Artificial Neural Network on GEFSv12 Reforecast products for Summer Rainfall forecast on Extended Range over CONUS

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The skillful prediction of rainfall on an extended Range (ERF) time scale is one of the challenges of the meteorological scientific community compared to short-range forecasts and seasonal outlooks. Weather forecasting in the Extended range is difficult because much of the memory of the initial atmospheric conditions on this time scale is lost, affecting the forecast prediction skill. The accurate predictions on this time scale are helpful for tactical adjustments to the strategic decisions made based on seasonal forecasts and help in the timely review of the prevailing seasonal conditions. In September 2020, NOAA NCEP implemented Global Ensemble Forecast System version 12 (GEFSv12) to generate sub-seasonal forecasts for climate risk management in various sectors such as hydrology, Agriculture, health, etc. Consistent reforecast data of GEFSv12 for 2000-2019 are initialized at 00 UTC once per day up to 16 days lead time forecasts with 5 ensembles except on Wednesdays when the forecast generation is extended to 35 days with 11 members. These reforecast products are based on NCEP's Global Forecast System version 15.1 (GFSv15.1) configuration that uses the Finite Volume 3 (FV3) dynamical core. The horizontal resolution of GEFSv12 is ~25 km (C384 grid) with 64 vertical hybrid levels. The initial conditions of GEFSv12 are used from the Climate Forecast System (CFS) reanalysis and GEFSv12 reanalysis for the periods (1989–1999) and (2000–2019), respectively. For the first 10 years of reforecast (1989-1999), breeding vectors and ensemble transforms with a rescaling (BV-ETR) technique were used to produce the initial perturbations, while ensemble Kalman filter (EnKF) analysis from reanalysis was used for the remaining 20 yearsreforecast (2000-2019).Direct Raw-GCMs products are rarely used because they exhibit systematic error due to the limited spatial resolution, simplified physics, thermodynamic processes, numerical schemes, or incomplete knowledge of climate system processes. Errors in GCM simulations relative to historical observations are large and require statistical post-processing to address the systematic errors to obtain more reliable and skillful forecast guidance. The success of deep learning techniques over the last few decades has opened up a new avenue of research for weather forecasting.In this study, we proposed an artificial neural network (ANN) to calibrate the GEFSv12 rainfall refo

recast against CCPA rainfall data for predicting summer monsoon rainfall on an extende d range time scale over CONUS for the reforecast period (2000-2019). This study will co mpare the proposed ANN approach with other traditional statistical post-processing meth ods.

Keywords: Artifical Neural network, Post-processing, GEFSv12, Summer Rainfall, CONUS.