Assessing the Skill of an All-season Statistical Forecast Model for the Madden-Julian Oscillation

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ABSTRACT

Motivated by an attempt to augment dynamical models in predicting the Madden-Julian Oscillation (MJO), and to provide a realistic benchmark to those models, the predictive skill of a multivariate lag-regression statistical model has been comprehensively explored in the present study. The predictors of the benchmark model are the projection time series of the leading pair of EOFs of the combined fields of equatorially-averaged outgoing longwave radiation (OLR) and zonal winds at 850 and 200hPa, derived using the approach of Wheeler and Hendon (2004). These multivariate EOFs serve as an effective filter for the MJO without the need for band-pass filtering, making the statistical forecast scheme feasible for the real-time use. Another advantage of this empirical approach lies in the consideration of the seasonal-dependence of the regression parameters, making it applicable for forecasts all around the year.

The forecast model exhibits useful extended-range skill for real-time MJO forecast. Predictions with a correlation skill of greater than 0.3 (0.5) between predicted and observed unfiltered (EOF-filtered) fields can be still detected over some regions at a lead time of 15d, especially for boreal winter forecasts. This predictive skill is increased significantly when there are strong MJO signals at the initial forecast time. The analysis also shows that predictive skill for the upper-tropospheric winds is relatively higher than for the low-level winds and convection signals. Finally, the capability of this empirical model in predicting the MJO is further demonstrated by a case study of real-time "hindcast" during the 2003/04 winter. Predictive skill demonstrated in this study provides an estimate of the predictability of the MJO and benchmark for the dynamical extended-range models.