Session: C1 Poster: M262A

Remote drivers of Australian intra-seasonal climate variability and their representation in POAMA

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We assess the ability of the Predictive Ocean Atmosphere Model for Australia version 1.5 (POAMA-1.5) to represent remote drivers of intra-seasonal climate variability over Australia using a 27-year hindcast dataset. Our analyses primarily focus on the simulation and prediction of weekly rainfall anomalies in association with three key drivers: the Madden-Julian Oscillation (MJO), the Southern Annular Mode (SAM), and blocking in the Australian region. POAMA-1.5 is shown to simulate well the weekly-mean rainfall variation associated with the evolution of the MJO over the tropical Indo-Pacific, but is less able to replicate the complicated higher-latitude rainfall signals of the MJO. Weekly rainfall anomalies associated with the SAM and blocking, however, are simulated reasonably well over the Australian region, despite noteable biases in the drivers' broad-scale representation due to the drifting basic state in the model. Skilful prediction is achieved out to 3 weeks for the MJO index, 2 weeks for the SAM index, and 1 week for the blocking index. These results translate to enhanced predictability of rainfall in weeks 2 and 3 over much of the tropical Indo-Pacific when the MJO is present in the initial conditions during October-March, and over south-eastern Australia when the SAM is large in the initial conditions during June-November. Our results indicate that the use of POAMA-1.5 for intra-seasonal forecasting is promising despite that fact that the model was not designed for forecasting at this timescale. Estimates of the potential predictability for each driver suggest that the prediction skill may be further improved through continued development of the POAMA dynamical prediction system. The next generation, POAMA-2, will include enhancements in the ensemble generation strategy and initialisation scheme, which are expected to lead to further improvements in intra-seasonal forecast skill.