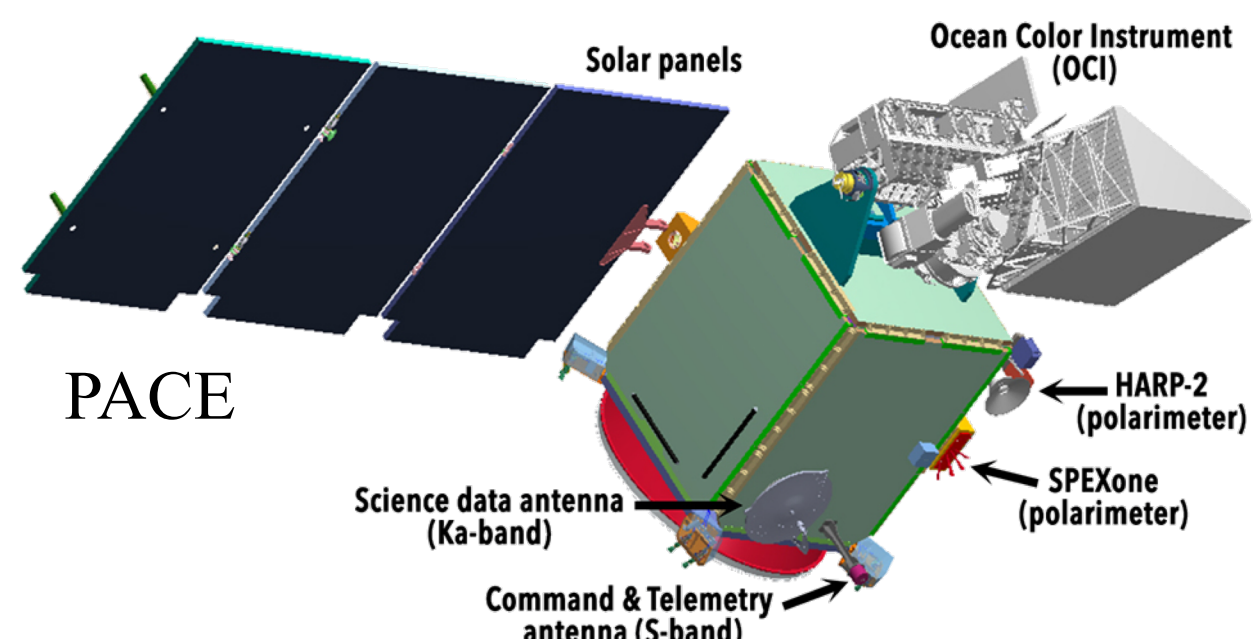


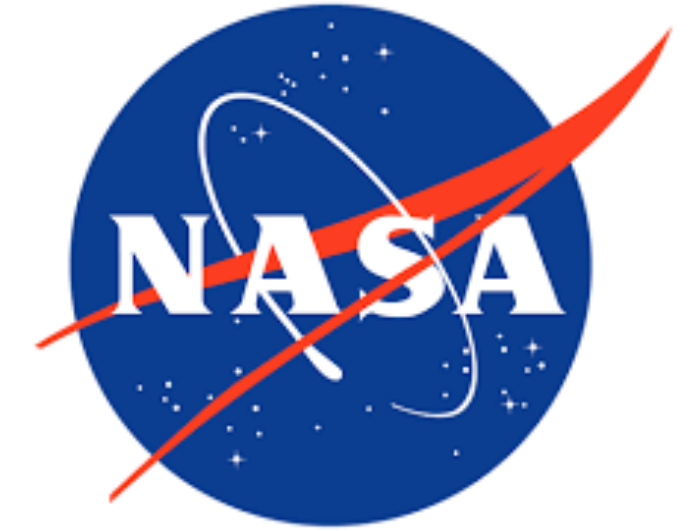
Atmospheric correction for coastal waters based on multi-angle polarimetric observations



