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Ground based MAX-DOAS measurements of the total water vapor column and comparison with model results and satellite observations

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Multi-AXis- (MAX-) DOAS instruments observe scattered sun light under different, mostly slant elevation angles. From such measurements the tropospheric profile or column density of many atmospheric trace gases like e.g. NO_2 or HCHO can be derived. Here we analyse the total atmospheric column density of water vapor from MAX-DOAS measurements made at Mainz, Germany in 2011. We performed measurements in the red spectral range, where water vapor shows some very characteristic and strong absorption features. The determination of the atmospheric water vapor column density (the so called vertical column density, VCD) is performed in three steps: first the slant column density of H_2O is analysed from the measured spectra of scattered sun light. Second, a correction for the saturation of the H_2O absorption is performed, which arises from the fact that the narrow H_2O absorption lines are not resolved by our instrument. Third, the geometric approximation is applied to deterine the H_2O VCD from the retrieved H_2O slant column densities. In contrast to observations at shorter wavelengths, the application of the geometric approximation should lead to smaller errors because of the much weaker Rayleigh-scattering by air moilecules in the red spectral range. Also the effects of clouds are expected to be relatively mall, at least for mid and high level clouds. Information on the cloud properties can be derived from the simultaneously measured absorption of the oxygen molecule (O_2) and oxygen dimer (O4).
We compare our MAX-DOAS H_2O VCD to indepenent data sets like satellite observations and model simulations.