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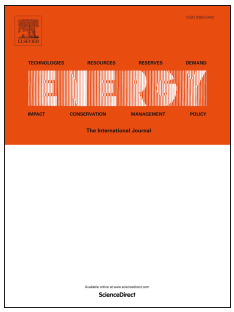

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ACCEPTED MANUSCRIPT

A New High-Dimensional Time Series Approach for Wind Speed, Wind Direction and Air Pressure Forecasting

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Abstract

Many wind speed forecasting approaches have been proposed in literature. In this paper a new statistical approach for jointly predicting wind speed, wind direction and air pressure is introduced. The wind direction and the air pressure are important to extend the forecasting accuracy of wind speed forecasts. A good forecast for the wind direction helps to bring the turbine into the predominant wind direction. We combine a multivariate seasonal time varying threshold autoregressive model with interactions (TVARX) with a threshold seasonal autoregressive conditional heteroscedastic (TARCHX) model. The model includes periodicity, conditional heteroscedasticity, interactions of different dependent variables and a complex autoregressive structure with non-linear impacts. In contrast to ordinary likelihood estimation approaches, we apply a high-dimensional shrinkage technique instead of a distributional assumption for the dependent variables. The iteratively re-weighted least absolute shrinkage and selection operator (LASSO) method allows to capture conditional heteroscedasticity and a comparatively fast computing time. The proposed approach yields accurate predictions of wind speed, wind direction and air pressure for a short-term period. Prediction intervals up to twenty-four hours are presented.

Keywords: Wind Speed; Wind Direction; Air Pressure; Heteroscedasticity; Stochastic Modelling; Multivariate Model; Time Series

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