Geophysical Research Abstracts
Vol. 21, EGU2019-12950-1, 2019
EGU General Assembly 2019

Multisite and multivariate post processing ensemble weather forecasts based on a rank shuffle and a Copulas theory

Xiangquan Li (1), Jie Chen (1), Chong-Yu Xu (1,2), and Hua Chen (1)

(1) Wuhan University, School of Water Resources and Hydropower Engineering, Hydrology and Water Resources Engineering, Wuhan, China (leexiangquan@whu.edu.cn), (2) Department of Geosciences, University of Oslo, Oslo N-0316, Norway

The statistical post-processing methods have been widely used to correct the biases of ensemble weather forecasts. However, most of the statistical post-processing methods are applicable to single weather variable at a single location, thus neglecting the spatiotemporal dependency structures of forecasting variables. This study extends the traditional single-site and single-variate (SSSV) method to multi-site and multivariate (MSMV) version by inducing the MSMV dependences based on the rank shuffle and Copula theory. Therefore, the study uses one SSSV method, Generator-based Post-Processing method (GPP), and three dependence reconstruction methods, i.e. Rank shuffle (RS), Gaussian Copula Coupling (GCC) and Empirical Copula Coupling (ECC). The dependence reconstructing methods are used to generate the spatially correlated random field for GPP to produce the MSMV ensembles (The pre-shuffling procedure) or to shuffle the generated GPP ensemble (The post-shuffling procedure). Therefore, a total of 6 MSMV methods (Pre-RS, Pre-GCC, Pre-ECC, Post-RS, Post-GCC, and Post-ECC) were evaluated in producing the skillful and correlated ensemble precipitation and temperature forecasts for the Xiangjiang Basin in China based on the 11-ensemble forecasts from the Global Ensemble Forecasting System (GEFS) reforecasts. The results showed that the uncorrected GEFS forecasts tend to be biased, under-dispersive, and over-estimated the inter-site and inter-variable correlation for precipitation and temperature. GPP is skillful to remove bias in the ensemble mean and improve the skill of the ensemble spread but at the expense of losing the inter-site and inter-variable dependences. All the 6 MSMV methods tend to perform well in removing the bias in the inter-site dependencies for one fixed variable, but the post-shuffling methods (Post-RS, Post-GCC, and Post-ECC) are more effective in reconstructing the inter-site and inter-variate dependencies while preserving the univariate ensemble forecasts performance.