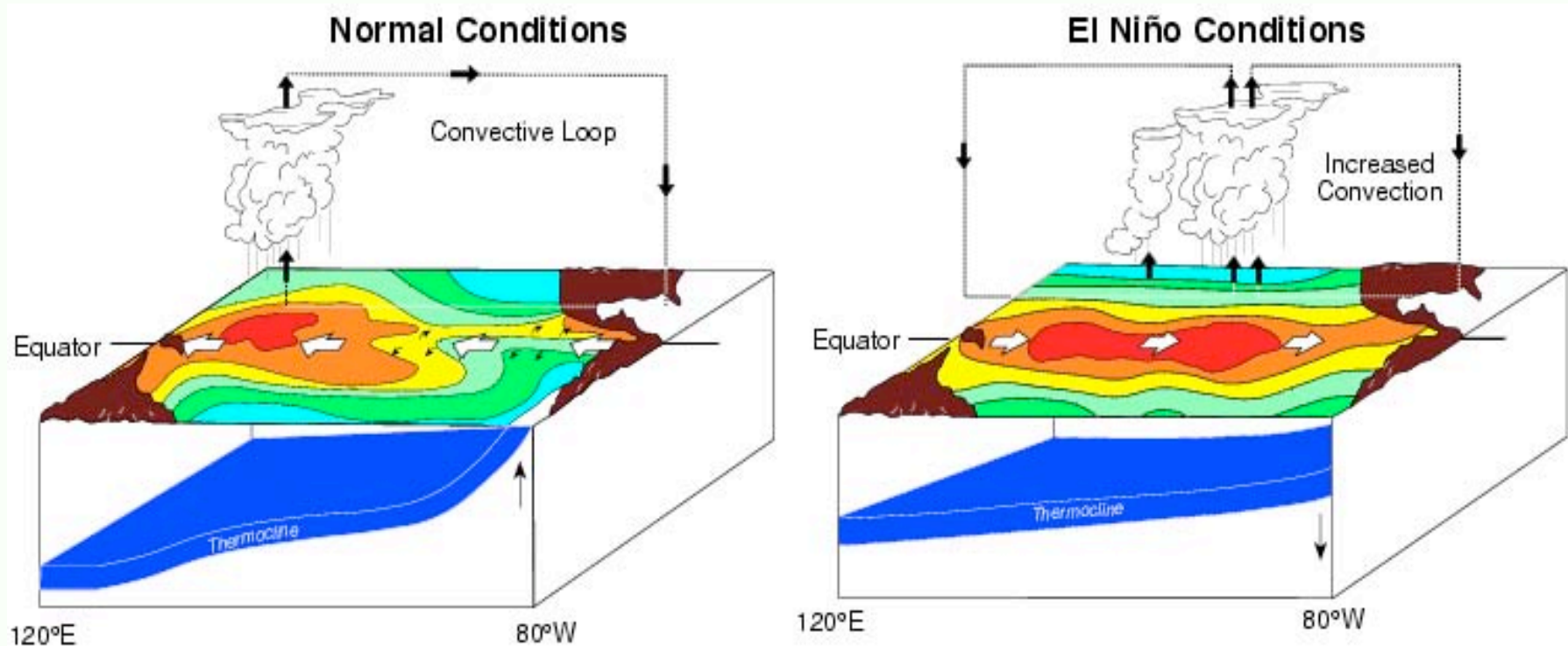


# **CLIVAR Pacific Implementation Panel input to OOPC - 9**

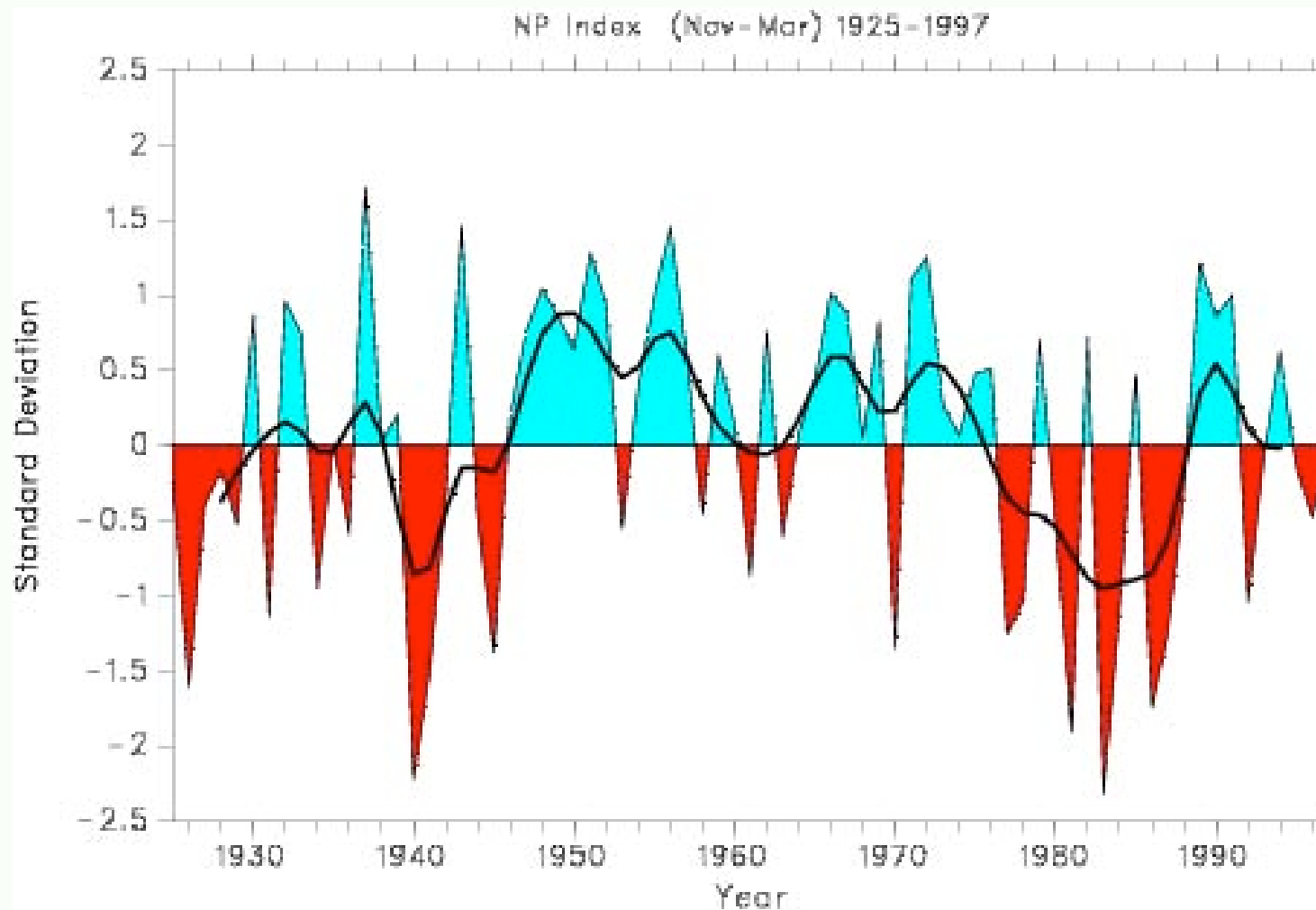
**Bob Weller and Katy Hill (ICPO)**



# G1: ENSO: Extending and Improving Predictions



## D4: Pacific and Indian Ocean Decadal Variability



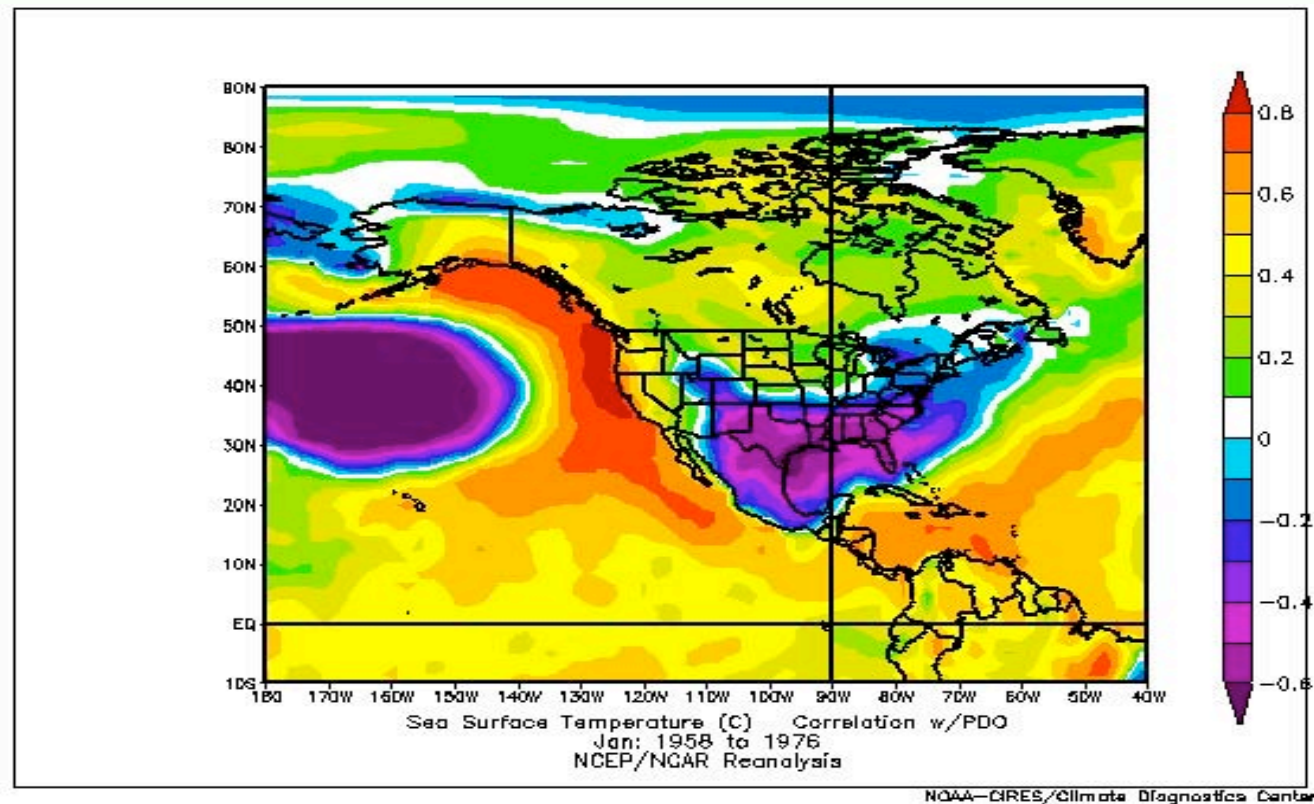
# CLIVAR - strategy

- **broad scale, basin-wide sampling**
- **data assimilation, model-based**
- **syntheses:**
  - **Fields and products developed from broad scale observations**
