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The Asian-Australian Monsoon: Sensitivity of dynamical intra-seasonal prediction skills to different initial conditions

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Predictability of Intra-Seasonal Oscillation (ISO) relies on both initial conditions and lower boundary conditions (or atmosphere-ocean interaction). The atmospheric reanalysis datasets are commonly used as initial conditions. Here, the biases of three reanalysis datasets (NCEP_R1, R2, and ERA_Interim) in describing ISO were briefly revealed and the impacts of these biases as initial conditions on ISO prediction skills were assessed. A signal-recovery method is proposed to improve ISO prediction. Although all three reanalyses underestimate the intensity of the equatorial eastward-propagating ISO, the overall quality of the ERA_Interim is better than the NCEP_R1 and R2. When these reanalyses are used as initial conditions in the ECHAM4-UH hybrid coupled model (UH_HCM hereinafter), skillful ISO prediction reaches only about one week for both the 850-hPa zonal winds (U850) and rainfall over Southeast Asia and the global tropics. An enhanced nudging of divergence field is shown to significantly improve the initial conditions, resulting in an extension of the skillful rainfall prediction by 2-4 days and U850 prediction by 5-10 days. After recovering the ISO signals in the original reanalyses, the resultant initial conditions contain ISO strength closer to the observed, whereas the rainfall spatial pattern correlation in the ERA_Interim reanalysis drops. The resultant ISO prediction skills, however, are consistently extended for all the NCEP and ERA-Interim reanalyses. Using these signal-recovered reanalyses as initial conditions, the boreal-summer ISO prediction skill measured with Wheeler-Hendon index reaches 15 days. The U850 and rainfall prediction skills, respectively, reach 23 and 18 days over Southeast Asia. It is also found that small-scale synoptic weather disturbances in initial conditions generally increase ISO prediction skills. Both the UH_HCM and NCEP Climate Forecast System (CFS) suffer the prediction barrier over the Maritime Continent.