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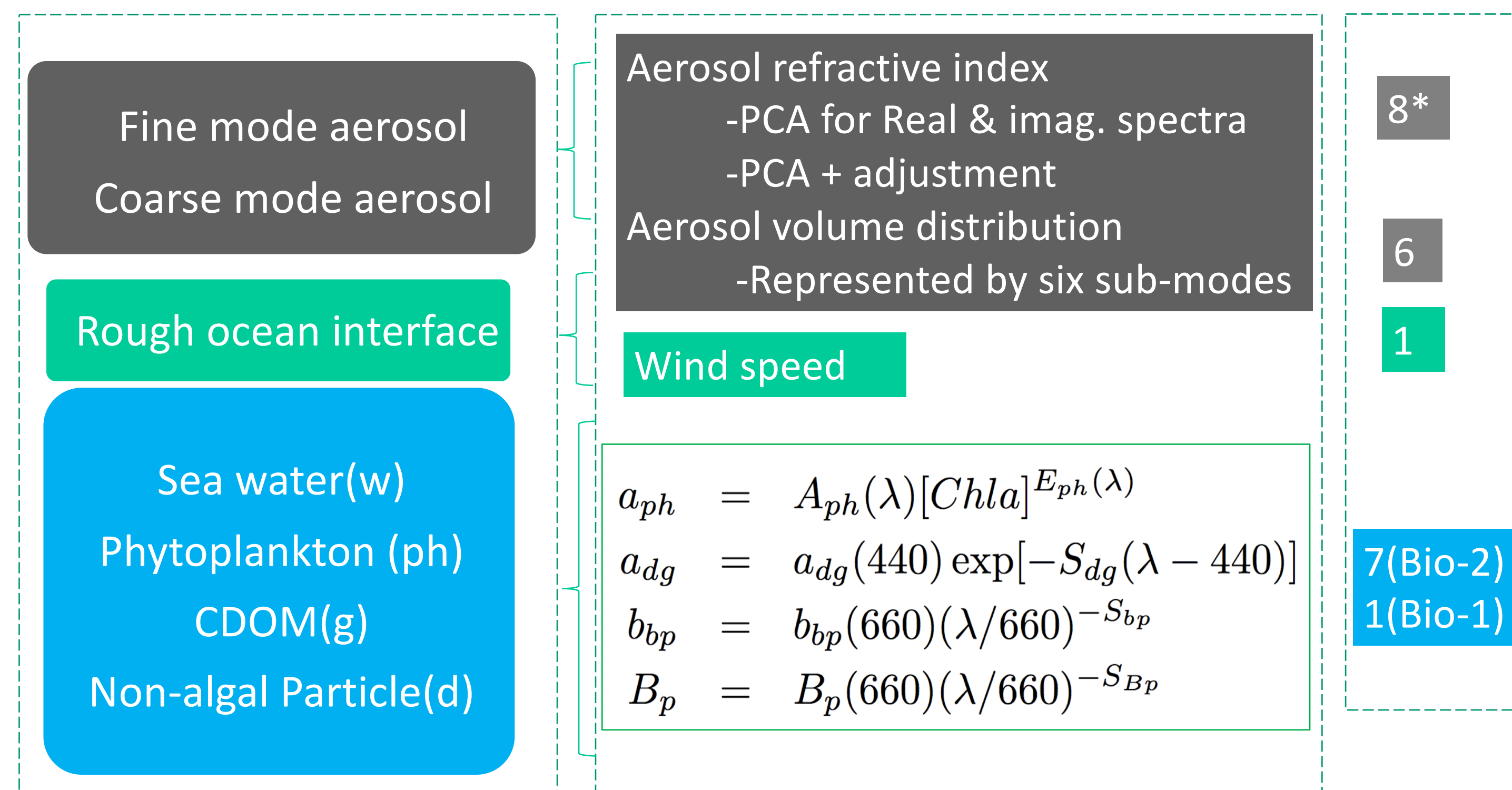
Background

- 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.