  - **Dedicated climate reanalyses**
  - **Ocean reanalysis workshop, Nov 2004**
- **hypothesis testing**
- **modeling, improved prediction**



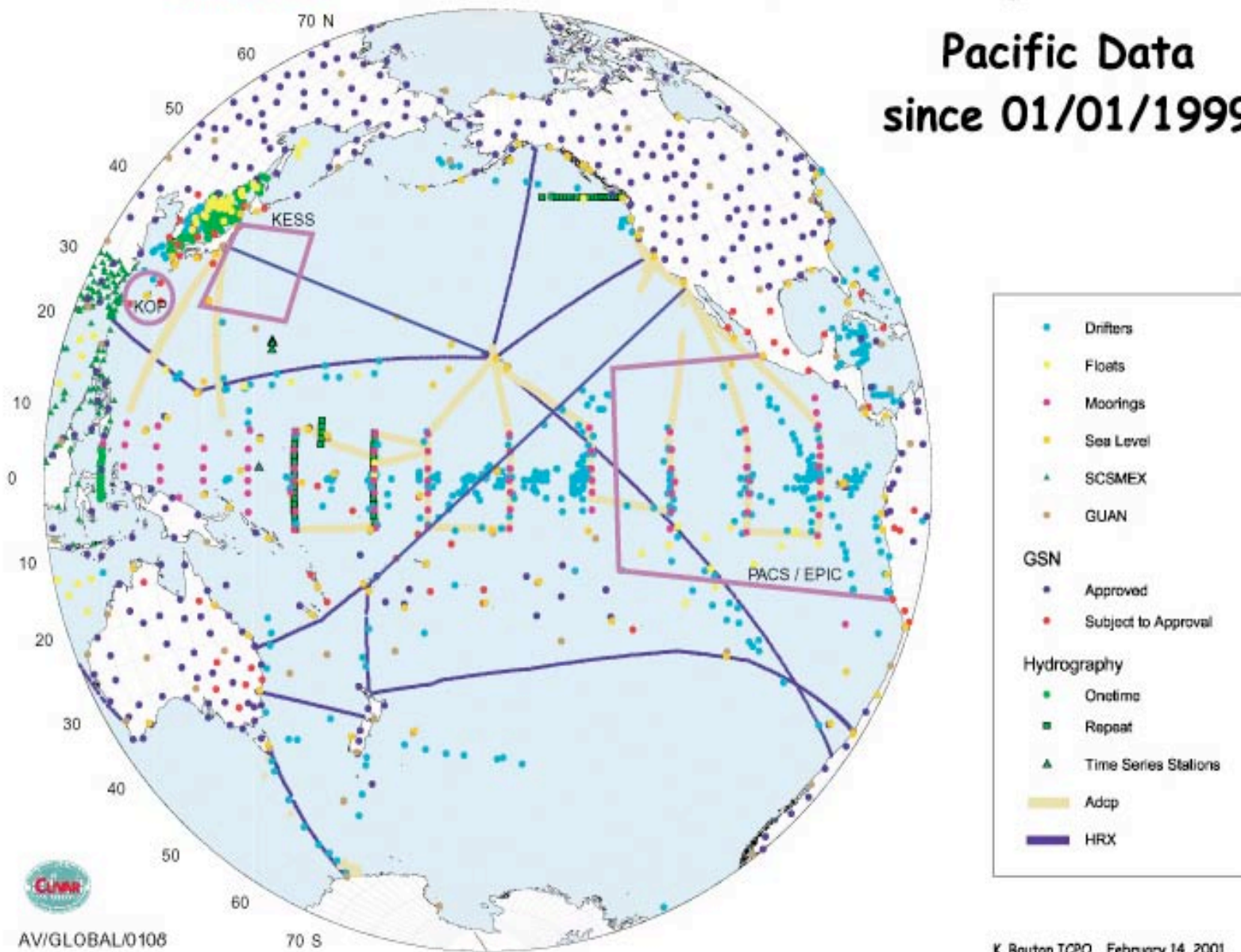
# CLIVAR Pacific

- Improved ENSO predictability, examining links to higher frequency (e.g., MJO) and to decadal variability
- Pacific decadal modes, tropical - extratropical exchanges, pathways - ocean and atmosphere
- Basin scale storage, transport, exchange, including air-sea fluxes, parameterization and effects of clouds



