The Argo Project

New observations of the physical state of the ocean and their potential application to climate including fisheries and ecosystems impacts

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Profiling the global ocean

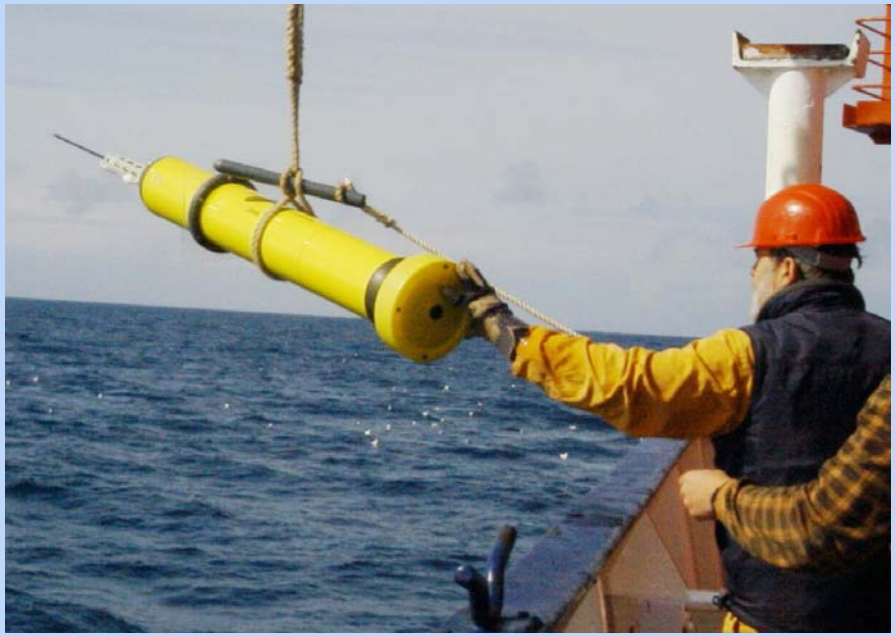
What is Argo ?

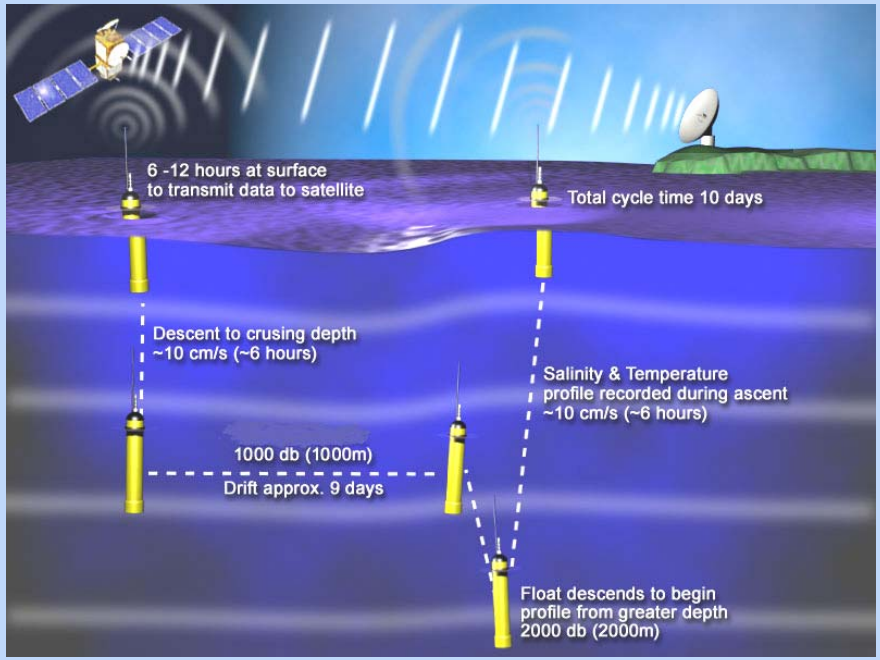
- A global (ice free areas) array of autonomous profiling floats
- Each float measures temperature and salinity to as deep as 2000m every 10 days and gives 1000m (and surface) velocities.
- Data are freely available within 24 hrs
- After delayed-mode QC data approach the quality of ship-base CTDs
- Target array is 3000 floats (3° x 3°)
- Floats contributed by 18 countries
  (Pacific - Australia, Canada, China, France, Korea, New Zealand, Russia, USA)
- Many other countries assist with float deployments and EEZ access and data management

