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A Linear Markov Model for East Asian Monsoon Seasonal Forecast

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A linear Markov model has been developed to predict the short-term climate variability of the East Asian monsoon system, with emphasis on precipitation variability. Precipitation,sea level pressure, zonal and meridional winds at 850 mb, along with sea surface temperature and soil moisture, were chosen to define the state of the East Asian monsoon system, and the multivariate empirical orthogonal functions of these variables were used to construct the statistical Markov model. The forecast skill of the model was evaluated in a cross-validated fashion. In both hindcast and forecast experiments, the model showed considerable skill in predicting the precipitation anomaly a few months in advance, especially in boreal winter and spring. The prediction in boreal summer was relatively poor, though the model performance was better in an ENSO decaying summer than in an ENSO developing summer. Also, the prediction skill was better over the ocean than the land. The model's forecast ability is attributed to the domination of the East Asian monsoon climate variability by a few distinctive modes in the coupled atmosphere-ocean-land system, to the strong influence of ENSO on these modes, and to the Markov model's capability to capture these modes.