# CLIVAR observations in the Pacific region

Pacific Data  
since 01/01/1999

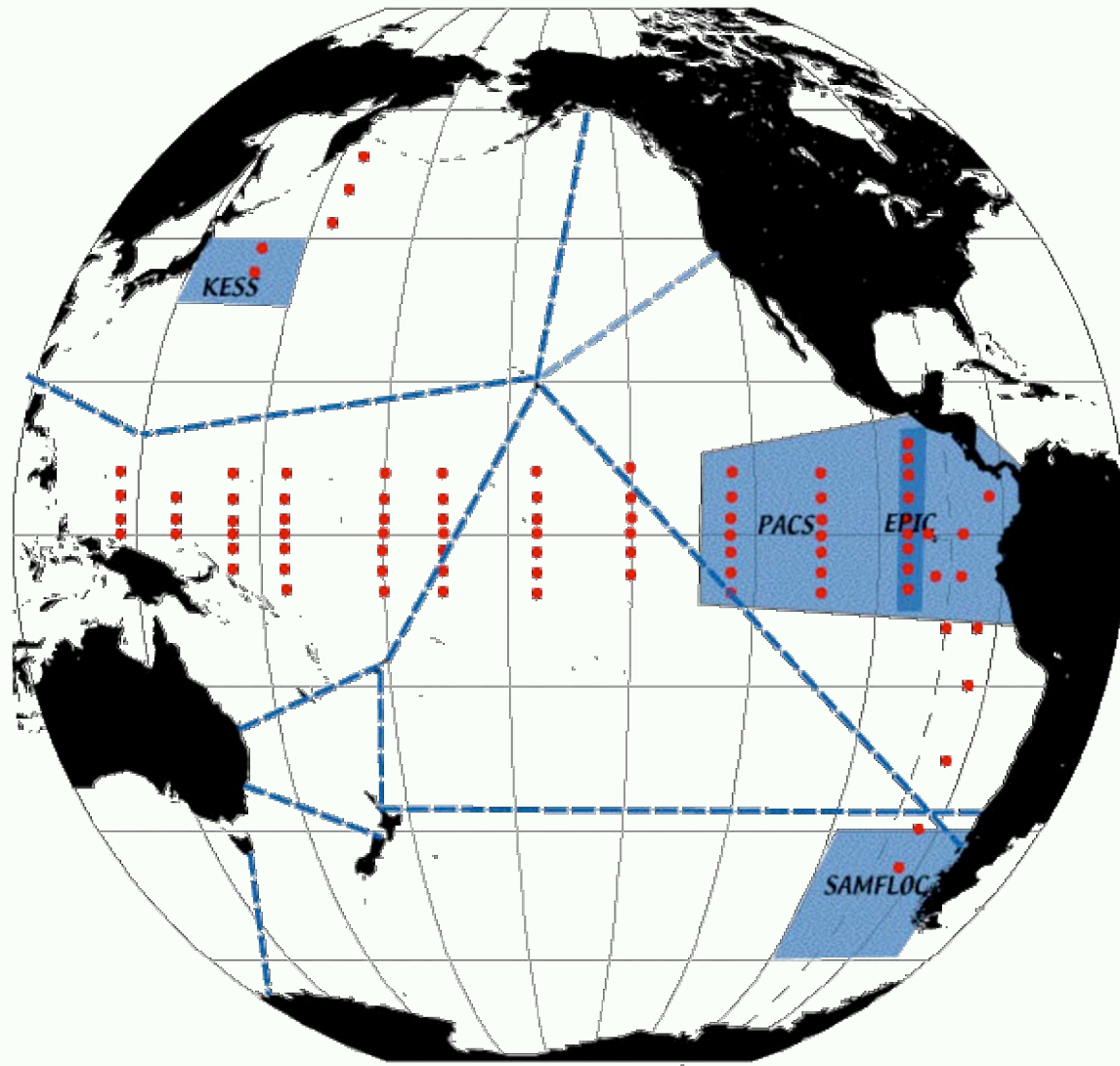


AV/GLOBAL/0108

K. Bouton ICPO February 14, 2001

*Ongoing and Planned Observations in the Pacific Basin.*

ICPO tracking observations, field studies.



-  Process Studies
-  Moorings
-  XBT Lines



Want 3x3 coverage - 3000

## Argo Status

1114 Operational Floats, 08-Mar-2004 07:41 UTC

The number of floats is updated twice daily by the [Argo Information Center](#)



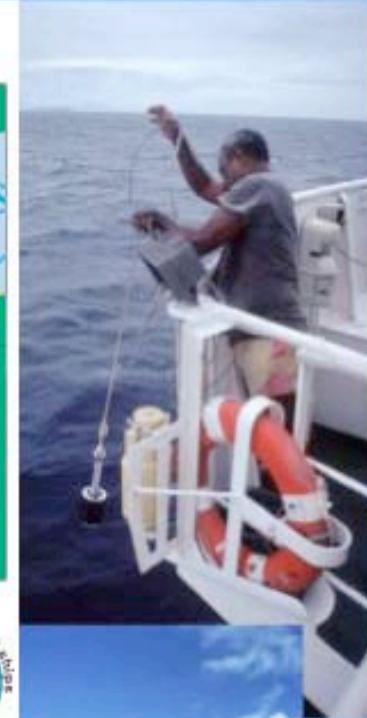
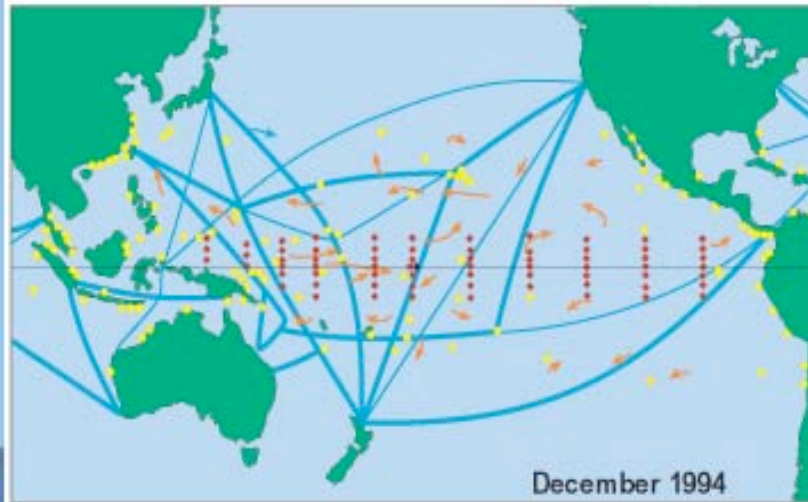
**37 % Complete**



# The ENSO Observing System

The ENSO observing system built up during the TOGA period (right panel) is one of the main cornerstones for successful prediction of ENSO events. Without a continuous collection (in space and time) of different meteorological and oceanographic data using the capabilities of research vessels, ships of opportunity, surface and satellite observations and the evolving knowledge and technology of climate modelling successful forecasts of ENSO events would not be possible. Compared to the benefit of the society the cost for the maintenance of the observing system and the modelling resources are neglectable.

