PACESAT UV Subgroup

Organizer: Lorraine Remer

Participants: Alexander Vasilikov, Amir Ibrahim, Andrew Sayer, Antonio Mannino, Brian Cairns, Bryan Franz, Christina Hsu, David Haffner, Dariusz Stramski, Emmanuel Boss, Glen Jaross, Greg Schuster, J. Vanderlei Martins, Jacek Chowdhary, Jeremy Werdell, James Allen, Joanna Joiner, Jungbin Mok, Lachlan McKinna, Nick Krotkov, Omar Torres, P.K. Bhartia, Penwang Zhai, Robert Frouin, Robert Levy, Ryan Vandermeulen, Zachary Fasnacht

PACE will be one of the first missions to measure
from the UV to the SWIR at 1 km resolution, and the first from NASA.

Ocean (Frouin et al., 2019):

- to separate absorption by CDOM and phytoplankton pigments,
- to distinguish hydrosol types (e.g., sediments from organic particles) in optically complex waters,
- to allow the discrimination of functional, taxonomic, and harmful algal groups.

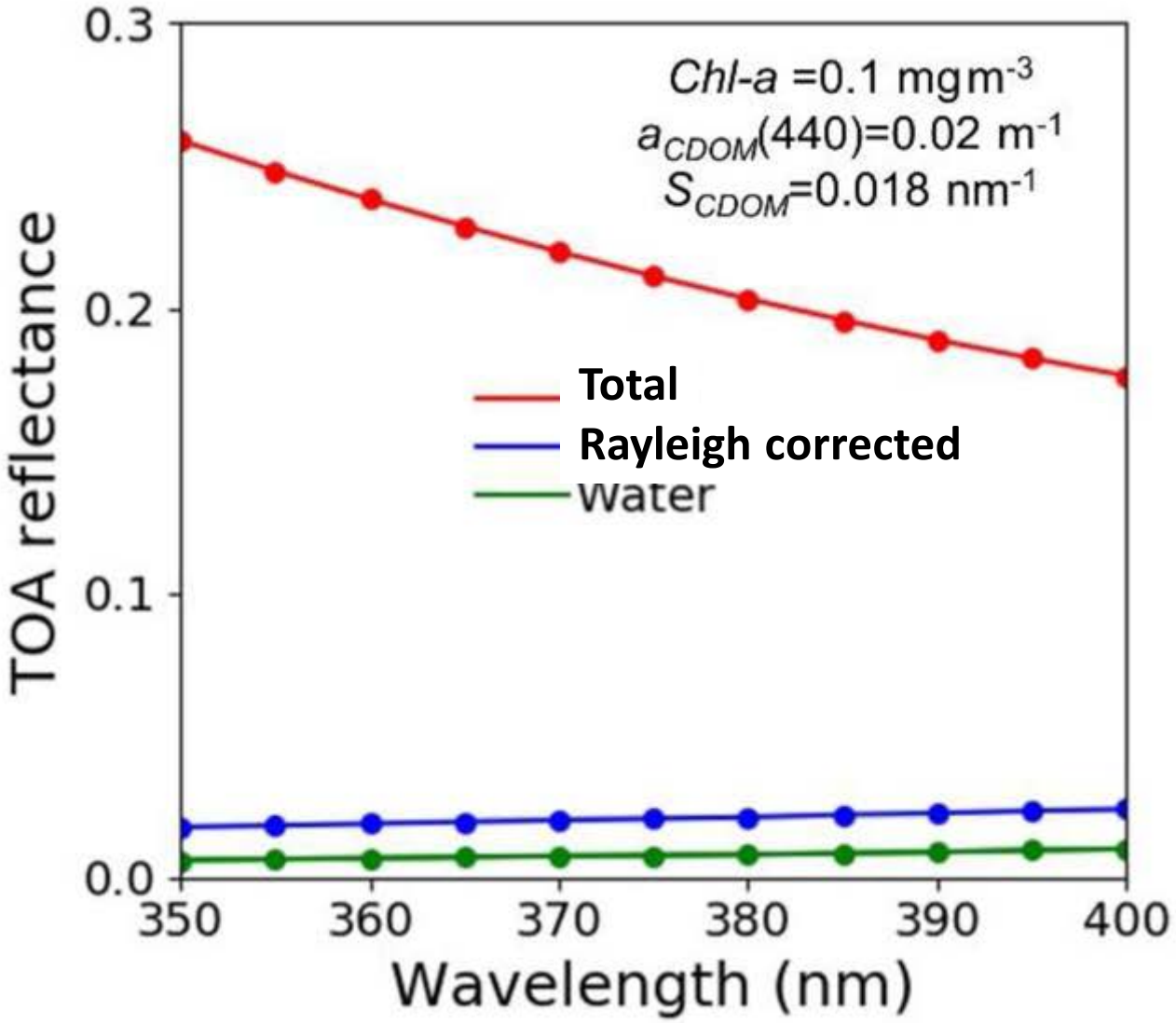
Atmosphere (Remer et al., 2019)

