Seasonal prediction of East Asian summer rainfall using a multi-model ensemble system

Joong-Bae Ahn (1), Doo-Young Lee (1), and Jin‑Ho Yoo (2)

(1) Pusan National University, Division of Earth Environmental System, Busan, Korea, Republic Of (jbahn@pusan.ac.kr), (2) APEC Climate Center (APCC), Busan, Republic of Korea

Using the retrospective forecasts of seven state-of-the-art coupled models and their multi-model ensemble (MME) for boreal summers, the prediction skills of climate models in the western tropical Pacific (WTP) and East Asian region are assessed. The prediction of summer rainfall anomalies in East Asia is difficult, while the WTP has a strong correlation between model prediction and observation. We focus on developing a new approach to further enhance the seasonal prediction skill for summer rainfall in East Asia and investigate the influence of convective activity in the WTP on East Asian summer rainfall. By analyzing the characteristics of the WTP convection, two distinct patterns associated with El Niño-Southern Oscillation developing and decaying modes are identified. Based on the multiple linear regression method, the East Asia Rainfall Index (EARI) is developed by using the interannual variability of the normalized Maritime continent-WTP Indices (MPIs), as potentially useful predictors for rainfall prediction over East Asia, obtained from the above two main patterns. For East Asian summer rainfall, the EARI has superior performance to the East Asia summer monsoon index or each MPI. Therefore, the regressed rainfall from EARI also shows a strong relationship with the observed East Asian summer rainfall pattern. In addition, we evaluate the prediction skill of the East Asia reconstructed rainfall obtained by hybrid dynamical–statistical approach using the cross-validated EARI from the individual models and their MME. The results show that the rainfalls reconstructed from simulations capture the general features of observed precipitation in East Asia quite well. This study convincingly demonstrates that rainfall prediction skill is considerably improved by using a hybrid dynamical–statistical approach compared to the dynamical forecast alone.