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A new water vapor retrieval algorithm for satellite observations in the blue spectral range

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Water vapor is involved in many important chemical reactions in the atmosphere and contributes most to the natural greenhouse effect. Its atmospheric abundance is highly variable. Thus observations of the spatio-temporal variation on a global scale are of great importance.
Water vapor observations are possible in different spectral ranges, e.g. in the microwave, thermal IR or near IR and visible spectral range. Satellite measurements in the red spectral range have the advantage that they are sensitive for the whole atmospheric column and that they provide global coverage including land and ocean.
In this study we present a new algorithm for the retrieval of the global water vapor distribution from satellite observations in the blue spectral range. Although the water vapor absorption in this spectral region is rather weak (about two orders of magnitude smaller than in the red spectral range), such retrievals have their advantages: First, because of the weak absorption, no corrections for spectral saturation effects (like in the red spectral region) have to be applied. Second, the surface albedo in the blue spectral region is very similar for land and ocean. Thus such observations have the same sensitivity over both land and ocean. Third, because of the stronger Rayleigh scattering the effects of clouds is smaller than at longer wavelengths. Fourth, the water vapor distribution can be retrieved also from satellite instruments, which do not cover the red spectral range (like e.g. OMI or the future Sentinel missions).
We show results of the spectral retrieval in the blue spectral range for spectra measured by GOME-2 and OMI. Since GOME-2 also covers the red spectral region, a direct comparison with the results of the standard water vapor retrieval is possible. We also show corresponding results from radiative transfer simulations. Based on observations and model simulations we characterise the accuracy and the detection limit of the new H_2O analysis. We show that it is possible to retrieve the global water vapor distribution in the blue spectral range with good accuracy (except parts of the polar regions and high mountains).