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Towards a quantification of how single trees affect the wind field

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Single trees, small forests and alleys are commonly occurring in agricultural landscapes, but their effect on the wind field is usually ignored in meteorological models. This omission is one of the motivations behind a current micro-meteorological experiment focused on a single tree, in which the wind field is measured upwind and downwind of an open grown 6 m tall European oak tree. In order to describe the tree geometry, a terrestrial lidar scan was performed from eight angles around the tree. The resulting point cloud was processed to make a tree parameterization for a Computational Fluid Dynamics (CFD) model, where the tree is represented as a distributed drag force. In addition to the high-detail tree parametrization, the total force of the tree on the wind field is quantified by a tree-adapted strain gauge measurement taken on the lower part of the stem. This observation, in combination with the high-detail tree model, is used to give an accurate weight to the tree parametrization. We present the first wind measurements taken around the tree and the CFD flow model validation in the wake of the tree. The effect of the tree on the wind field is found to vary remarkably over the season and the validation therefore covers both the leaf-on and leaf-off periods.