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Event-based climatologies of jet-streams and baroclinic wave activity

H. Wernli (1), P. Koch (2), C. Schwierz (2), M. Sprenger (2) and H.C. Davies (2)

(1) Institute for Atmospheric Physics, University of Mainz, Germany, (2) Institute for Atmospheric and Climate Science, ETH Zurich, Switzerland (wernli@uni-mainz.de)

Jet streams and baroclinic waves are key atmospheric flow features in midlatitudes. Baroclinic wave life cycles encompass the genesis of surface cyclones (typically in regions of strong baroclinicity), their intensification and decay. The final phase is frequently accompanied by Rossby wave breaking (RWB) at the tropopause level. In this study, novel techniques are presented that allow the compilation of climatologies of jet streams, surface cyclones and RWBs using reanalysis data sets from the ECMWF. Simple criteria and automated contour searching algorithms are used to identify (i) jet streams from the vertically averaged wind speed in the 100-400 hPa layer, (ii) surface cyclones from the sea-level pressure field, and (iii) RWBs as filaments and cut-offs on isentropic potential vorticity charts. It is common to all algorithms that features are identified individually at every time instant as spatially coherent structures with a finite area. Simple time averaging yields climatological frequency fields of the considered flow phenomena. Some selected results of the climatologies are presented for the northern hemisphere winter season. All three climatologies show pronounced zonal asymmetries. Finally, it is indicated that these event-based climatologies can be used to produce meaningful classifications and regional subsets of jets and cyclones, which reveal novel aspects of extratropical dynamical meteorology.