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## Extreme gust atlas over South Africa

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An atlas of the 50-year gust wind at a resolution of 3 s is calculated over South Africa, at a spatial resolution of 3.3 km at several heights, including 10 m and 60 m where measurements are available.

In developing the atlas, first, 30-year wind climate (1990 - 2019) is simulated using the Weather Research and Forecasting (WRF) model. The WRF model was initialized and forced with the ERA5 data, with three nested domains and the innermost one, covering the whole country, has a spatial resolution of 3.3 km. The model outputs include the wind time series at several heights (50 m, 100 m and 200 m) every 30 minutes. The 50-year 30-min winds at several heights are then obtained by application of a suitable extreme value distribution. Afterwards, the Kaimal turbulence model is applied, in connection with an assumption of Gaussian process for the time series in the time scale 30 min to 3 s, to obtain the corresponding 3 s gust value to the 30-min values of the 50-year winds.

There is a prevalence of a variety of strong wind events in South Africa, including mid-latitude cyclones, fronts and thunderstorms. The different physical mechanisms have different levels of challenges to the simple modeling approaches applied above. For more than 100 measurement stations, the 50-year gust values have also been calculated, mostly at 10 m, some at 60 m. They are used to validate the modeled values and identify regions and areas where our meso-to-turbulence modeling needs improvement or adjustment to eventually produce a verified extreme gust atlas.