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Long-term series of tropospheric water vapour amounts and HDO/H_2O ratio profiles above Jungfraujoch.

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Water vapour is a crucial climate variable involved in many processes which widely determine the energy budget of our planet. In particular, water vapour is the dominant greenhouse gas in the Earth's atmosphere and its radiative forcing is maximum in the middle and upper troposphere. Because of the extremely high variability of water vapour concentration in time and space, it is challenging for the available relevant measurement techniques to provide a consistent data set useful for trend analyses and climate studies. Schneider et al. (2006a) showed that ground-based Fourier Transform Infrared (FTIR) spectroscopy, performed from mountain observatories, allows for the detection of H_2O variabilities up to the tropopause. Furthermore, the FTIR measurements allow the retrieval of HDO amounts and therefore the monitoring of HDO/H_2O ratio profiles whose variations act as markers for the source and history of the atmospheric water vapour.

In the framework of the MUSICA European project (Multi-platform remote Sensing of Isotopologues for investigating the Cycle of Atmospheric water, http://www.imk-asf.kit.edu/english/musica.php), a new approach has been developed and optimized by M. Schneider and F. Hase, using the PROFFIT algorithm, to consistently retrieve tropospheric water vapour profiles from high-resolution ground-based infrared solar spectra and so taking benefit from available long-term data sets of ground-based observations. The retrieval of the water isotopologues is performed on a logarithmic scale from 14 micro-windows located in the 2600-3100 cm^{-1} region. Other important features of this new retrieval strategy are: a speed dependant Voigt line shape model, a joint temperature profile retrieval and an interspecies constraint for the HDO/H_2O profiles.

In this contribution, we will combine the quality of the MUSICA strategy and of our observations, which are recorded on a regular basis with FTIR spectrometers, under clear-sky conditions, at the NDACC site (Network for the Detection of Atmospheric Composition Change, http://www.ndacc.org) of the Jungfraujoch International Scientific Station (Swiss Alps, 46.5°N, 8.0°E, 3580m asl). Information content analysis of the retrieved H_2O products allows us to produce a long-term trend from 1996 to 2011 for different tropospheric levels. We will compare the annual cycle of tropospheric HDO/H_2O ratio profiles with those already produced at other sites (Schneider et al., 2010). We will also focus on the diurnal variability of water vapour to determine a time limit in the inter-comparison of different water vapour measurement techniques.

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