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Probabilistic sub-seasonal to seasonal forecasting of hydrological drought in a changing environment

Xing Yuan

CAS Key Laboratory of Regional Climate-Environment for Temperate East Asia (RCE-TEA), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China (yuanxing@tea.ac.cn)

Hydrological drought is not only caused by natural hydro-climate variability, but can also be directly altered by human interventions including reservoir operation, irrigation and groundwater exploitation, etc. Therefore, ensemble forecasting of hydrological drought in a changing climate at sub-seasonal to seasonal (S2S) scales raises the questions of how to define the predictability of the anthropogenic processes within a coupled hydro-climate system, how to distinguish the uncertainty from each component, and how to assess the forecast skill of hydrological drought with natural and anthropogenic forcings.

In this presentation, a set of 29-year (1982-2010) hydrological ensemble hindcasts from an established experimental seasonal hydrological forecasting system that consists of North American Multimodel Ensemble (NMME) seasonal climate forecast models, a well-calibrated large-scale land surface hydrological model (VIC) under natural conditions and a Bayesian post-processor to account for anthropogenic surface water use, are being used to investigate the hydrological drought predictability over a heavily managed river basin, the Yellow River basin in North China. In the naturalized condition, the climate-model-based forecasts have a Brier Skill Score of 11%-26% against the ESP-type forecasts for the probabilistic hydrological drought forecasting. In the anthropocene, the differences between two methods decrease, and preliminary results suggest that human interventions can outweigh the climate variability for the hydrological drought forecasting in the anthropocene. Moreover, a set of sub-seasonal to seasonal (S2S) hindcast datasets will be merged with the NMME/VIC seasonal forecasting system toward exploring the hydrological drought predictability “seamlessly”.