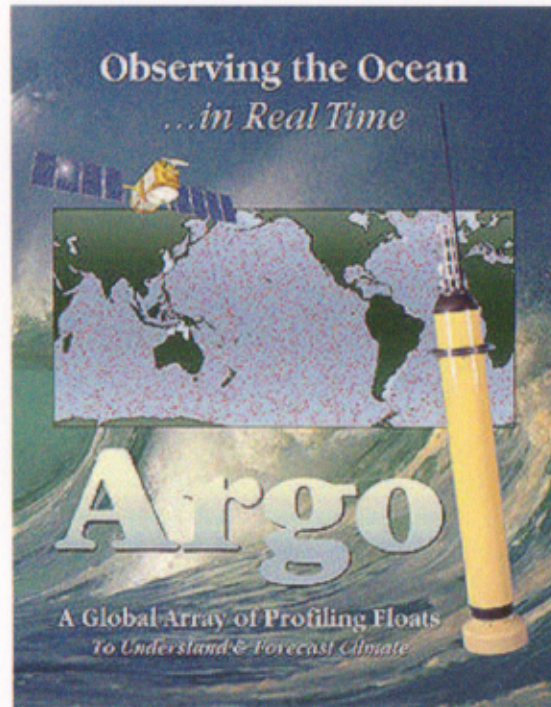


30 x 30 ARGO ARRAY TIDE GAUGE STATIONS MOORED BUOYS 50 x 50 DRIFTER ARRAY SHIP LINES

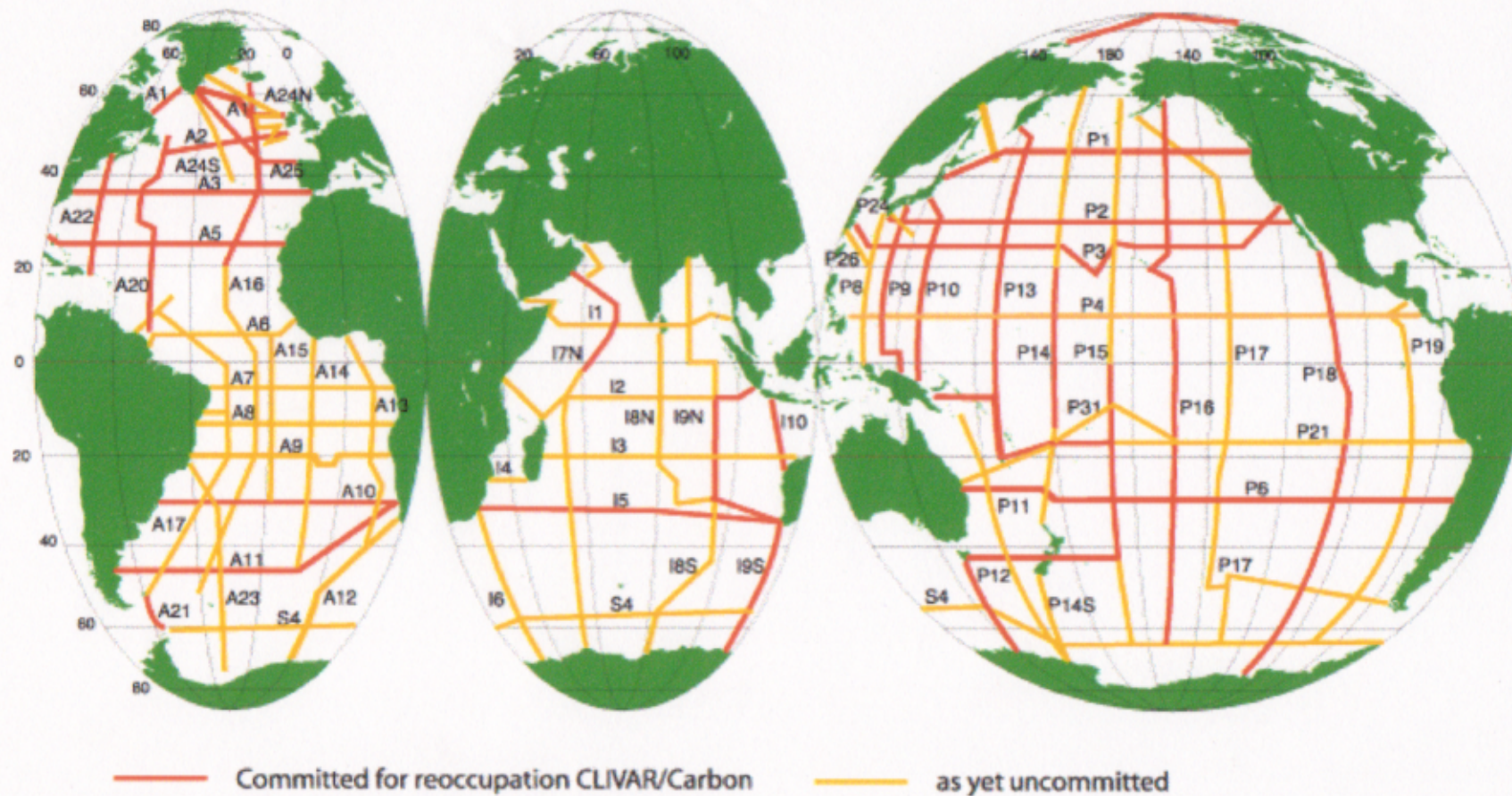
(from NOAA web site)

