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Variability on different time scales of Extra-tropical Cyclones and Windstorms in latest 20th century reanalyses ERA-20C and NOAA-20CR

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Extra-tropical cyclones and wind storms are responsible for a large portion of damages all around the globe. Thus, knowledge about the temporal variability of these events during the past is of high socio-economic importance.

In this study, the temporal variability of extra-tropical cyclones and wind storms during the past century are analysed using ERA-20C and NOAA-20CR reanalysis datasets. Cyclones are identified using six hourly mean sea level pressure fields whereas wind storms are identified based on near-surface wind speeds. Analyses focus on wintertime events over both hemispheres and also for several subregions. Long-term trends as well as higher-frequency variability are investigated. Therefore, cyclone and wind storm time series are low-pass filtered with a cut-off frequency of 1/31 years using 31 weights and the high-frequency time series are obtained by calculating the residuum of the original and low pass-filtered time series. To analyse long-term trends, a linear regression model is fitted to the original time series for three different periods: 1901-1930, 1931-1960 and 1961-1999.

Results suggest substantial differences regarding long-term trends between ERA-20C and NOAA-20CR for cyclones and wind storm events, especially during the first half of the 20th century. In general, a better agreement is found for extreme cyclones compared to all cyclones. Furthermore, high-frequency variability over the Northern Hemisphere is in good agreement for cyclones and wind storms over most regions and throughout the century, with the highest correlations found at the end of the 20th century. Analyses for the Southern Hemisphere show smaller agreement between ERA-20C and NOAA-20CR for cyclone and wind storms regarding their high-frequency variability.

The results of this study indicate that no reliable conclusion regarding long-term variability of cyclones and wind storms can be drawn, based on solely these two 20th century reanalysis products. However, analyses focusing on mechanisms steering higher-frequency variability of cyclones and wind storms might be useful, but long-term trends should be taken into account.