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Observations of elevated initiation leading to a surface-based squall-line during IHOP_2002

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Nocturnal deep convection is often associated with severe weather, but its prediction remains a difficult forecasting problem. Such convection often has its source air elevated above the planetary boundary layer. In some regions such elevated convection forms an important part of the diurnal cycle. For example, in the mid-west of the USA, a nocturnal convective maximum is observed, which during IHOP_2002 was shown to result from locally initiated storms rather than just storms that were initiated elsewhere during the day propagating into the IHOP area. During IHOP_2002 systems that formed from elevated initiation episodes were shown to live longer if they produced significant surface gust fronts. A case-study of such a system will be presented.

The nocturnal elevated initiation is shown to be from a combination of large-scale elevated convergence and trapped low-level gravity waves. Secondary initiation proceeded by a combination of the cold pool, bores and waves generated by the system. As the system propagated south-east a gradual transition to squall-line structure was observed, which was clearest when the cold-pool outflow could first lift near-surface air to its level of free convection. In the west this happened before significant daytime solar heating, when a deep cold pool uplifted air from a relatively warm nocturnal boundary-layer. Modelled sensitivities of these processes to the diabatic processes generating the cold pool will be discussed.