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Comparing a chain of models of increasing complexity for calculating the turbulence intensity within wind farms.

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As a result from turbulence generated by the rotors of the wind turbines, the turbulence intensity inside wind farms is enhanced. The higher turbulence lead to increased loads and a reduction in lifetime of wind turbines within windfarms compared to those of the free standing turbines and a reduction in the power generation. For the optimization of wind farm layouts (on- and offshore) these turbulence effects have to be taken into account. Thus the evaluation of the model accuracy is important in the load and power generation optimization of the wind farms.

Different methods to calculate the turbulence intensity in the wake are possible. They range from analytical methods, which allow fast and simple calculation, over steady state parabolic CFD models with k-epsilon turbulence closure to the simulation of the turbulence in the flow with the LES (Large Eddy Simulation) models.

Here we present a concept to compare the results of turbulence calculations from methods with different levels of complexity. The analytical model from the wind farm software FlaP (Farm Layout Program) is compared to CFD results obtained using the Phoenics CFD software with the k-epsilon turbulence model and the LES-Solver PALM. In this chain of models, the high resolution data from the verified LES model will be used to improve the analytical model and to investigate the accuracy of the turbulence description from the Phoenics CFD model, which calculates the transport and dissipation of turbulence generated by wind shear. Also, a first comparison is presented between FlaP and the Phoenics model at the example of an offshore wind farm with a double and a quintuple wake situation.