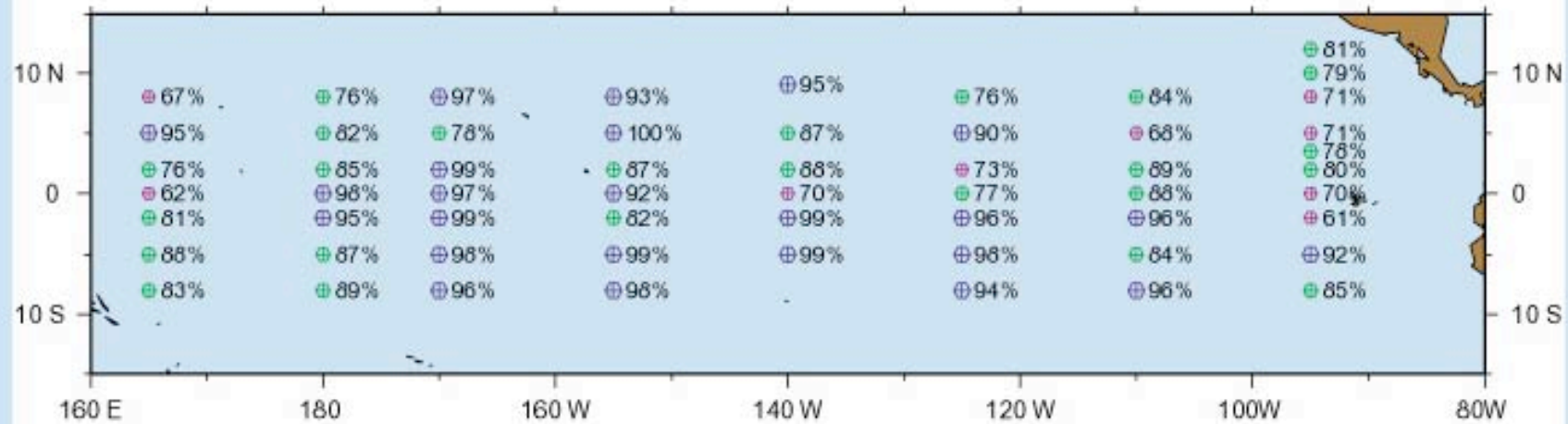
### TOGA in Situ Ocean Observing System Pacific Basin



Photos: above and right: maintenance of the TAO array (courtesy NOAA/PMEL), upper right: "classical" sea surface temperature measurements (bucket) (courtesy G. Meehl)

# Atlas Mooring Data Recovery

October 1997 - September 2000



## All Sensors

● 0% - 50% Recovered  
 ● 50% - 75% Recovered  
 ● 75% - 90% Recovered  
 ● 90% - 100% Recovered



Source: NOAA/PMEL

AV/G1/0110

# Main activities of the Pacific Panel

- **Development of Process studies to improve mechanistic understanding of key physical oceanic processes.**
- **Collaboration with modeling panels to improve representation of physics and variability in ocean models and the ocean component of coupled models**
- **Future focus: how to improve the South Pacific Observing network.**



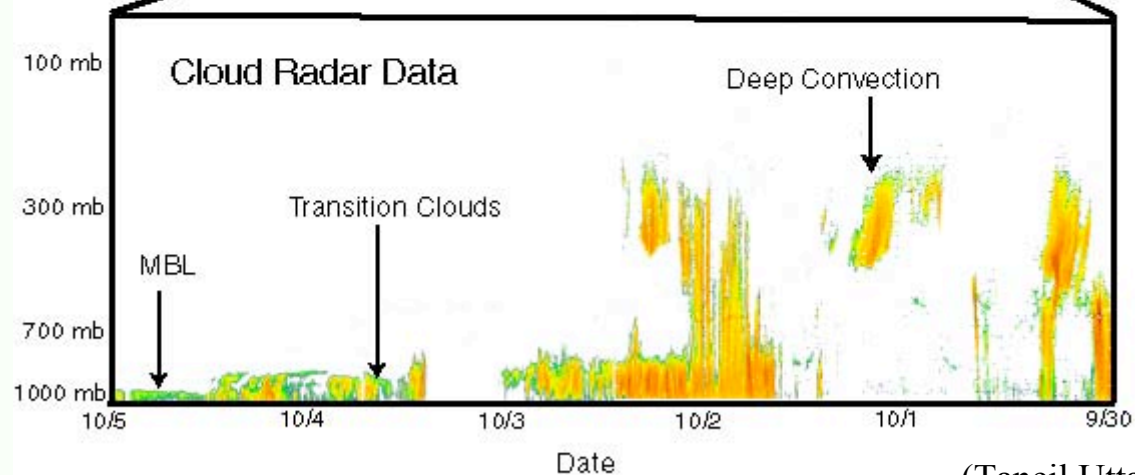
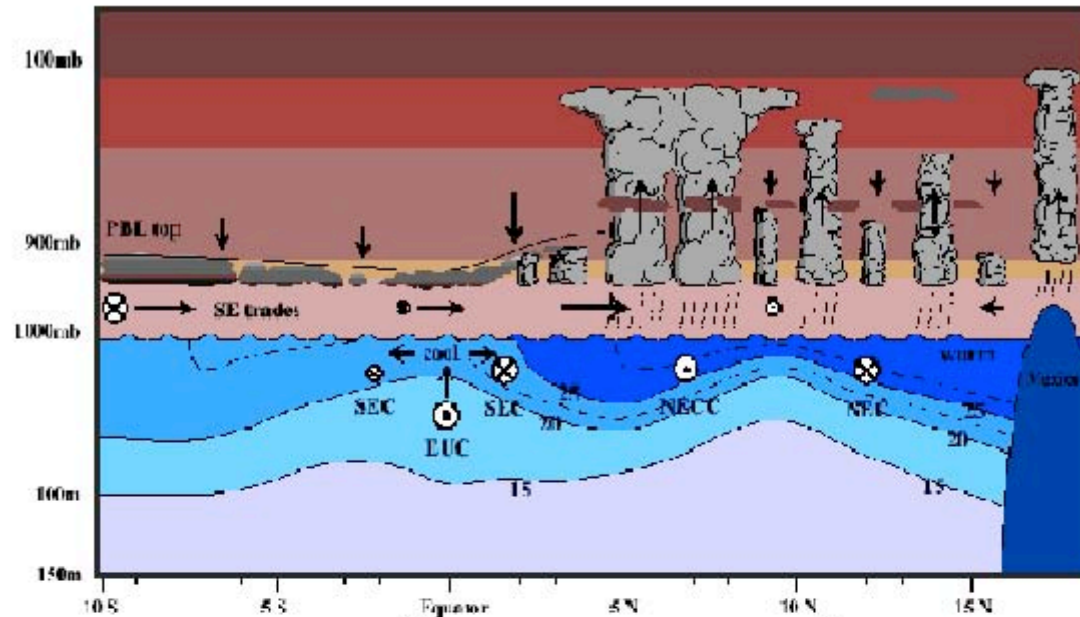
# Focus: Process Studies - Underway and proposed

