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Wind profiler observations of a sting jet

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Some of the most damaging surface winds experienced in midlatitude cyclonic storms have been attributed to a phenomenon known as a sting jet. Previous studies have deduced how sting jets develop from their mid-tropospheric origin, but there have been no direct observations of these wind features in the mid-troposphere. During windstorm Jeanette on the 27th October 2002, the tip of the storm's cloud head passed over a VHF wind profiler at Aberystwyth, Wales, allowing the structure of a sting jet to be measured with high spatial and temporal resolution. These observations showed a multiple slantwise structure to the sting jet region with two tails of increased winds which persisted after the passing of the cloud head aloft. Simulations by the Met Office Unified Model (UM) showed that the slantwise structure followed θ_w surfaces, and that the sting jet descended along θ surfaces as it passed over the UK, accelerating and drying during its descent. The horizontal and vertical scales of the observed structures are compatible with slantwise convection releasing Conditional Symmetric Instability within the cloud head. Further observations of the sting jet were obtained by a UHF wind profiler at Cardington in eastern England, where the sting jet had merged with the cold conveyor belt circulating around the storm. An unstable temperature profile in the lowest kilometre over Cardington enabled damaging gusts of strong winds to be brought to the surface in convective plumes; however, this strong vertical mixing was not represented correctly in the UM.