



A stream-based classification of European cyclone tracks

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The geographical region from where a cyclone enters Europe appears to play an important role in generating certain weather extremes. Some of the most devastating European floods have been associated with type Vb cyclones as in August 2002 or June 2013 for example. On the other hand, gale force storms in Western-Continental Europe are usually caused by cyclones that propagate from the north-eastern Atlantic into Europe.

A method is presented for tracking the paths of atmospheric cyclones with the ability to detect both linear and branching tracks. Cyclones are tracked at three atmospheric levels independently using the reanalysis data of NCEP1, ERA-40 and ERA-Interim over Europe in parts of the period 1948-2012. The cyclones are then classified by a new stream-based classification approach into nine types, on the basis of the geographic regions from where cyclones enter Central Europe.

Results show that the total number of tracks identified from ERA-40 is about 25% larger than those from NCEP1 due to the higher spatial resolution. The ERA-40 data suggest that, at 700hPa, 80% of all tracks are linear as compared to 65% at sea level pressure (SLP) due to the smoother pressure patterns at higher atmospheric levels. So branching events are more frequent at the surface. The relative number of linear tracks is always largest in the data with the coarsest resolution at all levels.

The classification indicates that the proportion of linear and branching tracks varies substantially between cyclone types. For example, the famous cyclone track type Vb has the highest ratio of complex (compound and merge/split) tracks with only 1/3 of linear cases at SLP (ERA-40).

The new cyclone type catalogue established in this paper will be used for identifying the temporal behaviour of cyclone tracks in the context of changing weather extremes in Central Europe.