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Glyoxal tropospheric column retrievals from TROPOMI, multi-satellite intercomparison and ground-based validation

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Abstract

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. Thus, the distribution and transport of water vapour are closely linked to atmospheric dynamics on different spatiotemporal scales. In this context, global monitoring of the water vapour distribution is essential for numerical weather prediction, climate modelling, and a better understanding of climate feedbacks.

Total column water vapour (TCWV), or integrated water vapour, can be retrieved from satellite spectra in the visible "blue" spectral range (430-450nm) using Differential Optical Absorption Spectroscopy (DOAS). The UV-vis spectral range offers several advantages for monitoring the global water vapour distribution: for instance, it allows for accurate, straightforward retrievals over ocean and land even under partly-cloudy conditions.

To investigate changes in the TCWV distribution from space, the Ozone Monitoring Instrument (OMI) on board NASA's Aura satellite is particularly promising as it provides long-term measurements (late 2004-ongoing) with daily global coverage.

In this talk, we present a global analysis of trends of total column water vapour retrieved from multiple years of OMI observations (2005-2020) and put our results in context to trends of other climate data records of TCWV and surface air temperature. Moreover, we investigate if the changes in TCWV follow a Clausius-Clapeyron response (i.e. if the water vapour concentration changes by approximately 7% per Kelvin) and demonstrate that the OMI TCWV data set can also give insights into changes of the global atmospheric circulation.