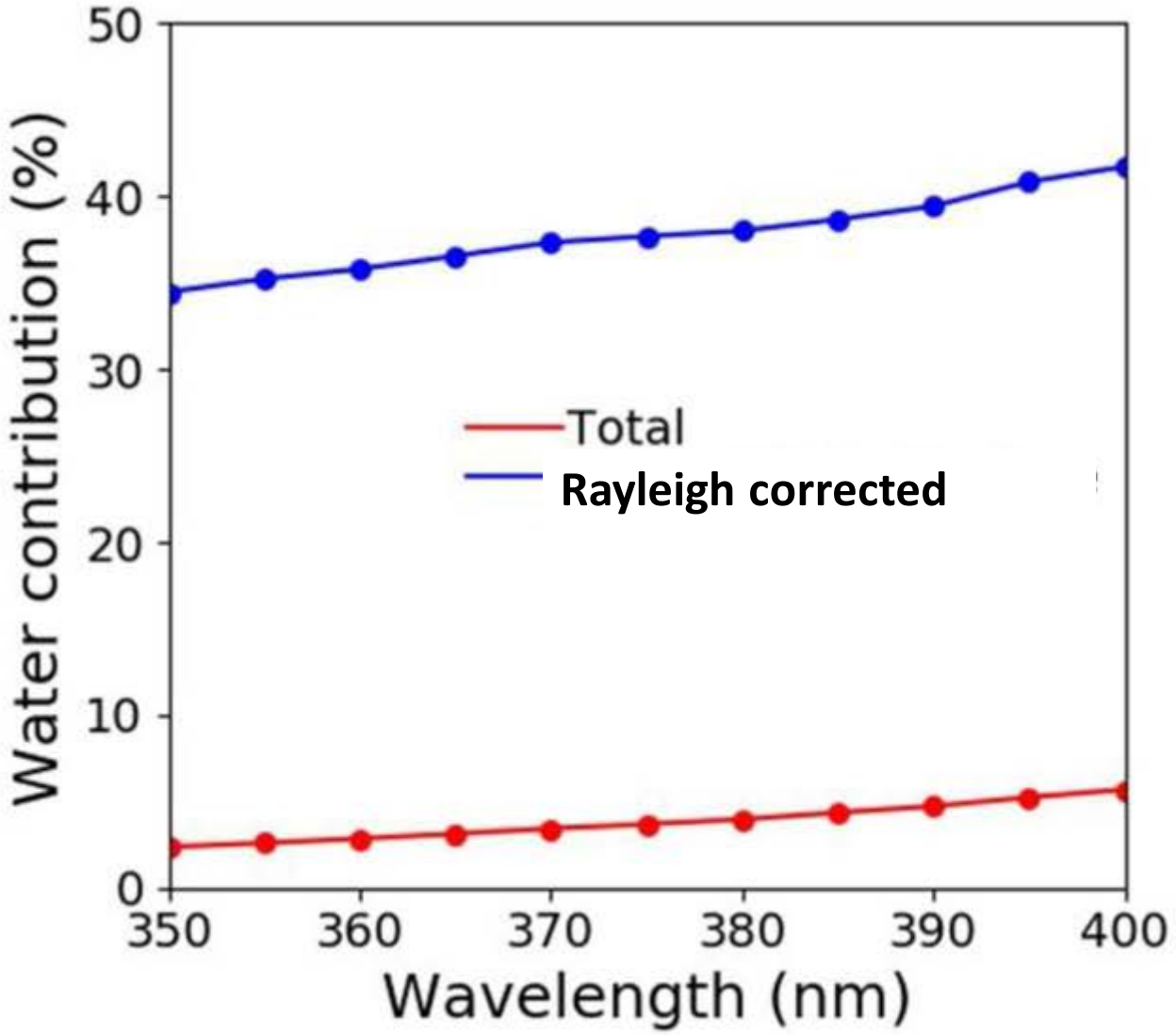
- to quantify aerosol absorption and a measure of particle size, along with AOD

Yet, OCI's hyperspectral capabilities get much more attention
than its pioneering experiment into the UV

