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Organizational Modes of Mesoscale Convective Systems

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Composite reflectivity Doppler radar data from June to September of 2007–2010 were used to classify mesoscale convective systems (MCSs) over Central East China into seven morphologies. The morphologies included one nonlinear mode (NL) and six linear modes: convective lines with no stratiform precipitation (NS), trailing stratiform precipitation (TS), leading stratiform precipitation (LS), parallel stratiform precipitation (PS), bow echoes (BE) and embedded lines (EL). Non-linear and linear systems composed 44.7% and 55.3% of total MCSs, respectively, but there was no primary linear mode. All MCS morphologies attained their peak occurrence in July, except BE systems which peaked in June. On average, TS and PS modes had relatively longer lifespan than did other modes.

Significant differences in MCS-produced severe weather existed between dry and moist environments. High winds and hail events were mainly observed in dry environments, and in contrast, short-term intense precipitation occurred more frequently in moist environments. BE systems generated the most severe weather on average, while most TS systems were attendant with short-term intense precipitation and high winds. EL and PS systems were most frequently associated with extreme short-time intense precipitation (>=50mm/h) as these systems preferentially developed in moist environments. BE systems generally occurred under strong low-level shear and intermediately moist conditions. LS systems were observed in weak low-level shear, whereas EL systems often developed in relatively stable conditions and weak low-to-middle-level shear. The largest instability was present in the environment for NS systems. The environmental parameters for TS systems featured the largest differences between the dry and the moist cases.