Deliverable Summary Report: D2.3

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Work Package: *WP 2 – 'WP2: Parameters to flow models and global case studies'*
Deliverable name: *D2.3 – 'Forest module for canopy-resolving microscale models'*
Deliverable status: *Completed*

Deliverable description

T2.4 Adaptation of flow models to satellite based inputs (DTU WE)

Existing flow models will be adapted to run with new satellite based input layers. In particular, the flow models included in the Wind Atlas Analysis and Application (WAsP) tool will be updated with a new module for forest modeling, which takes the properties of tall vegetation better into account.

Expected outcome:

- A new forest module for canopy-resolving microscale models (D2.3)

Activities and tasks completed

Development of a forest parametrization that can use additional information from satellites to give a better estimation of roughness and displacement height. Three approaches were tested:

- The objective roughness approach (ORA) described in Floors et al. (2018), which needs tree height as input
- The Raupach (1994) parametrization which needs tree height and leaf-area index (LAI) as inputs
- An approach based on Sogachev (2006) (SCADIS), which in addition can use a prescribed description of the leaf-area density profile.

Deliverables and outcomes

- New routines to deal with displacement height implemented in PyWAsP.
- Three models implemented for converting land cover classes, tree height and LAI into a roughness length and displacement height implemented in PyWAsP (see above).
- Discretization routines which split satellite layers into new classes with a roughness and displacement based on landcover, treeheight and LAI.

PyWAsP is currently available for the project partners EMD and Vestas. PyWAsP is the primary development platform for DTU and as such it is directly available for new calculations of numerical wind atlases, for partners to implement in their own software (WindPro from EMD) and in the WAsP GUI.

References

Floors, R., Enevoldsen, P., Davis, N., Arnqvist, J., & Dellwik, E. (2018). From lidar scans to roughness maps for wind resource modelling in forested areas. Wind Energy Science, 3(1), 353–370. https://doi.org/10.5194/wes-3-353-2018

Raupach, M. R. (1994). Simplified expressions for vegetation roughness length and zero-plane displacement as functions of canopy height and area index. Boundary-Layer Meteorology, 71(1–2), 211–216. https://doi.org/10.1007/BF00709229

Sogachev, A., Cavar, D., Kelly, M. C., & Bechmann, A. (2017). Effective roughness and displacement height over forested areas, via reduced-dimension CFD. Roskilde, Denmark.