Atmospheric correction for coastal waters based on multi-angle polarimetric observations

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Background

- Ocean color remote sensing is an important tool to monitor water quality and biogeochemical conditions of ocean.
- It is challenging to retrieve water leaving signals over coastal waters due to:
  - Complex water properties: non-zero NIR signals, etc
  - Complex aerosol properties: absorption, etc
- Improvement can be achieved through NASA’s Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission with:
  - Hyperspectral ocean color instrument (OCI);
  - Polarimeters: HARP-2 (UMBC) , SPEXone (SRON)
- We present a joint retrieval algorithm that determines the aerosol optical properties and the water leaving signals simultaneously based on polarimetric measurements. The retrieved aerosol properties can assist the atmospheric correction for OCI.

Algorithm Design

- Coupled Atmosphere and Ocean Model
  - Aerosol refractive index
    - PCA for Real & Imag spectra
    - PCA + adjustment
  - Aerosol volume distribution
    - Represented by six sub-modes
  - Wind speed

Aerosol Optical Depth and Remote Sensing Reflectance Retrieval

- Aerosol optical depth (AOD) retrieval
- Remote sensing reflectance retrieval

Atmospheric Correction along RSP Flight Track

- The joint retrieval is applied along a RSP flight track over NAAMES-Coastal case.
  - Pixel collocation
  - MODIS/RSP OC Comparison
  - Correlation

Retrieval Uncertainties and PACE Atmospheric Correction Requirement

- Comparison example between RSP measurement (solid line) and simulation (dashed line) on reflectance and polarized reflectance from NAAMES-Open case on 05/26/2016.

Conclusions

- A joint retrieval algorithm for water leaving signals and aerosol properties is developed for a coupled atmosphere and ocean system over open and coastal waters.
- The aerosol optical depth is accurately retrieved as comparing with HSRL and AERONET aerosol product. The retrieved water leaving signals are compared with in situ measurement, and the MODIS Ocean Color product with high accuracy.
- The retrieved aerosol properties might be used for the atmospheric correction on hyperspectral ocean color instruments.

References