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Does extreme springtime precipitation in Northeast Asia require extreme forcings?

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Abstract

The IPCC 6th report noticed that the frequency and intensity of meteorological extreme precipitation events increase with global warming. In addition, it is expected that areas vulnerable to extreme events, such as droughts and floods, will increase in the springtime over East Asia. Thus, assessment of the prediction skill of current state-of-the-art climate forecast models for springtime droughts and floods is prerequisite to mitigate damage from extreme events.

In the spring (March-May) of 1998, East Asia experienced an intensive and extensive flood event with the co-occurrence of a strong El Niño episode. In this study, we examined whether the strong El Niño condition plays an important role when the current climate forecast models predict the 1998 East Asia springtime flood. We quantitatively evaluated the predictability of springtime precipitation in East Asia using the North American Multi-Model Ensemble (NMME) forecast system from initial conditions in the 0.5 lead month (initial forecast month: March). We distinguished ensemble groups with high and low precipitation predictability in each forecast model and investigated their composite anomaly differences. Despite insignificant composite anomaly differences over the Pacific Ocean, the prediction skill of upper-level atmospheric circulations over East Asia determined the predictability of the 1998 flood. Furthermore, the prediction skill of the NMME models for the 2011 drought was assessed. Results showed that low precipitation skill of upper-level atmospheric circulations between the high and low predictability model groups, resulting in low seasonal forecasting of the 2011 spring drought. This is also detected in the AMIP experiment results using the atmospheric general circulation models without the complexity of ocean-atmosphere feedback. These findings suggest that springtime precipitation extreme events over East Asia simulated in the climate forecast models are likely to be rooted in noise from dynamic and physical processes of atmosphere circulations (unpredictable), which is a challenge in providing actionable information for springtime drought s and floods over East Asia.

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