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Retrieval of Stable Water Vapour Isotopologues from the TROPOMI Instrument

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Atmospheric moisture is a crucial factor for the redistribution of heat in the atmosphere, with a strong coupling between atmospheric circulation and moisture pathways responsible most climate feedback mechanisms. Conventional satellite and in situ measurements provide information on water vapour content and vertical distribution; however, observations of water isotopologues make a unique contribution to a better understanding of this coupling.

In recent years, observations of water vapour isotopologue from satellites have become available from nadir thermal infrared measurements (TES, AIRS, IASI) which are sensitive to the free troposphere and from shortwave-infrared (SWIR) sensors (GOSAT, SCIAMACHY) that provide column-averaged concentrations including sensitivity to the boundary layer. The TROPOMI instrument on-board Sentinel 5P (S5p) measures SWIR radiance spectra that allow retrieval of water isotopologue columns but with much improved spatial and temporal coverage compared to other SWIR sensors promising a step-change for scientific and operational applications.

Here we present the retrieval algorithm development for stable water isotopologues from TROPOMI as part of the ESA S5p Innovation programme. We also discuss the validation of these types of satellite products with fiducial in situ measurements, and challenges compared with other satellite measurements. Finally, we outline the roadmap for assessing the impact of TROPOMI data against state-of-the-art isotope enabled models.