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Impacts of pure water absorption to radiometric measurements: a sensitivity study

Peng-Wang Zhai

JCET/Physics Department, UMBC

Motivation

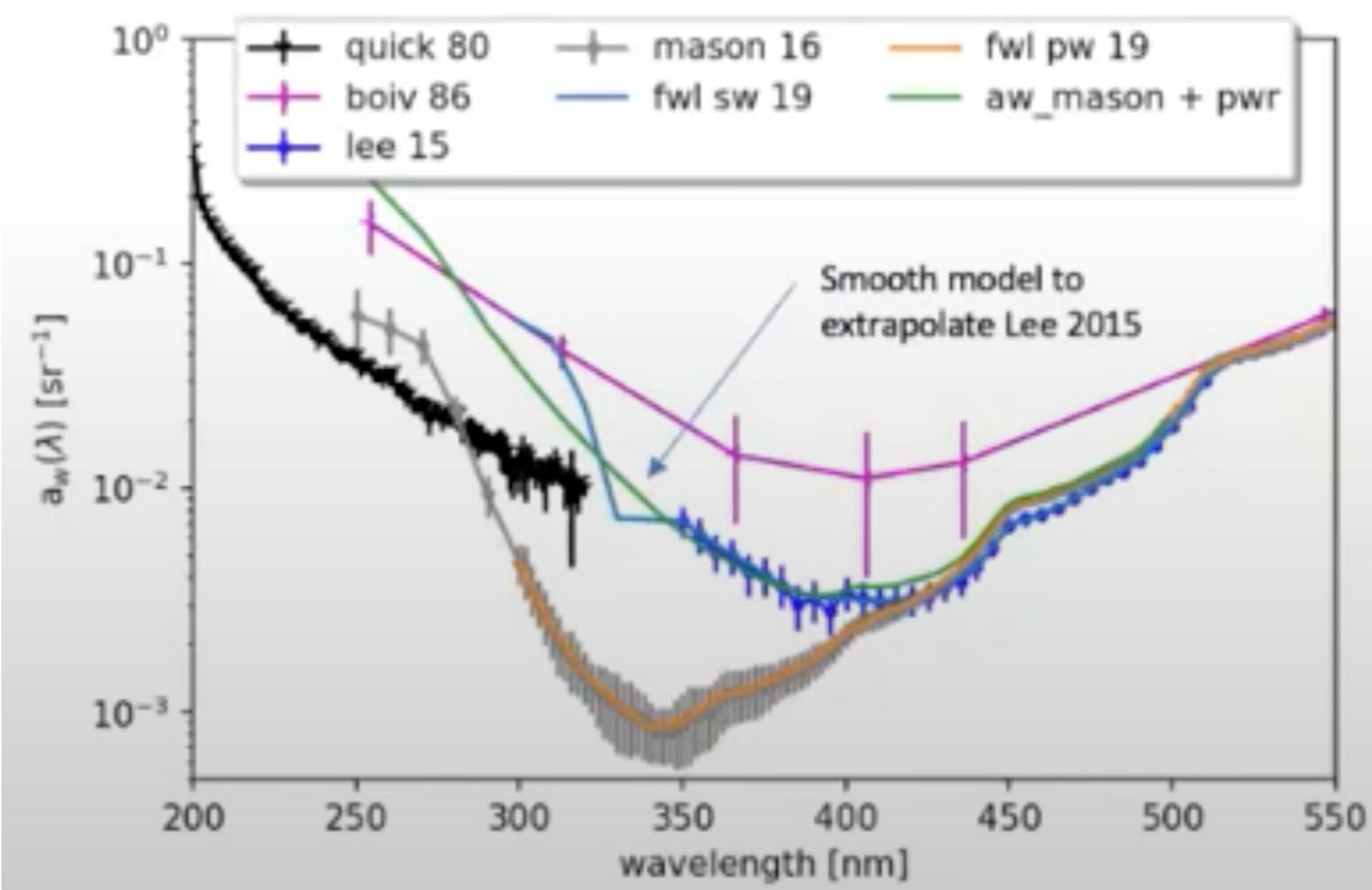
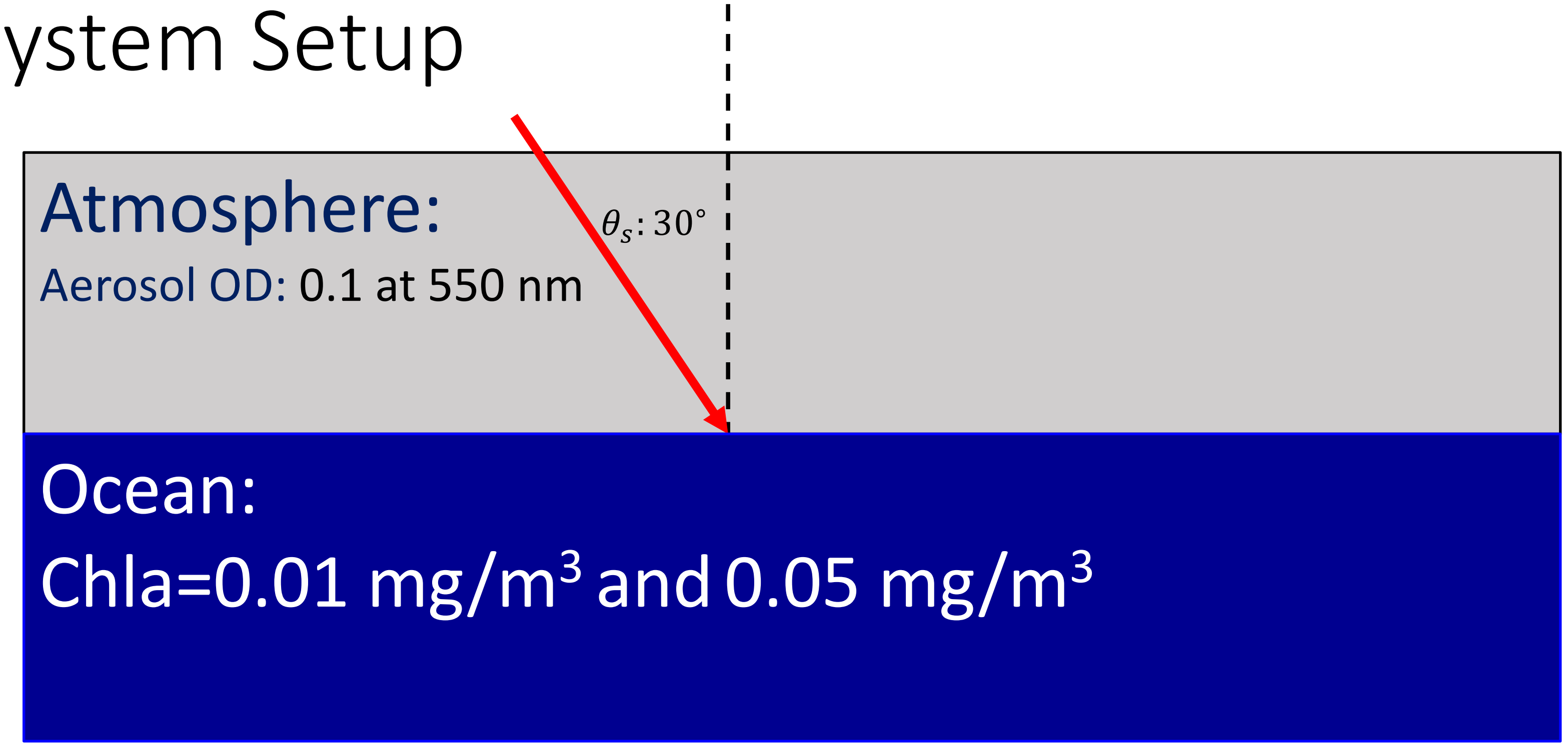
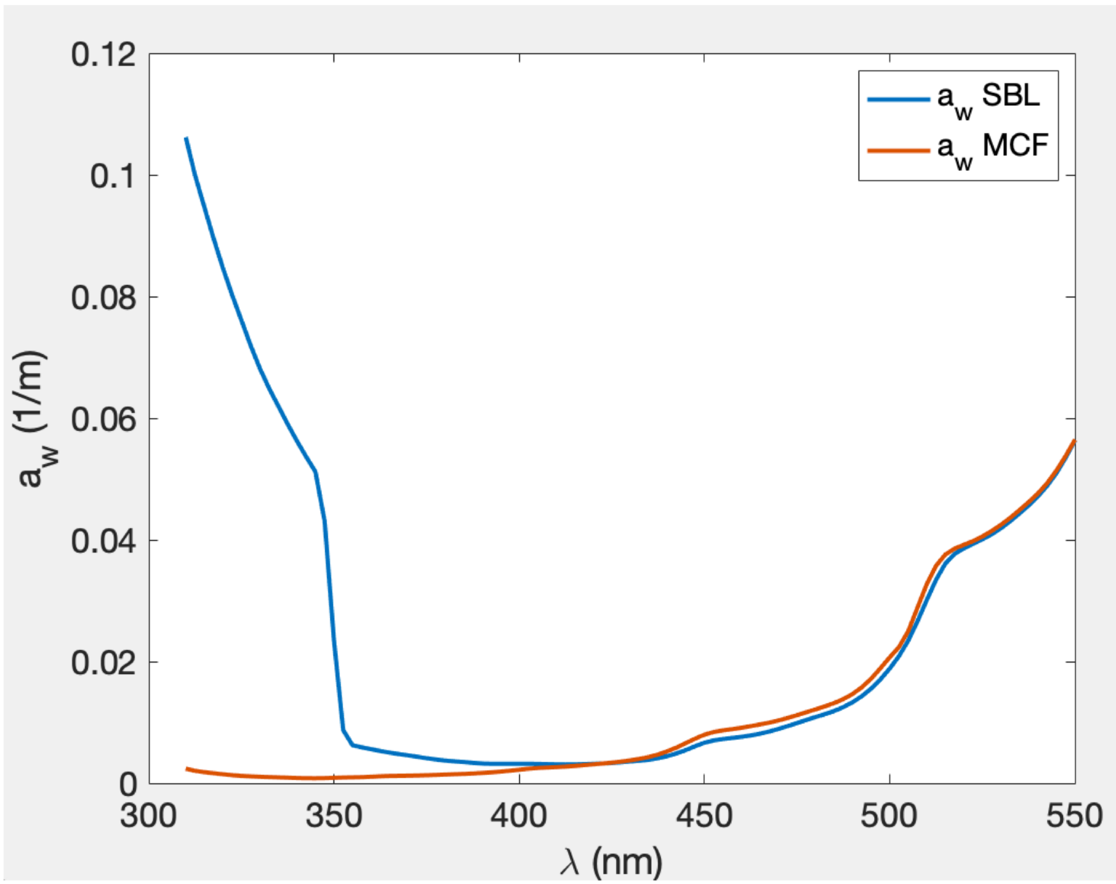


