



Turbulence, wind shear and wind speed downwind of forested terrain

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Wind flows can be significantly affected by the presence of forestry and thereby affect turbines' production and safety. In particular values of wind shear and turbulence intensity can reach significant levels downwind of forested terrain, leading to wind turbine fatigue, vibrations and sometimes failure. Energy yield can also be significantly affected by forestry as wind energy is dissipated by trees.

These characteristics of the flow can be assessed using measurements or modeling. However a set of standard curves showing turbulence intensity, wind shear, and wind speed downwind of forested terrain for various forest parameters would prove useful in order to approximately assess wind characteristics before carrying out more in-depth analyses.

The Ventos® CFD (Computational Fluid Dynamics) model was used for this purpose, as it includes a state-of-the-art canopy model enabling proper modeling of the physics at stake. Forestry height, density and depth were varied within a range of typical values, and values of turbulence intensity, wind shear, and wind speed are provided for each case depending on the distance to the forest and height above ground level. These CFD computations were validated by comparisons with measurements on sites matching the characteristics of the forest to be modeled.

Conclusions discuss the approach proposed here and its limitations.