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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Inelastic scattering in ocean water and its impact on trace gas retrievals from satellite data" *by* M. Vountas et al.

M. Vountas et al.

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We would like to thank the referee#1 for his inputs.

1. Reply to 'General Comments'

1.1. Comment 1.

Taking the shifts only from shorter to longer wavelengths (Stokes-Scattering) and not vice versa goes back to the physics of Raman scattering.

Anti-Stokes-Scattering (scattering from longer to shorter wavelengths, which is an increase of photon-energy after scattering occured) is only possible if the molecule is already in an excited state - and some always are at any temperature above absolute zero.

In this case the molecule may emit a photon of shorter wavelength than the incident photon, thereby returning to a lower rotational or vibrational state. However, at temperatures of liquid water, Raman scattering from longer to shorter wavelengths is insignificant because too few molecules are in an excited state!

See for example [Mobley, "Light and Water", (1994)]

=> We have added a new subsection 3.4 "Notes on Implementation". Here we added an appropriate note.

1.2. Comment 2.

True. We have indeed integrated the quantities over the Raman band, but did not mention this issue for brevity.

=> We have added an appropriate note in subsection 3.4 "Notes on Implementation".

1.3. Comment 3.

We tried to show limits of the impact.

=> Therefore we have set the values of Chlorophyll-a concentration to extreme values. However, for the sake of generalization of the results we agree with referee#2 and have therefore repeated computations for other values of C. We have also completed the computions for all combinations of C and SZA (see below). The radiative transfer model has been set up in a slightly different way compared to the original computions (the old setup has been lost in a computer crash). This led to slight difference in the

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SC values originally computed and the corresponding new ones. Of course, the trend remained the same.

Taking into account the comments of referee#1 and referee#2 on section 7 we decided to re-structure the whole section:

1. We have focussed on BrO (and only briefly discussed results for HCHO and other gases)
2. Instead of dealing with 6 cases only the first (true SC) and the second (neglecting VRS) remained.
3. Instead of dealing only with C=0.01, 0.001 mg/m^3 we have added scenarios with 0.1 mg/m^3. All computations have been repeated for 30, 50 and 70 deg SZA.
4. We have set up a new (tabular) table (as part of the text) and removed the eps-file originally containing the table.
5. As the theoretical results now agree better with the results for BrO retrieval from GOME (due to lower values of C) we have noted it in section 8 "BrO retrieval from GOME" and in the "Conclusions". Also a slight change in the "Abstract" has been necessary.

Overall, we find a consistent picture: If we increase C to 0.1 we see less impact on BrO for all SZA considered. The whole results in Tab. 1 show a consistent picture of what we have expected from our model.

We hope that this important section improved by focussing on VRS impact only.

2. Specific Comments

2.1. Comment 1.

We agree that highlighting of this IOP-issue could be helpful. However, in several references used (for example both references from Vassilkov et al.) this issue is extensively discussed.

=> For clarity, we now briefly discuss this issue in section "Inherent optical properties of sea water" (first paragraph).

2.2. Comment 2.

We agree:

=> For the sake of brevity we have removed this sentence and replaced it with a reference to the results of Vassilkov 2002. ("In a recent paper ..."). The preceeding paragraph was moved to the next section (2).

2.3. Comment 3.

Originally we did not want to focus on this rather qualitative comparison.

=> However, we agree that neglecting this information can lead to confusion: The compensation spectrum was based on water reflectances computed for a extremely low chlorophyll concentration C of 0.0001 mg/m^3 (in order to avoid numerical complications with zero C.). All other spectral inputs were defined in 3.1/3.2. Finally, the compensation spectrum was defined as in Eq. 2. In additional note has been added:

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r_r and r_w were computed according to the definitions in Eqs. (...) and (...) for an extremely low chlorophyll concentration (0.0001 [mg/m^3]).

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 2931, 2003.

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