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High impact weather: an assessment of energy production extremes

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The share of renewable energy in the electrical grid will likely increase as mitigation measures for future climate change are put into effect. Renewable energy production, such as wind and solar energy, is largely dependent on the variability of the weather and is thus subject to variability on daily, weekly and yearly timescales. This variability can be partly compensated by integrating the wind and solar energy resources over a large area. For this purpose, an optimal spatial distribution of renewable energy sources has been developed for Europe (Zappa and Van den Broek, in preparation).

The aim of the presented work is to characterise the meteorological teleconnections leading to highest impact on combined wind and solar energy production. In this study we use the optimal distribution of renewable energy sources to calculate 2000 years of daily wind and solar energy production. Meteorological input data were generated with the global climate model EC-Earth V2.3. Selection of events is made by extremeness of impact rather than by the extremeness of a chosen meteorological variable. This choice was made because compound events (combined low solar and wind energy production) cause the most extreme variations in production. We discuss the meteorological conditions that lead to periods of extreme underproduction. We show that these are not necessarily extreme in meteorological or climatic terms. Finally we investigate the frequency and occurrence of these high impact events under climate change.