Improved Oceanic Component within the NCEP GFS
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• 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 buys 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 Gaussian, 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 convariance with Hybrid EnKF