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Observations of HDO/H_2O ratio with IASI/MetOp

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Water vapor is a key gas for the climate system. Its radiative properties make it the strongest atmospheric greenhouse gas. But above all, humidity largely controls dynamic processes which regulate the global circulation of the atmosphere and therefore the climate. Tropospheric water is also associated with two major climate feedbacks, namely cloud and water vapour feedbacks. However, there is still an insufficient quantitative understanding of the global hydrological cycle to ensure reliable climate predictions. Measurements of the isotopologues ratios of water vapour (δD) in the atmosphere give information on exchange processes, which are helpful for constraining the atmospheric water budget and for identifying and quantifying the associated processes of the hydrological cycle. In this perspective the demonstrated capabilities of the Infrared Atmospheric Sounding Interferometer (IASI on MetOp) to measure water vapour isotopologues at any place twice a day, with relatively high spatial resolution and in a unique long term perspective (total period of 15 years) are of great interest for climate research.

Due to the high spatial and temporal variability of water (latitudinal and vertical), retrieving isotopologues ratios at the required accuracy is a challenging task. In order to get meaningful results the retrieval needs to be well constrained. Using the optimal estimation method, this constraint is here applied using an a priori probability density function containing correlation information between HDO and H_2O. We present in this work retrievals of δD from IASI radiance measurements. We show that these are mainly sensitive to δD in the troposphere between 3 and 6 km. We discuss our choice of a priori information as well as other retrieval parameters. Spatial and temporal distributions of δD in selected regions are used to evaluate and to exploit our retrievals. In particular we present times series at both a subsidence site (Izana) and a convective site (Darwin) and monthly variations of δD latitudinal gradient. Comparisons of our results with isotopologue-enabled Global Circulation Model (LMDz) will also be presented.