A Limited Domain Ocean Nowcast/Forecast System: Application to Northern South China Sea

Dong S. Ko and Ruth H. Preller
Naval Research Laboratory, Stennis Space Center, MS 39529
Ko@nrlssc.navy.mil

To support naval operation and oceanographic research we have developed an ocean nowcast/forecast system for a limited domain which can be deployed rapidly anywhere in the world ocean for real-time ocean prediction. This system may produce nowcast and up to 72 hours forecast the sea level variation, 3D ocean current, temperature and salinity fields.

There are several major components in the system:

1. Data-assimilating dynamic ocean model
2. Statistical 3D ocean temperature/salinity analysis model (MODAS) (developed by M. Carnes at NRL)
3. Real-time data from satellite altimeters and AVHRR and from NOGAPS (Navy Operational Global Atmospheric Prediction System) at FNMOC
4. Internet based data distribution for nowcast/forecast fields

The open boundary conditions including sea surface elevation, transport, temperature, salinity and currents are provided by a large scale ocean nowcast/forecast system which is operated daily. An one way coupling scheme is used to ingest those boundary conditions into the model.

To operate the system one needs only to specify the region of interest. The system automatically sets up the model grid, compiles the topography from a bathymetry data base and computes the other model parameters. The ocean model is initialized with analyses or fields from a large scale model or restarted from a previous model nowcast. Once the model is initialized/restarted, it continuously assimilates the synthetic temperature/salinity profiles generated by MODAS based on the satellite altimeter (GFO, TOPEX/Poseidon, ERS-2) sea surface height anomaly and AVHRR sea surface temperature and it is forced with the surface heat fluxes, wind stresses and air pressure from NOGAPS to produce the nowcast. Forecasts are produced with available NOGAPS forecasts. Once the nowcast/forecast are produced they are distributed through the Internet via updated web pages.

To support the ASIAEX program, we set up this ocean nowcast/forecast system at the northern part of the South China Sea including the southern part of Taiwan Strait and the Luzon Strait. The system uses output fields from the North Pacific Nowcast/Forecast system (NPACNFS - http://www7320. nrlssc.navy.mil/npacnfs_www/) for the open boundary conditions. The NOGAPS heat flux, solar radiation, wind stress and air pressure analyses and 3-hourly predictions are used for the surface forcing. Satellite altimeter data and MCSST are used for the data assimilation. The system has been running and produced nowcast and up to 72 hours forecasts daily.

This Northern South China Sea regional ocean nowcast/forecast (NSCSNFS) covers a complex area with high oceanic variability. The nowcast/forecast showed that during the February-March, 2000 the loop current of the Kuroshio intrusion near the Luzon Strait broke off and formed an anticyclonic eddy. This anticyclonic eddy propagated rapidly toward Chinese southeastern coast before turned equatorward along the selfbreak. It span up several cyclonic as well as anticyclonic eddies around its primer. Since the breakoff of the loop current at the Luzon Strait the Kuroshio in general stays outside the South China Sea possibly due to the strengthen of the southern monsoon. The circulation in the northern part of the South China Sea are mainly driven by a large scale interior cyclonic circulation.