ATLAS Mooring





The WOCE/JGOFS Survey 1990-98 and future commitments

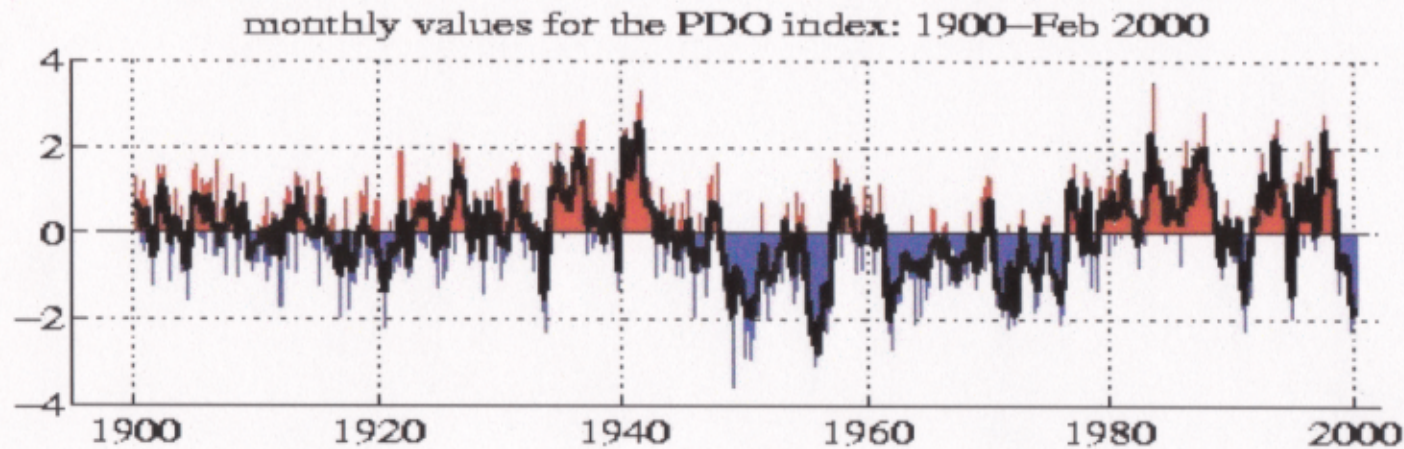
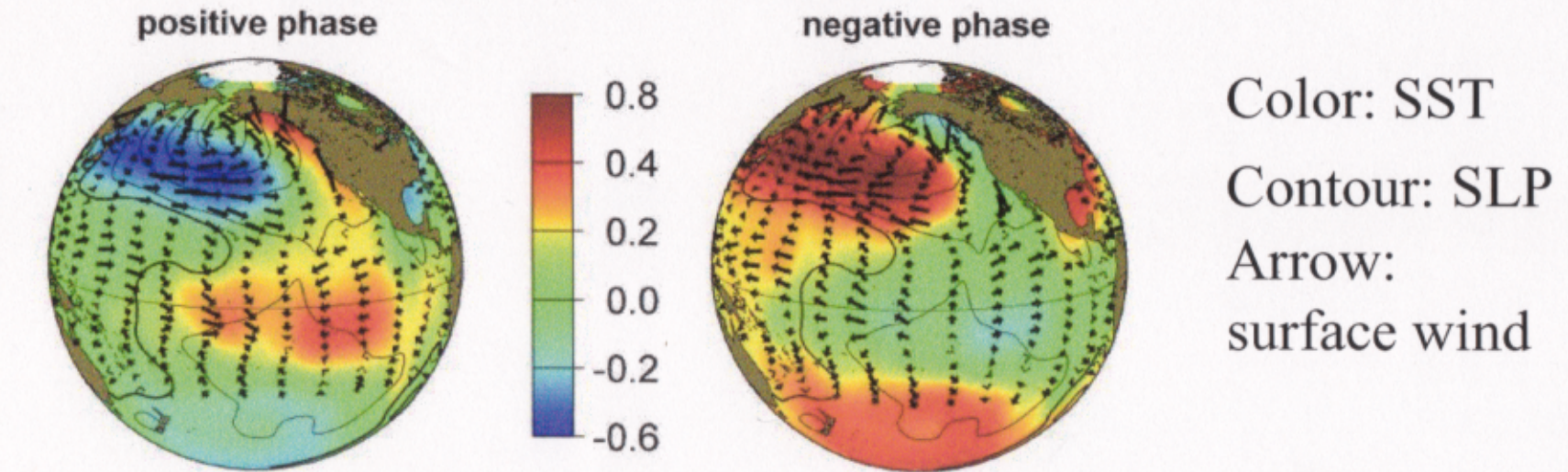


