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Six-month lead downscaling prediction of winter-spring drought in South Korea based on multi-model ensemble

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Given the changing climate, advance information on hydrological extremes such as droughts will help in planning for disaster mitigation and facilitate better decision making for water availability management. A deficit of precipitation for long-term time scales beyond 6 months has impacts on the hydrological sectors such as ground water, streamflow, and reservoir storage. The potential of using a dynamical-statistical method for long-lead drought prediction was investigated. In particular, the APEC Climate Center (APCC) 1-Tier multi-model ensemble (MME) was downscaled for predicting the standardized precipitation evapotranspiration index (SPEI) over 60 stations in South Korea. SPEI depends on both of precipitation and temperature, and can incorporate the impact of global warming on the balance between precipitation and evapotranspiration. It was found that 1-Tier MME has difficulties in capturing the local temperature and rainfall variations over extratropical land areas, and has no skill in predicting SPEI during boreal winter and spring. On the other hand, temperature and precipitation predictions were substantially improved in the downscaled MME (DMME). In conjunction with variance inflation, DMME can give reasonably skillful six-month-lead forecasts of SPEI for the winter-to-spring period. The results could potentially improve hydrological extreme predictions using meteorological forecasts for policymaker and stakeholders in water management sector for better climate adaption.