Climatological Analysis of Model Precipitation Forecast for China

Yuehong Shao*,#,

Yan Luo # and Yuejian Zhu #

*NUIST

 # Environmental Modeling Center, NCEP/NWS, College Park, MD

ABSTRACT

Precipitation climatology products are desired to be extensively used for several studies on probabilistic quantitative precipitation forecast (PQPF) calibration, systematic characters of Global Ensemble Forecast System (GEFS) precipitation forecast (model forecast bias, bias distributions for different regions, bias changes with forecast lead-time etc), hydrological ensemble forecast model and so on. Based on the precipitation forecast for the National Centers for Environmental Prediction (NCEP) GEFS reforecast for the period 1985-2010 and daily precipitation observations in China, climatological analysis of GEFS precipitation forecast is studied over China. An unbiased and robust linear moment method is used to compute the PQPF and assess the ability to identify the uncertainties of GEFS precipitation forecast over China.

Seasonal mean precipitations and the systematic characteristics of daily precipitations are analyzed in this study. Firstly, considering to the higher reliability and higher spatial and temporal resolution of the statistically adjust stage Climate Prediction Center (CPC) dataset, seasonal mean precipitations of GEFS reforecast are compared with CPC. Secondly, PQPF are calculated by using linear moment and the systematic bias and correlation of climatological mean precipitation is validated with the time-series of observed data on a daily timescale.

Monthly and Seasonal mean precipitations from GEFS reforecast (first 24 hours) are fairly closed to CPC longer climatological mean in terms of quantity and spatial distribution. An example of summer season, an intense rainfall center is mainly located in the southeast coast of China; GEFS reforecast indicates the same area with over 500mm which is largely agreed from climatological mean of ground observations. In this study, climatological mean of precipitation is analyzed and compared with selected ground observation. The Gamma distribution and L-moment method are used to fit precipitation forecast to each grid point for sampling the amount of daily precipitation.

Linear moment method and assumption of a gamma distribution are used to fit precipitation forecast for each day of the year and each 1*1 degree grid point. 286 samples (11member*26years) is used to calculate the linear moment ratio and to estimate the gamma distribution parameter in each grid point. It can be seen from the 10% to 90% probability that there is a good consistency in whole time trend. As for precipitation, it rises slowly at lower probability, and then goes up with it apparently quickly at greater than 50% probability. Model forecast precipitation of 80% probability is close to observation in arid climate region, and precipitation of 60% or 70% probability is close to observation in semi-humid or humid climate region.

The systematic characteristics (bias) of model forecasts are investigated by selected eight representative rain gauge stations over the northern, western, the Yangtze River valley and southeast coast area of China. It was found that climatological mean daily precipitation from model forecasts were in good consistence with observation by rain-gauge stations to a large extent; however, there is a different underestimate or overestimate in different climatological area in China. For example, there is a systematic bias (underestimate) in wulumuqi, and a seasonal bias (overestimate) in lasa and fuzhou. The correlations show that there is high correlation coefficient that is greater than 0.65 in climatological daily forecast and observation except for wumuluqi and chengdu stations. Generally speaking, there is an underestimate in the arid area, an overestimate in the humid area.

Various results will be presented to demonstrate the values of GEFS and explore the future applications in terms of real time PQPF forecast and extreme weather forecast.