

PACE-PAX research flight report 2024/09/17

Compiled by Kirk Knobelspiesse, Ivona Cetinić, Michael Ondrusek, Bridget Seegers
2024/09/22

Reviewed by Samuel LeBlanc

Successful ER-2 and ship (R/V Shearwater, R/V Blissfully, glider) operations with a PACE-OHS and EarthCARE (orbit 1742) overpass. Additionally, the ER-2 overflew Ivanpah Playa with a team from JPL characterizing the surface conditions. Conditions were clear with low AOD so this component is considered a success.

ER-2

Takeoff: 17:05, Landing: 23:19, Duration: 6.2
Instrument status: good
Pilot: Dean Neeley, mobile pilot: Kirt Stallings

Twin Otter

No flight day

R/V Shearwater

Mission Scientist: Michael Ondrusek
Sailed out: 15:42 UTC
Back in port: 23:04 UTC
[See end for full R/V Shearwater report](#)

R/V Blissfully

Mission Scientist: Bridget Seegers
Sailed out: 16:08 UTC
Back in port: 00:26 UTC
[See end for full R/V Blissfully report](#)

PACE

Overpass at 20:14 (Arizona)

EarthCARE

Overpass at 22:27 (Central California), orbit 1742

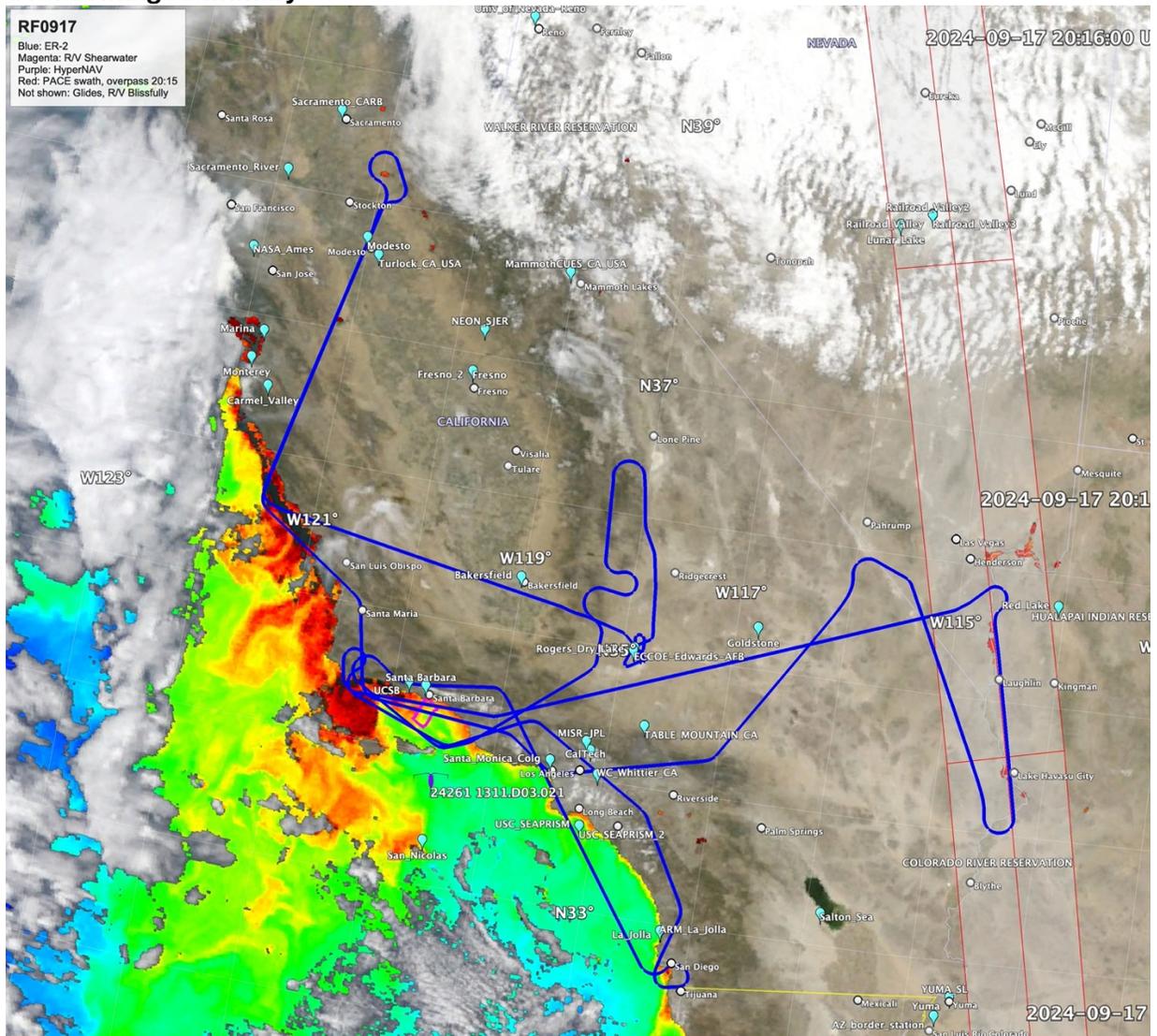
Glidern

Operational

HyperNAV

Operational

Overall image summary



Note: not shown is the EarthCARE track, which followed the NW most line of the ER-2 and had its overpass at 22:27

Validation Traceability Matrix itemized objectives

VTM elements in **black** satisfied, **blue** partially satisfied, **red** to be confirmed

| Time UTC | Platform | VTM(hrs) | |
|----------|----------|---------------------------|--|
| 15:42 | RS | | Shearwater departspowe |
| 16:08 | RB | | Blissfully departs |
| 16:35 | RS | | Shearwater on station #16 in clear skies, remains until 18:15. |
| 17:05 | ER2 | | Takeoff |
| 18:02 | ER2, RS | 1b(1.0), 1c(1.0), 6i(1.0) | ER-2 overpass of RS at station #16. Biologically productive waters |

| | | | |
|--------------|------------------|---|--|
| 18:03 | ER2, Glider | 1b(1.0), 1c(1.0*0.5), 6i(1.0*0.5) | ER-2 over glider in biologically productive waters and clear skies. Outside of PACE overpass +/-2hours by a few minutes. |
