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Predictability of Extreme Drought/Flood over China in 2015/16 Monster El Niño

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The past monster El Niño of 2015/16 resulted in widespread droughts and floods across the globe. Particularly, North China suffered extreme drought in the summer of 2015 (where two agricultural provinces (Henan and Liaoning) were hit by the worst drought on record since 1951), and the middle and lower riches of Yangtze river underwent catastrophic flooding in June and July of 2016 (where the damages from China's 2016 floods have already topped more than $22 billion according to the International Disasters Database). Both of these devastating hydrological extremes were well captured by a dynamical seasonal climate forecast model with a good prediction of the 2015/16 big El Niño.

Nevertheless, a strong El Niño does not necessarily result in an extreme drought, but depending on whether the El Niño evolves synergistically with Eurasian spring snow cover reduction to trigger a positive summer Eurasian teleconnection (EU) pattern that favors anomalous northerly and air sinking over North China. Added to El Niño is the high-latitude snow cover. The decreasing spring snow cover in Eurasia has been considered as one of possible reasons for the increasing of the positive EU pattern and severe droughts in North China in recent decades. We found that a dynamical-statistical forecasting approach that combines both the low- and high-latitudes precursors is more skillful than the dynamical forecast model at long lead. Therefore, the vanishing cryosphere should be considered as important factors for the extreme summer drought in North China as well in a warming future, and optimally combing them with the low-latitude signals (e.g., El Niño) will enhance the predictability of extreme droughts. In addition, we also found that the water vapor transport is more predictable than the extreme precipitation at short lead based on CFS2 seasonal real-time forecast, which may provide useful information for early warning.