Profiling the global ocean

The floats

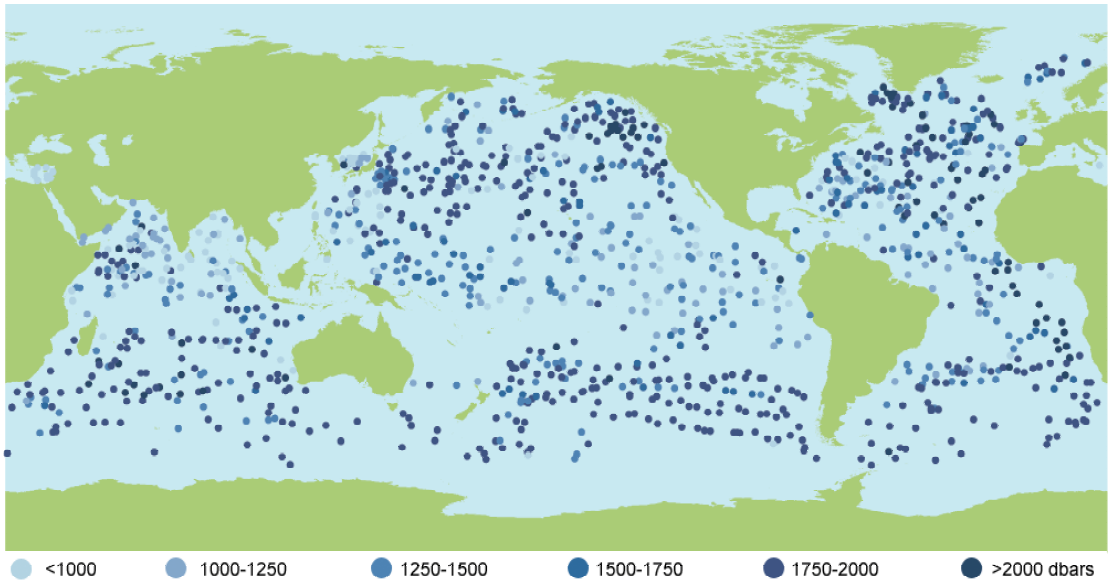
- Expendable, cost ca $15,000, 200 profiles
- 2 commercial designs (**Apex** - WRC, **Provor** - Martec)
- 1 designed and built by **SIO** - Solo
- Deployed by ship (research, commercial/charter) or aircraft



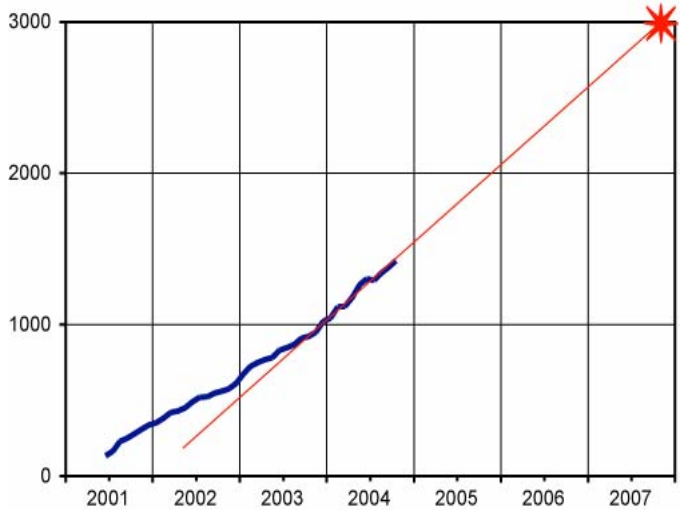


The array

- Presently almost 1500 floats
- Sparse array in four oceans



Float profile depths

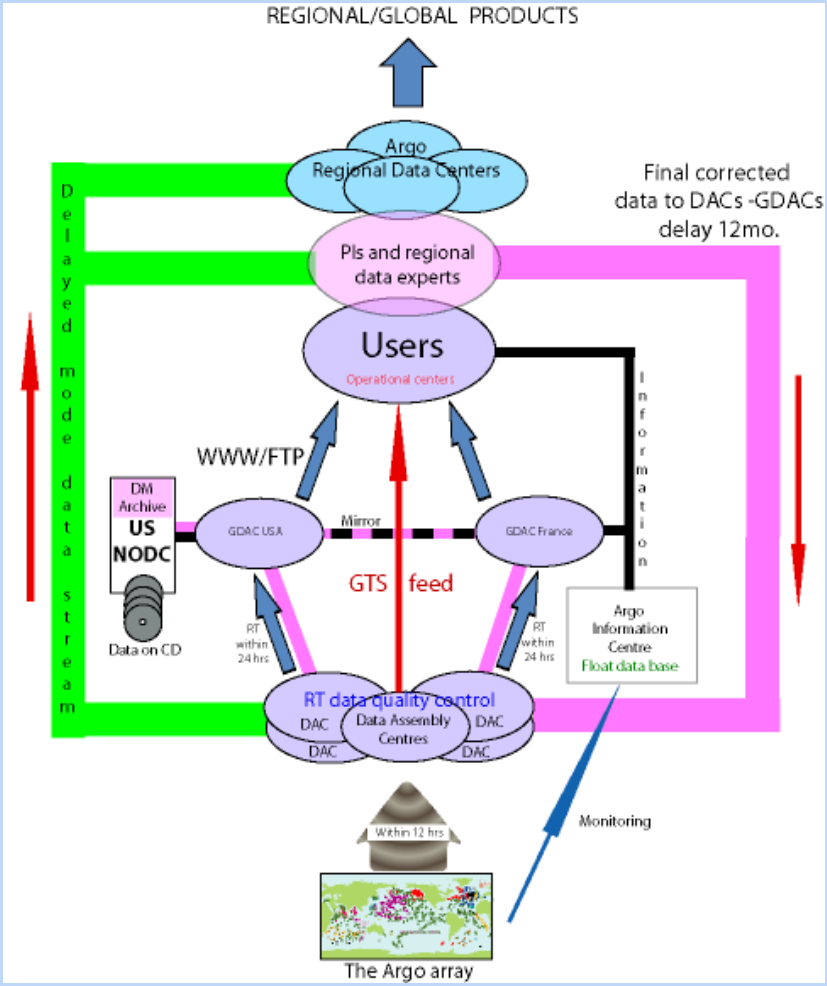


Number of active floats

- Array growth depends on
  - Number of floats deployed
  - Their survival rate

- Data are unique
  - Quasi random spatial
  - No seasonal bias
  - Deeper than XBTs
    + salinity