- **EPIC - (East Pacific Investigation of Climate)**, observation phase completed completed.
- **KESS - (Kuroshio Extension System Study)**, observation phase started
- **SAMFLOC - (Subantarctic Mixed Layers, Fluxes and Overturning Circulation )**, part funded
- **PUMP - (Pacific Upwelling and Mixing Physics)**, planning stages.
- **SOAPS - Subtropical Ocean-Atmosphere Process Study**, planning stages
- **LLWBC's - (Low Latitude Western Boundary Currents)**, early planning stages.
- **ITF - (Indonesian Throughflow)**, a possible future study in association with the Indian Ocean Panel.
- **VOCALS - (VAMOS Ocean Cloud Atmosphere Land Study)**, a possible future study in eastern Pacific under Chilean stratus



# EPIC/EPIC2001 analysis continues

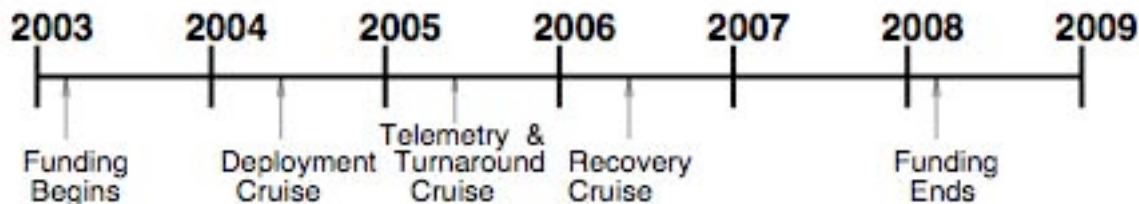
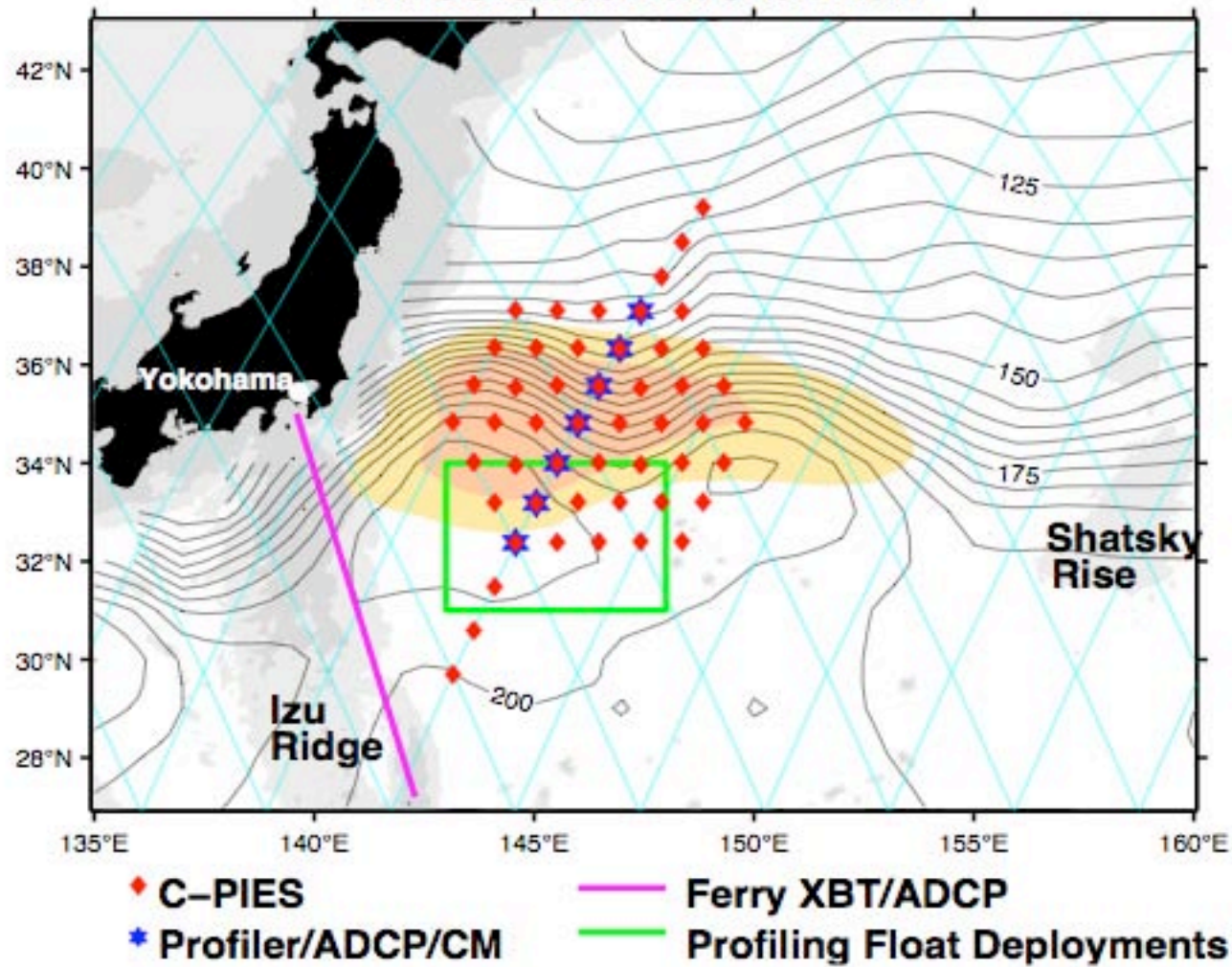
- Two BAMS articles submitted.
- AGU special session
- Joint meeting in Sept. with US PanAm CLIVAR



(Taneil Uttal)

5 days of data from the cloud radar taken as the Ron Brown moved from 10N to 1N showing the transition of clouds from deep convection in the ITCZ to Marine Boundary Layer (MBL) clouds near the equator. Top Figure is from the EPIC science plan.