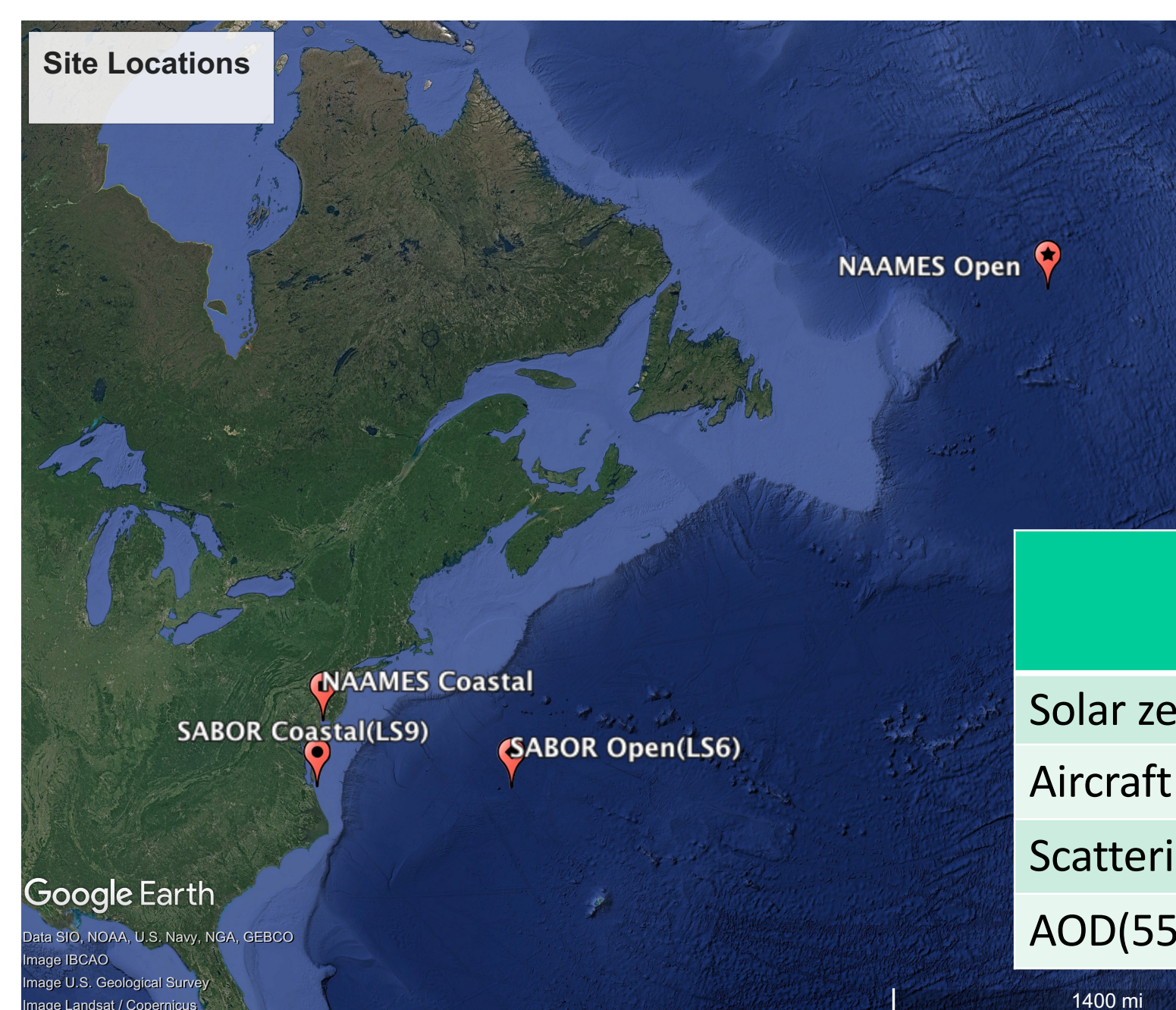
Algorithm Design

Coupled Atmosphere and Ocean Model

Parameters



Joint Retrieval for Open and Coastal Waters

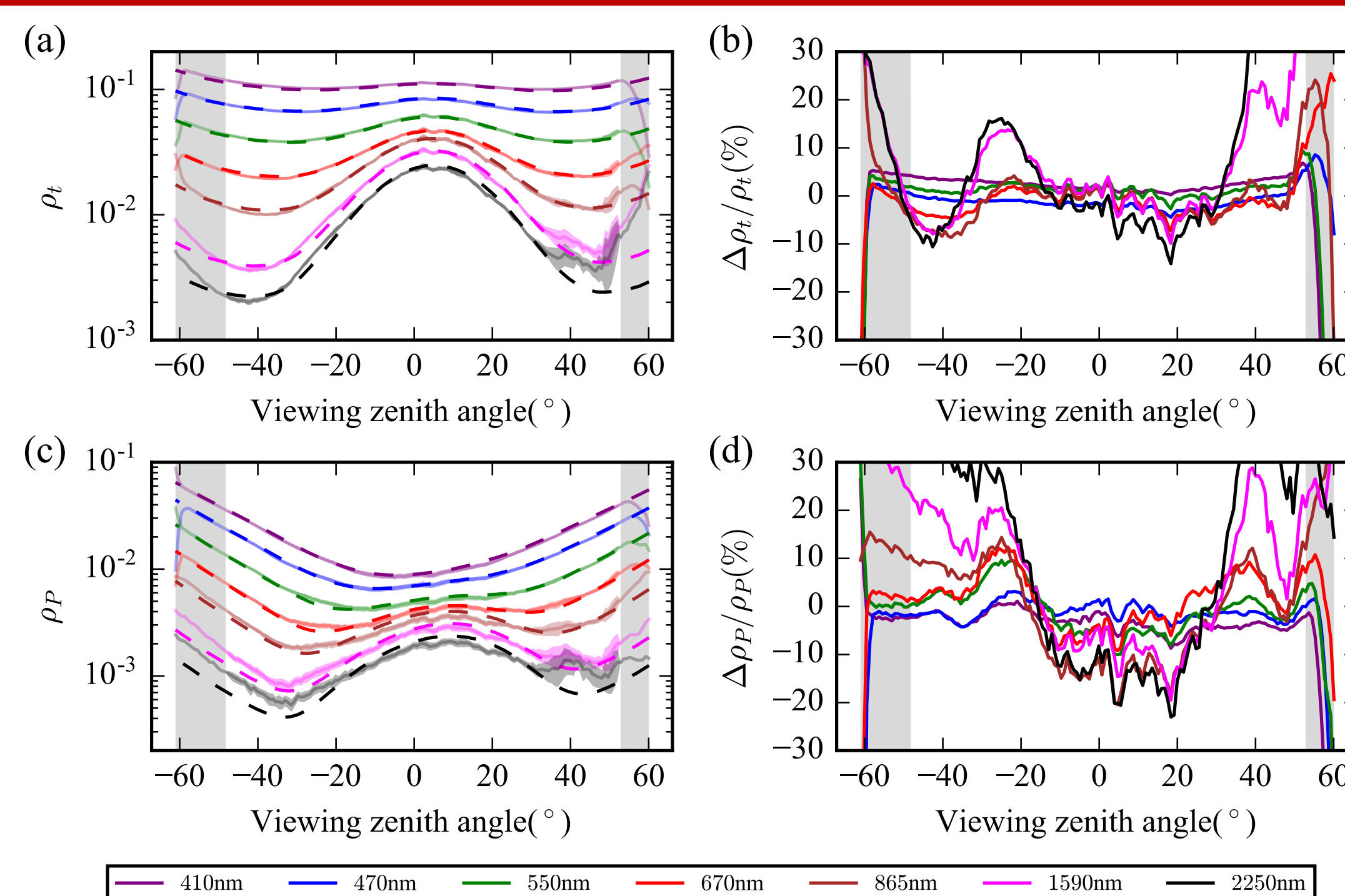


- Four test sites are selected with collocated polarimetric measurements from the Research Scanning Polarimeter (RSP) and in situ measurements from SABOR(2014), NAAMES(2015/2016) field campaigns.