The data



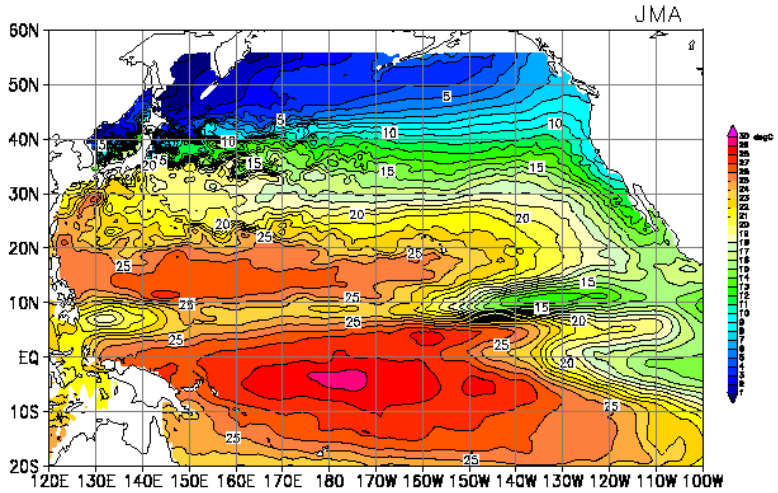
- About 200 points per profile
- Data available in real time (24 hrs) from GTS and by ftp and LAS from 2 global data centres (GDACs). USA and France
- Delayed mode salinities corrected against climatology and by float-float comparisons. Get from GDACs (delay at least 1 year)
- Archive at US NODC
- Regional data centres being set up

  Pacific centres IPRC, PMEL (USA), JAMSTEC (Japan)

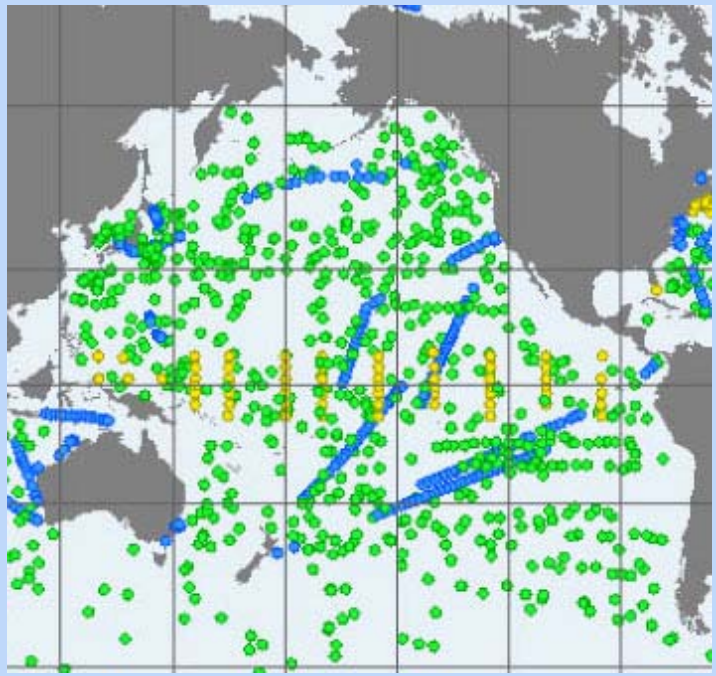
  Regional QC, regional products.
- Argo Information Centre in Toulouse

Argo data use

- Many operational centres now produce products and forecasts based on Argo data.
  - ENSO analysis and forecasts (Argo expands the area covered by the ENSO observing system)



JMA regional analysis 100m temp



Profiles 29 Sept - 8 Oct 2004 From :

