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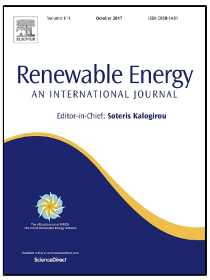

A hybrid approach based on the Gaussian process with *t*-observation model for short-term wind speed forecasts

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A hybrid approach based on the Gaussian process with *t*-observation model for short-term wind speed forecasts

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Accurate wind speed prediction is a significant factor in improving and optimizing wind power production. Particularly, reliable short-term wind speed forecasting contributes to the real-time optimization of wind farm operation. However, this short-term forecasting task remains challenging due to the strong stochastic nature and dynamic uncertainty of wind speed. This paper proposes a hybrid model that consists of the Empirical Wavelet Transform (EWT), Expectation Propagation (EP) algorithm and Gaussian process regression with the Student-*t* Observation Model (GPR-*t*) for short-term wind speed forecasting. The proposed approach firstly extracts meaningful information from a short-term wind speed series and subsequently models the inherent uncertainty and the dynamic features of the wind speed time-series. Additionally, the wind speed series presents a time-varying characteristic. Thus, this study adopts a moving window approach in the prediction processes, thereby permitting the proposed model to respond quickly to the dynamic characteristic of wind speed. To examine the forecasting performance of the suggested hybrid model, the validation of the proposed model is performed against several other existing models with half-hour and hourly wind speed data obtained from a windmill farm located in northwestern China. The computational results demonstrate that the proposed hybrid approach generates satisfactory point predictive accuracy and interval forecasting performance.

Keywords: Gaussian process regression with the Student-*t* Observation Model, Expectation propagation (EP) algorithm, wind speed forecasting

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