## KESS Observational Plan

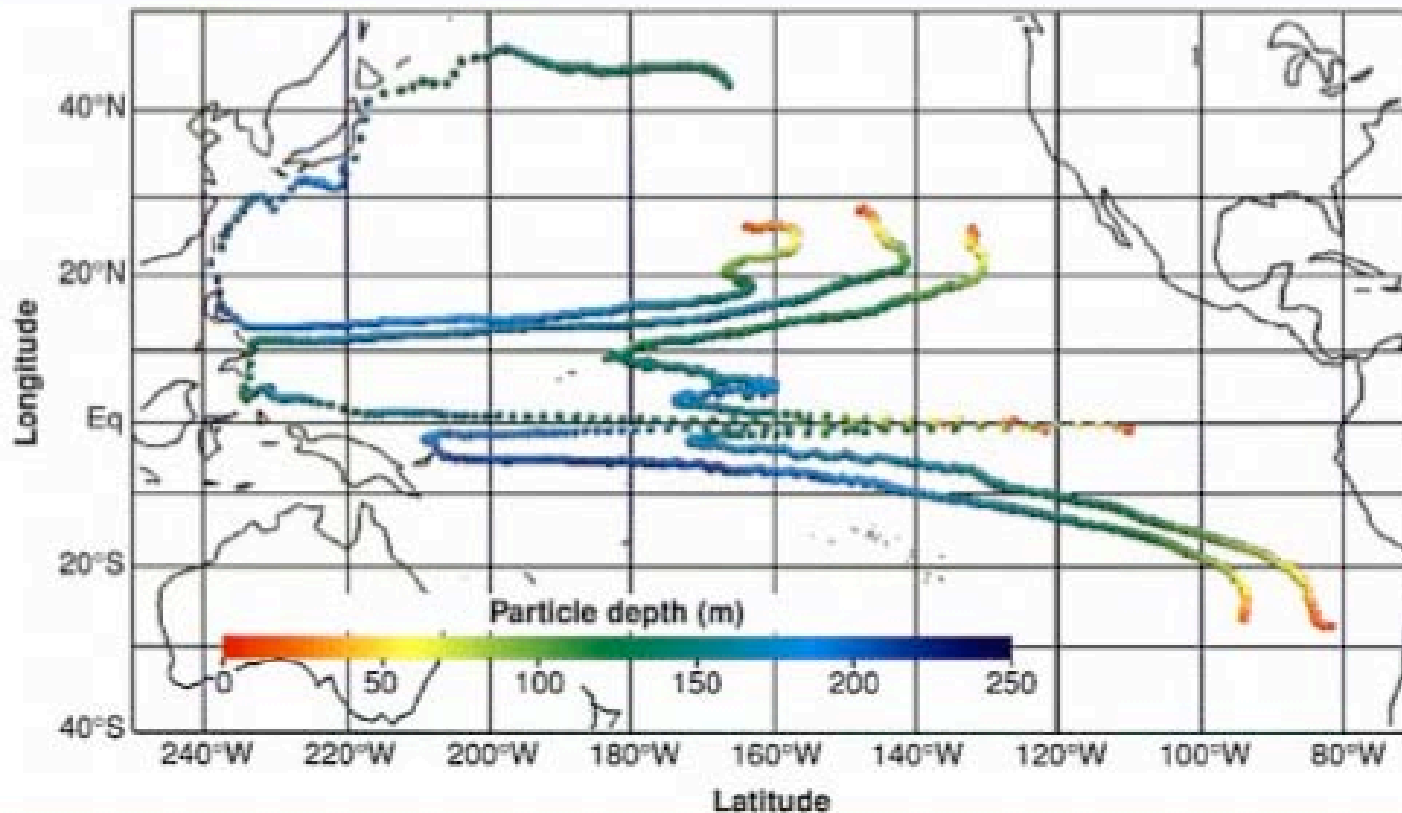


- A study of dynamic and thermodynamic processes in the Kuroshio Extension System.

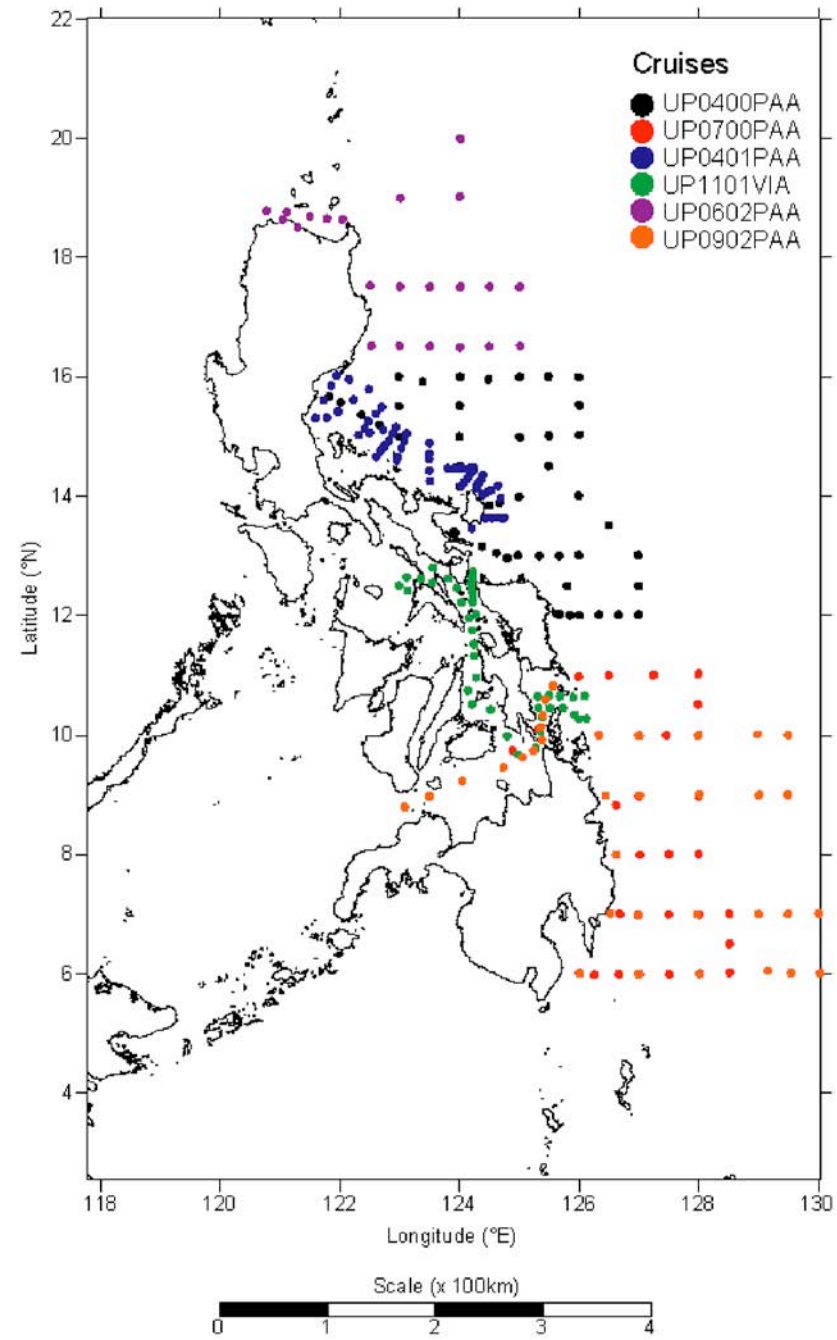
- Augmented with an air/sea flux mooring