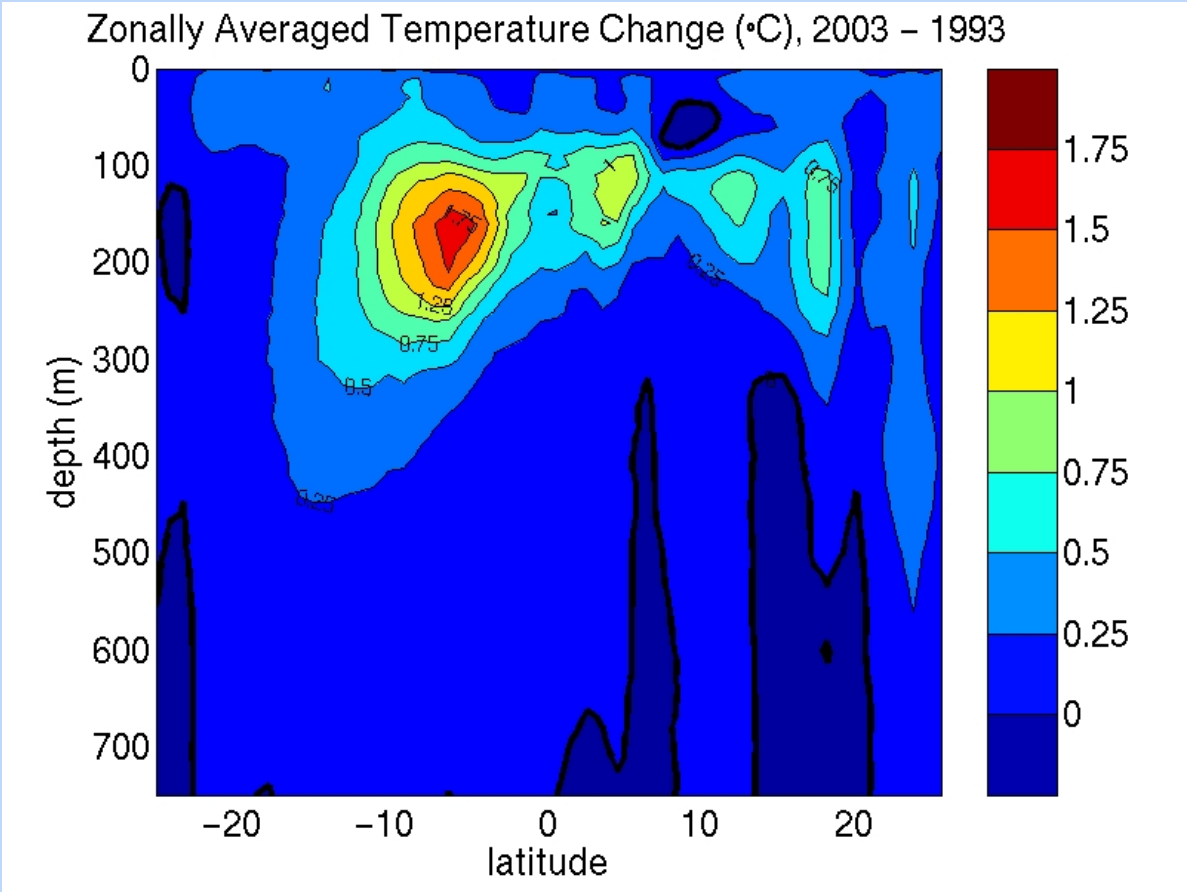
Argo XBT TAO array

Argo data use

- Monitoring regional and global long term temperature/salinity changes and heat storage

The 10-year warming signal in the western tropical Pacific is due to both warming of the surface layer and downward displacement of the thermocline.

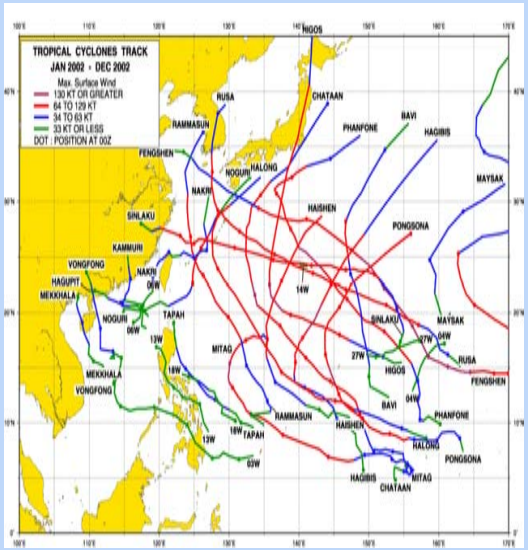
Averaged from 130°E to 140°W



Argo data use

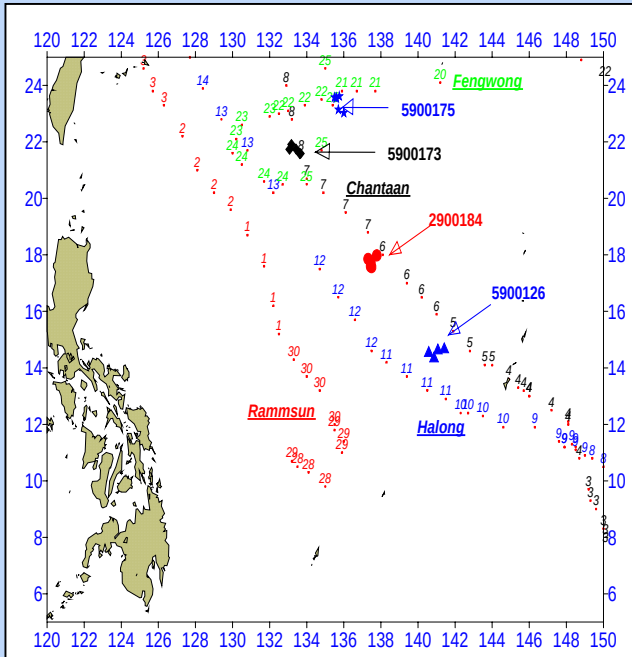
Temperature and salinity changes beneath tropical cyclones

