EMS Annual Meeting Abstracts
Vol. 12, EMS2015-63, 2015
15th EMS / 12th ECAM

Advanced Raman lidars for humidity, temperature and aerosol observations

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The talk will present the design and measurement results from two Raman lidars for simultaneous water vapor, temperature and aerosol observations, recently developed at the Swiss Federal Institute of Technology –Lausanne (EPFL). In both lidars, the water vapor mixing ratio is derived from water vapor and nitrogen vibrational Raman signals and the aerosol extinction and backscatter are measured using elastic and pure-rotational Raman signals.
The first lidar is a fully automated, water vapor /temperature/aerosol lidar developed for operational use by the Swiss national Meteorological service (MeteoSiss). The lidar supplies water vapor mixing ratio and aerosol extinction and backscattered coefficients at 355 nm. The operational range of the lidar is 150-12000 m (night time) and 150- 5000 m (daytime) with time resolution of 30 min. The spatial resolution varies with height from 25 to 300 m in order to maintain the random measurement error below 10%. The system is designed to provide long-term database with minimal instrument-induced variations of the measured parameters in time. The lidar is operational since 2008 in the main aerological station of Meteoswiss in Payerne .
The second lidar is a new generation solar-blind system with an operational range 50-500 m and high spatial (1.5 m) and temporal (1 s) resolutions for simultaneous humidity, and temperature, measurements in the lower atmosphere. To maintain the measurement accuracy while operating with fixed spatial and temporal resolution, the receiver is designed to provide lower than 10 dynamic range of the signals within the operational distance-range of the lidar. The lidar has 360° azimuth and 240° scanning ability and can be operated in an automated mode. The lidar is used to study the structure of the lower atmosphere over complex terrains and in particular to advance our understanding of turbulent blending mechanisms in the unstable atmosphere.