Image credit:
Lachlan McKinna

System Setup



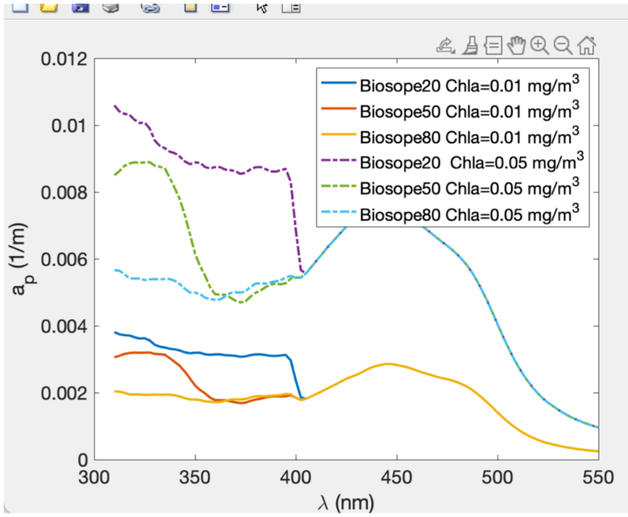
Water IOPs

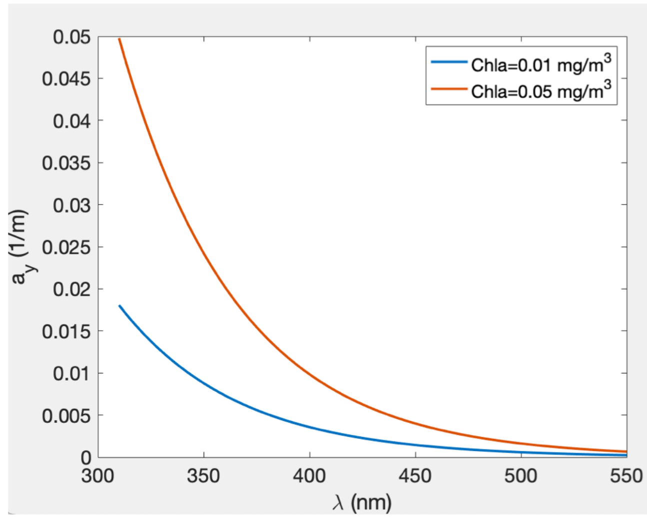


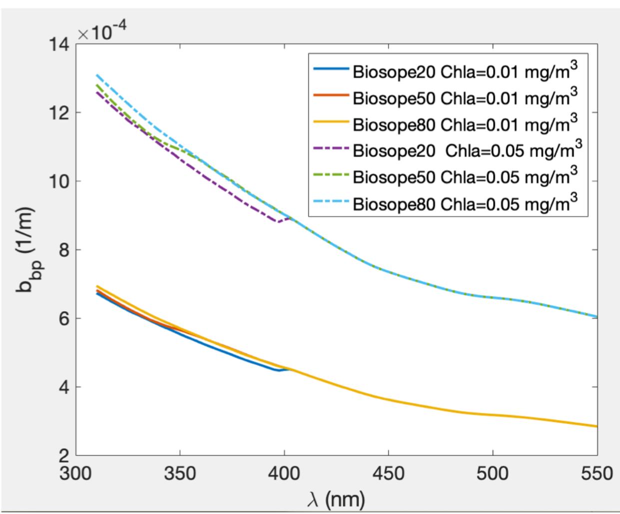
SBL: Smith-Baker-Lee
300-350 nm: Smith-Baker 1981
350-550 nm: Lee et al. 2015.