See also Poster S7-2007 JJ Park

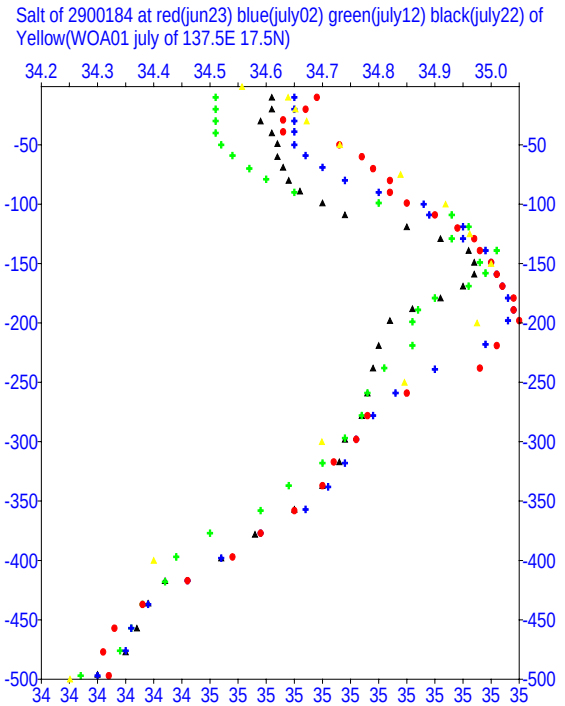


Typhoon tracks 2002

Xu Dongfeng
2nd Inst Oceanography
Hangzhou, PRC



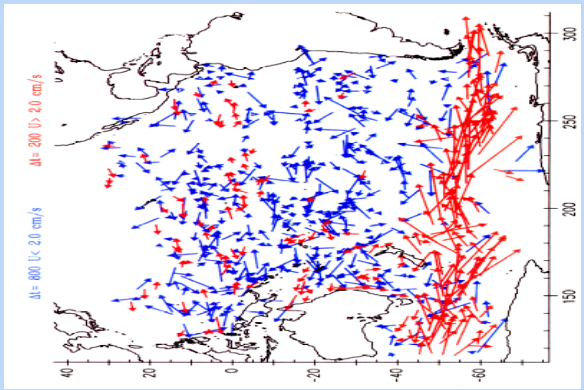
Track of Rammsun(red); Halong(blue); Fengwong(green); Chantaan(black) ; Argo 2900184(circle) and 5900126(triangle) 5900173(diamond) 5900175(star) July 2002

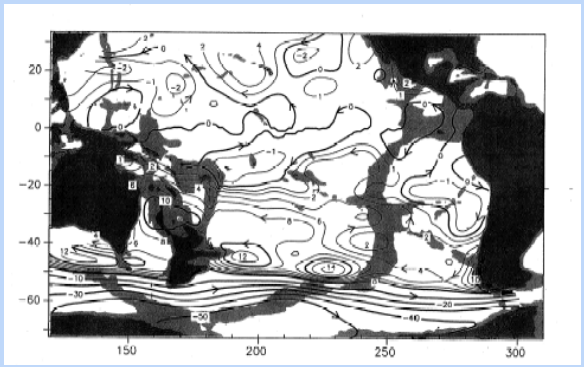


Profiling the global ocean

Argo data use

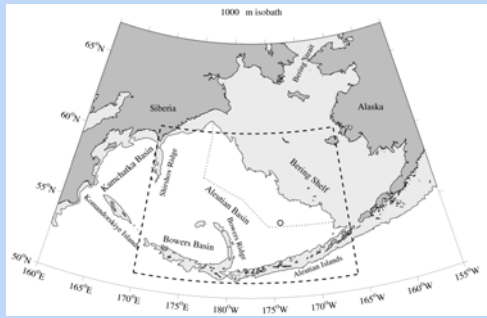
- Mapping subsurface circulation (changes in larval migration)

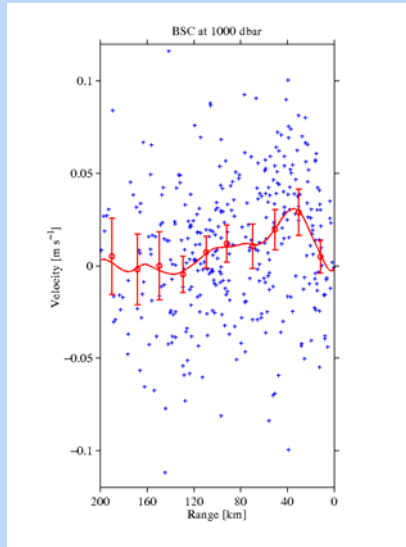


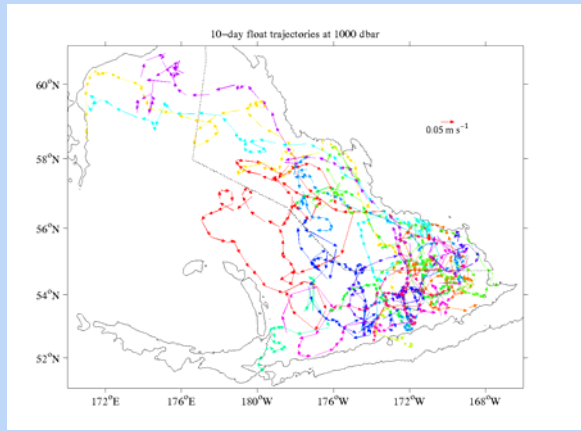


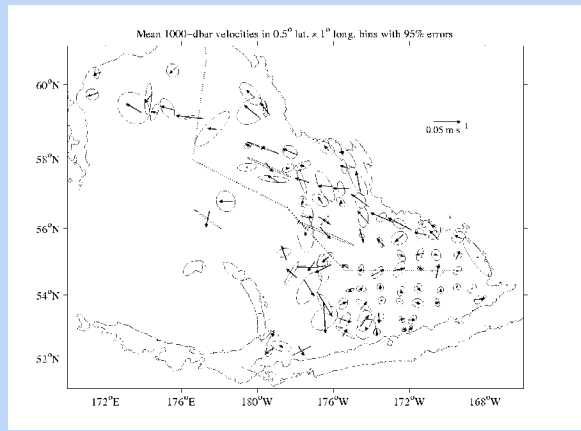
Pacific-wide 900m circulation for 1990s (WOCE)

