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Improved global atmospheric HDO/H2O retrievals with SCIAMACHY

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We study the near-surface distribution of water vapor isotopologues using satellite retrievals of global HDO/H2O abundances. The relative abundance of the heavy water isotopologue HDO provides a deeper insight in the atmospheric hydrological cycle, because evaporation and condensation processes deplete heavy water in the gas phase. A better understanding of the hydrological cycle is crucial for climate predictions, climate reconstructions and water resources management. For our satellite retrievals of atmospheric HDO/H2O we use the 2.3 micron (SWIR) channel of the SCanning Imaging Absorption spectroMeter for Atmospheric CartograpHY (SCIAMACHY) instrument on-board ENVISAT. Since our method uses absorption spectroscopy of reflected sunlight, we are sensitive down to lowest parts of the atmosphere were most of the water vapor resides. First results of atmospheric HDO/H2O have been presented and look promising. The 2003-2005 dataset shows expected latitudinal and continental gradients, strong (re-)evaporation signals over the tropics and the Red Sea and highly depleted values over mountain ranges. Considering the great potential of the HDO/H2O dataset, we set out to further improve the accuracy of our retrievals, extend the dataset beyond 2005 and provide these data to the public. As a first step to improve the accuracy we have derived an improved spectral linelist for H2O and its isotopologues in the 2.3 micron window. We used the laboratory spectra of Jenouvrier et al. (2007), for which we improved the line intensities, pressure broadening coefficients and the pressure-induced line shifts for the 4174-4300 cm^{-1} spectral range. Other improvements deal with known instrumental effects, such as an ice layer on the SWIR detector and better filtering for bad detector pixels. In this presentation we give an overview of the status of the current improvements and their impact on the retrievals of the atmospheric HDO/H2O abundances. We also provide an outlook for the new TROPOMI instrument, scheduled for launch in 2014 on-board ESA's Sentinel 5 precursor satellite. With its smaller ground pixels, shorter revisit time and increased sensitivity, TROPOMI will greatly increase the amount of useful data for retrieving near-surface water vapor isotopologues in the atmosphere.