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Influence of resolution on storm studies

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The risk of wind-induced damage to infrastructure as well as forests is projected to increase in western, central, and northern Europe due to anthropogenic warming of climate and concurrent increase in the frequency of strong storms. Recent studies have highlighted the importance of resolution in capturing small scale features such as tropical storms and hurricanes as well as mesoscale features embedded in larger extratropical storms. Because reanalyses are good homogeneous datasets of the current climate, they are of help when studying storms and extreme winds as well as the influence of resolution. To know more about the resolution impact on modelled storms and extreme wind speeds we have in our work concentrated on two European reanalyses: ERA-40 (1957-2002) and ERA-Interim (1979-current).

We have analyzed parameterized surface wind gusts and geostrophic and ageostrophic isallobaric wind speeds to see how storm intensity and movement are captured depending on the dataset used. We have also done up-scaling of the datasets to daily resolution to find out how much information is lost when the temporal resolution given to the end-user is low. This is important, because daily temporal resolution is often used in climate research for example in ensemble studies when the focus is on defining uncertainties due to the choice of model.

Our preliminary results show that with high spatial and temporal resolution, the reanalysis datasets placed the rapidly moving storms spatially more correctly than with lower resolutions. In the storm cases, the wind speeds in ERA-40 and its lower spatial resolution were, for instance, 15% smaller than those from ERA-Interims higher spatial resolution. Using a 1.125° grid instead of a 0.7° grid shifted the location of storm Anatol's maximum winds by several hundred kilometers. Additionally decreasing the temporal resolution from three hours to 24 hours reduced the estimate of the maximum storm wind speeds by 40-70% and also placed the area of maximum winds in a different location along the track.

Due to such examples, we presume that projections of storms under climate change may have large uncertainties. This is due to the varying spatial resolution employed and also the temporal resolution available for the end-users. Focusing on the effects of different resolutions may help to minimize the uncertainties in the results.