R.E. Davis SIO





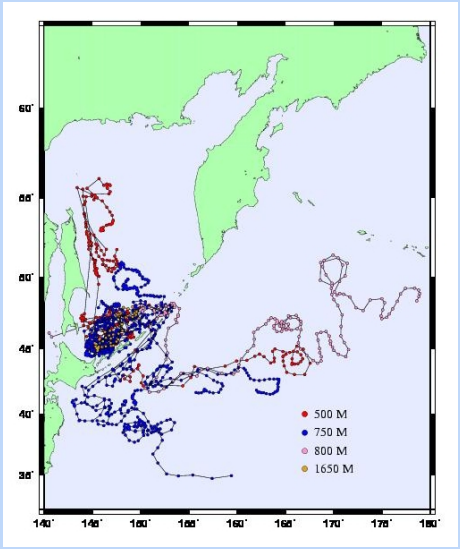


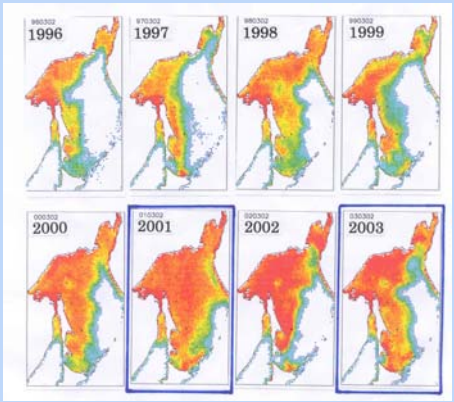


Bering slope current structure and variability
Greg Johnson, NOAA, PMEL

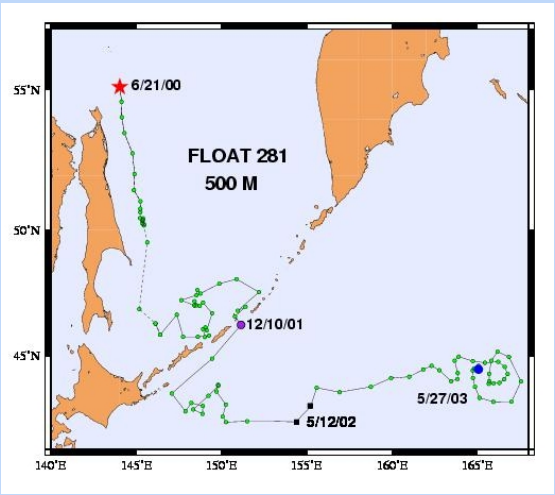
Argo data use

Year to year changes in temperature/salinity
Case 1 - Okhotsk Sea

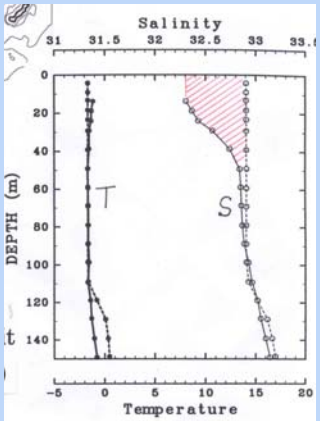


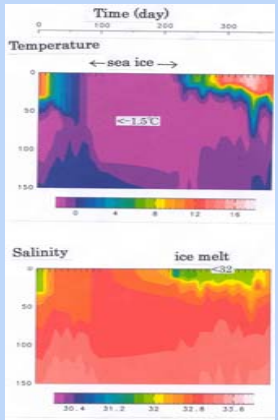


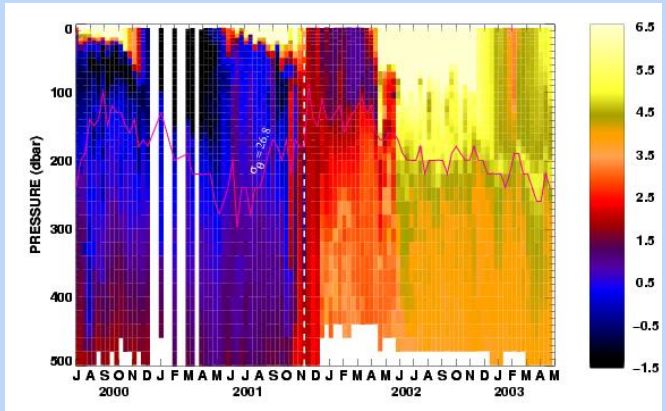
Okhotsk Sea ice cover in March, 1996-2003



First deployments in June, 2000; the present dataset consists of over 1500 profiles. Data collection will continue for several more years. Some floats have exited the Okhotsk Sea via the Kuril Straits.