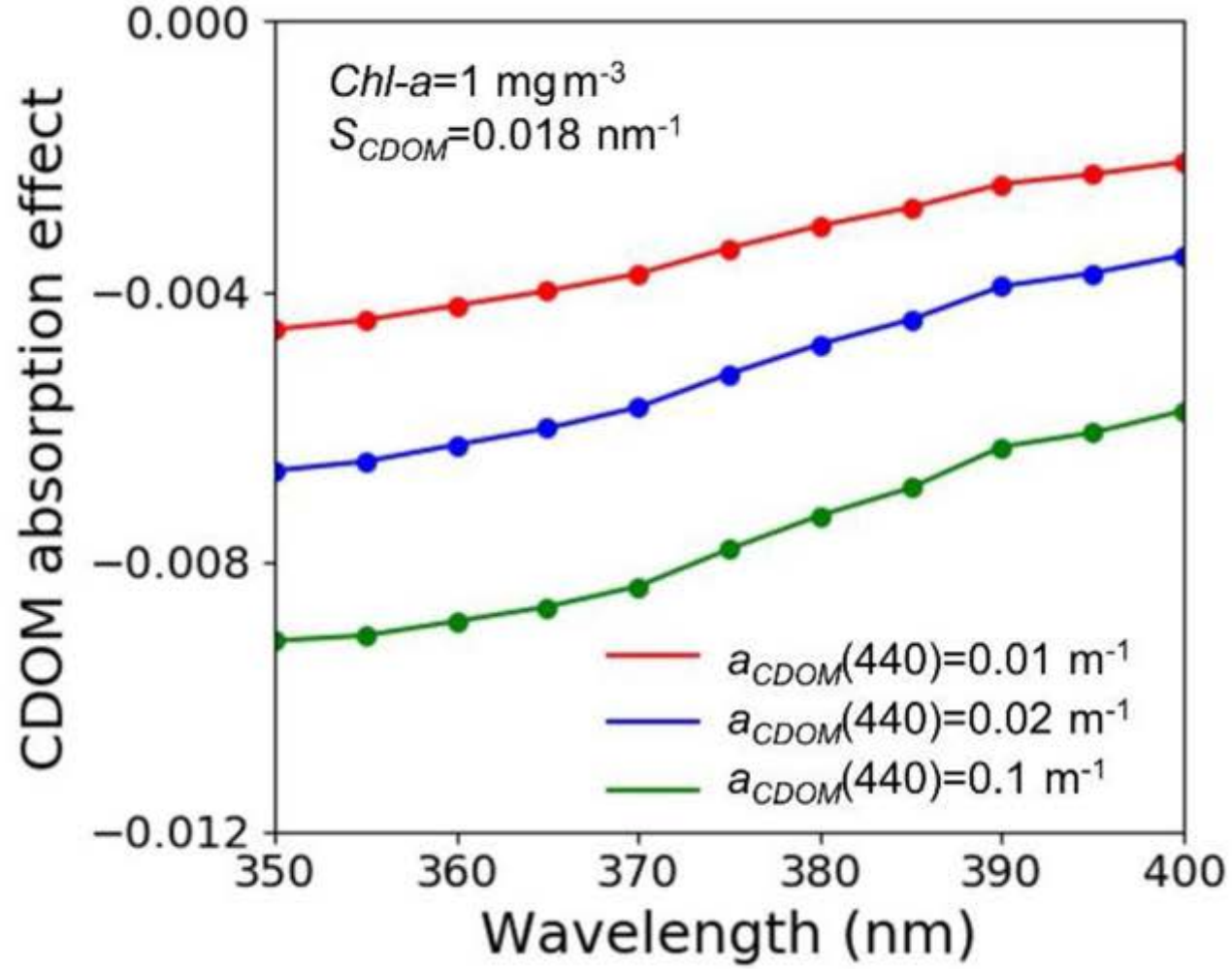
Challenges for ocean and land retrievals (Frouin et al. 2019).

