Aerosol properties from the Research Scanning Polarimeter (RSP) during NASA's CAMP^{2}Ex campaign near the Phillipines

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Polarimetric aerosol remote sensing relevance and method

- Provides microphysical and optical properties, some unavailable from, e.g., lidar, spectrometer or in situ
- Airborne data provides proxy for satellite data
  - PARASOL (POLDER polarimeter 2005-2013)
  - PACE (HARP-2 and SPEXone polarimeters, launch Dec. 2022)
  - Metop-SG (3MI polarimeter, launch 2023)
  - Future NASA A&CCP mission (UV-SWIR polarimeter +HSRL likely, launch ~2030)

Data and retrieval method details:

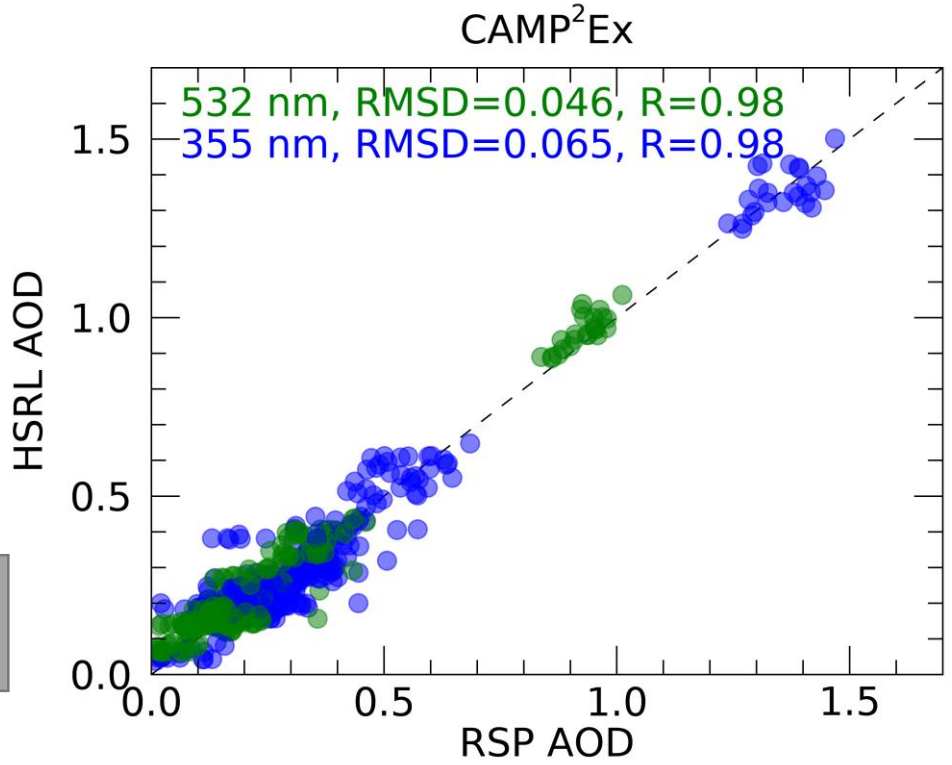
- Reference: "Simultaneous polarimeter retrievals of microphysical aerosol and ocean color parameters from the "MAPP" algorithm with comparison to high spectral resolution lidar aerosol and ocean products", Stamnes et al., Applied Optics, 2018
- RSP observations: multi-angle reflectance and degree of polarization in 7 bands from 410-2260 nm
- Assumptions
  - Refractive index assumed to be spectrally flat
  - Coarse mode refractive index consistent with hydrated sea salt
- Retrieved aerosol parameters:
  - Column optical thickness @ 555 nm (2 modes)
  - Effective radius and variance (2 modes)
  - Fine mode complex refractive index @ 555 nm
  - Fine mode layer height
- Retrieved surface:
  - Sea surface windspeed
  - Sea surface wind speed and ocean body scattering/absorption parameterized by chlorophyll-a concentration (Chowdhary et al., 2006, 2012)
- Derived parameters
  - Spectral optical thickness & single scattering albedo
  - Number concentration
  - Ocean diffuse attenuation coefficient and total scattering coefficient