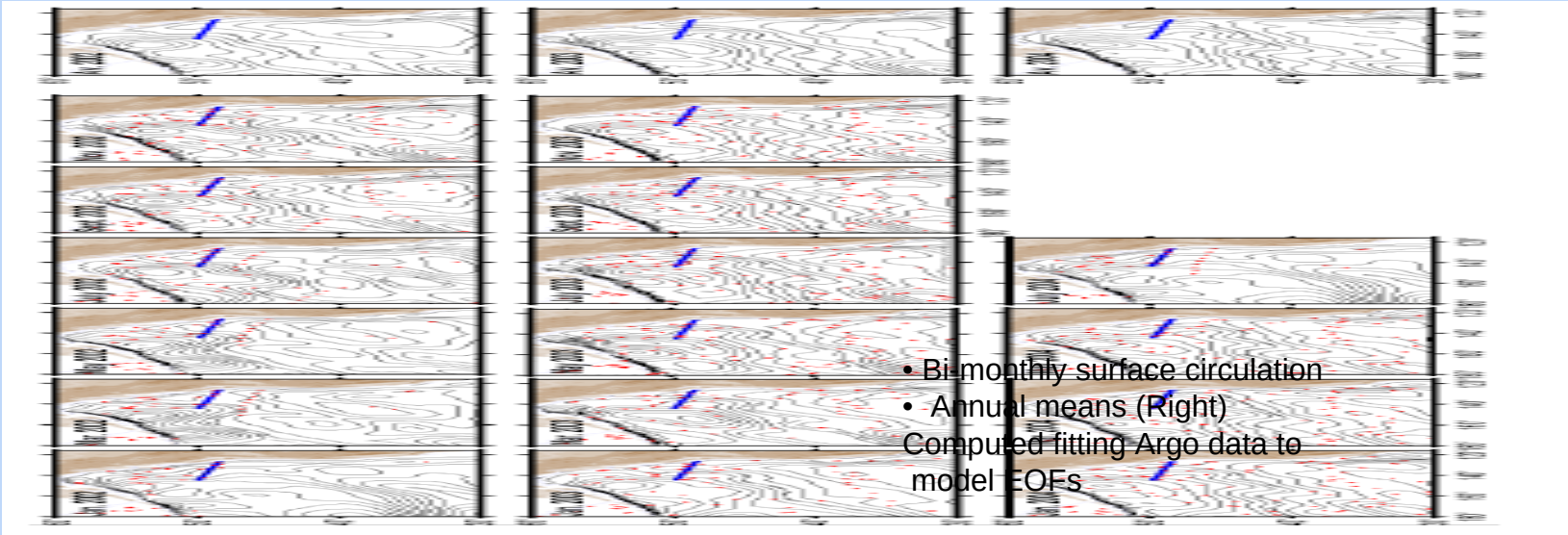
Estimate ice thickness from spring freshening

K. Ohshima (Hokkaido University, Sapporo, Japan
M. Wakatsutchi (Hokkaido University, Sapporo, Japan)
S. Riser (University of Washington, USA)

Argo data use

Year to year changes in ocean structure

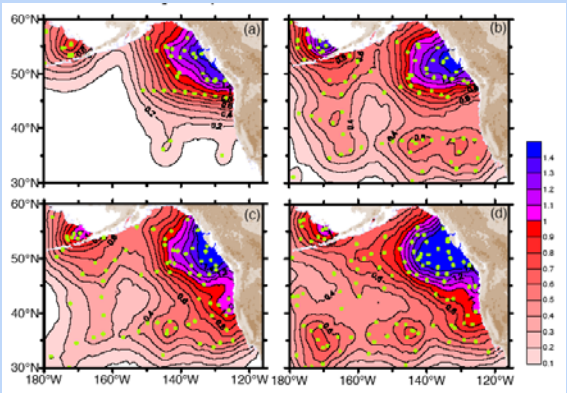
Case 2 - Gulf of Alaska (Freeland and Cummins, IOS, DFO,Canada)

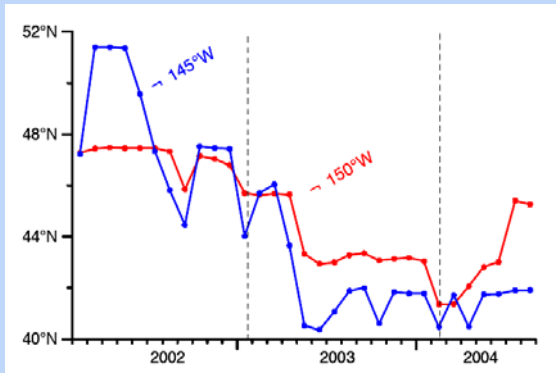


- Bi-monthly surface circulation
- Annual means (Right)

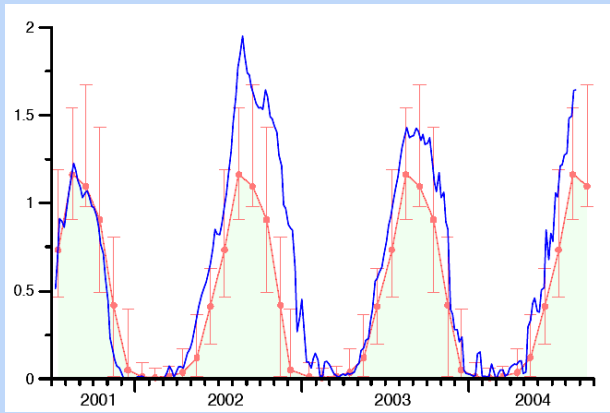
Computed fitting Argo data to model EOFs

