



The Zugspitze High-Power Raman Lidar System: Highlights from 2010

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A very powerful Raman lidar system is currently under development at the Schneefernerhaus research station (Zugspitze) at 2675 m a.s.l. By using a 350-W XeCl laser system (emitting at 308 nm) and a particularly large 1.5-m-diameter receiver we aim at extending our lidar measurements of atmospheric water-vapour [Vogelmann and Trickl, 2008; Vogelmann et al., 2010] to 30 km. Recent simulations of the lidar performance for pure shot noise yield error levels up to this altitude of less than 5 %. Our first, quite demanding requirement, to achieve narrow-band operation of the powerful excimer laser that is normally used for industrial production, has been meanwhile fulfilled. Stable single-line emission with a spectral purity of at least 99.5 % and a bandwidth of less than 0.057 nm was achieved by introducing a large intracavity etalon into the laser cavity. Thermal drifts that matter at repetition rates above 100 Hz cease within roughly five minutes. The single-line operation of the laser is the principal requirement for narrow-band spectral filtering the backscattered radiation. This is particularly important for the planned temperature measurements within the troposphere and lower stratosphere via rotational Raman backscattering. The temperature profiles will be extended to more than 80 km by processing the Rayleigh return for an additional emission at 353-nm, generated via stimulated Raman shifting the laser output in high-pressure hydrogen.

A second highlight in 2010 was the installation of the receiver cabin on the top terrace of the Schneefernerhaus. All components, in particular the tower and the astronomical dome covering the cabin were transported to the high-altitude site with a big double-rotor helicopter and successfully mounted above the lidar laboratory.

References:

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H. Vogelmann, R. Sussmann, T. Trickl, T. Borsdorff, Intercomparison of atmospheric water vapor soundings from the differential absorption lidar (DIAL) and the solar FTIR system on Mt. Zugspitze, *Atmos. Meas. Technol. Discuss.* **3** (2010), 5411-5428