# Decadal Variability in the North Pacific

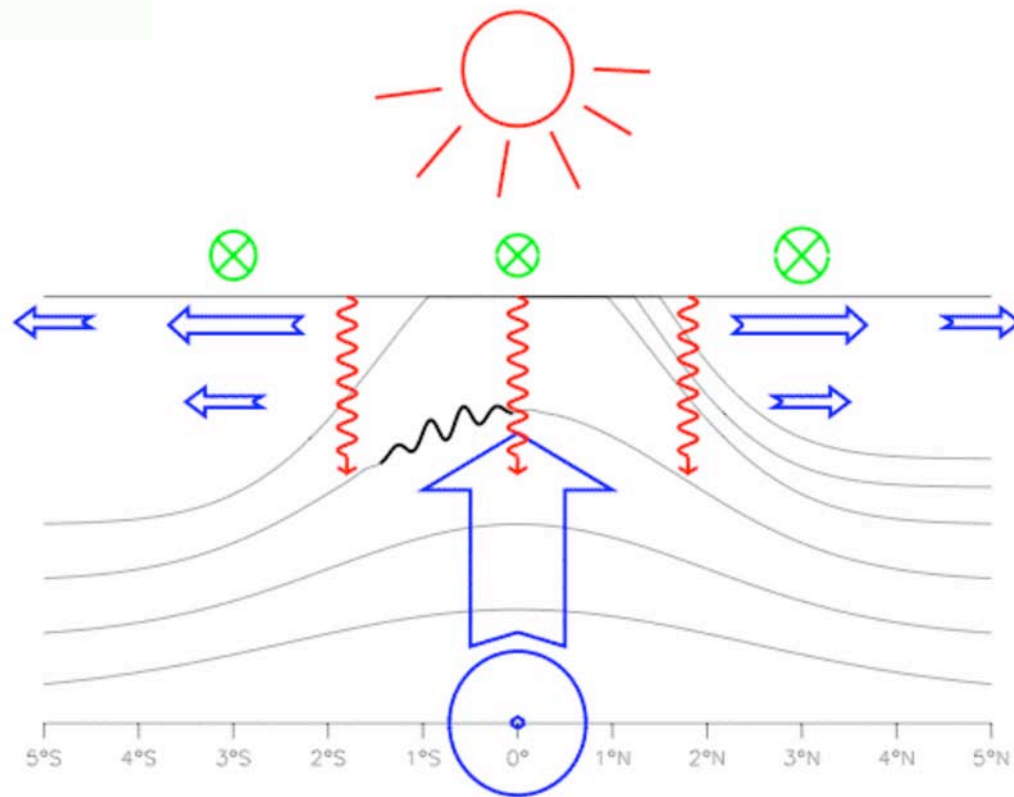
## - The Subduction Hypothesis -



The paths of water parcels over a period of 16 years after subduction off the coasts of California and Peru as simulated by means of a realistic oceanic general circulation model forced with the observed climatological winds. From the colours, which indicate the depth of the parcels, it is evident that parcels move downward, westward, and equatorward unless they start too far to the west off California, in which case they join the Kuroshio Current. Along the equator they rise to the surface while being carried eastward by the swift Equatorial Undercurrent (Gu, Philander, 1997, *Science*, 275, 805-807).



## Pacific Upwelling and Mixing Physics (PUMP)



•Study the balance that maintains the equatorial thermal structure:

Near-surface divergence

Upwelling

Heating from the atmosphere

Turbulent mixing

•These processes are currently quantifiable only as integrals over very large areas.

•Correctly modeling equatorial circulation and SST variability requires the ability to accurately represent all of these processes.

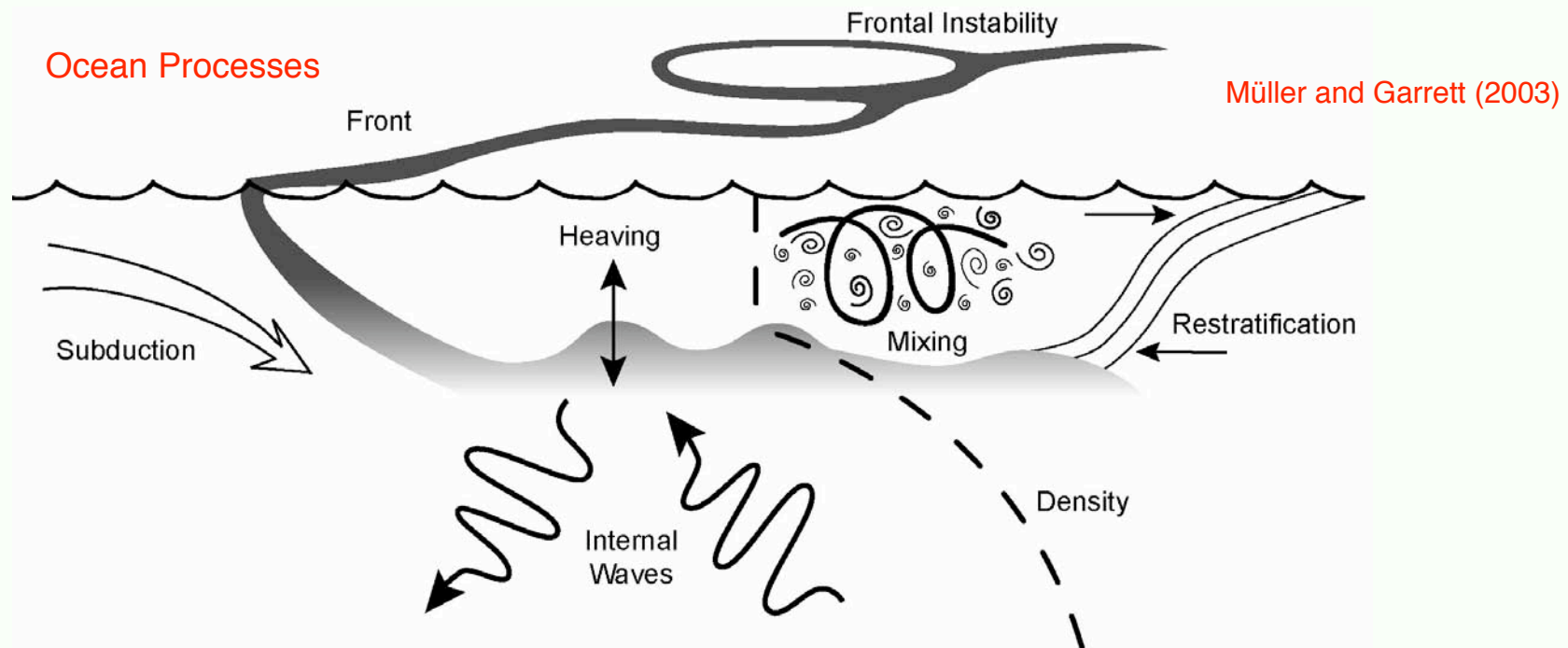
## Subtropical Ocean-Atmosphere Processes (SOAP)

- Subtropical ocean – downward branch of shallow meridional overturning cell (MOC)