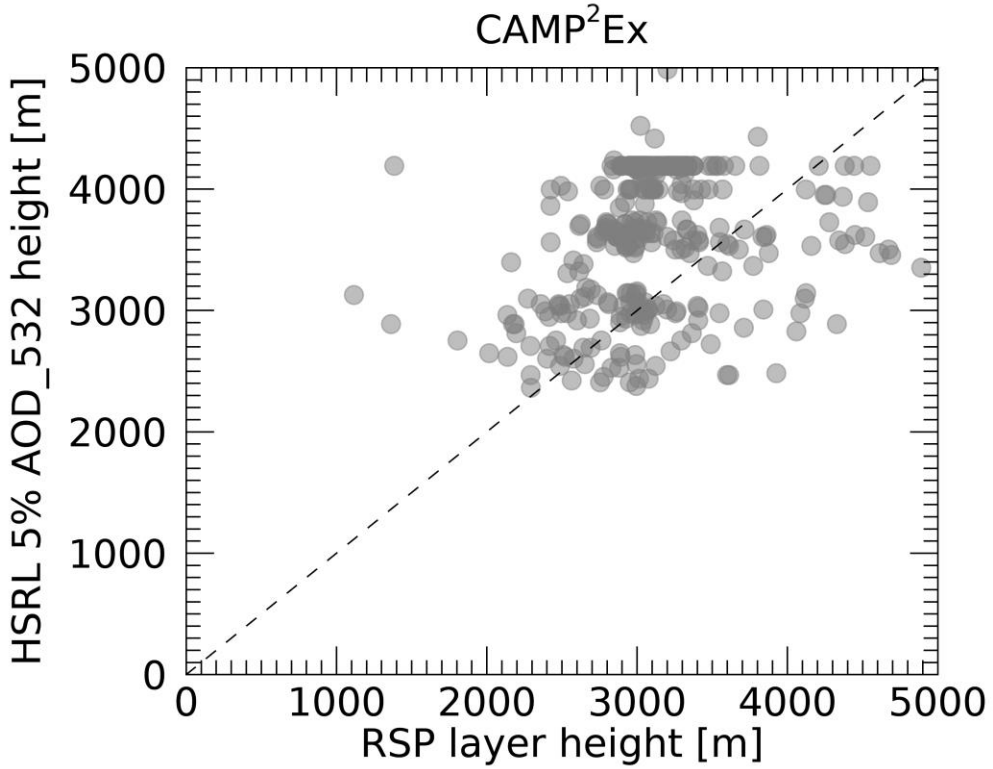
- August 24 – October 5, 2019
- Philippines
- NASA P3B and SPEC Learjet
- Focus
  - Aerosol/Chemistry
  - Clouds
  - Remote sensing
- All data available here: https://www-air.larc.nasa.gov/cgi-bin/ArcView/camp2ex

Colocated RSP vs HSRL-2 lidar during CAMP²Ex

- RSP Data filtered for cirrus above aircraft and goodness-of-fit
- Comparison at 532 nm is largely consistent with expected uncertainties
- 355 nm is out of RSP range (extrapolated based on size distribution and complex refractive index retrieval)
- HSRL layer height is arbitrarily defined by determining height at which 5% of total AOD is observed
- Polarimeter layer height uncertainty is expected to be ~1 km (Wu et al., GRL, 2016 doi:10.1002/2016GL069848)

