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Lidar-based Water Vapor, Temperature and Wind Measurements with Turbulence Resolution during the EUREC4A Field Campaign onboard RV Merian

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The EUREC4A (EUcidating the RoLE of Clouds-Circulation Coupling in Climate) field campaign takes place in the lower Atlantic trades, over the ocean east of Barbados from 20 January to 20 February 2020. During this campaign, for the first time, simultaneous measurements of surface turbulence, cloud microphysical properties, cloud radiative properties, convective activity and the large-scale environment in which clouds and convection are embedded (large-scale vertical motion, thermodynamic stratification, surface properties, turbulent and radiative sources or sinks of energy).

Our new Atmospheric Raman Temperature and Humidity Sounder (ARTHUS) observes temperature and moisture profiles over the ocean with turbulence resolution of up to 10 s and 7.5 m. By this, the thermodynamic properties as well as statistics of their turbulent fluctuations in the oceanic boundary layer can be investigated in detail including relative humidity, buoyancy, CAPE, and CIN. In addition, ARTHUS is also a aerosol Raman lidar and provides profiles of particle extinction and backscatter coefficient independently at 355 nm. Two Doppler lidars – one vertical pointing the second in scanning mode – measure horizontal wind profiles as well as profiles of vertical wind fluctuations, turbulent kinetic energy, and momentum flux. The combination of the three lidars will provide synergetic data products like latent and sensible heat flux profiles. Thus, this combination allows to investigate boundary-layer properties including cloud formation and aerosol-cloud interaction.

During the EGU General Assembly, we will show our first results from the campaign.