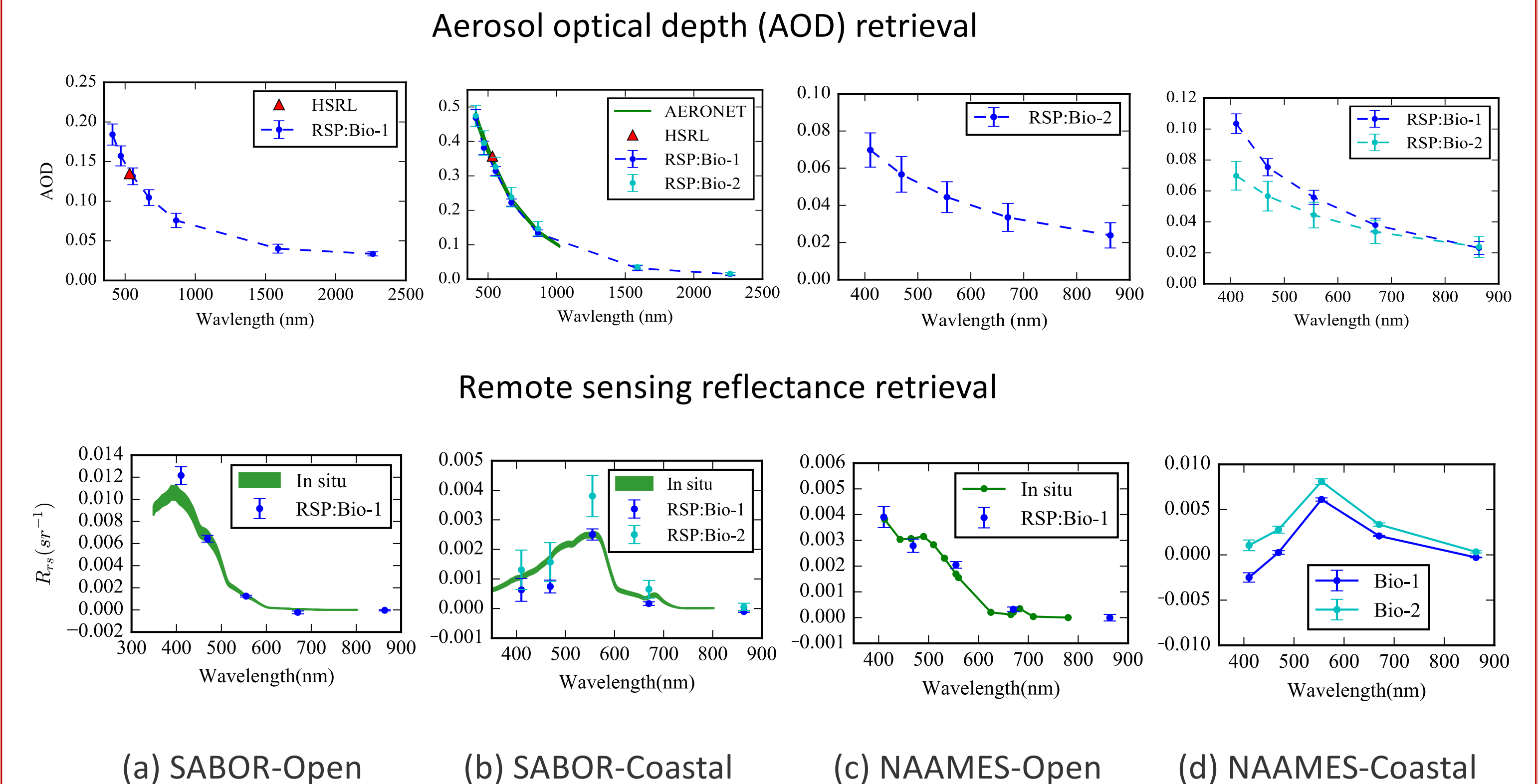
	(a) SABOR-Open	(b) SABOR-Coastal	(c) NAAMES-Open	(d) NAAMES-Coastal
Solar zenith (°)	36	31	27	60
Aircraft height (km)	9.0	8.9	6.7	6.8
Scattering angle (°)	103-148	89-164	116-154	90-123
AOD(550nm)	0.17	0.34	0.10	0.06