Importance of GODAR in Climate Research

- The global ocean observing system ensures acquisition of the data only from now on to the **future**
- We need data in the **past** to extend the record of climate variability as long as possible
- GODAR is an essential project to understand decadal/interdecadal climate variability

Pacific Decadal Oscillation (PDO)

Pacific Decadal Oscillation

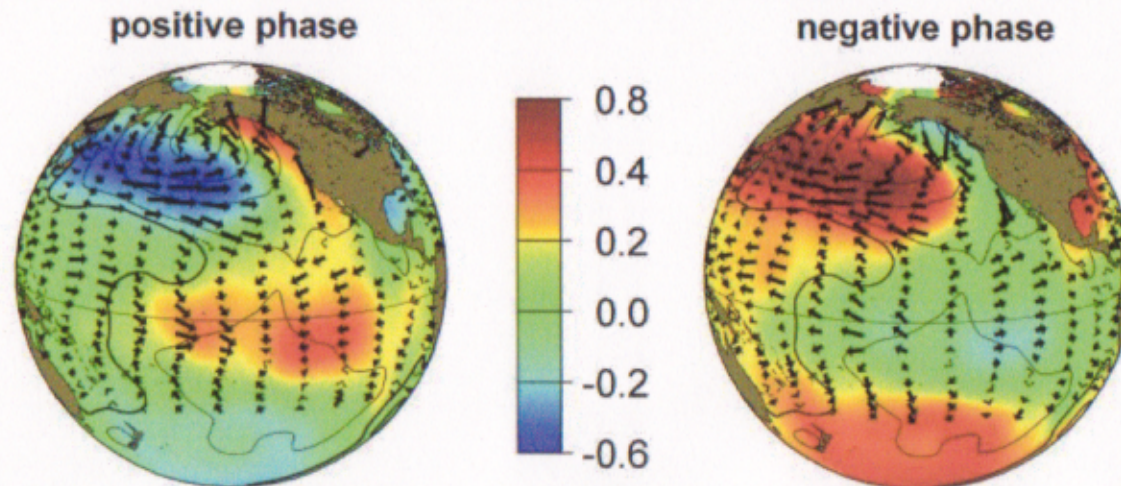


Mantua (2000)

Hypotheses about Mechanism of PDO

- I. Baroclinic Rossby wave propagation and its effect on the baroclinic adjustment time of the subtropical gyre set the time scale (e.g., Latif and Barnett, 1994, 1996)
- II. A thermal anomaly is subducted and slowly propagates from the midlatitudes to the tropical thermocline, altering tropical SST, which is rapidly sent back to the midlatitudes via teleconnection (e.g., Gu and Philander, 1997)

