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Nocturnal Elevated Convection Initiation Leading to a Daytime Surface-Based Squall Line during 13 June IHOP_2002

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In the summertime Great Plains of the USA the nocturnal maximum in precipitation is influenced by both mesoscale convective systems (MCSs) moving into the region, as well as local nocturnal initiation. During the morning, the majority of MCSs tend to dissipate, but a significant minority intensity. The greater contribution of elevated convection at night contributes to the poor forecasts of nocturnal storms (we refer to convection where the conditionally unstable source air is located above the boundary layer as "elevated" and storms fed from the boundary layer as "surface based"). Despite their importance, there are very few studies of elevated nocturnal systems leading to surface-based daytime MCSs.

During the International H_2O Project, the elevated nocturnal initiation of an MCS, which developed into a surface-based squall-line was observed. The elevated initiation occurred in northwest-southeast-oriented lines where a southerly nocturnal low-level jet (LLJ) terminated, with waves also observed to trigger initiation. During the morning, the structure and orientation of the MCS evolved to a southwest-northeast-oriented squall line, which built a cold-pool outflow.

Convection-permitting simulations demonstrate the importance of environmental preconditioning on MCS reorganisation; the development of the SW-NE rainband is facilitated by a zone of antecedent mesoscale upward motion. Consistent with the observations, the modelled MCS develops a surface cold pool and evolves into an squall-type system. The cold pool is not necessary for the reorganisation and maintenance of the MCS. However, the latent cooling does influence the MCS strength, structure, and motion by early in the post-sunrise stage.