

Interactive comment on “Spectral studies of ocean water using DOAS” by M. Vountas et al.

M. Vountas et al.

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We would like to thank the referee2 for his inputs.

1)Referee comment

Finally some minor technical remarks from a readers point of view who is not familiar with the details of the DOAS approach. The definition of the measured optical depth $\tau = \text{Log}[I/I_0]$: May be it is worth to discuss that here are also included surface reflectance terms (albedos), which are for water in the order of 5this is accounted for in the polynomial term.

- To clarify we add after “ τ is a function of the wavelength λ and the solar zenith angle θ (dependence omitted in the following).” (p464/2): “The optical depth contains all radiative contributions from atmosphere and water including multiple scattering and surface reflectance effects.”

2)Referee comment

Therefore slightly more description would be preferable. It is not clearly stated at this point regarding which internal parameters the functional is minimized, and what are the primary model input parameters. Also the kind of the norm is not indicated. Probably it is an integral over one of the below mentioned wavelength regions.

- Regarding the minimization and internal parameters: Instead of “Here the input parameters to DOAS are: “ we will write: “The error vector as given by Eq. (1) is minimized with respect to the following primary input parameters:“. After the listing of the input parameters we will add: “No internal parameters are necessary.“
- As DOAS uses a least-squares minimization the norm employed is L2 (Euclidean length). For clarity we have added in brackets: “The fitting is formalized as a least-squares minimization (employing an L2-norm to the error vector):“

3)Referee comment

(Why not to include both at one time?).

- The reason why we haven't retrieved both wavelength regions simultaneously is based on SCIAMACHY's channel design: the UV channel (channel 2) used for the VRS retrieval is lying between 309 - 405 nm. The wavelength range for fitting phytoplankton absorption spectra is located in channel 3 (394-620). In the overlap region between both channels is a spectral discontinuity which is significantly degrading the fit quality and therefore prohibiting the use of concatenated radiances/optical depths.

4)Referee comment

In the summations there are twice used the parameter S with virtual summation indices i - trace gases j - pseudo absorber (later mentioned Ring spectra?) The trace gas factor

Sk is probably a misspelling and should be Si, but must be clearly distinguished from the Sj-absorber coefficients, since the summation indices are so called mute ones.

- As the referee suspected, this is a typo and should be Si.
- The referee is right: there is a risk that indices 'i' and 'j' could easily be mixed up. In order to distinguish we propose to use the index 'k' for the trace gases and keep 'j' for the pseudo absorbers (Ring spectra etc.). The index 'i' is then used for the polynomial.

5)Referee comment

The remark about the problem of spectral correlation of reference spectra (page 464 line 21 ff) is not well understandable. It is clear that rising correlations will increase inversion problems, since the equation tends to an ill posed problem. But at least the polynomials in (1) are highly correlated, especially for the below mentioned relatively narrow spectral ranges. I mention all this because this part of the article is very important for the further understanding of the method.

- We wanted to emphasize that DOAS behaves like any other retrieval: increasing correlations increase the ill-posedness of the problem.
- From internal discussions and after reading the comments of referee2 we realized that especially the correlation of the target quantity with the polynomial (there is **only one** polynomial fitted per ground pixel/optical depth) should be discussed. Accordingly we will add a paragraph, see our answer to Referee1: “referee comment 2)“

Interactive comment on Ocean Sci. Discuss., 4, 459, 2007.