



Sting jets in severe northern European wind storms: a case study of Windstorm Gudrun

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Extratropical cyclones often produce strong surface winds, mostly associated with low-level jets along the warm and cold fronts. Some severe extratropical cyclones have been found to produce an additional area of localised strong, and potentially very damaging, surface winds during a certain part of their development. These strong winds are associated with air that originates within the cloud head, exiting at the tip of the cloud head and descending rapidly from there to the surface. This rapidly descending air associated with the strong surface winds is known as a sting jet. The aim of this project is to determine the mechanisms that lead to sting jets and develop diagnostics for predicting their formation and development. In previous work mesoscale slantwise circulations have been found in the cloud heads of sting jet storms; these have been speculated to be due to the release of conditional symmetric instability (CSI).

Here we present an analysis of the windstorm known as “Gudrun”, which passed over the UK and northern Europe in January 2005. A sting jet has been identified in this case, and the relationship between this sting jet feature and the release of CSI has been examined using two diagnostics for CSI: SCAPE (slantwise convective available potential energy) and a diagnostic based on moist potential vorticity (MPV). SCAPE exists near the tip of the cloud head and decreases during the time leading up to and during the sting jet’s descent, indicating that CSI is being released during this time. This is further supported by a corresponding decrease in the MPV-based CSI diagnostic during the same period.