The HErZ VITAL Campaigns

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One focus of HErZ – the Hans Ertel Center, a cooperation on fundamental weather research between the German Weather Service (DWD) and German universities, are novel observations. The VITAL I and II campaigns develop, apply and assess novel vertical profiling methods of the troposphere for enhancing our understanding of the ABL, improving NWP models and for future data assimilation, e.g. in DWD's ICON model.

The VITAL I campaign took place in August 2024 at the Jülich Observatory for Cloud Evolution (JOYCE) and generated vertical profiling data sets using state-of-the-art observational approaches for tropospheric profiling. This contribution will show a first comparative analysis. Proof of concept studies were carried out for potential instruments of the next-generation DWD observational network, including uncrewed aircraft systems (UAS), water vapor lidars and microwave radiometers. The observations were compared against satellite data, radiosondes and data from the 120m meteorological tower. VITAL I also participated in a core phase of the 2024 world-wide WMO UAS Demonstration campaign with two small UAS applying a novel, improved wind and turbulence estimation technique on board.

Observational gaps in the ABL exist because ground-based instruments are not able to provide consistent three-dimensional data, and satellites struggle to accurately measure ABL conditions due to the proximity to the surface. This limitation is addressed by VITAL II.

VITAL II is currently planned for summer 2026 in the Rhineland Metropolitan Region (RMR) between Aachen, Bonn and Cologne, a densely populated region consisting of heterogeneous landscapes. VITAL II extends upon the success of FESSTVaL, which was largely 2D focused on the meso-γ-scale (2-20km) scale. VITAL II will observe the meso-β-scale (20-200km) and enhance our observation potential of the 3D ABL development through sensor synergy as well as understanding and modeling of cold pools and key turbulent processes.

We will present research questions and observational strategy of the planned VITAL II areas of research:

- Compilation of an unprecedented data set of synergistic satellite (MTG) and ground-based observations for weather research
- Understanding, observing and modeling of convectively driven cold pools
- Three-dimensional turbulent structure and variability of the ABL at meso-ß scale over a heterogeneous rural-urban landscape