Measurements of turbulence and vegetation structure across a forest clearing

**Challenge**
The turbulent flow around flux measurement sites and the exchange of energy and mass between atmosphere and land surface are affected by vegetation structure. The vegetation layers of forests act as storage for energy, and advective fluxes cause remarkable uncertainties in the measured fluxes. Calculating reliable fluxes depends on realistic wind fields and thus on the parameterisation of the vegetation in numerical models.

**Site & Setup**
Ultrasonic measurements at 32 sensor positions in total placed on four towers and five 2 m stands, 16 thermocouples, radiation balance, thermal camera, 15 laser scanner recordings.

**Fluxnet Station Tharandt**
Spruce stand: 120 years, 30 m height, 90 m radius. Clearing: 50 m × 90 m. 16 thermocouples, radiation balance, thermal camera, 15 laser scanner recordings.

**Method**
Registration of the different scans in a single coordinate system and generation of a multi-scale voxel structure with attributes to derive the plant area density distribution from selected measurement intervals (19 half-hourly runs) made at reference point (42 m, red dot in the figure on the right) and results from a Large-Eddy Simulation (LES, Schlegel et al. 2012) from the corresponding grid point (plus 5 grid points transversal to the wind direction).

**Parameterisation**
Calculation of complete balances requires knowledge of advective fluxes over the boundaries of the control volume. Measurements within tall vegetation can provide few vertical profiles only and must be complemented by numerical models considering the canopy architecture.

**Application (next steps)**
Calculation of complete balances requires knowledge of advective fluxes over the boundaries of the control volume. Measurements within tall vegetation can provide few vertical profiles only and must be complemented by numerical models considering the canopy architecture.

**Expected Outcome**
Combining meteorological measurements (wind, temperature etc.) with measurements of plant area density this study aims at the following:
- investigation of the effect of inhomogeneities in canopy structure on exchange processes and quantification of the resulting uncertainties of flux measurements,
- derivation of effective parameters for numerical models like drag coefficient, mixing length, displacement height and roughness length from the canopy structure,
- validation of results from numerical models.

This presentation aspires to make the dataset public and to invite modellers to further data analysis.

**References**

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