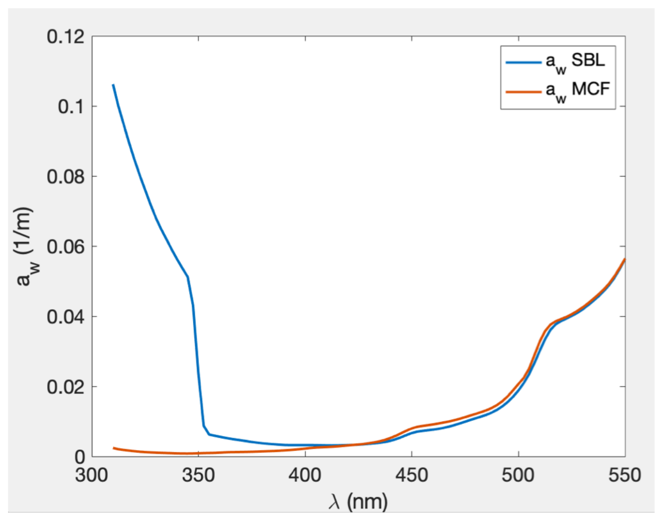
MCF: Mason-Cone-Fry 2016

Other water constituents





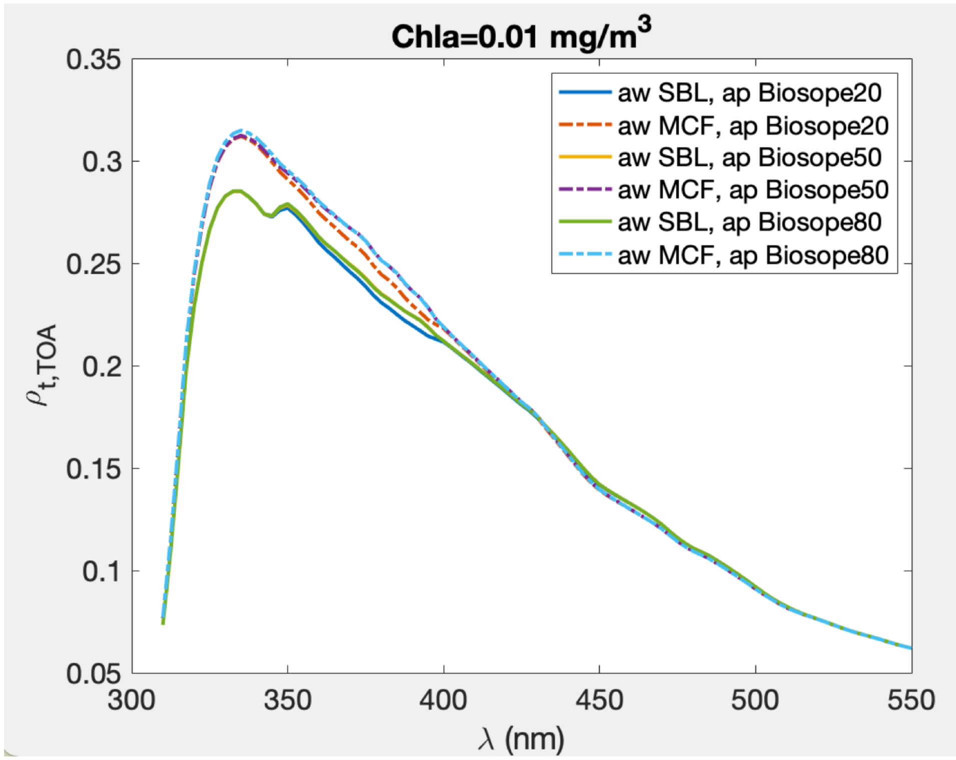


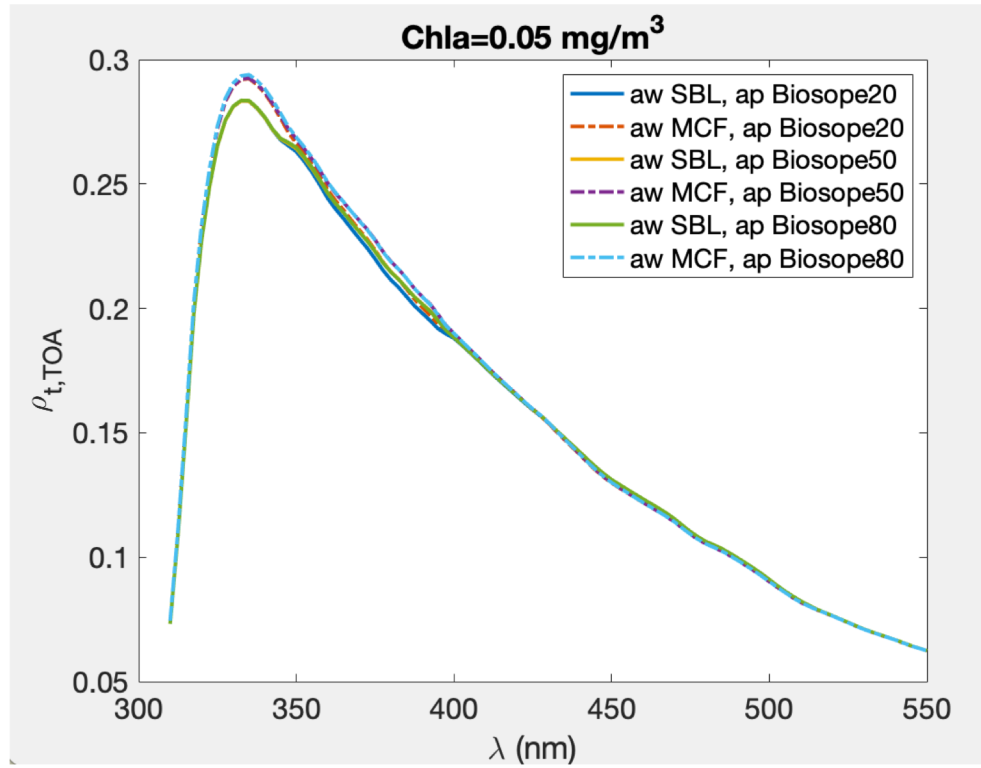


Tool: PACE simulator

- A monochromatic multiple scattering model based on successive order of scattering method
  - Atmosphere-ocean coupling;
  - Polarization;
  - Flexible atmospheric and ocean scattering properties;
  - Pseudo-spherical treatment of spherical shell.
- Atmospheric gas absorption:
  - H_2O, CO_2, O_2, CH_4: ARTS + HITRAN;
  - Ozone and NO_2: databases from Serdyuchenko et al. (2013); Bogumil et al. (2003).
- Flexible on wavelength ranges and relative spectral response functions.
- Inelastic scattering: Raman scattering and Fluorescence.

