



Free troposphere water vapor mixing ratio based on Raman LIDAR and GPS, PFR and radiosounding observations

I. Balin (1), J. Morland (2), S. Nyeki (2), G. Larchèvêque (1), P. Quaglia (1), B. Calpini (4), V. Simeonov (7), and Hubert van den Bergh (7)

(1) EnviroScopY SA (start-up project), PSE - EPFL, CH-1015 Lausanne, Switzerland,

(2) University of Bern, Institute of Applied Physics, Sidlerstrasse 5, CH 3012 Bern Switzerland

(4) MeteoSwiss, Aerological Station, Les Invuardes, CH-1530 Payerne, Switzerland

(5) Swiss Federal Institute of Technology, LPAS, CH 1015 Lausanne, Switzerland

Contact information: ioan.balin@a3.epfl.ch , Phone: +41 21 625 89 62

This work reviews the implementation of a Raman lidar technique at the Jungfrauoch station for the measurement of the water vapor mixing ratio. The ratio of the rotational - vibrational Raman shifts at ~ 407 nm (H_2O) and at ~ 387 nm (N_2), is used to derive the upper troposphere water vapor mixing ratio as a direct measurement. The Raman lidar setup specifications are described together with the water vapor retrieval procedure (profile calculation, corrections, errors, and calibration). After application of the necessary corrections, the absolute values of this profile are obtained by assimilating the first point (~ 75 -300 m above the station) of the Raman profile with the *in situ* value determined from simultaneous meteorological measurements. The specific Raman lidar setup allows high resolution (75-150 m) profiling of the water vapor in the upper troposphere (< 8 -10 km) within 1-2 h integration time. The present detection limit is $\sim 10^{-2}$ g/kg (~ 15 ppmv). Regular measurements have been taken since August 2000, and selected typical profiles are presented. Different comparisons with co-located techniques such as PFR (precision filter radiometer) and GPS at Jungfrauoch or with the closest radio-soundings show realistic agreement. At present, the Raman lidar setup is the only technique that is able to profile at high resolution the nighttime water vapor above Jungfrauoch station.