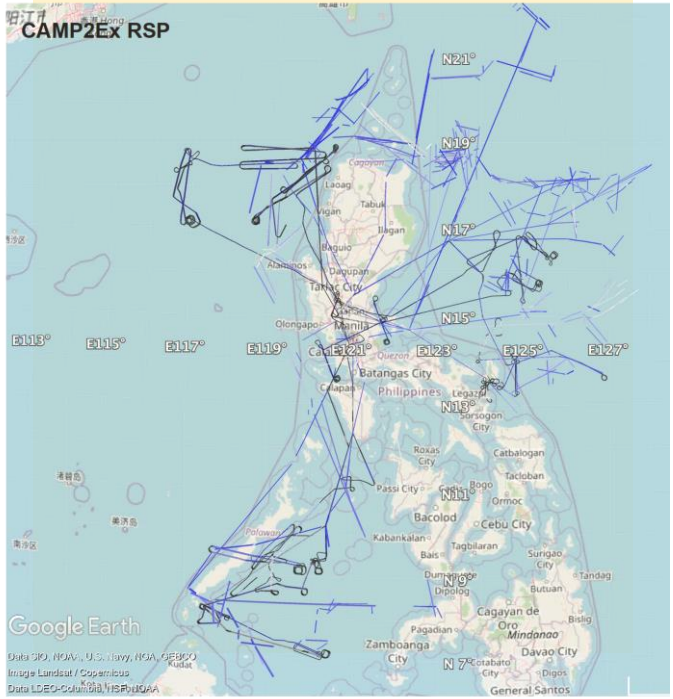
HSRL-2 data from NASA Langley

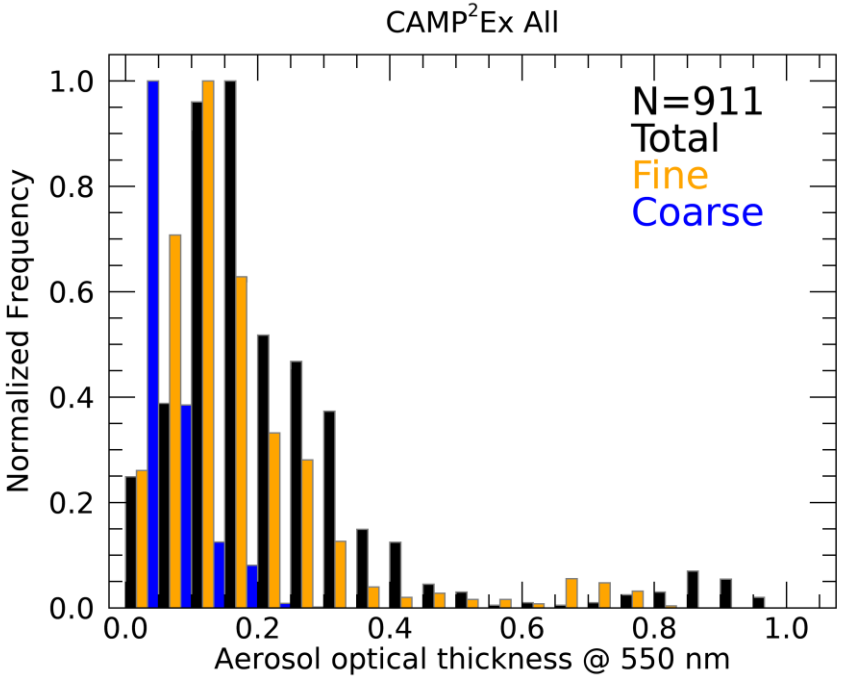


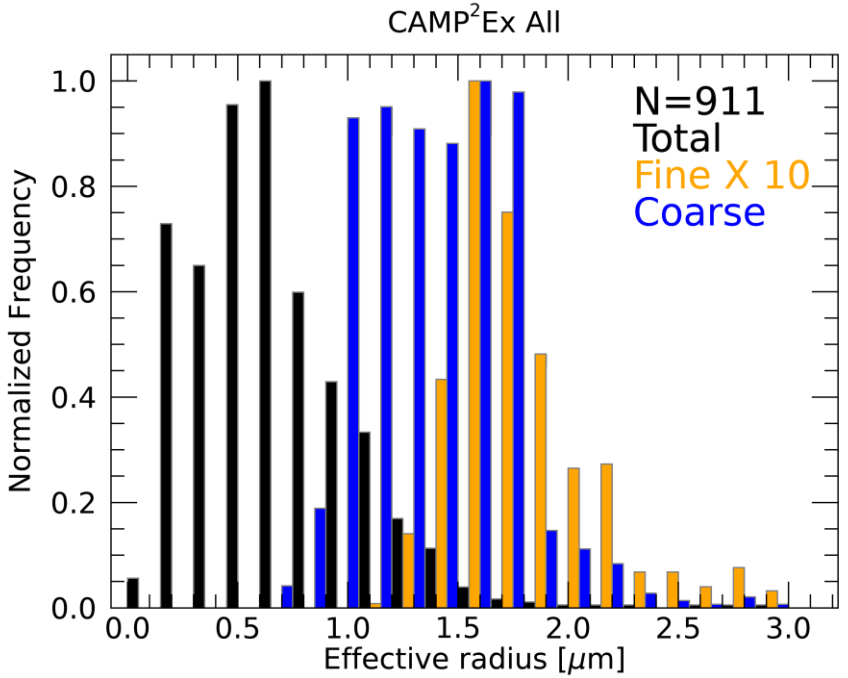


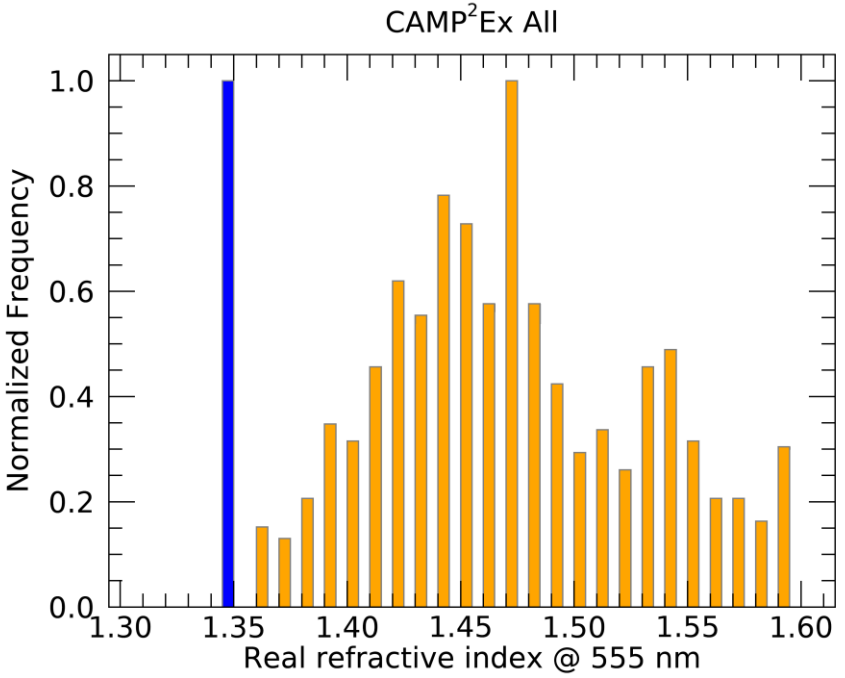
