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Compact and low resolution spectrometer for the inversion of water vapor total column amount

E. Sepulveda (1,2), M. Schneider (3), F. Hase (3), O.E. Garcia (2), M. Gisi (3), S. Dohe (3), T. Blumenstock (3), Y. Gonzalez (2,3), and J.C. Guerra (1)

(1) Universidad de La Laguna, Spain (esepulvedah@aemet.es), (2) Izaña Atmospheric Research Center, Agencia Estatal de Meteorología (AEMET), Spain, (3) Institute for Meteorology and Climate Research (IMK-ASF), Karlsruhe Institute of Technology, Germany

Water vapor (H_2O) is the main responsible atmospheric gas that regulates the weather and climate and contributes with about 90% of the Earth´s natural greenhouse effect. A continuous monitoring of H_2O around the globe is very important to assess, predict and mitigate future climate change. Currently, different instrumentations (gps, radar, micro-waves, high resolution spectrometer,...) and networks (NDACC, TCCON, AERONET,...) are dedicated for this purpose. In this work we present a compact, commercial and low resolution Fourier transform spectrometer for near infrared spectroscopy (ARCspectro ANIR; named throughout the document as μ-FTIR) and suitable to retrieve total column amount of H_2O.

The μ-FTIR has been adapted to measure the solar absorption spectra (3800 – 11100 cm^{-1}; 0.9 – 2.6 μm). The compact (14.6 x 10.5 x 7 cm) spectrometer achieves an OPDmax of 0.049 cm (i.e. $\sim$ 18 cm^{-1} resolution). The μ-FTIR based on the lamellar grating concept [1]. None beamsplitter is mounted in the light path and a low power laser is used to control the position of the scanning system. Please refer to http://www.ftir-spectrometer.com for further details. The μ-FTIR is coupled by means of an optical fiber to a precise solar tracker and through a USB-conector to a PC. The measurements are recorded by a commercial software also provided by the same spectrometer´s manufacturer.

A high spectral resolution spectrometer (Bruker IFS 125HR) and the μ-FTIR are operated side-by-side at Izaña Atmospheric Research Center [2] since June 2011. The IFS 125HR record the spectra in the same spectral region as the μ-FTIR but at a higher resolution (0.02 cm^{-1}). Recording of one spectrum requires few seconds for both spectrometers. In order to increase the signal to noise ratio several spectrum are co-added (6 for the high- and 25 for the low- resolution spectrometer). The measured spectra have been processed with the nonlinear least squares fitting algorithm PROFFIT [3].

The μ-FTIR spectrometer and the methodology applied to carry out this work will be explained. First results of the H_2O total column amount comparison between the low- and high- resolution spectrometer will be shown. This inter-comparison documents that the μ-FTIR is well suitable for measuring H_2O total column amount.

References:

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2 http://www.aemet.izana.org

3 F. Hase, J.W. Hannigan, M.T. Coffey, A. Goldman, M. Höpfner, N.B. Jones, C.P. Rinsland and S.W. Wood, “Intercomparison of retrieval codes used for the analysis of high-resolution, ground-based FTIR measurements”, *J. Quant. Spectrosc. Ra.*, 87, 25–52 (2004)