



## **Tracking thunderstorm movements in the UK using lightning data: early warning and preparedness**

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Thunderstorms can produce severe weather such as intense bursts of heavy rainfall, strong winds and lightning activity. This means that preparedness in high risk and vulnerable areas, together with early warnings of thunderstorm activity, are key to mitigating the extent of possible damage and disruption. This study focuses on whether thunderstorm tracking, by using lightning data to compile a historical catalogue of thunderstorm tracks, could provide useful probabilistic information contributing to preparedness and early warning systems such as nowcasting.

A case study, focusing on the UK, was undertaken for the periods 1st May to 31st August (the thunderstorm season) of 2011 and 2012. Lightning data was provided by Blitzortung.org which operates a network of sensors across Europe, detecting the electromagnetic waves emitted by lightning in the very low frequency range. Thunderstorms were classified as present when clusters of 10 or more lightning flashes within a 50km radius during a 1 hour time iteration were recorded. Thunderstorm tracks were mapped and data on their duration, distance travelled and direction of travel noted. Thunderstorms occurring in neighbouring countries were counted and storms that travelled into the UK from abroad were also tracked and their movement characteristics compared with those that originated in the UK.

Areas most frequently affected by thunderstorms were identified as East Anglia, the Midlands, London and the Thames Estuary. The probability of the UK experiencing a thunderstorm on any given day of the thunderstorm season was calculated as 22% and the probabilities of a storm tracking into the UK from Belgium or the north of France were calculated as 4.2% and 2.1% respectively. 89% of the thunderstorms that tracked into the UK exhibit a SW propagation. 52% of thunderstorms originating in the UK remained local to the formation point and of those that created a track, there was greater variability than imported thunderstorms. However, despite showing greater variability there remained identifiable trends with 67.6% exhibiting SW/W propagation. High risk areas identified as experiencing frequent thunderstorms were confined to areas with large catchments. Although these are thought to be at low risk from flash flooding, they contain large cities, extensive urban areas, roads and other infrastructure at risk from surface water flooding.