



Current and future risk of wind droughts in Europe

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As wind power share is showing a significant growth in the European electricity generation system assessments regarding long-term variation of wind fields related to climate change are becoming more and more relevant for this sector. Several studies analysed the impact of climate change on the wind energy sector in Europe (Tobin et al, 2015) finding light impact (not exceeding 5% at continental scale) in terms of mean wind speed. However, in the last few years wind power producers have been reporting remarkable losses in energy production due to the long lasting wind droughts in Europe and also in USA. This fact claims the need of detailed risk assessments of low winds elaborated till now only for special cases for Europe (Vautard et al, 2018).

The study considers 11 high-resolution (0.11 [U+25E6]) bias-corrected climate projections from the EURO-CORDEX ensemble with 5 Global Climate Models (GCMs) downscaled by 6 Regional Climate Models (RCMs), and one additional regional model, KNMI-RACMO with 16 member ensembles.

Annual and seasonal changes of extreme low wind speeds (2th percentile) on both continental and country scale are determined for current and mid-century climate compared to the reference period of 1971-2000. In order to support risk assessments in energy sector changes of return periods of the full wind speed range are also given. On continental scale robust changes in wind droughts frequency are detected during the winter period. The 5th percentile winter wind speed (3.66 m/s) in the past period (which occurred about once in every 20 years) becomes twice as frequent in current and future climate having a return period of about 9.5 year. Changes in low wind frequency have direct impact on energy production and this impact is not linear. The study also includes a case study determining the changes in wind power generation induced by the winter wind drought situations taking into account the power curve of an Enercon E70 2.3MW turbine.

Changes in wind drought frequencies show different regional patterns over Europe. Based on the high agreement among the models (more than 80%) negative changes are more likely in the Mediterranean region and also in the northern part of the continent, while scattered positive changes are detected in the centre part of Europe.

Tobin I et al. (2015): Assessing climate change impacts on European wind energy from ENSEMBLES high-resolution climate projections, *Climatic Change* 128.1-2 99-112.

Vautard R et al. (2018): Attribution of wintertime anticyclonic stagnation contributing to air pollution in Western Europe, *Bulletin of the American Meteorological Society* 99(1):S70-S75