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Regional CWRF optimized ensemble precipitation prediction over the United States

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The Climate extension of the Weather Research and Forecasting model (CWRF) currently contains over 1024 configurations representing key physical processes of surface (land, ocean), planetary boundary layer, cumulus (deep, shallow), microphysics, cloud, aerosol, radiation, and their interactions. It provides a unique modeling tool to explore the optimized physics ensemble to improve precipitation prediction. This poster will demonstrate such improvement for the summer 1988 drought and 1993 flood in the U.S. Midwest based on 40 simulations each using different physics configurations. Three ensemble predictions are constructed and compared. The first two are ensemble averages of all runs with equal and optimal weights, the latter results from hindcasts by local minimization of root mean square errors. Their skill scores depict respectively the lower and upper limit of precipitation predictability that any effective ensemble scheme should achieve. The third ensemble applies equal weights on all runs with bias correction using the quantile mapping method. It is shown that all three ensembles remarkably enhance precipitation predictive skills than individual members. The bias correction is proven to be more effective than the simple average. However, both the ensembles of equal weights, with or without the bias correction, have notably less skill enhancement than that of optimal weights. As such, there exists substantial room to further enhance that skill through intelligent optimization of the ensemble, especially for precipitation.