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Predictability and Model Uncertainty of MJO Convective Initiation and Propagation in ECMWF Stochastic Ensemble Forecasts

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The convective initiation of the Madden-Julian Oscillation (MJO) over the Indian Ocean and its eastward propagation across the Maritime Continent is the most challenging problem in MJO prediction. Observations from the Dynamics of MJO (DYNAMO) field campaign showed complex multiscale interactions among convective cloud systems and their large-scale environment on time scales from hours to weeks. This study explores the predictability and assesses model uncertainty using the ECMWF model ensembles initialized at various leadtimes with perturbed initial conditions (IC) as well two stochastic perturbations: Stochastic Kinetic-Energy Backscatter Scheme (SKEBS) and Stochastically Perturbed Parameterization Tendencies (SPPT). Model experiments were conducted with IC perturbation, and with/without SKEBS and SPPT. The ensemble forecasts of the MJO convection were evaluated by a new Large-scale Precipitation Tracking (LPT) method based on TRMM observations. It is found that the MJO convective initiation was not predicted in leadtime beyond 2-3 days. The model suffers an exaggerated "barrier" by the Maritime Continent on MJO convection. In general, SKEBS and SPPT improve the model mean state and variability, especially over the Maritime Continent, compared with IC perturbation alone. A new ensemble analysis method is used to assessing the added value of median and extremes in the ensemble model forecasts.