| 18:26 | RB | 1b(1.0), 1c(1.0*0.5) | Blissfully on station RB_14, ER-2 overhead in clear skies. Nearby USC_SeaPRISM inoperable |
| 18:44 | ER2 | 1d(0.5),1c(0.5*0.5) | ER-2 over La_Jolla (coastal site) AERONET site. moderate AOD(500)=0.14 |
| 18:59 | ER2 | 1d(0.5) | ER-2 over CalTech AERONET site. moderate AOD(500)=0.12 |
| 18:39 | RS | | Shearwater on station 17 in clear skies, remains until 20:00 |
| 19:12 | ER2, RS | 1b(1.0), 1c(1.0), 6i(1.0) | ER-2 over Shearwater in clear skies and biologically productive waters |
| 19:19 | ER2, glider | 1b(1.0), 1c(1.0*0.5), 6i(1.0*0.5) | ER-2 over glider in biologically productive waters and clear skies |
| 19:58 | RB | 1b(1.0), 1c(1.0*0.5) | Blissfully on station RB_15, PACE overhead in clear skies. Nearby USC_SeaPRISM inoperable |
| 20:02 | ER2, Ivanpah | 1a(2.0), 1d(0.5), 4a(2.0) | ER-2 overflies Ivanpah Playa with JPL surface team present for characterization. Clear skies, low AOD |
| 20:14 | PACE | | PACE overpass |
| 20:15 | ER2 | 1d(1.0), 3b(2.0) | ER-2 in PACE-OHS swath in Western Arizona. Low AOD |
| 20:18 | RS | 1b(1.0) | Shearwater on station 18 in clear skies, remains until 20:39. PACE overpass |
| 20:40 | ER2, Ivanpah | 1a(2.0), 1d(0.5), 4a(2.0) | ER-2 2 nd overflies Ivanpah Playa with JPL surface team present for characterization. Clear skies, low AOD, roughly 90° from last overpass. |
| 20:51 | RS | | Shearwater on station 19 in clear skies, remains until 22:21 |
| 21:08 | RB | | Blissfully on station RB_16 in clear skies |
| 21:22 | ER2, RS | 1b(1.0), 1c(1.0), 6i(1.0) | ER-2 over Shearwater in clear skies and biologically productive waters |
| 21:58 | ER2 | 1d(0.5) | ER-2 over Turlock AERONET site. moderate AOD(500)=0.15 (again at 22:15) |
| 22:27 | EarthCARE | | EarthCARE overpass |
| 22:27 | ER2,EC | 3d(3.0), 3e(1.0), 6d(1.0*0.5) | Very long out and back along EarthCARE line. Moderate AOD, some thin cirrus reported by HSRL with aerosol under cloud. |
| 22:50 | ER2 | | ER-2 over Bakersfield AERONET site. No AOD reported |
| 23:04 | RS | | Return |
| 23:19 | ER2 | | ER-2 lands |
| 00:26 | RB | | Return |

