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Observed, reanalysed and simulated trends of daily peak wind gusts across Northern Europe

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Extreme wind hazards have a substantial societal and environmental impact due to their complex origins and the uncertainties in the capability of predicting them. For this reason, more detailed extreme wind analyses are required by regional planners, policy-makers and meteorological institutes for understudied regions like Northern Europe to get new insights on wind gusts and associated hazards. This study aims to assess the variability of daily peak wind gust (hereafter DPWG) across Northern Europe by investigating multidecadal trends in the frequency (90th percentile; in days decade-1) and magnitude (in m s-1 decade-1) of these events.
DPWG series are obtained from available anemometer observations across Denmark, Finland, Norway and Sweden for 1996-2016 (2004-2016 in Denmark); these series are then quality-controlled and homogenized by applying a robust homogenization protocol in CLIMATOL. 20-years (and 13-years) of observations are not enough to assess variability and changes of DPWG as the Weather Meteorological Organization recommends. For this reason, DPWG are also retrieved from reanalysed, i.e. the European Medium-Range Weather Forecasts Reanalysis (ERA-Interim), and simulated, i.e. the Coordinated Regional Climate Downscaling Experiment (CORDEX), datasets, where wind gusts are parametrized by different techniques. After using the observed DPWG dataset to quantify the spatial scale of wind gustiness, ERA-Interim and CORDEX are compared with the observations in order to evaluate the performance of both datasets in representing wind extremes. In particular it is estimated how different type of parametrization are able to simulate wind gusts. Spatial and temporal long-term trends of modelled DPWG are then investigated during the past (1979-2016) and the future (2017-2100). Moreover, the role played by different atmospheric circulation indices (e.g., the North Atlantic Oscillation index) on the decadal variability of DPWG is explored in order to assess extreme wind risks for Northern Europe.