# Assess the Performance of the CFSR by an Ensemble of Analyses

Li Zhang
Climate Prediction Center, NCEP, MD; Wyle Science, Technology and Engineering, VA

Wesley Ebisuzaki and Arun Kumar
Climate Prediction Center, NCEP, NOAA, MD

The Climate Forecast System Reanalysis (CFSR) is the latest global reanalysis from the National Centers of Environmental Prediction (NCEP). In this study, two ensembles of analyses are used to compare the CFSR tropospheric analyses. The first high-frequency ensemble consists of various operational analyses from different operational weather centers (Canadian Meteorological Centre, European Centre for Medium Range Weather Forecasts, Fleet Numerical Ocean and Meteorological Center and UK MetOffice), which demonstrate how well the CFSR represents the daily variability; the second low-frequency ensemble consists of six different reanalyses (ERA-Interim, JRA, MERRA, R1 and R2), along with the observation, which shows how the assimilation system responds to the changing observational networks.

The high-frequency ensemble showed the CFSR was very good representing the daily variability in the current environment. The CFSR was comparable to the operational circa 2007. Compared with the older JRA, R1 and R2, the CFSR did better at capturing the daily variability of the 200hPa zonal winds, and 850 hPa relative humidity. The biggest improvements were over the oceans which result from the improved satellite instruments and the improved data assimilation of the satellite data. Over the well observed land areas, the improvements over R1 and R2 were smaller. The CFSR can resolve the small-scale features (0.5 degree vs 2.5 resolution) and does better at resolving the daily variability at 2.5 resolution.

The low-frequency ensemble was used to investigate the extra-annual variability which is difficult for the reanlayses to capture because the amplitude is usually much smaller than the daily variability and is often masked by changes in the observation platforms. For the zonal averaged 200 hPa height at the equator from the different reanalyses, the CFSR has the strongest warming trends that is not in the observations and not found in the other reanalyses. Rawinsonde data at Singapore and Ascension Island don't' show any large trends unlike the CFSR. This CFSR 200 hPa height trend corresponds to a decadal warming of the average tropospheric temperature which has affects the circulation both on the off the equator and can be seen in the Northern Hemisphere mid-latitudes too. A lot of effort went into investigate the problem. This study will show some very promising results, in which the CFSR is not outliner anymore in terms of height, temperature and winds at 200 hPa.

**Corresponding Author:**

**Name:** Li Zhang
**Organization:** Climate Prediction Center, NCEP
**Address:** 5200 Auth Road
Camp Springs, MD 20746
USA