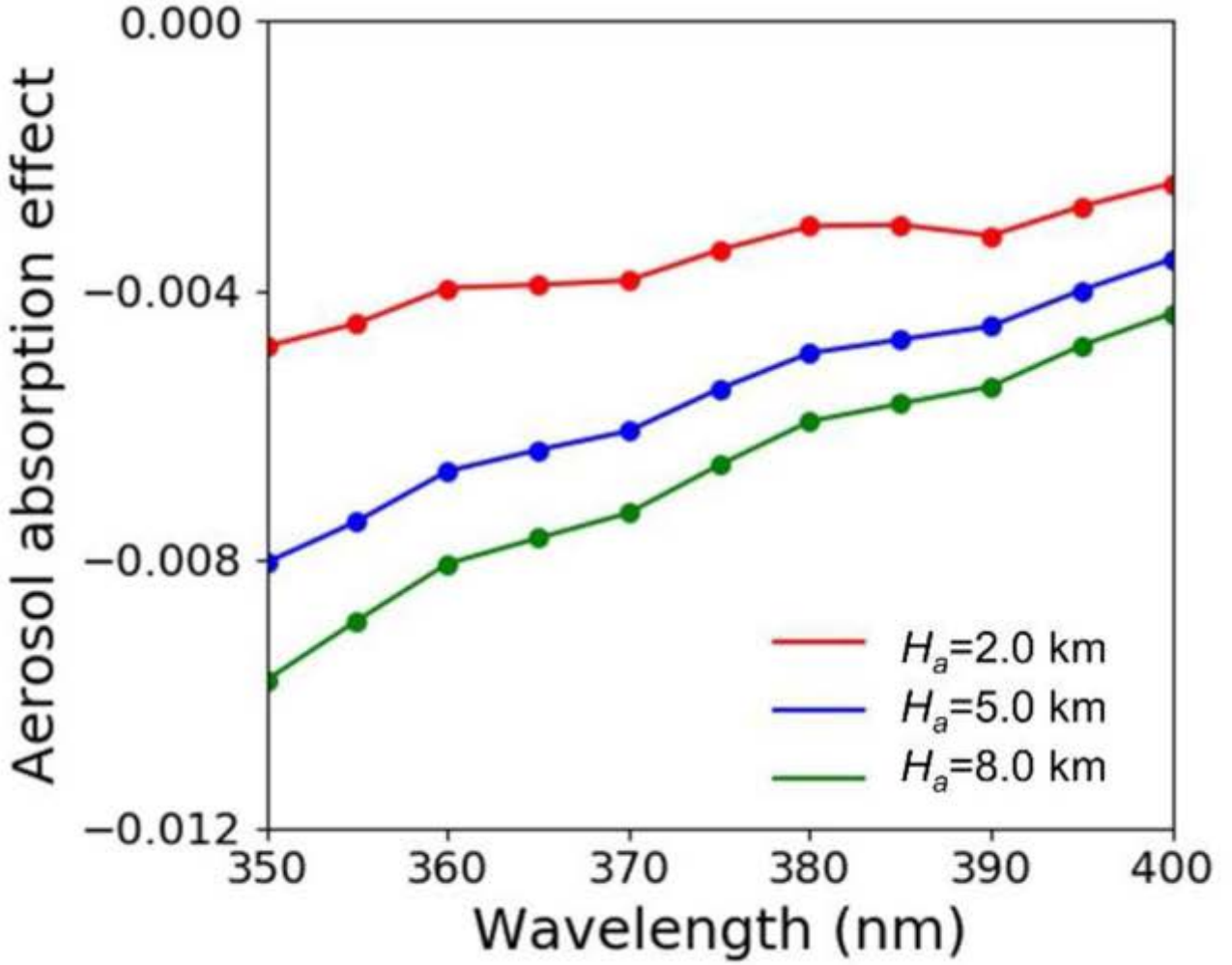
- **Water reflectance is smaller and atmospheric signal larger** in the UV than visible
- **aerosol and CDOM absorption** mimic each other
- **steep decrease of solar irradiance** due to absorption bands
- Multiple scattering and coupling processes between molecular scattering and aerosol absorption means need to **know aerosol vertical profile**.
- Thicker atmosphere means **more adjacency effect**
- **Spherical albedo becomes large**
- The UV is a long way from NIR and SWIR which introduces **error in the spectral extrapolation** because of different aerosol types





Frouin et al. (2019)


0.000
−0.004
−0.008
−0.012
CDOM absorption effect
Chl-a=1 mg m-3
S_CDOM=0.018 nm-1
a_CDOM(440)=0.01 m-1
a_CDOM(440)=0.02 m-1
a_CDOM(440)=0.1 m-1
350
360
370
380
390
400
Wavelength (nm)


0.000
−0.004
−0.008
−0.012
Aerosol absorption effect
H_a=2.0 km
H_a=5.0 km
H_a=8.0 km
350
360
370
380
390
400
Wavelength (nm)

- The UV is a long way from NIR and SWIR which introduces **error in the spectral extrapolation** because of different aerosol types

At a Town Hall meeting at an AGU meeting a few years ago:

“Challenging,” says Lorraine

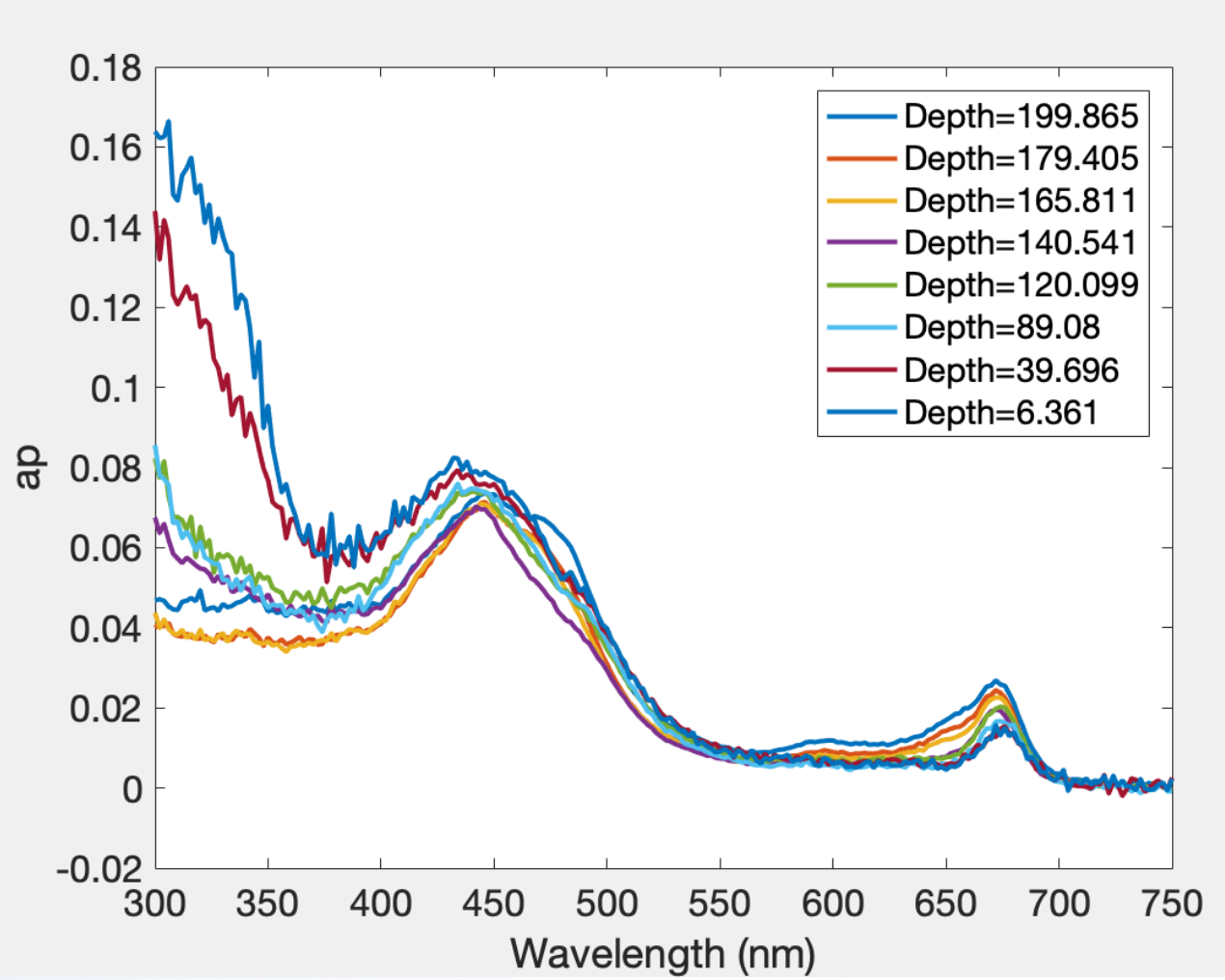
”A physical impossibility”, says Ralph Kahn

Meetings to date

June: Introduction. Lorraine's concerns. Pengwang shows us this:

Emmanuel identifies this as MAAs

Everybody is energized.



The data is from the biosope project:
http://www.obs-vlfr.fr/proof/vt/op/ec/biosope/bio.htm

The measurement was made by Bricaud:

July:

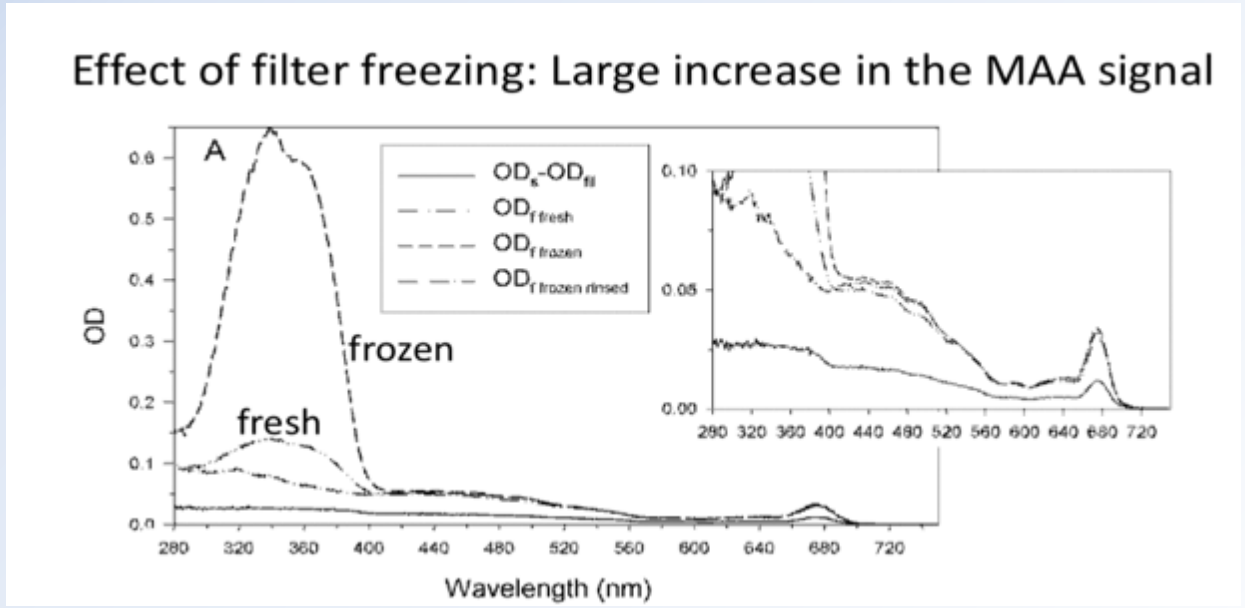
Jacek reports on a deep dive into MAAs.