Pacific Decadal Oscillation



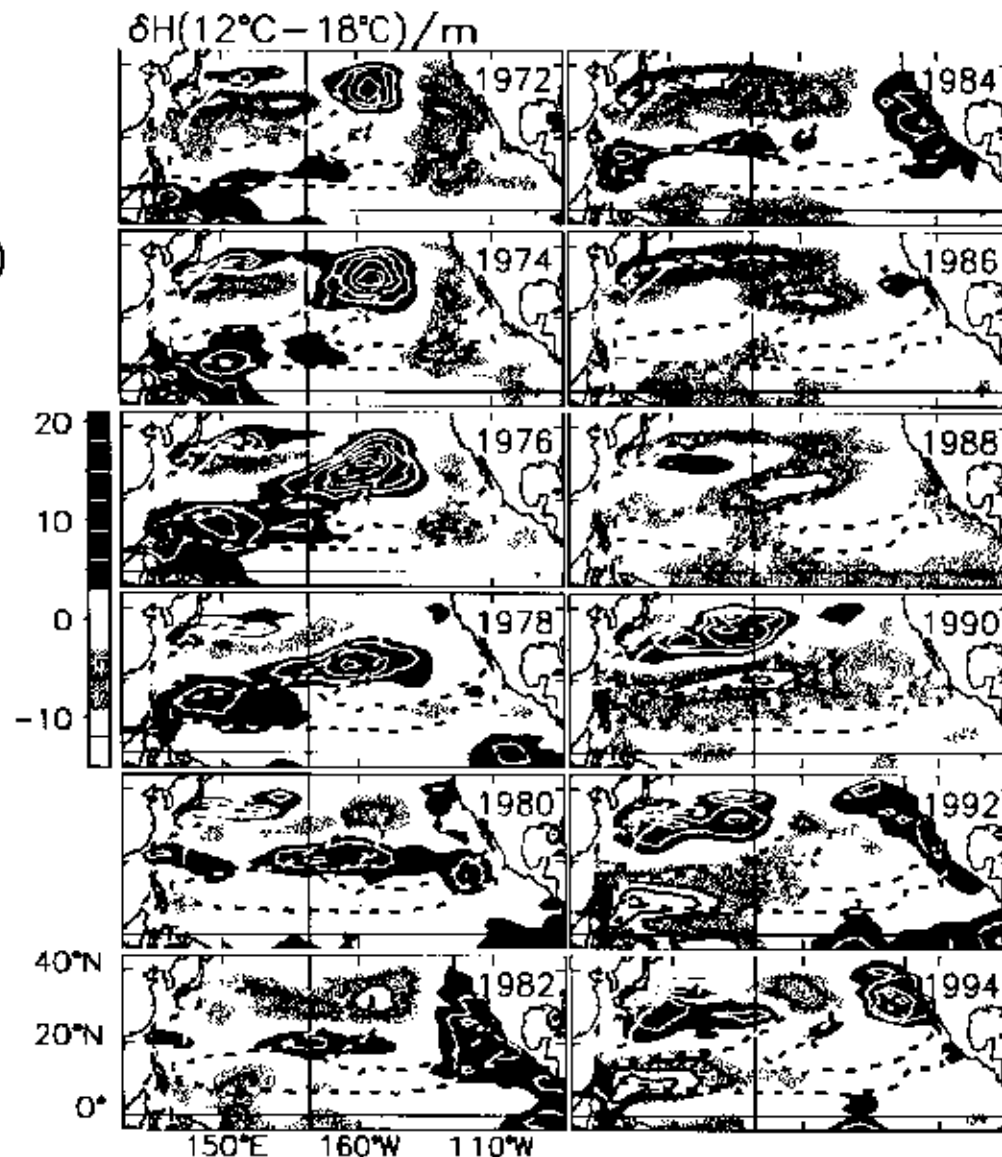
Examination of Hypothesis II

Average of the depth
anomalies of the 12°, 15°,
and 18°C isotherms
(Schneider et al., 1999)

A warm (cold) anomaly
generated for 1973-1976
(1980-1984) in the central
North Pacific doesn't
appear to reach to the
equatorial Pacific

Anomalies in the western
tropical Pacific seems to be
caused by local forcing

...negative result but the
record is not long enough...



