Progress Report for Q1 FY15:

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HIWPP Task 3.1.1

We have continued to examine different methods of introducing variability in the SSTs in the Global Ensemble Forecast System (GEFS). Results from the following 4 experiments are compared:

- Control. As run operationally, SSTs are fixed in time and are the same for each ensemble member.

- Random SST Perturbations. Perturbations were randomly applied directly to the SST fields. Experiments were conducted with the magnitude of the standard deviation of these perturbations set to 1.0 K. Perturbations were fixed in time, but differed between ensemble members.

- Geographically varying random SST perturbations. As in the experiment above, except that the magnitude of standard deviation of the perturbations varied spatially, as determined by the estimated error of the SST analysis. A typical pattern of SST error in January is shown in Fig. 1.

- SST perturbations increasing with forecast hour. As in the experiment above, except that the magnitude of standard deviation of perturbations increases in time, capped at 0.1 K/day. The geographic pattern of daily increases is determined by abs(SST5 – SST0)/5, where SST5 is the SST analysis 5 days prior to the initial date, and SST0 is the SST analysis at the initial date.

A sampling of results from our experiments are presented in Fig. 2. Results shown are averages over 8 January forecasts, 2 from each of the years 2007-2010. RMS errors are computed against a consensus analysis which includes NCEP, ECMWF and UK Met Office analyses. All forecasts were conducted with 11 members ensembles, run at T254 resolution out to 10 days.

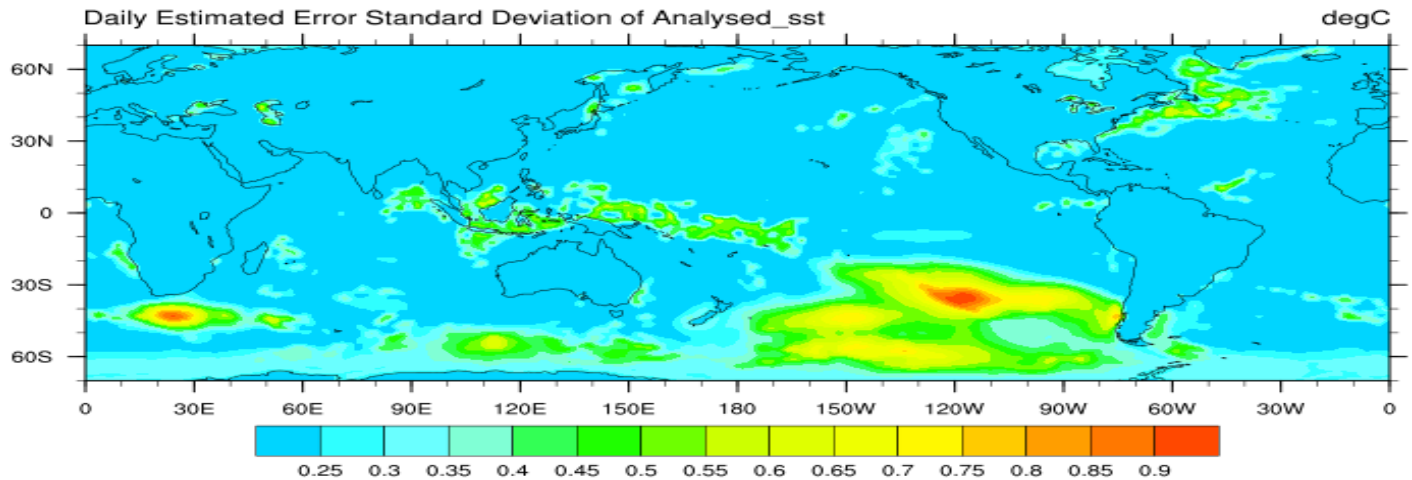

Figure 1. Typical geographic distribution of estimated error in the SST analysis. The estimated error is less than 0.25 K over most ocean areas, with maxima of about 1.0 K at some southern hemisphere mid-latitude locations.

