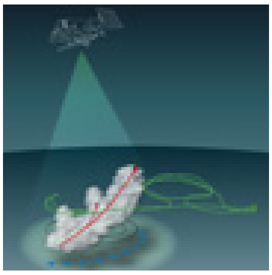

Contribution ID: **2** Type: **Oral presentation**

Embedded convection in the warm conveyor belt of a North Atlantic cyclone and its relevance for large-scale dynamics

Tuesday, 10 March 2020 10:55 (25 minutes)

The strong diabatic processes during warm conveyor belt (WCB) ascent modify the potential vorticity (PV) distribution, which can subsequently influence the large-scale flow evolution. According to the classical concept, WCBs rise continuously from the boundary layer to the upper troposphere with ascent rates of less than 50 hPa/h and thereby predominantly form stratiform clouds. Recent studies identified mesoscale embedded convection in the large-scale WCB ascent region with faster ascent rates. However, its dynamical significance and role for surface precipitation have not yet been analysed systematically.
We present a detailed case study of embedded convection in the WCB of a North Atlantic cyclone that occurred during the NAWDEX campaign. Satellite observations and online trajectories from a high-resolution convection-permitting model simulation consistently suggest that convection, with ascent rates exceeding 100-200 hPa/h, is embedded in extended areas of the large-scale WCB ascent.
Composites along the convectively ascending WCB trajectories show locally enhanced surface precipitation rates and large hydrometeor contents, including the formation of graupel and high cloud tops. Moreover, the composites reveal the formation of strong low-level positive and upper-level negative PV anomalies along the convective ascent, which are substantially stronger than the PV anomalies formed by the 'classical' more slowly ascending WCB trajectories. On the mesoscale, the composites show the formation of diabatically-produced horizontal upper-level PV dipoles centered around the convective WCB ascent, similar to the formation of PV dipoles in convective storms in a sheared environment. These mesoscale PV dipoles are associated with coherent wind anomalies, a cyclonic and anticyclonic circulation anomaly around the positive and negative PV poles, respectively. On the large-scale, these convectively-produced mesoscale PV dipoles aggregate to elongated PV dipole bands aligned with the elongated convective region and the vertical wind shear vector. Several examples of such PV dipole bands illustrate that the negative pole can interact with the upper-level waveguide, influence the jet stream and lead to jet streaks downstream.
Altogether, our detailed analysis of WCB ascent provides new insights into the characteristics of the WCB ascent and its embedded convection and highlights the potential of embedded mesoscale convection for the modification of the meso- and larger-scale circulation and the downstream flow evolution.

Primary authors: OERTEL, Annika (ETH Zurich); Dr BOETTCHER, Maxi (ETH Zurich); Dr JOOS, Hanna (ETH Zurich); Dr SPRENGER, Michael (ETH Zurich); Prof. WERNLI, Heini (ETH Zurich)

Presenter: OERTEL, Annika (ETH Zurich)

Session Classification: Session 2

Track Classification: Workshop: Warm Conveyor Belts –a challenge to forecasting