Array density % of 3° x3°





Position of N Pacific current



Surface - 75m stratification at Station Papa

Blue Argo, Red climatology

Profiling the global ocean

Argo ecosystem applications

- Argo can help define the physical conditions of the open ocean
  (Temperature/salinity/velocity)
- The Argo array is sparse so it needs to be combined with other data to resolve frontal and mesoscale features) (e.g altimetry, infrared imagery, ocean color)
- Argo cannot provide data from continental shelves
  (Models are needed to link open ocean to shelf. Gliders may help with observations)

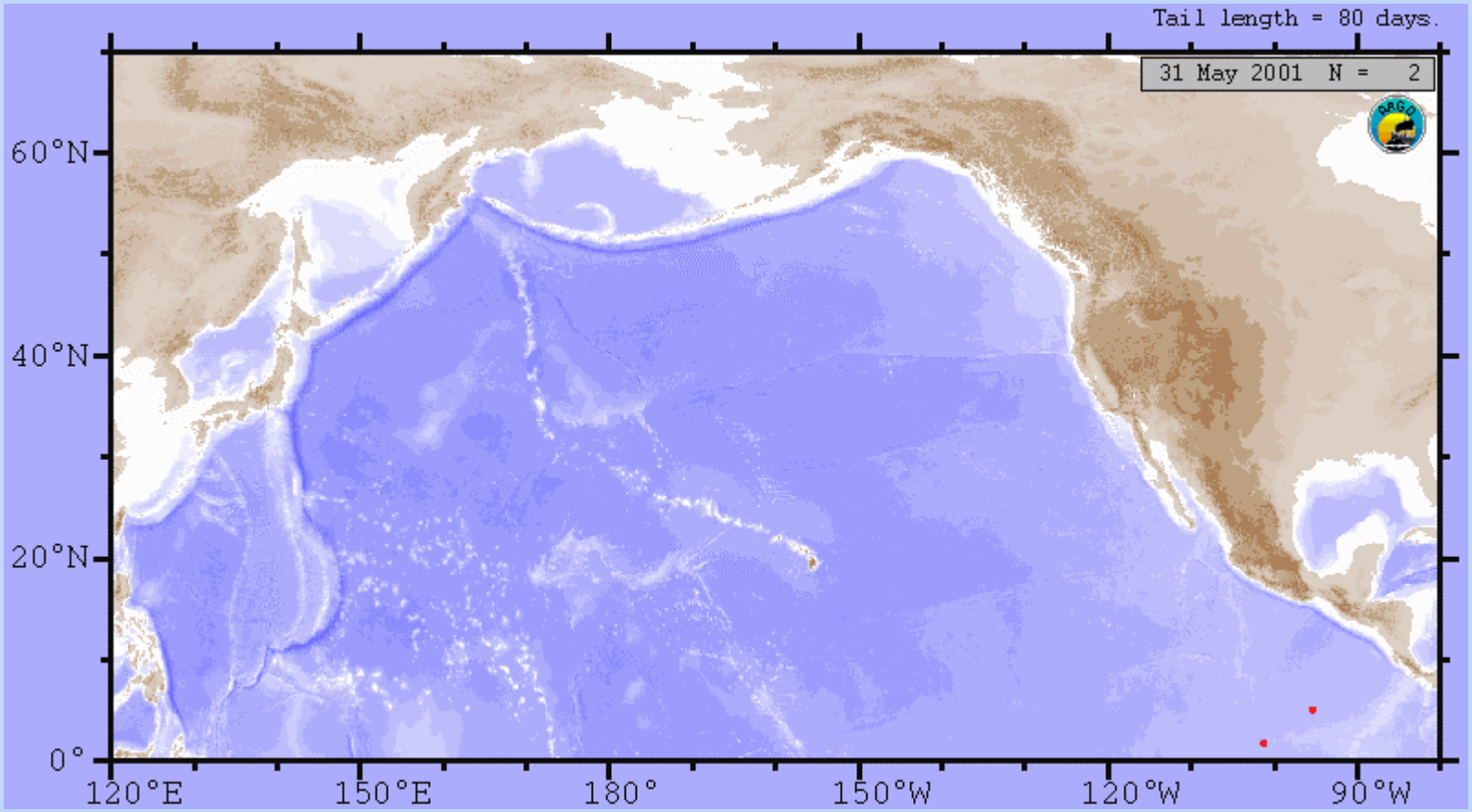
The future

- Routine products based on Argo data
- Learn how to use these novel data
- New sensors - Now dissolved oxygen, shear, microstructure
  - In future nutrients, fluorometers, rain and wind, + +

  Develop new technologies in parallel with Argo
- Better communication (cleaner data, more points per profile)
- Argo still needs ship-based CTD data to update climatologies
- How to sustain Argo in the long term?

  Operational - but still needs strong research involvement - partnership.

Explore Argo at :- http://www.argo.net



Animation by Howard Freeland

Profiling the global ocean