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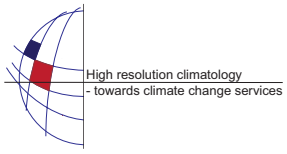

Estimation of the (change in the) probability of simultaneous extreme weather events - a case study for snow & wind

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Society is vulnerable for extreme weather events. Especially the simultaneous occurrence of multiple weather variable may lead to hazards. Examples are high astronomical tides and surges for sea dikes, and snow melt and precipitation for river discharges.
Here we highlight the probability of the simultaneous occurrence of high wind speeds and extreme (wet) snowfall. Such a situation led at 25/26 November 2005 to the rupture of many high voltage overhead lines, leading to power failure for multiple regions in The Netherlands and Germany. The Netherlands Electrical Committee was interested in the probability of such an event, as well as in the change of the probability in a changing climate.
We used the 5-member ensemble 18-year hindcast of the monthly forecasts of the ECMWF from March 2008 to March 2009. The negligible skill in the model for forecasts of 7 days and further results in more than 100,000 independent days, resembling 300 independent years of 'synthetic' weather.
This huge dataset enabled us to look for analogues compared to the observed situation, and to estimate the probability of such events with more accuracy than directly from the observed data. Other advantages are that it enables to study the sensitivity and probability for a larger region, and to analyze the effect of climate change.
After comparing the model's Probability Density Functions (PDFs) with the observed PDFs for wind, snowfall, precipitation and temperature, we concluded that the a similar event like the 25/26 November 2005 case has locally a return period of about 100 years. For an arbitrary location in The Netherlands, the probability of such an event is once in 50 years.
Climate change will presumably lead to a reduction of 10-50% in the number of critical situations. The main reason is that the expected temperature rise will decrease the probability of temperatures around 0°C, and thus the probability on wet-snow conditions. This temperature effect is considerably larger than the (uncertain) effect of changes in wind- and precipitation climate.
Ensemble predictions thus point out to have an unexpected application to determine probabilities of (simultaneous) weather events.
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