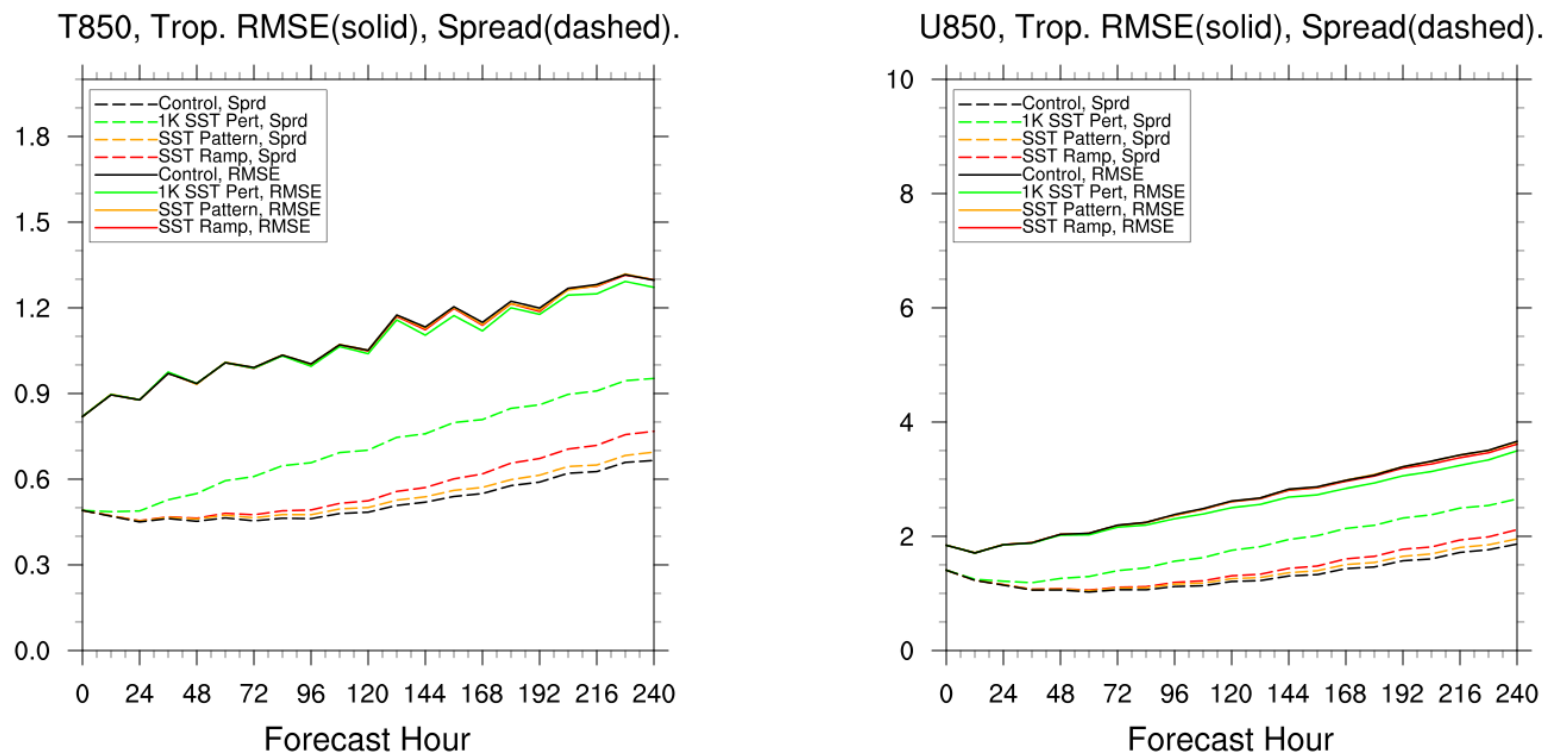

Figure 2. Comparison of 850 mb (a) temperature and (b) zonal wind RMS errors and spread in the 4 experiments, averaged over Tropics (20S<lat<20N). Experiments with a 1K SST perturbation applied (green) show the greatest increase in ensemble spread compared to control (black). Increase in spread is much more modest in experiments in which the magnitude of SST perturbation varies geographically (orange) as determined by estimated SST errors as shown in Fig. 1. Increasing magnitude of perturbations with forecast hour (red) increases spread somewhat above those values.

Average differences in spread were generally smaller in the southern and northern hemispheres (not shown).