INITIAL RESULTS FROM THE COUPLED AND EXTENDED SCIATRAN VERSION INCLUDING RADIATION PROCESSES WITHIN THE WATER

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To date, the software package SCIATRAN [*V. V. Rozanov et al.*, 2002; *A. Rozanov et al.*, 2005, 2008] has been used for modelling radiative processes in the atmosphere for the retrieval of trace gases from satellite data from the satellite sensor SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric CHartographY onboard the satellite ENVISAT). This SCIATRAN version only accounted for radiative transfer within the atmosphere and reflection of light at the earth surface. However, radiation also passes the air-water interface, proceeds within the water and is modified by the water itself and the water constituents. Therefore, SCIATRAN has been extended by oceanic radiative transfer and coupling it to the atmospheric radiative transfer model under the terms of established models for radiative transfer underwater [*Kopelevich*, 1983; *Morel et al.*, 1974, 2001; *Shifrin*, 1988; *Buitevald et al.*, 1994; *Cox and Munk*, 1954a, 1954b; *Breon and Henriot*, 2006; *Mobley*, 1994] and extending the data bases to include the specific properties of the water constituents [*Pope and Fry*, 1997; *Haltrin*, 2006; *Prieur and Sathyendranath*, 1981].

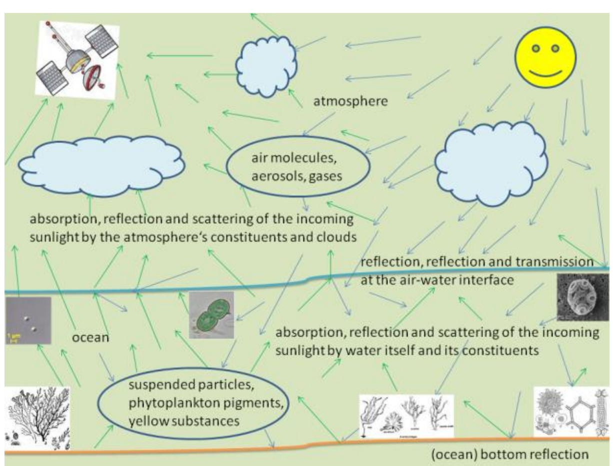

Figure 1: Scheme of atmospheric and oceanic coupled radiative transfer

So far, the coupling for the scalar radiative transfer is included. To analyse the quality of this new scalar coupled ocean-atmosphere radiative transfer version of SCIATRAN, model results of this and of the uncoupled SCIATRAN version are compared to observations, using satellite and in-situ measurements. In particular, we compared MERIS-TOA (top of the atmosphere) reflectances with SCIATRAN calculations. The data were chosen due to varying chlorophyll concentrations at different sites during different seasons. The main input parameters required to model the measured data properly, such as concentrations of water vapour, ozone, chlorophyll, aerosol optical thickness as well as observation and illumination geometry, are taken from the MERIS satellite and AERONET data base measurements and used in the same way for both versions. Each version takes the optical properties of organic and inorganic small (phytoplankton, bacteria, dust etc. < 1µm) and large (phytoplankton, zooplankton, sand etc. >/= 1µm) particles measured by in-situ observations into account. Furthermore, in the coupled version the single scattering albedo and the extinction coefficient can be set. Nevertheless, these two properties of water particles have a non-neglecting impact on the modelled result, but they are not often measured and not available from the MERIS satellite data at all. Therefore, common values based on theory and own tests are used.

Figure 2 shows first results of these comparisons for two sites in the Pacific Ocean.

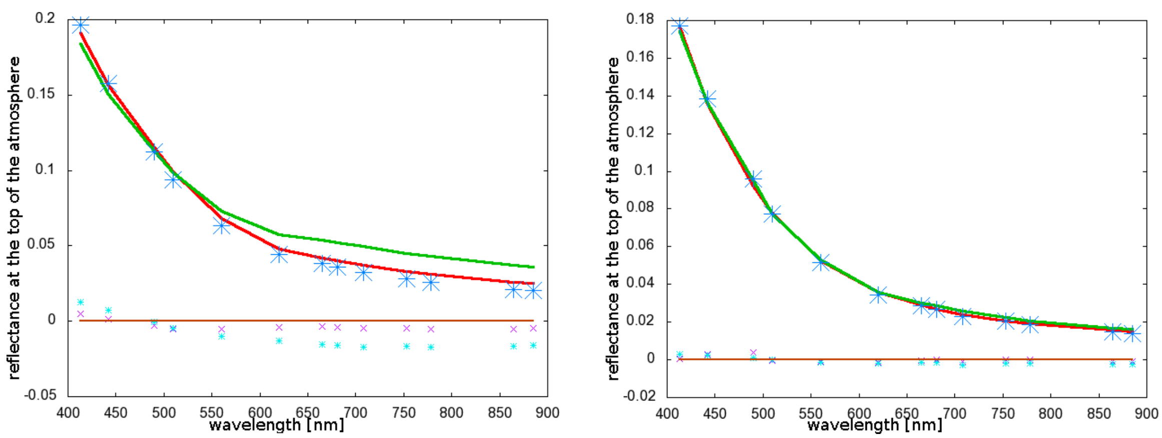

Figure 2:
Modelled (red line: coupled, green line: uncoupled SCIATRAN version) and measured (blue star: MERIS data) reflectances at the top of the atmosphere for (left panel) an oceanic region with chlorophyll concentration of 0.21806335 mg/m³, near the aerosol station Dunedin (New Zealand, 163.47° E and 42.59° S), and (right panel) an oceanic region with chlorophyll concentration of 0.091333464 mg/m³, near the aerosol station Midway Island (Atoll close to Hawaii, 177.35° W and 28.34° N), both on September 18, 2006. The purple cross shows the deviation of the coupled version versus measured reflectance, and the small cyan star the deviation of the uncoupled version versus measured reflectance in absolute values.

CONCLUSION

As the above pictures show, each version yields close agreement to the satellite measurement, but the reflectance modelled by the coupled version is closer to the measured one than those modelled by the uncoupled version. However, there are still differences which will be analysed and explained.

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