PACE-O: within swath of PACE's OCI instrument

PACE-OH: within swath of PACE's OCI and HARP2 instruments

PACE-OHS: within swath of PACE's OCI, SPEXone and HARP2 instruments

RB: R/V Blissfully

RS: R/V Shearwater

ER2: NASA ER-2

Assessment:

- 11.9% of objectives observed. Largely successful new observations of aerosol+ocean conditions in biologically active areas, both PACE and EarthCARE underpass, overflight of Ivanpah Playa with JPL team.
- Top remaining objectives (score above 6.0): PACE aerosol in narrow swath (3a,b)

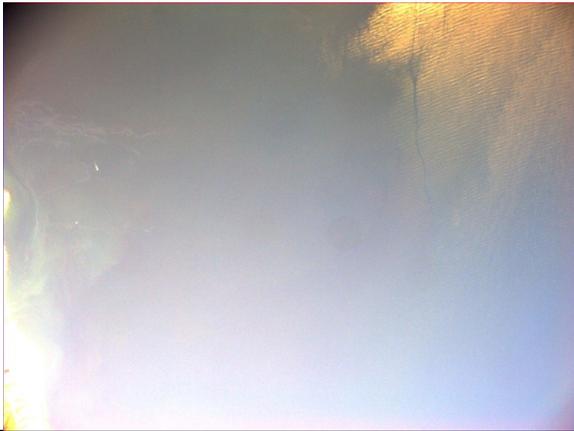
| PACE-PAX progress tracking | | | | | | | | | | | | | | | |
|---|--------|--|---------------|-----------------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|---------------|-----------------|------|
| Validation objectives | ID | Measurement objectives | Importance, w | Observation time, h (hours) | Total observed (hours) | Fractional success 9/16 | Fractional success 9/17 | Fractional success 9/18 | Fractional success 9/19 | Fractional success 9/20 | Fractional success 9/21 | Fractional success 9/22 | Total success | Remaining score | |
| 1. Validate new retrieval properties | a | Land surface parameters | 8 | 2.0 | 4.0 | 0.0% | 39.3% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.938 | 0.5 | |
| | b | Ocean radiometric parameters | 10 | 8.0 | 8.0 | 0.0% | 2.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.985 | 0.2 | |
| | c | Aerosol parameters over the ocean | 12 | 8.0 | 5.0 | 0.0% | 4.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.952 | 0.6 | |
| | d | Aerosol parameters over land | 12 | 8.0 | 3.0 | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.998 | 0.0 | |
| | e | Cloud parameters | 12 | 8.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.695 | 3.7 | |
| | f | Ocean surface parameters | 1 | 8.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.000 | 1.0 | |
| 3. Validate in a narrow swath | a | Aerosol parameters over the ocean (PACE) | 10 | 8.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.354 | 6.5 | |
| | b | Aerosol parameters over land (PACE) | 10 | 8.0 | 2.0 | 0.0% | 17.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.403 | 6.0 | |
| | c | Cloud parameters (PACE) | 5 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.713 | 1.4 | |
| | d | Aerosol parameters (EarthCARE) | 8 | 4.0 | 3.0 | 0.0% | 52.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.992 | 0.1 | |
| | e | Cloud parameters (EarthCARE) | 8 | 4.0 | 1.0 | 0.0% | 19.5% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.313 | 3.8 | |
| | a | Validate large reflectances | 6 | 2.0 | 4.0 | 0.0% | 49.3% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.923 | 0.5 | |
| 4. Validate radiometric and polarimetric properties | b | Validate large reflectances with high polarization | 6 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.393 | 3.6 | |
| | c | Validate large reflectances with low polarization | 6 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.777 | 1.3 | |
| | d | Overfly vicarious calibration sites | 6 | 4.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.268 | 4.4 | |
| | a | High aerosol loads over land | 4 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.000 | 0.0 | |
| 6. Focus on specific processes or phenomena | b | High aerosol loads over ocean | 4 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.393 | 2.4 | |
| | c | Multiple aerosol layers | 1 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.000 | 0.0 | |
| | d | Aerosol under thin cirrus | 2 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.900 | 2.0 | |
| | e | Aerosol above liquid phase cloud | 4 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.826 | 0.7 | |
| | f | Broken clouds with complex structure | 4 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.528 | 1.9 | |
| | g | Dust aerosols over ocean | 4 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.430 | 2.3 | |
| | h | Aerosol and ocean parameters over turbid waters | 2 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.790 | 0.4 | |
| | i | Aerosol and ocean parameters over biologically productive waters | 4 | 2.0 | 4.0 | 0.0% | 86.5% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.865 | 0.5 | |
| | k | Smoke aerosols over ocean | 1 | 2.0 | 0.0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.713 | 0.3 | |
| | total: | | | 150 | 98 | 34.0 | 0.0% | 11.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.695 | |
| | | | | | ER-2 flight hours | 15.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15.8 |
| | | | | TO flight hours | 11.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.2 | |
| | | | | Shearwater days | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | |
| PACE-PAX overall objectives satisfied: | | | | | | | | | | | | | 0.695 | | |