CAMP²Ex RSP retrievals overview

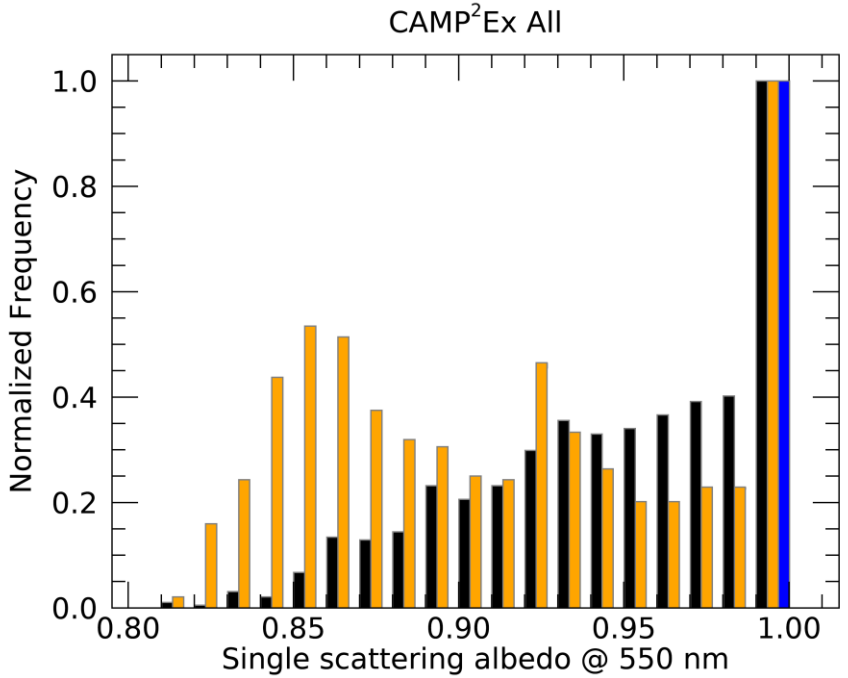
- Lots of variability in all parameters



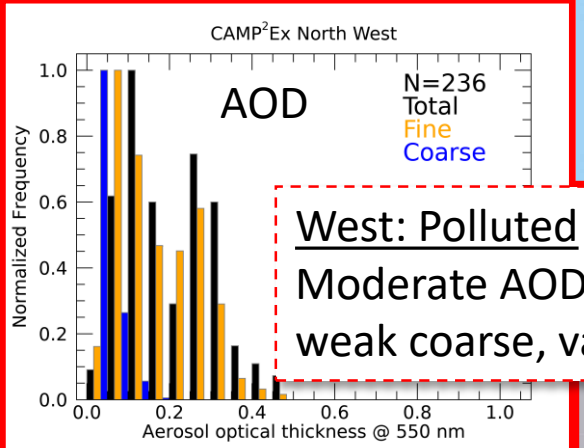