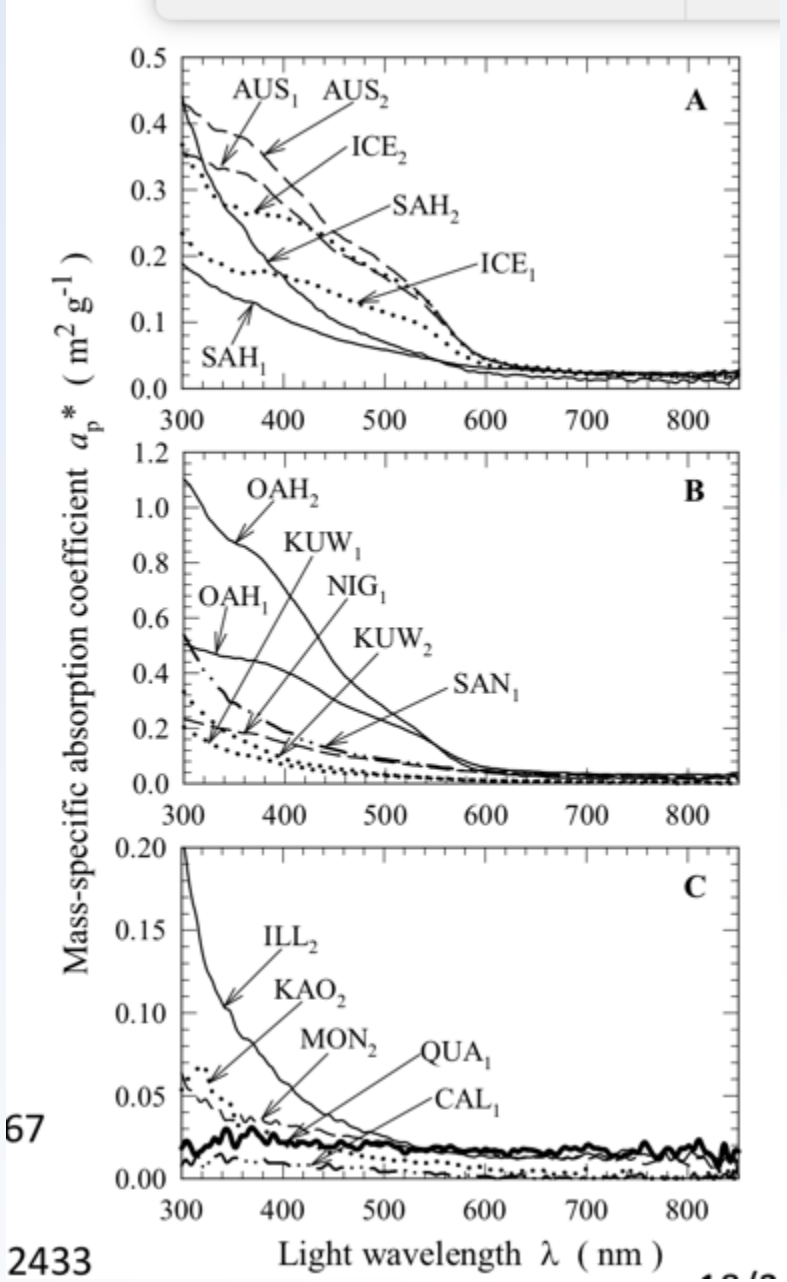
- All the different species
- Different absorption spectra per species
- Absorption can be comparable to CDOM
- Thoughts about how to parameterize

Dariusz describes spectral absorption measurements

Several methods

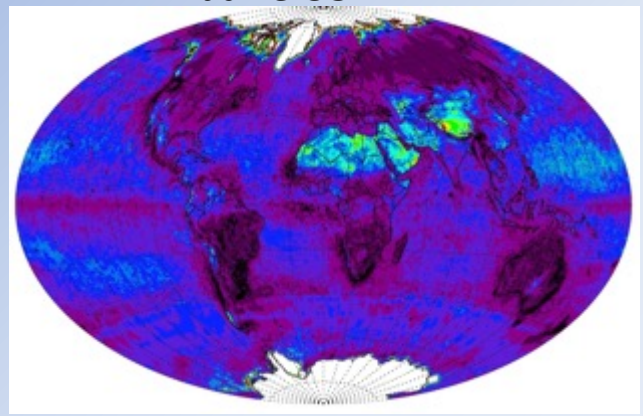
- All sorts of artifacts in the measurements
- Many examples of measurements
- Great variation in UV absorption, not necessarily linked to chlorophyll



