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Spatial and temporal variability of hydrometeorological variables based on UAV measurements

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Hydrometeorological variables in the lower planetary boundary layer (PBL) are strongly dependent on the land surface temperature (LST) as this temperature controls the water vapor transport at the soil-atmosphere boundary or via stomatal conductance between the biosphere and the atmosphere. LST refers to the temperature which is calculated from infrared radiation measured at the interface between the land surface and the atmosphere.
We present LST investigations on a local scale that were performed by unmanned aerial vehicle (UAV)-based mapping of meteorological variables and LST over a grassland site, located in the foothills of the Alps in Germany. While air temperature, relative humidity and LST were measured with sensors installed at a hexacopter, wind speed and direction were derived from the hexacopter's onboard attitude sensors and GPS data. The investigation area was about 350 x 150 m over a soil moisture and soil temperature network installed in a grassland area, operated in the framework of the TERENO-preAlpine observatory.
During the ScaleX campaign in the summer 2016, flights were made under different meteorological conditions and in three levels above ground (5, 10, 15 m). Statistical methods were applied to investigate the relationship between the measured variables in combination with soil and surface characteristics. Results show that the spatial LST pattern over the site is strongly dependent on vegetation height/ cover and the absolute values on incoming radiation. While air temperature differed horizontally up to 1.5 K, LST showed differences up to 18 K during warm and sunny days. We finally show first results of a geostatistical analysis of pattern characteristics for selected hydrometeorological variables.