Introduction

Seasonal freshwater runoff into the Bay of Bengal (BoB) due to the Monsoon makes the Bay one of the freshest oceans in the world. Despite the societal importance of the BoB, few observational analyses of the sources and sinks of salinity have been carried out. The increased resolution of satellite observations available from the Aquarius mission provides a new opportunity for understanding the basic physical dynamics of the BoB and the role of the oceans in the hydrological cycle.

Purpose

We seek to understand the processes underlying salinity variability in the Bay of Bengal, including:

- What are the spatial patterns of salinity and how do they evolve seasonally?
- To what extent do advection, mixing, and surface fluxes cause observed changes in salinity?

Because of the known importance of mesoscale advection in this region, we study processes in the moving frame of the ocean using Lagrangian modeling.

Salinity budget

\[
\frac{DS}{Dt} = \nabla \cdot (\kappa \nabla S) + \frac{E - P}{h} S + V
\]

Sources and sinks

- \(\kappa \nabla^2 S\): Lateral mixing
- \(E - P\): Evaporation minus precipitation divided by mixed layer depth
- \(V\): Vertical mixing and mixed layer entrainment

Error calculations

At spatial scales of 9 km or above (the Aquarius along-track resolution), Aquarius and a thermosalinograph from an ASIRI cruise observe the same spatial gradient in sea surface salinity (SSS). Despite the societal importance of the BoB, few observational analyses of SSS variability have been carried out. The increased resolution of SSS observations available from the Aquarius mission provides a new opportunity for understanding the basic physical dynamics of the BoB and the role of the oceans in the hydrological cycle.

Methods

We tracked observed salinity from Aquarius along water parcel trajectories calculated from satellite-derived surface geostrophic and Ekman currents (OSCAR). This method assumes the surface layer is well-mixed. We estimate the material derivative using measurements of salinity at two time points along a single trajectory.

We ascribed the observed changes in salinity to oceanic processes and surface fluxes using evaporation estimates from OAFlux, precipitation measurements from GCPC [NASA TRMM], MIMOC mixed layer depth, and Finite Time Lyapunov Exponents estimates of horizontal strain.

Results: Late Monsoon (Aug. - Oct., 2012)

Conclusions

- Satellite along-track lateral salinity gradients are representative of ship-based measurements at spatial scales greater than 9 km.
- Surface fluxes are most important in the NE BoB, but rates of change due to surface fluxes are an order of magnitude smaller than advection and mixing across the whole Bay.
- The largest changes in salinity are due to advection, which is balanced by mixing. However, errors in these estimates are large compared to surface flux estimates.

Works cited