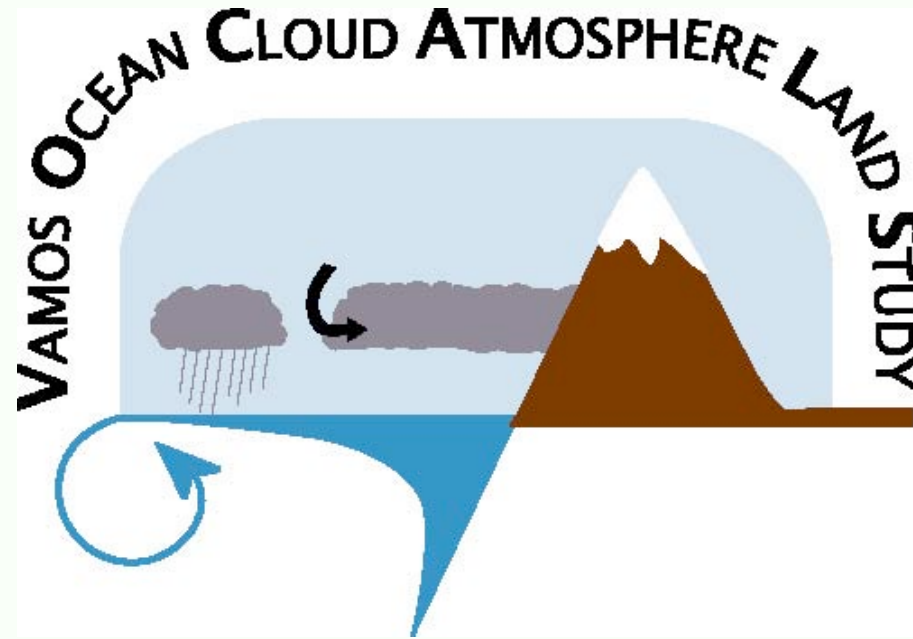
Focus – diabatic processes that set initial water properties in MOC

- Subtropical atmosphere – air/sea interaction dominated by winter storms

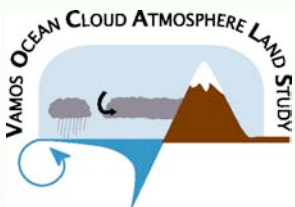
Focus – boundary layer processes in region of strong wind



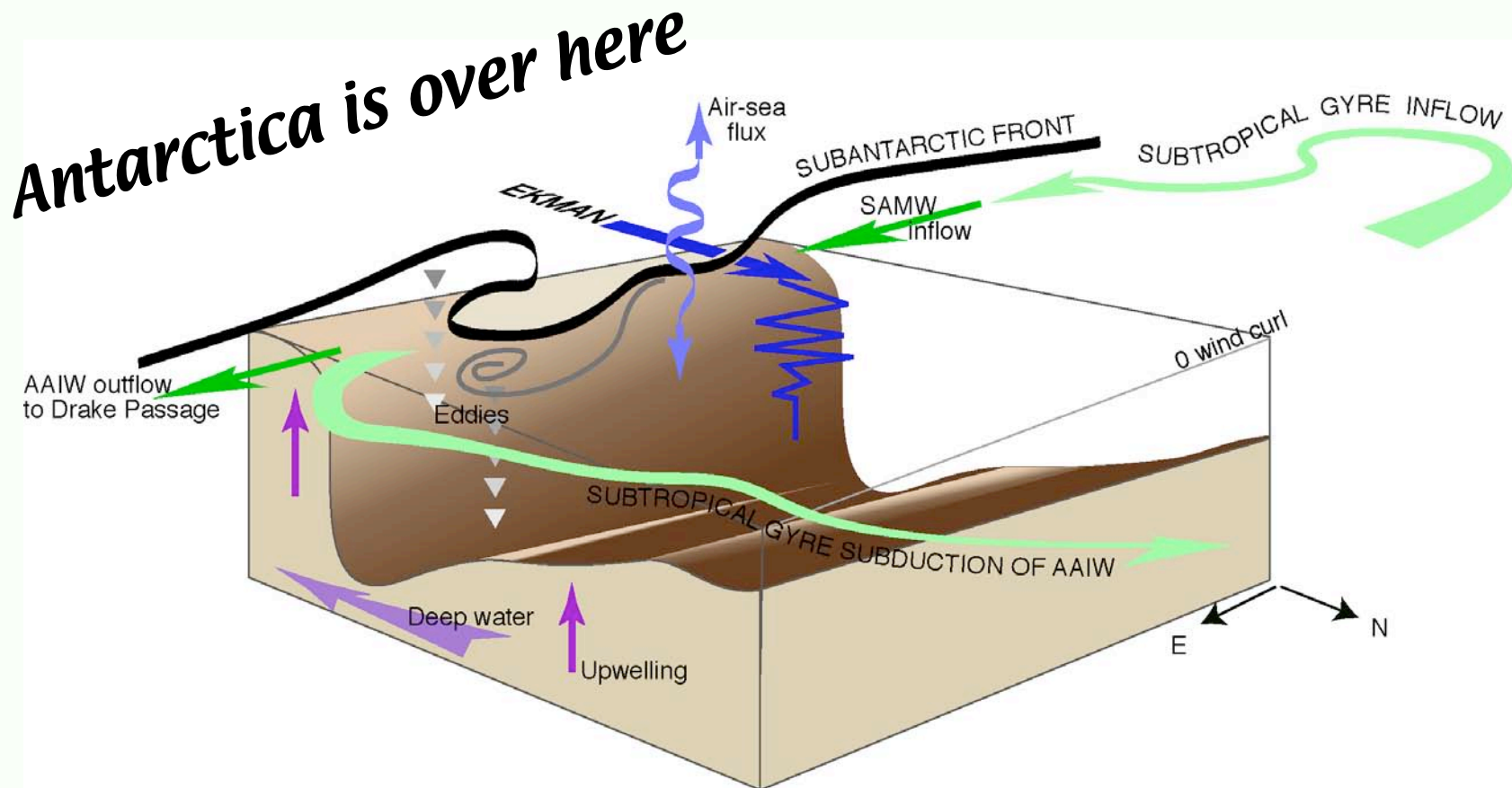
# VOCALS



**The focus of VOCALS is to better understand and simulate how marine boundary layer cloud systems surrounding the Americas interact with the coupled ocean-atmosphere-land system on diurnal to interannual timescales.**



# Schematic of AAIW formation process (generic for SAMW)



*Chile is where we're looking from*

# Future focus: South Pacific Observing System

- **Propose a workshop to address ways of improving data coverage in the South Pacific (in conjunction with OOPC?) to:**
  - **Determine present understanding of the role of the South Pacific in interannual to decadal variability**
    - Basin Scale teleconnections
    - Influence on regional climates
  - **Assess adequacy of present models and observational networks**
    - Broadscale (in situ, satellite measurements, surface fluxes)
    - Regional (process studies)
  - **Propose future numerical experimentation**
  - **Assess need for dedicated South Pacific Climate Observing System (similar to SACOS)**



# Focus: Collaboration with Modeling Groups.

- **Joint activities with WGSIP aimed at improving representation of ocean processes in models of the tropical Pacific used in seasonal prediction.**
  1. **mixing (vertical and lateral) - Possibly a process study as an expansion of the US PUMP proposal.**
- **Joint activities with WGOMD to allow easy comparison of the behavior of ocean models.**
  1. **Produce a common suite of diagnostics for ocean reanalyses**
  2. **Comparison of low frequency behaviour of forced ocean models and the ocean component of coupled models.**



# Comments on requirements From Panel Members

- **Salinity plays an important role in ocean dynamics in the Pacific (particularly at the surface) but is poorly sampled. An increase in sampling is required.**
- **We look forward to the benefits coming from the global coverage of the SSS provided by missions such as Soil Moisture and Ocean Salinity (SMOS, European Space Agency) and AQUARIUS (American Inner Space Mission).**



# Action required from OOPC

- Support for a joint CLIVAR/OOPC workshop on the South Pacific and suggested names of people and groups that should be involved.

