Kolloquium Energie- und Halbleiterforschung

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Development & evaluation of classification patterns for combinations of wind power predictions

The continuous growth of the wind energy sector in Germany puts high demands on forecasting systems in terms of prediction accuracy. An important part in the post-processing of wind power forecasts is the linear combination of different numerical weather prediction (NWP) models. Prediction models of different weather forecasting services or institutes can differ a lot from each other due to varying numerical models, varying parametrization of physical phenomena and assimilation data. The advantage of this variety is that different models often produce uncorrelated errors. In the prediction combination opposing errors cancel out each other, leading to an overall higher forecast quality. However, no currently used method exploits the full potential of prediction combinations. Despite already existing methods that attempt to calculate linear factors which are dependent on certain weather situations, the gap in forecast quality between combination potential and current combination results (especially for short time domains) is large. Yet, it is not easy to successfully predict optimal linear factors for short periods. In the operational application weights from short optimization time spans are too volatile to reliably create high quality results. Therefore, in the first part of this master thesis the combination potential will be compared to the stability of the weights depending on the time domain. This helps to clarify the question where the optimal trade-of between combination potential and weight stability is. In the second part of the thesis prediction combinations are examined historically for situations in which the optimal prediction combinations would have increased the forecast quality significantly compared to a standardized prediction combination. Then, the situations with high combination potential have to be linked to meteorological situations. In order to map a set of meteorological parameters onto the evaluated combination situations, a principal component analysis is performed to reduce the dimensionality of the meteorological input. The resulting main components are linked via machine-learning techniques to the situations with high combination potential. This helps to determine in advance if special combination factors have to be used in future predictions. Alternatively, if the amount of data samples is large enough this approach can also be used aiming for specific linear combination factors. Consequently, one could be certain that a set of linear factors has to be applied when the corresponding meteorological situation occurs.