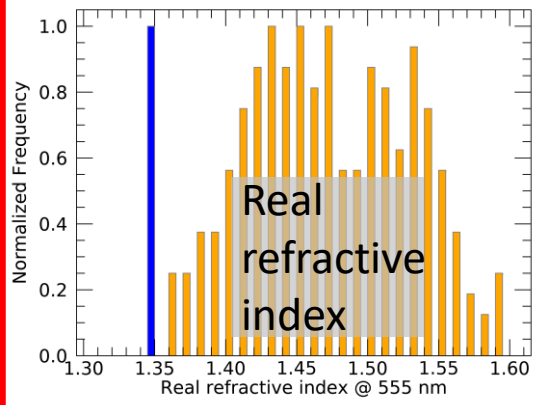


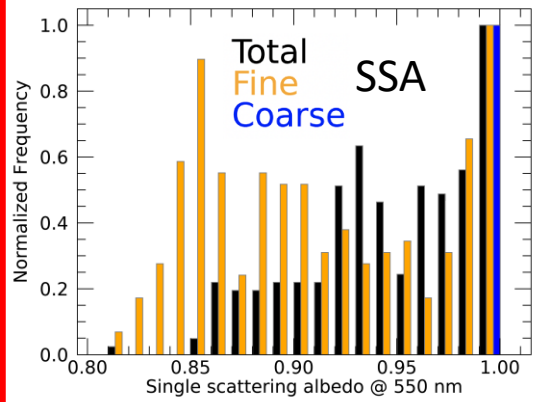


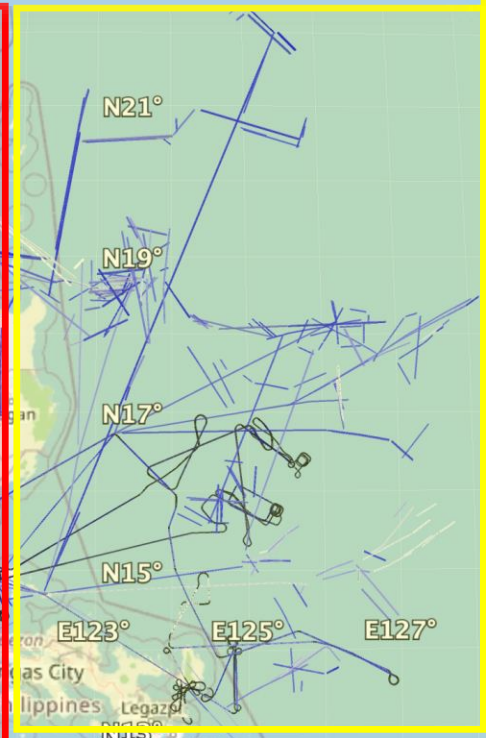
Regional variation of RSP Aerosol properties during CAMP²Ex

