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# Compact automatic rotational Raman lidar system for continuous day- and nighttime temperature and humidity mapping

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Water-vapor and temperature profiles with high accuracy and vertical resolution from the surface to the lower troposphere are fundamental for accurate weather forecasts, process studies, and validation of satellites. Within the ACROSS project (Advanced Remote Sensing - Ground Truth Demo and Test Facilities) of the Helmholtz Alliance of German Research Centers, a new remote sensing system fulfilling these requirements are is currently being developed by the Institute of Physics and Meteorology (IPM) at the University of Hohenheim (UHOH).
The aim of the ACROSS project is close the gap in the data assimilation of satellite-based earth-observing systems, offering reference data of environmentally essential parameters in different spatial and temporal resolution, in order to enable its interpretation in the field of environmental science.
This new remote sensing system is a robust, portable, high-power, scanning rotational Raman lidar. It is based on the knowledge acquired at the IPM in the development of different generations of rotational Raman lidar systems in the recent years. The system measures atmospheric temperature profiles with high resolution, even in daytime due to the use of strong UV laser radiation and an optimized receiving chain in each one of the implemented channels.
It is well known that different parts of a pure rotational Raman backscatter spectra show different temperature dependence. Therefore, the ratio from two backscattered signals from two of this parts can be used to obtain a temperature profile of the atmosphere. Besides, an elastic and water-vapor profile are measured.
First atmospheric measurements have been obtained during the Land-Atmosphere Feedback Experiment (LAFE) at the ARM Southern Great Plains (SGP) central facility, OK, USA, in August, 2017, and will be presented at the conference.
The new lidar will enhance the Terrestrial Platform planned inside the ACROSS project, showing the potential of remote sensing systems gathering ground-truth information about the land-surface-atmosphere feedback, the behavior of the atmospheric boundary layer and the lower troposphere. Furthermore, it may serve as prototype for a future network of automatic thermodynamic lidar profilers.