Information content of absorption spectra and implications for ocean color inversion

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Background:
- Information content analysis has no been for spectral ocean parameter.
- Needed to establish how much information (or # of independent products) can one hope to have

Analysis:
- Analysis of Spectral particulate absorption coefficient collected on board the R/V Tara globally.
- Use Twomey's (1977) information content analysis framework as well as principal component analysis.
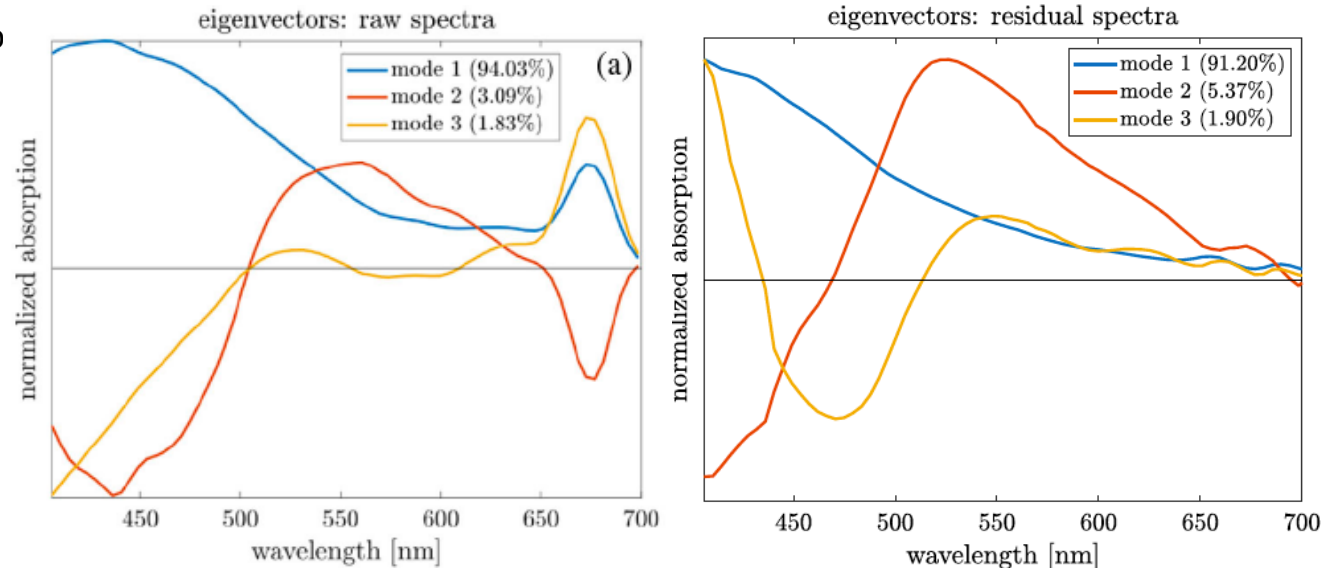
Left: 1st three modes of non-normalized particulate absorption spectra. First mode is clearly the mean chlorophyll varying phytoplankton absorption. Right: after removing the spectra covarying (non-linearly) with chlorophyll most of the variability is due to non-algal particles (mode 1) with additional variability by some pigments.

Findings:
- Hyperspectral particulate absorption spectra have ~5 degrees of freedom, meaning that this data can provide only course community structure information.
- error characteristics and the mathematics of inversion need to be carefully considered for hyperspectral data to provide information beyond that which chlorophyll provides

Significance:
- Ocean color, even hyperspectral (as in PACE, is not expected to provide us more than ~7 DoF.
- More information will need to come from polarimetry, UV and other ancillary measurement.