TOA Reflectance $\pi I / E_d$

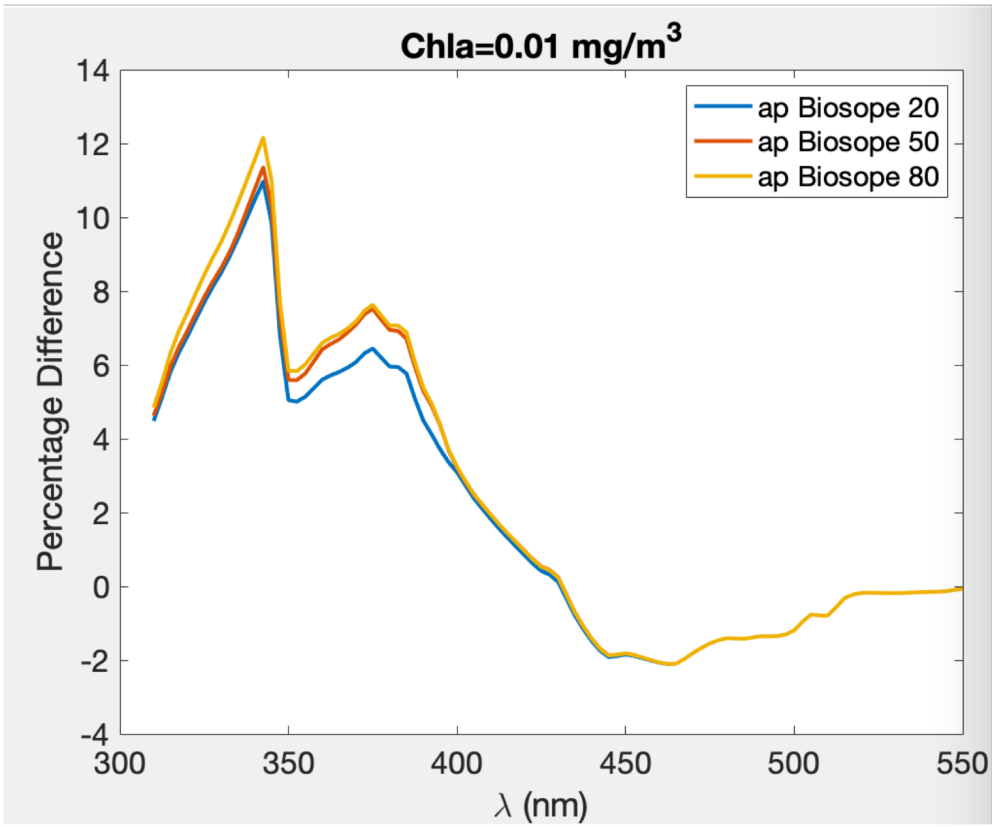


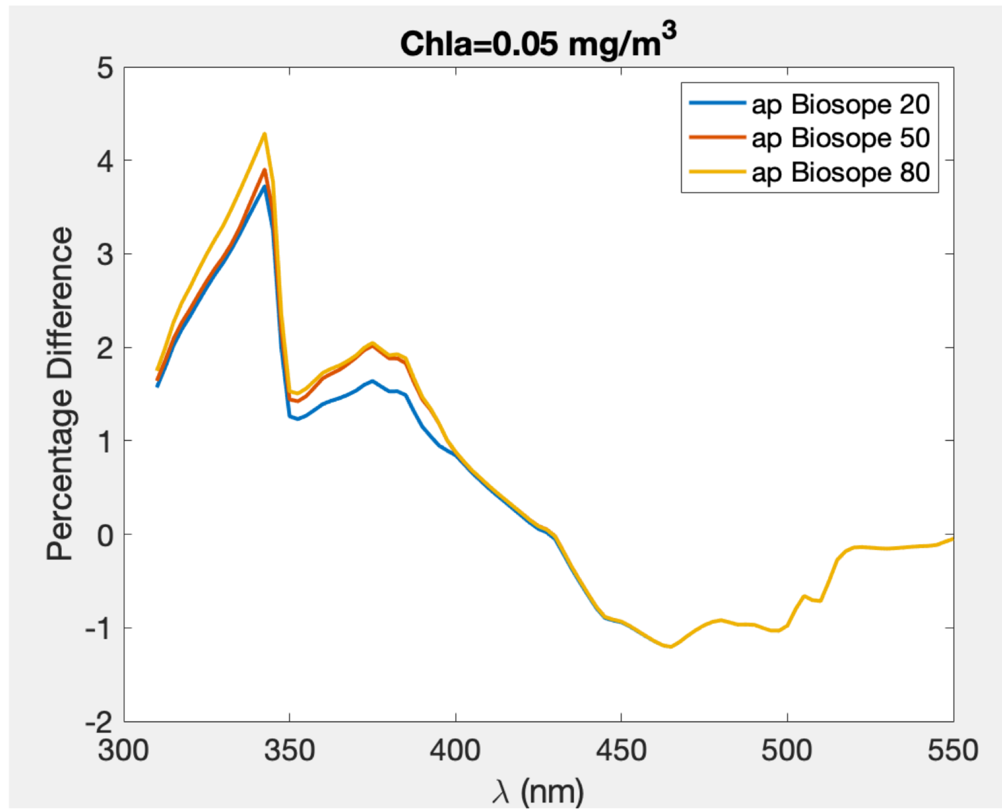


Solar zenith angle: 30 degree.
Atmosphere:
$\tau_{a,550\ nm}$=0.1
Gas absorption: H_2O, Ozone, CO2, CH4, O2, NO2.

