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Total Column Water Vapour Retrieval from S-5P/TROPOMI in the Visible Blue Spectral Range

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Atmospheric water plays a key role for the Earth's energy budget and temperature distribution via radiative effects (clouds and vapour) and latent heat transport and the distribution and transport of water vapour is closely linked to atmospheric dynamics on all spatio-temporal scales. In this context, global monitoring of the water vapour distribution is essential for numerical weather prediction, climate modeling and the understanding of climate feedbacks.

In the visible spectral range, total column water vapour (TCWV) was first retrieved using Differential Optical Absorption Spectroscopy (DOAS) in the red spectral range (e.g. 620-670nm) as implemented in the GOME Data Processor GDP taking advantage of the relatively strong water vapour absorption in that spectral range. However, this method has some limitations: several corrections e.g. due to non-linear effects (for strong water vapour absorptions) have to be applied during post-processing and the low ocean surface albedo leads to low sensitivity for near-surface layers. In addition, some of the new satellite sensors do not cover the red spectral range, e.g. TROPOMI on board ESA's Sentinel-5 Precursor.

Here, we present results applying a new approach using the spectral absorption structures of H_2O in the blue spectral range (430-450nm). It has the advantage that nonlinear effects are much weaker and may be neglected. Furthermore, the sensitivity for near-surface layers over ocean is improved and a smoother spatial distribution is achieved due to the advantageous surface albedo compared to the red spectral range.

We use this new algorithm for retrieving TCWV from TROPOMI as well as OMI and GOME-2 spectra and compare the results with a variety of different reference data sets.