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UAS Measurements of the Boundary Layer Late Afternoon Transition

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The late afternoon transition (LAT) of the convective planetary boundary layer (CBL) into a lower stably-stratified boundary layer and an overlying turbulent residual layer contributes to several atmospheric processes, for example the transport of water vapour and pollutants from the surface into the free troposphere. However, the decay of the CBL occuring at some point in the afternoon is difficult to observe and model correctly.
During the Boundary Layer Late Afternoon and Sunset Turbulence (BLLAST) 2011 field experiment in southern France, in-situ measurements taken with towers, balloons, airplanes, and unmanned aerial systems (UAS) were combined with remote sensing data in order to obtain a comprehensive and unique observational dataset of the LAT.
As a contribution to this BLLAST experiment, measurements were taken using the automatically operating Meteorological Mini Aerial Vehicle (M^2AV), developed at the Institute of Aerospace Systems (ILR), Technische Universität Braunschweig. This UAS has a wingspan of 2 m and a maximum take-off weight of 6 kg, including a payload of 1.5 kg. Due to its powerful yet small batteries, it can stay airborne for 50 – 60 min and cover a total flight distance of 60 – 70 km across the entire boundary layer height down to as low as a few 10 m above ground. The M^2AV is equipped with fast meteorological sensors that are capable of measuring wind vector, temperature, and humidity. The typical cruising speed of 22 ms-1 and sample frequency of 100 Hz results in a high spatial resolution, allowing to resolve even small-scale atmospheric fluctuations.
Preliminary results of the M^2AV measurements will be presented with regards to CBL decay in comparison with other participating measuring systems during BLLAST 2011.