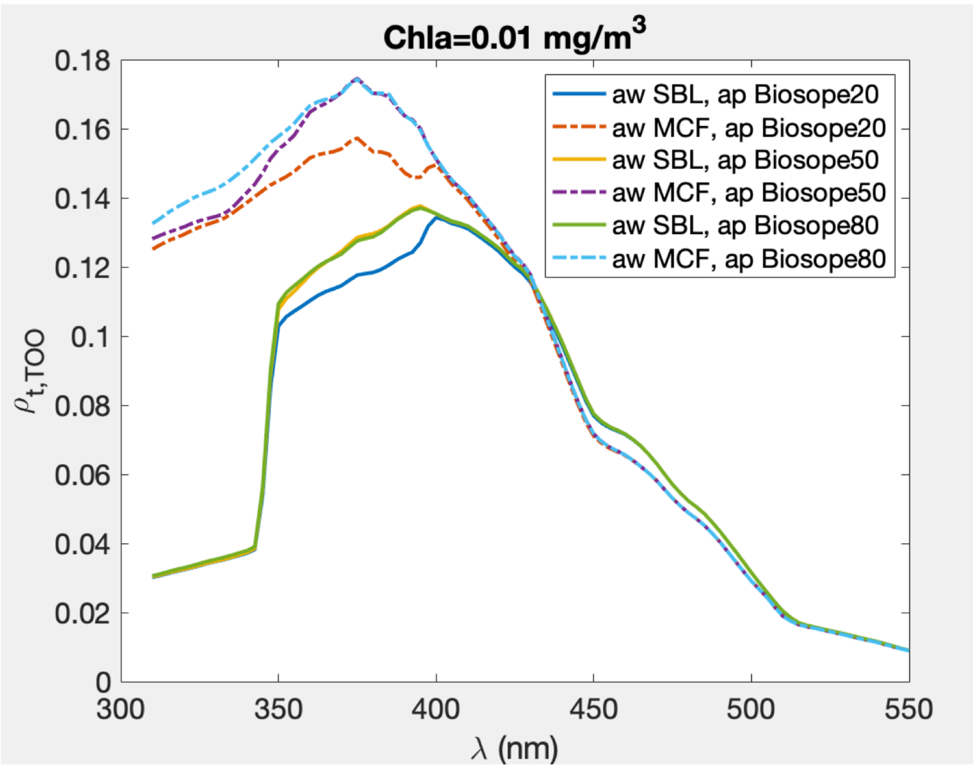
Ocean water model:
pure sea water,
phytoplankton covariant particle,
CDOM

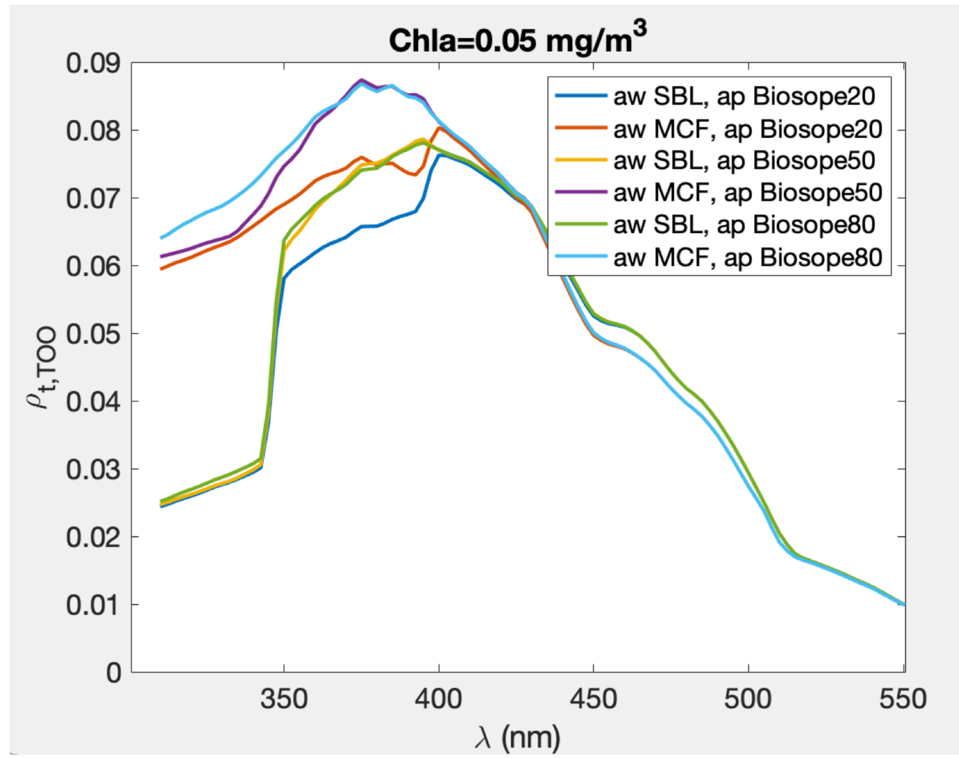
Relative Difference at TOA between SBL and MCF





