



Improved compensation of liquid water spectral effects in the DOAS analysis (410–500 nm)

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It is well known that spectral effects of liquid water are present in DOAS measurements above the ocean. Usually, the effects of surface reflectance are successfully compensated by a broadband polynomial. In addition, the absorption of liquid water and Vibrational Raman Scattering (VRS) in the water body can be considered in the DOAS fit by including the respective (literature) cross-sections.

Here, ship-based MAX-DOAS measurements collected during the TransBrom campaign across the Western Pacific in October 2009 are presented. For these observations, the telescope of the instrument was pointing directly into very clear natural sea-water. These measurements were performed in a way minimizing atmospheric contributions to the resulting optical depth while at the same time maximizing the liquid water influence. Average light paths of up to 50 m under water were achieved.

Systematic structures were found to remain in DOAS fit residuals in the visible wavelength range even if liquid water spectral effects are included in the fit. It can therefore be concluded that currently available cross-sections compensate liquid water effects only insufficiently in DOAS applications. Thus, empirical correction spectra for uncertainties of currently available liquid water absorption and VRS cross-sections were determined from the MAX-DOAS measurements. The influence of the retrieved correction spectra on fit quality and NO₂ slant columns is estimated in MAX-DOAS measurements, both towards the water surface and at small elevation angles above the horizon.