Insight into the physical and dynamical processes that control rapid increases in total flash rate

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Rapid increases in total lightning (also termed "lightning jumps") have been observed for many decades. Lightning jumps have been well correlated to severe and hazardous weather occurrence. The main focus of lightning jump work has been on the development of lightning algorithms to be used in real-time assessment of storm intensity. However, in these studies it is typically assumed that the updraft "increases" without direct measurements of the vertical motion, or specification of which updraft characteristic actually increases (e.g., average speed, maximum speed, or convective updraft volume). Therefore, an end-to-end physical and dynamical basis for coupling rapid increases in total flash rate to increases in updraft speed and volume must be understood in order to ultimately relate lightning occurrence to severe storm metrics. Herein, we use polarimetric, multi-Doppler, and lightning mapping array measurements to provide physical context as to why rapid increases in total lightning are closely tied to severe and hazardous weather.