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SUBMITTED ABSTRACT

0.	**Paper Number**	118
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1.	**Title of the paper**	A Breakthrough in 24/7 Operational Observations of Lower Tropospheric Thermodynamic Profiles with High Temporal and Vertical Resolutions by Means of Raman Lidar

2.	**Institution**	Institute of Physics and Meteorology, University of Hohenheim			
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4.	**Abstract of the paper**
	Severe gaps exist in the observation of lower tropospheric water-vapor and temperature profiles, which in the following are called thermodynamic (TD) profiles. Therefore, still to date, the structure of the lower troposphere from the surface layer, to the atmospheric boundary layer, to the lower troposphere must be considered as "terra incognita" in the earth system. We present a promising solution to close these observational gaps. Within the ACROSS project (see http://across-project.de), an advanced active remote sensing system for water-vapor and temperature profiling was developed by the Institute of Physics and Meteorology (IPM) of the University of Hohenheim (UHOH). This remote sensing system is based on the Raman lidar technique which has been incorporated in a very robust, compact, and automatized device, which can be continuously operated during daytime and nighttime. We demonstrate that the ACROSS Raman lidar fulfils the WMO breakthrough requirements for lower-tropospheric water-vapor and temperature measurements. To the best of our knowledge, these specifications exceed the performance of passive remote sensing systems by approximately one order of magnitude in vertical and temporal resolutions. This performance is very beneficial for process studies as well as the test and improvement of parameterizations of mesoscale models. Furthermore, recent data assimilation studies confirm the significant positive impact of Raman lidar-derived TD profiles for short-range weather forecasting. This is due to their high accuracy and resolution, the real-time provision of the error covariance matrix, and the very short latency of the results. Consequently, networks of active TD profiling systems are promising options for deriving climatologies of TD fields, process studies, model verification, and data assimilation. In order to realize these visions, a Raman lidar system for high-resolution and accurate TD profiling is commercially available now, which will be presented for the first time at the Meteorological Technology World Expo 2018.