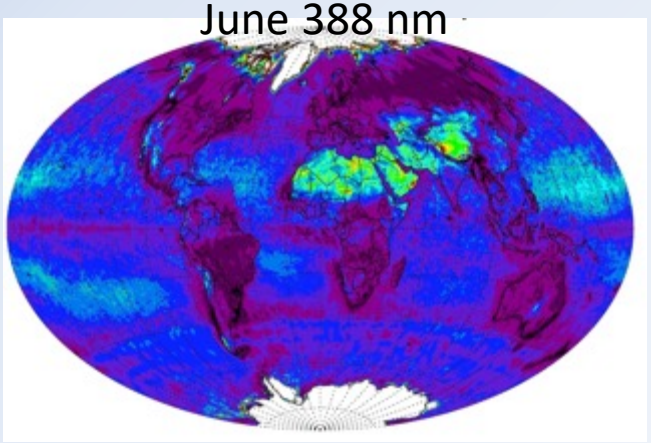


August

OMI Surface Minimum Reflectivity
June 354 nm



June 388 nm



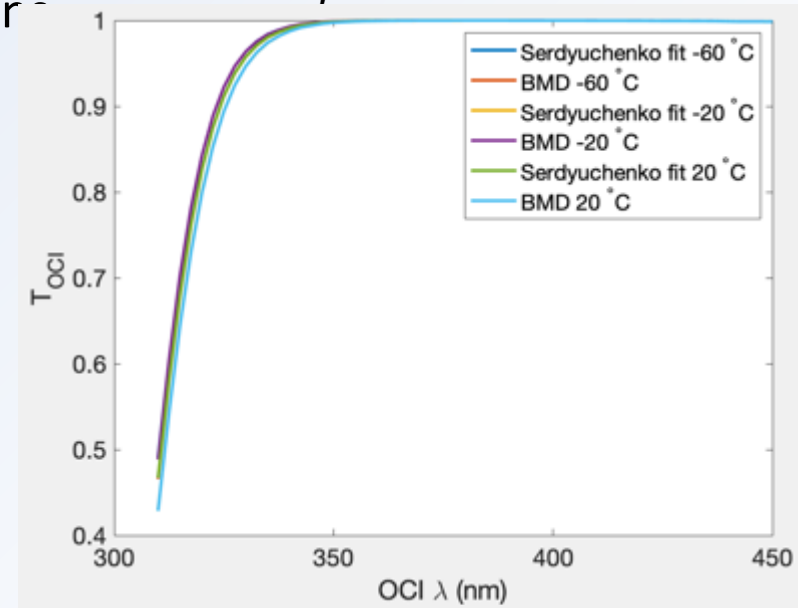
Omar Torres presented reference surface reflectances
in the UV over land and ocean, used by the TOMS/OMI family of aerosol algorithms

