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CloudRoots: an integrated field experiment and modelling approach to study soil-plant-atmosphere interactions

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Due to their high-quality routine measurement programme, ICOS sites lend themselves as anchors for additional experiments. As an example, we describe the CloudRoots campaign near the agricultural site Selhausen (DE-RuS) in spring 2018.
Little is known about the two-way feedback between stomatal control (controlling the partitioning of energy into sensible and latent heat) and cloud development (affecting potential evapotranspiration). Coupled models of the soil-vegetation-boundary layer continuum have the potential to explain this, but their calculations are only as robust as the data used to parameterize or validate the model. For observations and modelling, the challenge is in interconnecting processes at leaf level to the physics of turbulence and clouds.
We temporarily amend the existing radiation, flux and soil dynamics/respiration measurements of the ICOS site by scintillometry, sap-flow and leaf-level flux measurements, vertical profiles and isotope measurements. Scintillometers provide minute-scale turbulent fluxes enabling to connect stomatal responses to the energy, moisture and CO_2 fluxes at this timescale [1]. Sap-flow [2], leaf-level chamber, canopy-resolving profile [3] and isotope measurements have the potential to distinguish stomatal CO_2 and H_2O fluxes from the eddy-covariance based net fluxes. Relating the leaf and canopy level measurements to cloud development and potential cross-scale feedbacks are integrated and explored with the CLASS model ([4], https://classmodel.github.io).
The campaign is partnering with two complementary test campaigns for the FLEX mission (https://earth.esa.int/web/guest/missions/esa-future-missions/flex) and the MOSES project (https://moses.eskp.de/home/), taking place, among others, in the same region in spring and summer 2018. The poster will show first results and method intercomparisons from the CloudRoots field campaign.

[1] van Kesteren et al. 2013, Agric. For. Meteorol. 178-179:75-105
[2] Langensiepen et al. 2014, Agric. For. Meteorol. 186:34
[3] Ney and Graf 2018, Bound.-Layer Meteorol. 166:449
[4] Vilà-Guerau de Arellano et al. 2015, Atmospheric Boundary Layer: Integrating air chemistry and land interactions. Cambridge University Press.