



Northern Hemisphere extratropical winter cyclones variability over the 20th Century derived from ERA-20C Reanalysis

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Strom-track variability and trends over the 20th Century using long-term reanalyses is a subject of interest among the scientific community. However the homogeneity of these datasets throughout the time is questioned and results less conclusive or unreliable for early periods of the century.

In this study we intend to better understand the climatology of extra-tropical cyclones during the last century using a vorticity-based tracking algorithm applied to the new-released long-term ERA-20C reanalysis from ECMWF since the beginning of the century. The main originality of our study relies on the physical interpretation of the detected cyclone trends in terms of changes in the large-scale circulation. It provides confidence in the results despite the heterogeneous assimilated observations throughout the analysed period.

The variability of moderate-to-deep extra-tropical winter cyclones in ERA-20C show three distinct periods. Two at the beginning and at the end of the century (1900-1935 and 1980-2010) present no significant trends in the Northern Hemisphere and one in between (1935 - 1980) is marked by a significant increase in frequency of these cyclones. During this latter period, polar regions underwent a significant cooling that increased the mid-latitude meridional temperature gradient over the whole troposphere and consequently the baroclinicity. As a result, extra-tropical cyclones intensified. In contrast, the first and third periods are characterized by warmer polar temperatures. However, as the stronger warming is confined to the lower troposphere, the mid-latitude meridional temperature gradients and the baroclinicity do not uniformly increase in the whole troposphere. This may explain why the recent rapid increase in polar temperatures has not affected the behaviour of extratropical cyclones very much.