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Observation and simulation of mesoscale diabatic potential vorticity structures in north Atlantic cyclones

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Heating due to moist diabatic processes in extratropical cyclones can modify potential vorticity (PV) which in turn may be associated with flow anomalies on the mesoscale. Such mesoscale flow anomalies may influence the evolution of severe wind and precipitation events. The interaction between cloud-scale thermodynamical processes and the resulting mesoscale flow anomalies is poorly understood. Furthermore, the representation of this interaction in numerical weather prediction models is uncertain. A primary goal of the DIAbatic influences on Mesoscale structures in ExTratropical cyclones (DIAMET) experiment is to describe this interaction using both airborne observations and high resolution numerical model simulations of storms around the UK. This paper will demonstrate the origin, structure, and dynamical consequences of mesoscale PV structures in several DIAMET cases. To clarify the origin of the PV structures, a PV tracer technique is applied. Each tracer is integrated online in the Met Office Unified Model (MetUM) and represents a contribution of a specific modelled process (e.g., the convection scheme) to the total PV.