

# Science Splinter Overviews

Part 1 : Large-scale Oceanography

Part 2 : Climate change in the ocean and sea level rise

Part 3 : Mesoscale & sub-mesoscale oceanography

Part 4: Large-scale oceanography & Argo

# Part 1 : Large-Scale Oceanography

## Altimetric analyses in different ocean basins :

- **Andersen et al.** : Large-scale sea level variation in the Arctic from CR2 SAR altimetry
- **Jayne et al.** : Mapping the ocean's surface circulation from altimetry
- **Goni et al.** : Meridional changes in the South Atlantic MOC
- **Kelly et al.** : Contribution of Ekman advection to Atlantic Ocean meridional heat transport anomalies
- **Zavala-Garay et al.** Satellite-based ocean analyses for the MidAtlantic Bight
- **Bulusu et al.** : Integrated mutli-mission altimetry & detection of the Madden-Julian Oscillation
- Need to extend the altimetric data series and coverage in coastal zones, marginal seas, boundary currents & high latitudes (incl. specific reprocessing of present & past missions – T/P – J, & ERS-ENV-CR-SARAL)

# Part 2: climate change and sea level rise

- A new gridded sea level product over 1993-2010 is available from AVISO :  
« Sea –level ECV product» with time-consistent corrections and reduced altimetry sea level errors over the wole period 1993-2010

## **At global scale :**

- At global scale recent research has focused on interannual variability of GMSL. Altimetry indicates a unprecedented global mean sea level drop during la Nina 2011 that can not be explained by the sole nina-related precipitation patterns. It is actually due to a conjunction of low phase in MEI, IOD and SAM in 2011 that generated heavy precipitations in central Australia where there is no coordinated runoff to ocean and the storage is particularly persitent.

## **At regional scale :**

- Recent results from Altimetry, Sea level reconstructions and reanalysis show that the PDO evolution dominates the North Pacific mid-latitude sea level trend of the past 20 years and the probably the past 60 years.
- Over the last 20 years PDO explains the sea level slight drop observed on the eastern coast of USA over the last 20 years. It also appears to plays a role at global scale and seems to have contributed to 0.5 mm.yr in the global sea level rise of 3.2 mm/yr since 1993
- Sea level variations across the Artic basin are dominated by barotropic fluctuations mainly driven by along-shelf wind patterns

## Part 3 : Mesoscale/submesoscale oceanography

- **Global eddy tracking** – New understanding of eddy dynamics/statistics and interaction with biogeochemical processes. The first global map of correlation between eddy SSH and surface chlorophyll with regional interpretations.
- **Modeling and assimilation** – Increasing operational capabilities into higher resolution models
- **Assimilation** – First inversion of (chlorophyll) submesoscales into (SSH) meso and larger scales. Development of Ensemble and Stochastic strategies for mesoscale DA.
- **Long term change (EKE)** – Finding of slight but significant decadal increase of eddy kinetic energy in the Southern Ocean. What is the responsible mechanism? What is the balance between Intrinsic and Forced climate variability due to turbulence in the world ocean ?
- **Spectral analysis**- Finding a pervasive flatter wavenumber spectral slope than in-situ observations and model simulation. Altimetry errors? Missing physics? Internal waves?
- **Submesoscale dynamics** – Modeling studies suggest that submesoscale processes are not dissipative, but actively contribute to the energy balance via cascade, frontogenesis and mixed-layer instability.
- **New altimetry missions** – AltiKa provides results with less noise and possibly new information at wavelengths shorter than 50 km.

# Part 4 : Large Scale Oceanography & Argo

- Schmid: Talk withdrawn due to Gov't shutdown
- Hakkinen: North Atlantic Sea Level & Heat Content
  - Long term, wind driven slowing of the subpolar gyre slowing allows more tropical water to go north causing cooling Gulf Stream, warming subpolar gyre.
- Kosempa: Southern Ocean Transport from altimetry and profile data
  - Combining satellite SSH and geoid with Argo T/S fields allows estimate of ACC transport
- Zilberman: Western Boundary Currents from in situ and altimeter data
  - XBT transects & Argo T, S, and trajectories & AVISO SSH show that El Nino is related to decrease and eastward migration of EAC due to wind stress curl changes.
- Qiu: Pacific Sea Level and the PDO
  - PDO winds drive changes in subtropical gyre with 9 month lag and modify Kurishiro Extension stability with 4 year lag
- Roemmich: Equatorial Pacific Annual Cycle
  - Present Argo array captures over 80% of variance in temp & steric height for 10 day & longer time scales
  - plan to double Argo coverage in Tropical Pacific

# Science Applications Round Table

## Discussion Points

- Altimetric science is now covering a wide range of scales, from sub-mesoscales to global MSL
- Challenges remain in closing the global MSL budget and the radiative imbalance – understanding systematic errors/drifts/biases
- Interannual thermohaline & ocean mass changes remain undersampled, esp < 2005
- Work needed to extend the altimetric data series and coverage in coastal zones, marginal seas, boundary currents & high latitudes (incl. reprocessing of past missions – T/P – J, & ERS-ENV-CR)
- Recalculating AVISO products relative to a 20-year mean : many scientific & operational impacts – suggest setting up a science working group to evaluate its impact before release
- Science applications – support the recommendation to have a seamless transition between the altimetric missions, and a timely launch of J-3 and J-CS