Skill of the ECMWF SEAS5 ensemble prediction system in streamflow and rice yield forecasting for Mainland Southeast Asia

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The potential use of European Centre for Medium-Range Weather Forecast (ECMWF) ensemble prediction system SEAS5 over Mainland Southeast Asia was evaluated. The evaluation spans 30 years (1985–2014), examining SEAS5's skill in predicting temperature and precipitation. Subsequently, SEAS5 data was used to force the Variable Infiltration Capacity (VIC) hydrological model for runoff and streamflow forecasts, as well as the WOrld FOod Studies (WOFOST) crop model for rice production forecasts. These hydrological and agricultural results were compared against the WFDE5-driven reanalysis using verification skill metrics at grid cells for each month. Furthermore, the hydrological results were compared against observed station data. The reanalysis of rice yield was also compared against FAO observations, but proved inconclusive. The findings reveal promising predictive capabilities for temperature beyond a 2-month forecast, while the skill of precipitation and streamflow forecasts extend to a 1-month. Noteworthy, strong seasonal and regional dependence occurs, with high forecast skills during the pre-monsoon (April–May) and post-monsoon (October–November). Year-to-year precipitation tercile plots highlight skill in predicting the anomalous seasonal conditions associated with ENSO. The significant streamflow skill at each initiation month and lead time corresponds to the forecasting skill of meteorological variables. Nevertheless, it is important to note that the skill level of discharge and runoff forecasts is generally lower compared to the skill in temperature and precipitation. For the rice prediction, SEAS5 exhibits high performance at the beginning of the rainy season, where strong seasonal climate predictions are observed. The model shows the ability to capture anomalous rice yields and consistent accuracy throughout a 1-month to 3-month forecast. However, limitations in skill are evident when rice planting times are delayed by one or two months during the rainy season, as well as when planting in the dry season. SEAS5 shows useful skills that can potentially be used for hydrological and agricultural anticipatory management. The results could already support an initial step to come to potential anticipatory (agro-)hydrological management and could be utilised as an input for an early warning system in various sectors.