Geophysical Research Abstracts
Vol. 16, EGU2014-5981, 2014
EGU General Assembly 2014

The interaction between warm conveyor belts and breaking Rossby waves: a climatological perspective.

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Warm conveyor belts (WCBs) are moist ascending airstreams in extratropical cyclones. Climatologically, they are key for the meridional and vertical transport of water vapour and heat. The rapid ascent of WCBs from the boundary layer to the upper troposphere in about 1-2 days leads to cloud formation, (intense) precipitation and the release of latent heat, which modifies their potential vorticity (PV) value in a significant way. Typically WCBs reach the tropopause level with low PV values ($\sim$0.5 pvu) and therefore the cross-isentropic transport of low-PV air in WCBs can amplify upper-level Rossby waves and contribute to the formation of PV streamers downstream. Here, filamentary PV streamers are regarded as clear signs of breaking Rossby waves. They in turn can act as precursors of extreme weather events and/or trigger the genesis of another cyclone, potentially generating a new WCB.

The aim of this study is to quantify the interaction of WCBs and PV-streamers from a climatological point of view for the ERA-Interim data set for the period 1989-2010. WCBs are identified from comprehensive trajectory calculations that select air parcels in the vicinity of cyclones with a minimum ascent of 600 hPa in 48 hours. From these WCB trajectories, coherent features of WCB outflows are derived and checked for overlapping with PV streamers, which are identified using a contour searching algorithm. Both, WCBs and PV-streamers are then tracked using a novel feature tracking technique, which is based upon a modified region growing approach. With this technique, the interaction of WCBs and PV-streamers is analysed for a 22-years period leading to novel insight about the role of WCBs for triggering the breaking of Rossby waves, as well as, vice versa, about the importance of PV-streamers for the formation of new WCBs.