Understanding the Spatiotemporal Structures in Atmosphere-Land Surface Exchange at the Jülich Observatory for Cloud Evolution

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1. JOYCE-CF Ground Based Observations and Site Characteristics

The Jülich Observatory for Cloud Evolution Core Facility (JOYCE-CF) provides a diverse set of instruments (Fig. 1) for continuous and highly-resolved measurements of the boundary layer since 2011. Together with a heterogeneous environment in terms of topography and land use, the interactions between atmosphere and land-surface can be observed.

2. Plant Induced Water Vapor Variability in the Atmosphere

- Land use: large variability around the JOYCE-CF site (Fig. 3)
- Assumption: heterogeneity causes spatial differences in the water vapor field
- First case analysis: the water band index (WBI) derived from the high-performance airborne imaging spectrometer HyPlant [2] shows directional variations that can also be seen in the integrated water vapor (IWV) measurements by a microwave radiometer (MWR) and the MODIS Terra/Aqua satellites (Fig. 4)
- Future work: select suitable days using a boundary layer classification (see 3) to investigate the correlation between IWV distribution and plant phenology

3. Boundary Layer Classification Based on Doppler Lidar

- Applications:
  - Identify specific situations for long-term analysis of land surface-atmosphere coupling
  - Evaluation of Large-Eddy-Simulations (LES)
  - Large potential for Doppler lidar network

4. Clear Sky Convective Boundary Layer Statistics

The long-term application of the boundary layer classification (Fig. 6) allows for an evaluation of e.g. clear sky convective cases, showing clear seasonal and diurnal variations in the equivalent potential temperature (Fig. 7), water vapor variability (Fig. 8) and a connection to the height of the boundary layer (Fig. 9).

References: