SIMULATION AND ANALYSIS OF OCEAN CLIMATE VARIABILITY

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We propose to study the strength, shape and seasonal to inter-annual variability of the subtropical gyre in the North and South Atlantic. Proper simulations of this gyre are important for climate research since, e.g., the latitudinal distribution of the sea surface temperature has an impact on the heat exchange between the atmosphere and the ocean. The approach to this problem will be two-fold. One part of the work is focused on the analysis of observations, and the other part involves numerical simulations.

We will analyze hydrographic data (historic as well as near-realtime) to determine the strength and shape of the subtropical gyres of the Atlantic Ocean. The main quantities coming out of this analysis will be the vertical extent of the gyres, the latitude of the eastward and westward branches of the gyres, and the zonal geostrophic transports at different longitudes. We also will use velocity observations from surface drifters and profiling floats to get a better estimation of the circulation around the gyres. These data will be used to detect signs of variability and will be used for model verification.

We will study the product of available simulations with the Hybrid Coordinates Ocean Model (HYCOM), in close comparison with the observations:

1) We will compare mean and seasonal cycle with the observed results using 1-2 years of high resolution global simulations at 1/12 degree resolution, without data assimilation. Based on that model we will also study the dynamics of the seasonal adjustment of the subtropical gyres of the North and South Atlantic. (Model results can be seen in http://hycom.rsmas.miami.edu/global_sim.html, An update of the 1/12 global HYCOM effort, J.Metzger, 11/09/2006).

2) In addition, we will study the longer term (decadal) variability of the subtropical gyre in the North Atlantic based on a North and Tropical Atlantic 1/3 degree model that has been run successfully for 50 years. This simulation was recently produced with the Hybrid Coordinates Ocean Model (HYCOM) driven by six-hourly surface fields obtained from the NCEP/NCAR (before 1979) and NCEP/DOE MIP-II (1979-now) atmospheric reanalysis. The model reproduces the anomaly patterns of the Sea Surface Temperature (SST), as well as the subtropical and subpolar gyre responses associated with the North Atlantic Oscillation (NAO). At this resolution the Florida Current is weaker than observed, but the normalized transport anomalies agree very well with the same variable from the cable data (ftp://hycom.rsmas.miami.edu/zulema/zgarraffo_hycom_apr07.ppt).

3) A similar long-term simulation of the North and Tropical Atlantic is being conducted at 1/12 degree resolution, for the same period. Results of this high resolution simulation for the adjustment of the northern subtropical gyre will be analyzed thoroughly, for which the observations of the gyre will be very valuable.

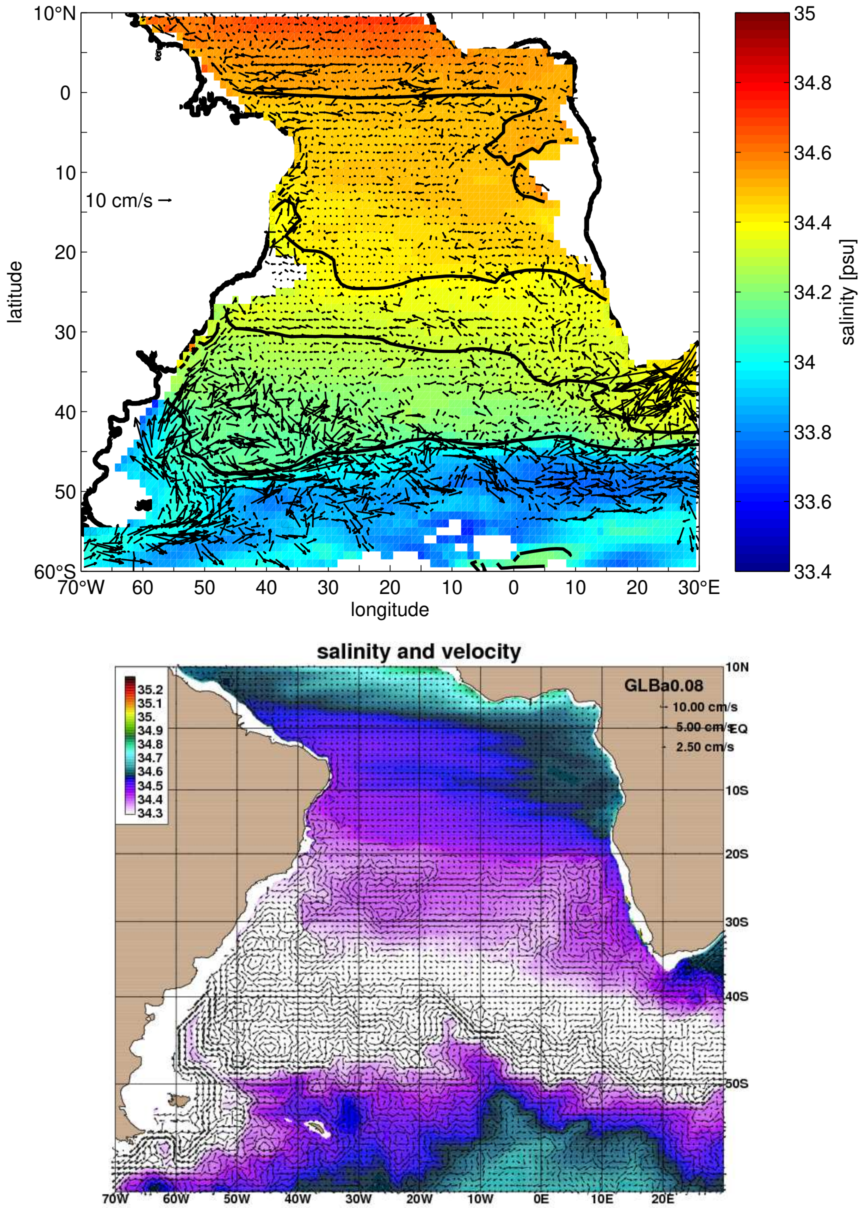


FIG. 1: Top: Observed salinity at the depth of the salinity minimum and the velocity at 800-1100dbar (includes the depth of the salinity minimum north of about 40°S. Bottom: Salinity and velocity in layer XXXX containing the salinity minimum from the HYCOM Model run XXXX.