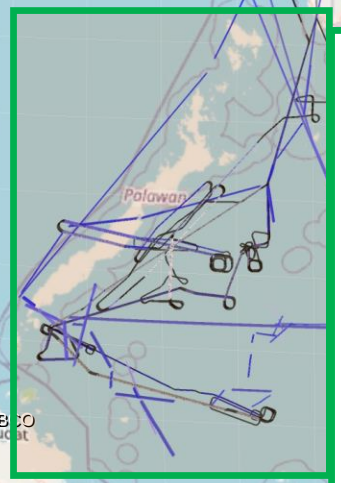


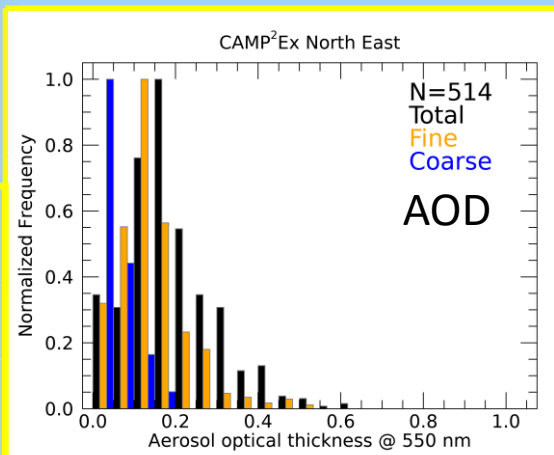
West: Polluted
Moderate AOD, low SSA, weak coarse, variable refr.

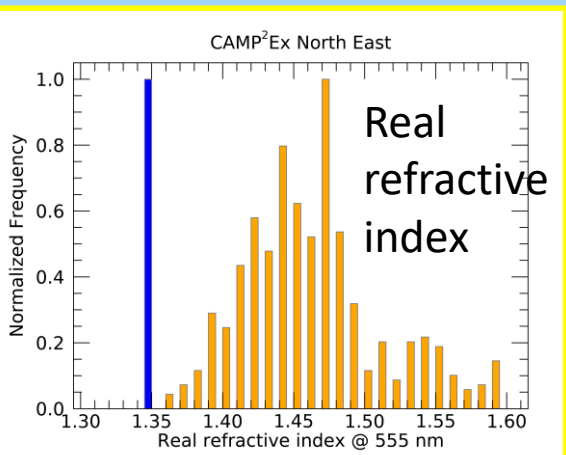




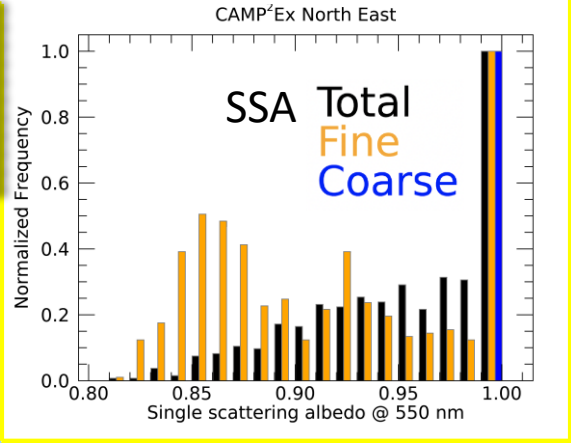








East: Mostly clean
Low AOD, high SSA, strong coarse mode



South: Smoke + clean
Smoke cases with high AOD, low SSA, high refr. index