Geophysical Research Abstracts
Vol. 12, EGU2010-14001-2, 2010
EGU General Assembly 2010


# Lidars as an operational tool for meteorology and advanced atmospheric research

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The talk will present the concept and observation results of three advanced lidar systems developed recently at the Swiss federal Institute of Technology- Lausanne (EPFL) Switzerland. Two of the systems are Raman lidars for simultaneous water vapor, temperature and aerosol observations and the third one is an ozone UV DIAL system.
The Ranan lidars use vibrational water vapor and nitrogen signals to derive water vapor mixing ratio and temperature, aerosol extinction and backscatter are measured using pure-rotational Raman and elastic signals.
The first Raman lidar (RALMO) is a fully automated, water vapor /temperature/aerosol lidar developed for operational use by the Swiss meteorological office (MeteoSiss). The lidar supplies water vapor mixing ratio and temperature plus aerosol extinction and backscatter coefficients at 355 nm. The operational range of the lidar is 100-7000 m (night time) and 100- 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 maximum measurement error of 10%. The system is designed to provide long-term database with minimal instrument-induced variations in time of the measured parameters. The lidar has been in regular operation in the main aerological station of Meteoswiss- Payerne since September 2008.
The second Raman lidar is a new generation, solar-blind system with an operational range 10-500 m and high spatial (1.5 m) and temporal (1 s) resolutions designed for simultaneous humidity, temperature, and aerosol 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 ten dynamic range of the signals within the distance range of the lidar. The lidar has 360° azimuth and 240°elevation scanning ability. The lidar was used in two field campaigns aiming 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.
The third lidar is an ozone UV DIAL system designed for studies of the upper troposphere, lower stratosphere ozone exchange processes. The lidar is based on a commercial fourth harmonic Nd:YAG laser. The DIAL wavelengths (284 and 304 nm) are produced by stimulated Raman conversion in high pressure nitrogen. A 76 cm in diameter Cassegrein telescope is used in the receiver and the spectral separation of the signals is carried out by an imaging-grating based polychromator. The operational distance of the lidar is 6000 -12000 m ASL with a statistical error lower than 10%. The lidar is deployed at the High Altitude Research Station Jungfraujoch at 3600 m altitude in the Swiss Alps. The lidar accuracy was verified by comparison to profiles taken by ECC balloon-borne sondes launched by Meteoswiss from Payerne.
The lidar has been in use from September 2008 and since that time several stratospheric intrusions and cases of intercontinental transport and transport from the atmospheric boundary layer have been observed.