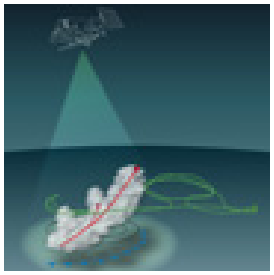

Contribution ID: **38** Type: **Oral presentation**

The effect of clouds, radiation and turbulence on upper-level PV

Wednesday, 11 March 2020 15:05 (25 minutes)

The dynamics of extratropical cyclones entails several important near-tropopause flow features, including sharp PV gradients and jet streaks, deep troughs and tropopause folds (positive PV anomalies) and the formation of large pole- and upward expanding ridges (negative PV anomalies). The evolution of these PV features are modified by non-conservative processes, such as cloud latent heating, radiative transfer and turbulence, which are represented by parameterizations in numerical weather prediction models.
Using a Lagrangian method, material PV modification and PV anomalies near the tropopause are attributed to specific parameterized processes in the global model of the ECMWF, both in a case study and systematically over a winter season.

The results suggest that turbulence is a key process for modifying PV on the mesoscale near strong upper-level jets, with direct implications for horizontal and vertical PV gradients and PV anomalies near the tropopause, and for stratosphere-troposphere exchange.
Diabatic PV anomalies generated by cloud processes are primarily found on the synoptic scale in warm conveyor belt outflows and related to cloud formation in regions of a lowered tropopause, exhibiting strong case-to case variability. Their role for near-tropopause PV depends crucially on the properties of the WCB, such as the outflow height.
Radiative PV modification near the tropopause is typically weak in terms of instantaneous PV tendencies and acts at longer time scales, but is distributed more homogeneously across large regions and therefore adds a major contribution to the PV budget in a time- or domain-averaged perspective. It is shown that the lower stratospheric PV production strongly depends on the presence of clouds.

The particular strengths of the Lagrangian trajectory-based diagnostic used in this study are that it connects prominent tropopause structures that are relevant for the dynamics of extratropical weather systems with non-conservative PV modification along the flow, and that it quantifies the relative importance of parameterized turbulence, radiation and cloud processes for these modifications.

Primary authors: SPREITZER, Elisa (ETH Zurich); Dr BOETTCHER, Maxi (ETH Zurich); WERNLI, Heini (ETH Zurich) (presenting for Elisa Spreitzer, ETH Zurich); Dr JOOS, Hanna (ETH Zurich)

Presenter: WERNLI, Heini (ETH Zurich) (presenting for Elisa Spreitzer, ETH Zurich)

Session Classification: Session 8

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