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Can spontaneous synchronization of lightning flashes occur in a network of distant thunderstorms?

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There is now a considerable body of theoretical and experimental research that relates the properties of complex dynamical phenomena in nature to those described by network theory [Strogatz, *Nature*, 2001]. In this context, a network is a system composed of several separate interacting entities, relating to each other in different modes with varying levels of complexity. We propose that thunderstorm cells embedded within mesoscale convective system (MCS) constitute a network, and their lightning frequency is closely connected. Analysis of space-shuttle video footage of 6 storm systems with varying flash rates showed that when the storm flash rate was high, lightning activity in horizontally remote electrically active cells became clustered, with bursts of nearly simultaneous activity separated by quiet periods [Yair et al., *JASTP*, 2006]. This behavior is similar to the collective dynamics of a network of weakly coupled limit-cycle oscillators, best described in terms of phase-locking of a globally coupled array. We expand our analysis to other data-sets of thunderstorm activity, derived from ground-based lightning location systems, and compare the basic parameters of the observed lightning rate with predictions of random-graph network models. Initial results suggest that network theory parameters of lightning activity in

distant cells exhibits a high clustering coefficient and small average path lengths. This type of networks is capable of supporting fast response, synchronization and coherent oscillations. Several physical mechanisms are suggested to explain the observed phenomenon.