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Evolution of wind behaviour and of its potential for wind power production in Belgium during the last 22 years : a comparison between WRF forced by NCEP2 reanalysis and WRF forced by ERA-INTERIM reanalysis

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The number of wind turbines in the world grows significantly every year due to politics proposing green energy productions as solutions to mitigate climate change effects. However, this kind of energy is dependent on the weather. This implies that the wind production is irregular at a very short time scale. But the short time scale availability of the wind-based energy is important to the producers of energy as well as to the electric grid managers because the wind energy production can rise or fall rapidly which creates some financial and voltage variations.

For these reasons, we study the past evolution of the availability of the wind quantity by analysing the intermittence of the wind speed in Belgium during the last 22 years (1989-2010). To reach this goal, we use the regional model WRF (Weather and Research Forecast model) developed by the UCAR community users. In a first time, the WRF model is forced by the NCEP2 reanalysis outputs to obtain a regionalisation of the weather conditions over a domain centred on Belgium at a resolution of 10 km. This resolution allows to capture the minute-based time scale variability of wind speed and consequently the irregular behaviour of the wind power production. In a second time, the WRF model is forced by the ERA-Interim reanalysis outputs with the same configuration.

To obtain a value of the wind intermittence, we calculate the persistence of a wind blowing continuously with a minimum speed of 1 ms-1, then the persistence of a wind blowing continuously with a minimum speed of 2 ms-1, etc. The persistence of the wind speed and its evolution over 22 years are characterised by : (a) the mean wind speed over a fixed period (monthly, seasonally, ...), (b) the mean duration of a wind speed above x ms-1 over the same fixed period and (c) the evolution of (a) and (b) during the studied period.

This analysis is made with the outputs of WRF-NCEP2 and with the outputs of WRF-Interim allowing to evaluate the impact of forcing fields into WRF-based wind climatology.