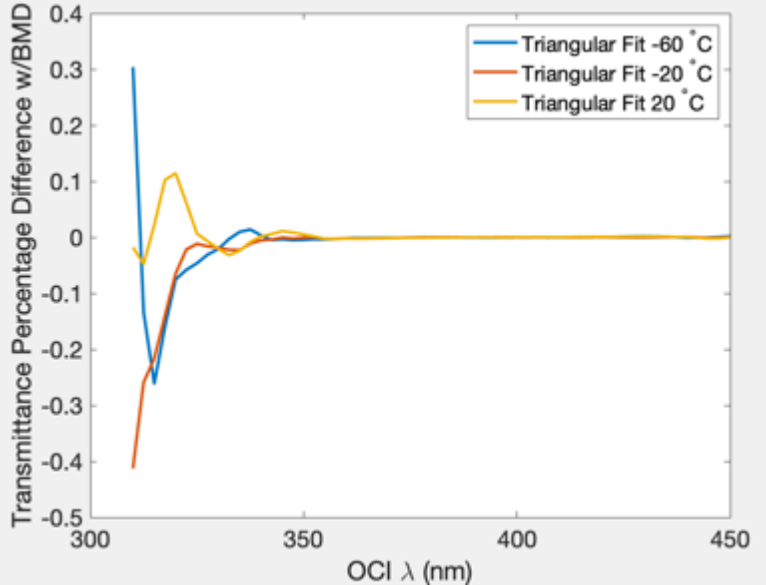
Transmittance convolved with OCI RSR

$$T(\lambda) = e^{-\tau(\lambda)}$$

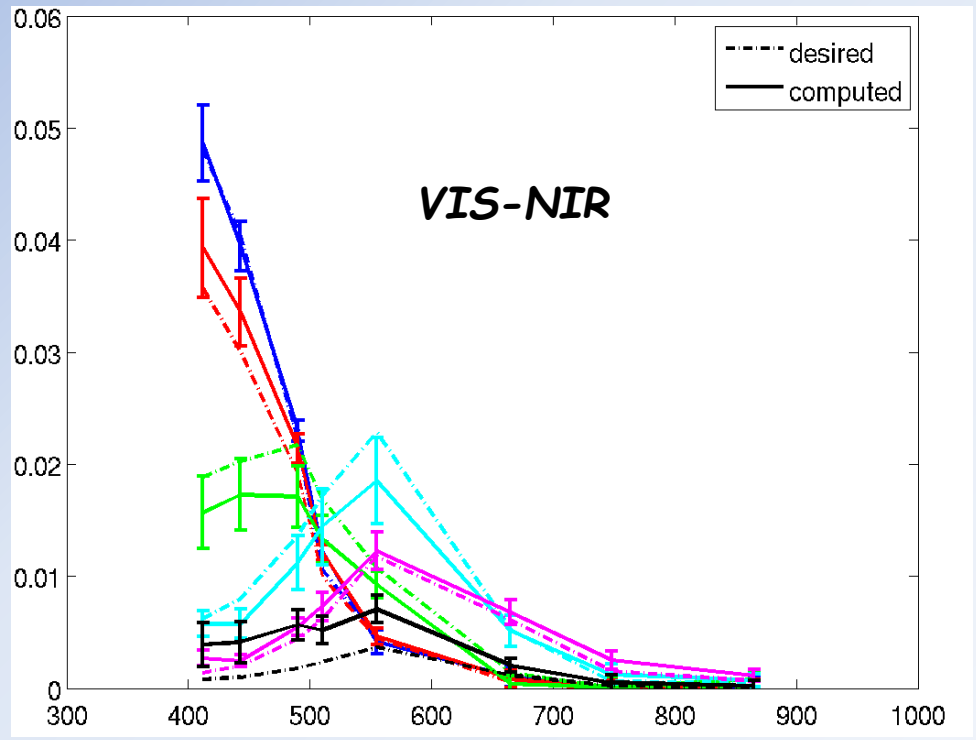
Pengwang Zhai presented new ozone cross sectior

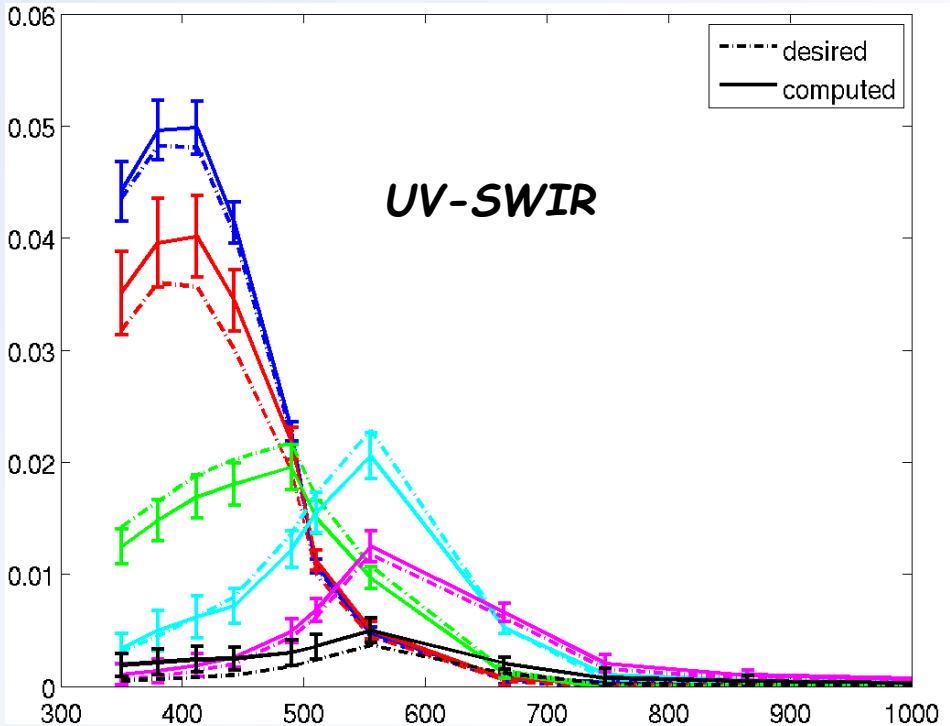
$$T_{OCI}(\lambda) = \int^{\infty} T(\lambda')RSR(\lambda', \lambda)d\lambda'$$





September: No meeting
October: General discussion
November: Robert Frouin presented Contribution of Ultraviolet and Shortwave Infrared Observations to Atmospheric Correction of PACE Ocean-Color Imagery





Error bars depict standard deviation of estimated spectra for each desired spectrum under various atmospheric and geometric conditions (about 1300 situations). Retrievals are generally more accurate using the extended spectral range.

January:

Lachlan and Jeremy discuss new information on properties of sea water in the UV

Postponed due to attack on the U.S. Capitol 6 January

Do we have an end goal?

Perhaps (at least this is what I'm thinking)

- Another half year or so with random presentations and lots of discussion
- Year 2: a more focused goal where we define the state-of-the science for retrieving atmosphere and ocean products using the UV.
- Year 3: we write a review paper together