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# Two major modes of variability of the East Asian summer monsoon

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East Asian Summer Monsoon (EASM) is a major feature of the summer (JJA) global atmospheric circulations, and we study the two primary modes of variability associated with the East Asian summer monsoon, as identified using a multivariate Empirical Orthogonal Function (EOF) analysis. The second mode is shown to be related to changes in intensity of the South Asian High at 100 hPa while, consistent with previous work, the first mode is associated with an index for the shear vorticity of the 850 hPa zonal wind over the monsoon region. We show that a linear, dry dynamical model, when driven by the diabatic heating anomalies associated with each mode, can reproduce many of the anomalous circulation features, especially for the first EOF and in the lower troposphere. The model results indicate the importance of diabatic heating anomalies over the tropical Indian Ocean in the dynamics of both modes, especially EOF-1, and illustrate the role of local diabatic feedback for intensifying the circulation anomalies; in particular, the subtropical anticyclonic anomalies that are found in the positive phase of both modes, and the circulation anomaly associated with the Meiyu/Changma/Baiu rain band. A running cross-correlation analysis shows that the second EOF is consistently linked to both the decaying and the onset phase of El Niño/Southern Oscillation (ENSO) events throughout the study period (1958-2001). We attribute the connection in the onset phase to zonal wind anomalies along the Equator in the west Pacific associated with this mode. On the other hand, a link between the first EOF and ENSO is found only in the post-1979 period. We note also the role of sea-surface temperature anomalies in the tropical Indian Ocean in the dynamics of EOF-1, and a link to the variability of the Indian summer monsoon in the case of EOF-2. Further studies with model experiments support the hypothesis that the second mode of variability of the East Asian Summer Monsoon is influenced by the variability of the Indian Summer Monsoon. The results suggest that the recent trend towards drier conditions in northern China in summer is, at least partly, a consequence of the synchronous drying trend over India in summer noted by some authors.