

Evaluation of European winter extreme extra-tropical cyclones in ERA-20C

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One of the challenges in understanding the risk 'extreme' extra-tropical cyclones pose to Europe in winter is the relatively short record and consequently the small number of events of interest. In addition, two commonly used re-analyses, ERA-Interim and NCEP-CFS, start in 1979 just after a known 'stormy period'. ERA-20C covers a period 3 times longer than NCEP-CFS and ERA-Interim which should result in an increase in the number of storms of interest as well as capturing a number of 'stormy periods', thus improving our understanding of the risk associated with extra-tropical cyclones. Identifying the differences between re-analyses is important to be able to constrain future projections from climate models.

This study uses a feature-identification method, TRACK, to identify extra-tropical cyclones in all three datasets using the relative vorticity at 850hPa. Meteorological fields are then referenced onto these tracks, e.g. wind speeds, precipitation, vertical velocity. Using these tracks, the relationship between the variables within the cyclone can be examined. Composites of the horizontal and vertical structures of storms can be created to investigate the processes within storms of interest.

It is shown that ERA-20C captures a similar number, and intensity, of windstorms in the same period covered by NCEP-CFS and ERA-Interim. However, several discrepancies are also identified with ERA-20C, including unrealistic trends in the number of cyclones and the intensities of the extremes (wind and precipitation) over the whole period. The precipitation from ERA-20C is also shown to be much lower when compared to ERA-Interim and NCEP-CFS. The precipitation intensities from all three datasets are compared to the CMORPH data. The relationships between the precipitation and vertical velocity fields and wind fields are also examined in each dataset to look to explain some of the differences seen between the datasets and the observed trends.