Comparison of measurement and simulation

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

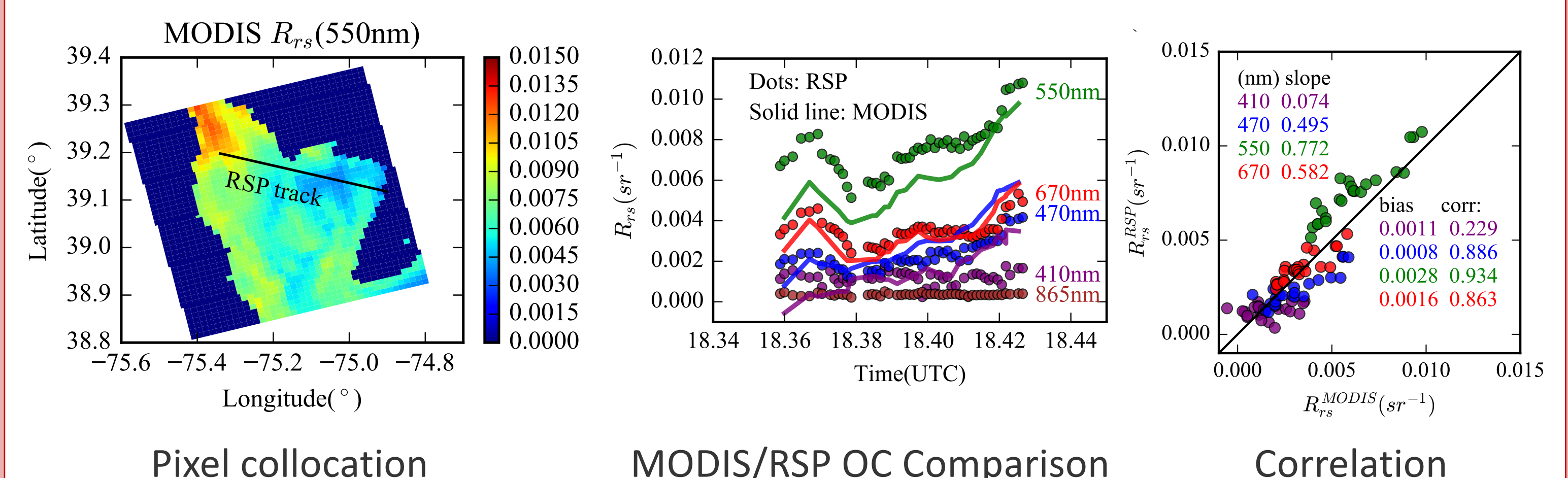


Aerosol Optical Depth and Remote Sensing Reflectance Retrieval

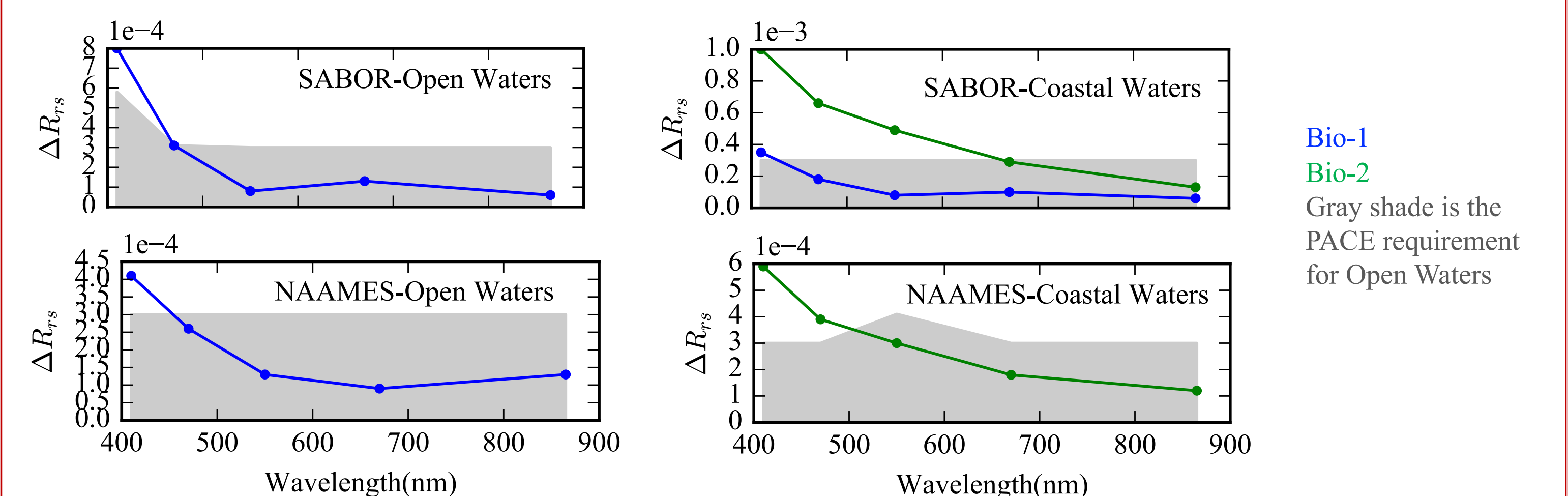


Atmospheric Correction along RSP Flight Track

The joint retrieval is applied along a RSP flight track over NAAMES-Coastal case.



Retrieval Uncertainties and PACE Atmospheric Correction Requirement



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

- Meng Gao, Peng-Wang Zhai, Bryan Franz, Yongxiang Hu, Kirk Knobelspiesse, Paul J. Werdell, Amir Ibrahim, Feng Xu, Brian Cairns, "Retrieval of aerosol properties and water leaving reflectance from multi-angular polarimetric measurements over coastal waters", Optics Express, **26**(7), 8968-8989 (2018)
- Meng Gao, Peng-Wang Zhai, Bryan Franz, Yongxiang Hu, Kirk Knobelspiesse, Paul J. Werdell, Amir Ibrahim, Brian Cairns, Alison Chase, "Inversion of multi-angular polarimetric measurements over open and coastal ocean waters: a joint retrieval algorithm for aerosol and water leaving radiance", in review.