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Origin and triggering of nocturnal convective storms that occurred in the PECAN study area

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The Central Great Plains of the United States has a nocturnal maximum frequency in warm season precipitation. Much of this precipitation comes from organized mesoscale convective systems (MCSs) that result from elevated storm initiation. Understanding of this maximum in precipitation frequency is not well understood nor is it well predicted. In order to improve this understanding and predictability a large field program called PECAN (Plains Elevated Convection at Night) was conducted in June-July 2015. The field program included three research aircraft, nine mobile radars a fixed research S-band radar, a mesoscale network of lower tropospheric profiling systems and a mobile mesonet of surface weather stations. In addition there were six operational NEXRAD S-band radars within the study area and eight more closely surrounding the PECAN area.

There are a variety of proposed triggering mechanisms for this high frequency of nocturnal storms which include, a) storms starting in the afternoon along the Rocky Mountains that propagate eastward into the adjoining plains during the night, b) gravity waves induced by the Rocky Mountain afternoon thunderstorms which propagate eastward initiating nocturnal convective systems over the Plains, c) vertical motion associated with mesoscale potential vorticity anomalies, generated over the Rocky Mountains, which advect eastward triggering convective storms, d) wind convergence at the northern exit region of the low level jet which initiates elevated storms and e) synoptic scale features. No doubt all these and other phenomena are responsible for the Great Plains nocturnal frequency maximum in rainfall.

Studies in progress show the origin location and triggering of nocturnal storms occurring in the PECAN area are highly variable. Many of these storms initiated directly within the PECAN area. Synoptic scale features and the nocturnal low level jet often played a significant role. Afternoon storms initiating over the Rocky Mountains frequently dissipate before reaching the PECAN study area; however as yet it is unknown if gravity waves from these storms play a significant role in initiating storms. Elevated initiation events were associated with mid-level convergence features such as gravity waves, bores, the low level jet, fronts aloft and unexplained phenomena. These initiation events take the form of a single line, set of parallel lines, completely random in appearance, a T formation, and what is called a bow and arrow formation. Statistics and examples of initiation triggering mechanism will be shown and discussed.