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Near-surface mean and gust wind speed in ERA5 across Sweden: towards an improved gust parametrization

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Driven by the twenty-century surface air temperature rise, extreme wind events could change in their frequency and magnitude of occurrence, with drastic impacts on human and ecosystems. As a matter of fact, windstorms and extreme wind conditions contribute to more than half of the economic losses associated with natural disasters in Europe. Across Scandinavia, the occurrence of wind gust events can affect aviation security, as well as damage buildings and forests, representing severe hazards to people, properties and transport. Comprehensive extreme wind datasets and analysis can help improving our understanding of these changes and help the society to cope with these changes. Unfortunately, due to the difficulty in measuring wind gust and the lack of homogeneous and continuous datasets across Sweden, it is challenging to assess and attribute their changes. Global reanalysis products represent a potential tool for assessing changes and impact of extreme winds, only if their ability in representing observed near-surface wind statistics can be demonstrated.

In this study the new ERA5 reanalysis product has been compared with hourly near-surface wind speed and gust observations across Sweden for 2013-2017. We found that ERA5 shows better agreement with both mean wind speed and gust measurements compared to the previous ERA-Interim reanalysis dataset. Especially across coastal regions, ERA5 has a closer agreement with observed climate statistics. However, significant discrepancies are still found for inland and high-altitude regions. Therefore, the gust parametrization used in ERA5 is further analyzed to better understand if the adopted gust formulation matches the physical processes behind the gust occurrence. Finally, an improved formulation of the gust parametrization is developed across Sweden and further tested for Norway, which is characterized by more complex topography.