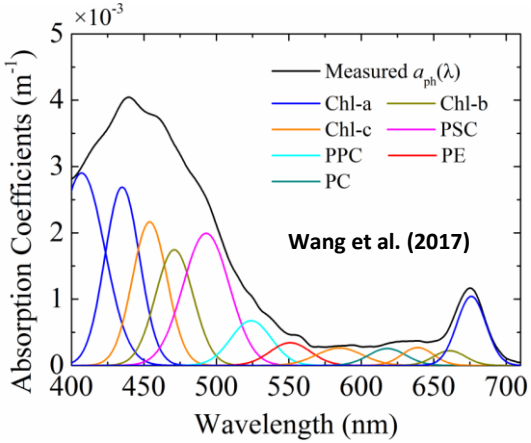
Synthetic data sets: hyper- *vs* multi-spectral

Jianwei Wei (UMASS Boston) and **Ryan Vandermeulen** (NASA/GSFC)

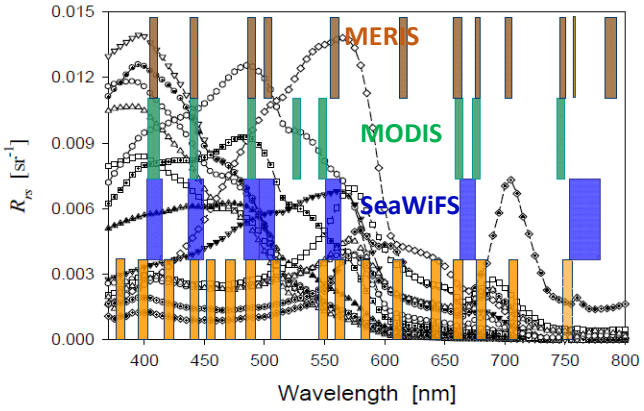
Gaussian decomposition of a_{ph} spectra

Hoepffner & Sathyendranath (1991)



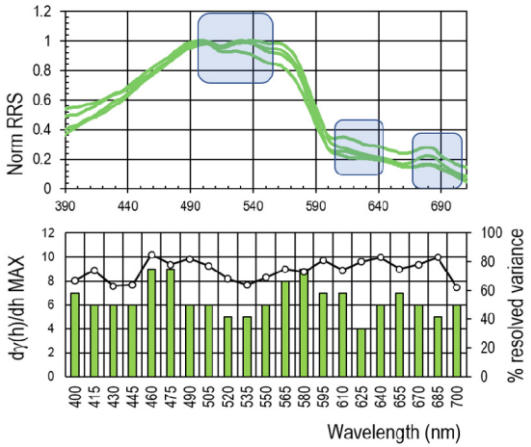
Derivative analysis of R_{rs} spectra

Lee et al. (2007)



Variance analysis of a_{ph} and R_{rs} spectra

Vandermeulen et al. (2017)



Consensus:

1. The numbers of bands with past and currently operational satellites are not sufficient.
2. Hyperspectral R_{rs} measurements (with ~5 nm intervals) have advantages for PFT inversions

Open question:

1. Where the multiple bands should be placed?
2. Which spectra, a_{ph} and/or R_{rs}, will give rise to representative bands?

Challenge:

1. The data used are by no means exhaustive.

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Synthetic PFT data

Absorption coefficient

1. A limited number of PFTs are focused:

   diatoms, coccolithophores, and cyanobacteria

2. Use of measured specific absorption coefficients to derive total absorption:

$$a_{ph}(\lambda) = CHL_{diatom} \times a^*_{diatom}(\lambda) + CHL_{cocco} \times a^*_{cocco}(\lambda) + CHL_{cyano} \times a^*_{cyano}(\lambda)$$

3. How well does the culture-based measurements represent in vivo absorption coefficient?

Particulate backscattering coefficient

1. Severe lack of in situ b_{bp} measurements
2. b_{bp} spectra are assumed by a power-law model, so we have

$$b_{bp}(\lambda) = CHL_{diatom} \times bb^*_{diatom}(\lambda) + CHL_{cocco} \times bb^*_{cocco}(\lambda) + CHL_{cyano} \times bb^*_{cyano}(\lambda)$$

3. But, it is not clear how to assign the spectral shape parameter (η) to the power-law function.

Simulation of R_{rs} spectra:

1. Hydrolight

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Questions for the community

1. **There exist major gaps in the knowledge of the PFT-specific optical properties**!!! We need more measurements!!!

2. **A representative/comprehensive synthetic data set is needed** for PFT algorithm development and testing.

3. When will **the vertical distribution of IOPs** become important for the accuracy of PFT inversion?

4. **Hyper-spectral satellite R_{rs} data are susceptible to large noise**, which may not be neglected for PFT inversion.