TOO Reflectance $\pi I / E_d$





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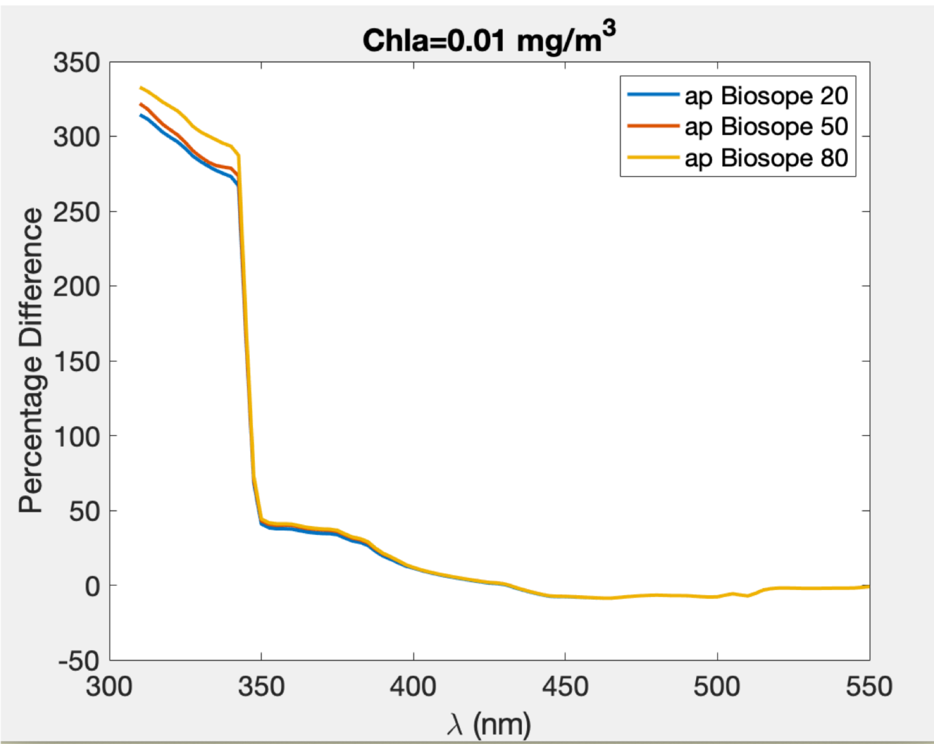

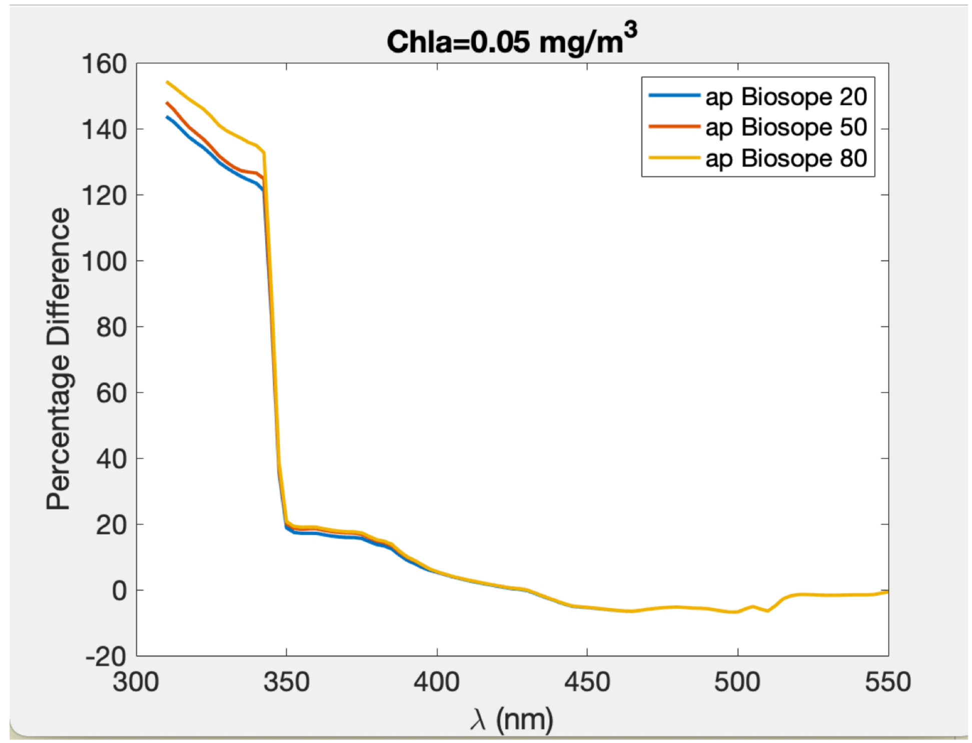

Summary

- A series of tests have been done to test the sensitivity of TOA and TOO sensors to the choice the water absorption coefficient spectra.
- The relative difference of sensor measurements for different water absorption coefficients depends on the choice of other constituents.
- At TOA, the relative difference is 6% near 350 nm for Chla=0.01 mg/m^3; This number is 2% for Chla=0.05 mg/m^3, the differences are due to Lee et al.(2015) and MCF (2016).
- At TOO, the relative difference is 40% near 350 nm for Chla=0.01 mg/m^3; This number is 20% for Chla=0.05 mg/m^3.
- For shorter wavelength, the difference is even larger as the difference between the Smith-Baker (1981) and MCF (2016) is larger.
- Alex Lyapustin's Quest: Can current spaceborne UV sensors be used to help quantify water absorption coefficients?