

Improved Oceanic Component within the NCEP GFS

Xu Li, IMSG at EMC/NCEP/NOAA

- An SST analysis scheme has been developed within the NCEP GFS
 - SST extended to NSST (Near-Surface Sea Temperature), a T-Profile due to diurnal warming and sub-layer cooling.
 - The foundation temperature(T_f) is selected as the oceanic analysis variable.
 - NSST model developed to relate T_f and observed satellite radiance (plus CRTM) and oceanic temperature.
 - The combination of T_f and NSST profile provides the appropriate boundary condition of radiative transfer model and atmospheric forecasting model.
 - All the data are assimilated directly, including wavelength dependent satellite radiance and depth dependent in situ buoys and ships sea temperature.
 - T_f is analyzed 6-hourly together with atmospheric variables by minimizing a single cost function with GSI, but without the covariance between the ocean and atmosphere.
 - Partially atmosphere-ocean coupled in prediction mode: Diurnal warming and sub-layer cooling coupled with atmospheric model every atmospheric model time step, but T_f is steady.
- The cycling runs have been done for one summer and one winter season
- Results
 - **SST analysis:** Improved, in terms of (O-B) statistics against buoys, such as more Gaussin, lower bias and RMS, more used data.
 - **SST prediction:** Improved against buoys but degraded against own analysis, since more variability introduced in the new scheme and the suppressed variability in the control run.
 - **Fluxes prediction** against the average of the 1st 6-hour own prediction: improved in tropics, neutral or slightly worse in Northern and Southern hemisphere, for wind stress, net heat flux, fresh water flux at air-sea interface.
 - **Atmosphere prediction** against own analysis: improved in tropics, neutral in higher latitude areas.
- Conclusions
 - An atmosphere-ocean partially coupled data assimilation and prediction system has been developed within the NCEP GFS.
 - The results are encouraging.
- Fully Coupled data assimilation (future)
 - Strongly coupling: the combination of NSST and the NCEP CFS
 - Atmosphere-ocean covariance with Hybrid EnKF