Possible Further Examination of Hypothesis II

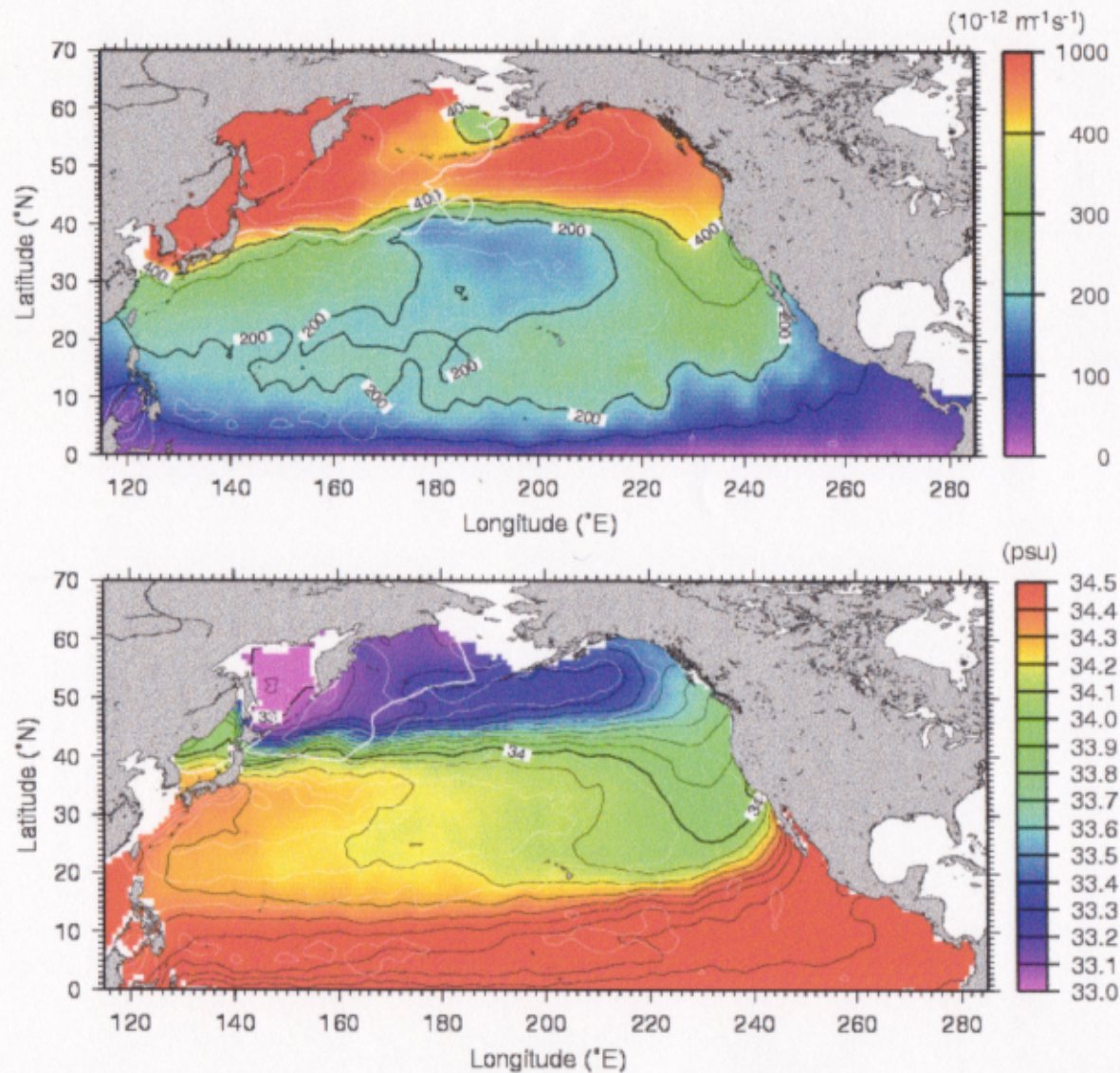
“No significant coupling of the mid-latitude and equatorial regions via advection?”

We need to further examine

- much longer record
- water mass anomalies (e.g., freshening or salinification on isopycnal surfaces)
- anomalies in the western tropical Pacific especially near the western boundary region in more detail

“Long-term data with sufficient spatial coverage in the WESTPAC region are needed!”

Water mass properties in the thermocline



Potential vorticity (top) and salinity at $26.4\sigma_\theta$ (Suga et al., 2001)

Desired Data Types

- Profile data from various types of observations (temperature, salinity, oxygen, etc., by bottle, CTD, STD, MBT, XBT) with wide and long coverage in space and time as possible
- Higher resolution in space and time in the western boundary regions—repeat sections and/or stations will be particularly useful

Desired Data Quality

- Quality control of the data to a moderate degree including
 - checking duplications,
 - checking errors in locations and dates
- Various metadata including information about countries, institutions, ships instruments, etc.

Access to the Data

- The data should be open to the worldwide community without restriction according to the IODE policy, which is also the policy of the global observing system
- Both CD-ROM distribution and on-line access would be convenient for individual users

Rescue the data in the past
for the future!