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Mesoscale wind fluctuations and their correlation with solar variability

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The produced wind energy is due to the wind characteristics highly fluctuating. The safe integration of this energy into the transmission grid requires high-quality wind power predictions. To improve wind power predictions, the atmospheric conditions which cause strong wind fluctuations have to be understood. This study examines the characteristics of mesoscale wind fluctuations with a duration of one minute to several hours and a spatial extension of hundreds of metre to several kilometre. To investigate the atmospheric conditions which cause mesoscale wind fluctuations we use measurement data of the offshore wind park Horns Rev, satellite data and "Weather Research and Forecasting "(WRF) simulations. This dataset allows the investigation of the spatial pattern of wind fluctuations and the wind time series at one point. Furthermore, it is possible to examine the interaction of the spatial and the temporal wind fluctuations. Apart from the wind components, additional meteorological variables are available to find interdependencies between the wind fluctuations and meteorological situation.
The main focus of this study is on the correlation between wind fluctuations and spatial solar variability derived from the geostationary satellite MSG. The relation between high solar variability and wind fluctuations is investigated in situations of convection.