Evaluation of NCEP next Global Ensemble Forecast System (GEFS v12)

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With the successful upgrade of its deterministic model GFS (v15) on June 12, 2019, NCEP has scheduled the implementation of its next Global Ensemble Forecast System (GEFS v12) in the summer of 2020. These two model upgrades on deterministic and ensemble forecast systems are substantially different from previous upgrades. A new dynamical core (FV3) is adopted for the first time in the NCEP operational models, replacing the previous spectral dynamical core. The previous 3-category Zhao-Carr microphysics scheme is also being replaced by a more advanced 6-category GFDL microphysics scheme. From an ensemble model perspective, the previous GEFS has already demonstrated great success in past decades for weather and week-2 prediction by providing reliable probabilistic forecasts. Recently, there has been a large demand for subseasonal prediction, and GEFS v12 forecasts will be extended to 35 days to cover this time range. To better represent large uncertainties associated with this time scale, SPPT (stochastic physics perturbed tendency) and SKEB (stochastic kinetic energy backscatter) stochastic schemes are taking the place of the original STTP (stochastic total tendency perturbation), and a prescribed SST generated from combination of NSST and bias corrected CFS forecasts is also applied to simulate the sub-seasonal variation of SST forcing.

As a major system upgrade, a 2.5-year retrospective run of GEFS v12 is carried out to evaluate the model performance. A 30-year reforecast will be provided to stakeholders and the public to calibrate the forecast. The improvement of predictability and prediction skill will be studied through various measurements across tropical to extratropical areas in terms of deterministic (ensemble mean) and probabilistic (ensemble distribution) forecasts. The characteristics of model systematic error will be identified from comparing the major changes of the two state-of-art ensemble systems. As GEFS serves the most crucial model guidance for 5-7 day hurricane forecasts in support of the NHC (National Hurricane Center) and other customers, model capability in predicting tropical cyclone track and intensity is also examined from the retrospective runs. The results show there are significant improvements for tropical cyclone track forecast in North Atlantic and the western North Pacific, in particular, the intensity forecast is improved remarkably in all the basins.