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# A Vector Auto-Regressive Model for Onshore and Offshore Wind Synthesis Incorporating Meteorological Model Information

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The growth of wind power production in the electricity portfolio is striving to meet ambitious targets set, for example, by the EU, to reduce emissions by 20% by 2020. The potential of wind power needs to be fully assessed if effects of climate change on food production, water resources and associated insurance costs are to be avoided. In order to make such assessments, representations of the UK wind field in syntheses which capture the inherent structure and correlations between different locations are required. Such model based wind synthesis containing information about the annual and diurnal trends as well as the stochastic component has been developed previously based on onshore wind data, [1].
Huge investments are now being made in new offshore wind farms around UK coastal waters that will have a major impact on the GB electrical supply. Thus, it is important that the above syntheses include offshore information. Here, Vector Auto-Regressive (VAR) models are presented and extended in a novel way to incorporate offshore time series from a pan-European meteorological model called COSMO, with onshore wind speeds from the MIDAS dataset provided by the British Atmospheric Data Centre. The derived synthesis has been validated by reproducing probability density functions at the nodal points where data existed and also by establishing an accurate, short-term (1 to 6 hours ahead) forecasting ability. Comparisons of onshore syntheses are made utilising models with/without offshore COSMO information, in order to ascertain how large scale meteorological effects alter the syntheses. Whilst the total wind speed is known to be Weibull distributed, the underlying assumptions of the VAR model that the de-trended series (i.e. with annual and diurnal cyclical components removed) is closer to being Normally distributed are shown to be largely upheld, via the calculation of skewness parameters. These syntheses form a powerful tool for use in power system impact studies.

[1] “Application of auto-regressive models to UK wind speed data for power system impact studies”, D. Hill, D. McMillan, K.R.W. Bell, D. Infield, IEEE Trans. on Sustainable Energy, Vol. 3, No. 1, pp134-141, Jan 2012.