Note: images and data presented in this report are preliminary, and not for publication, presentation, or scientific use. The PACE-PAX data archive is:

<https://www-air.larc.nasa.gov/missions/pacepax/index.html>

ER-2 MVIS quicklooks

18:02 R/V Shearwater station 16 + glider



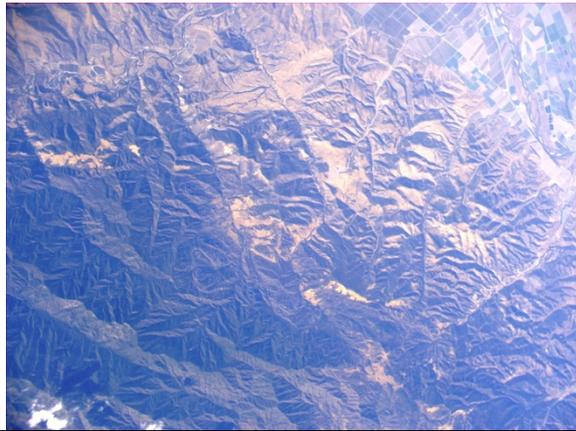
20:02 1st overpass of Ivanpah Playa



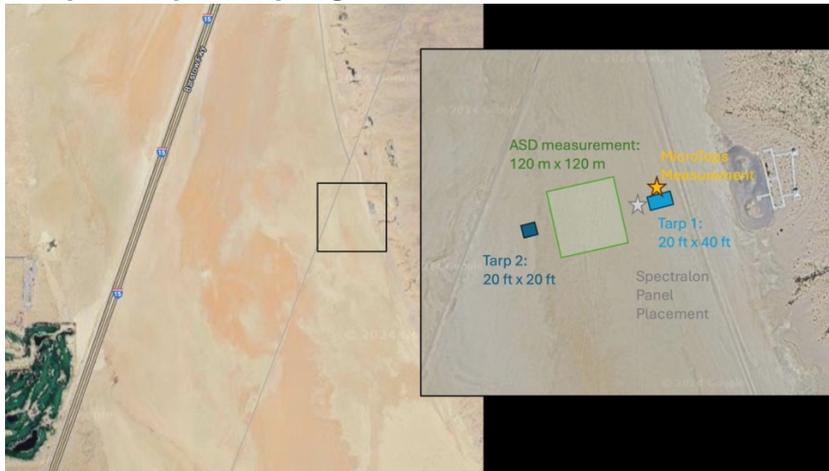
20:40 2nd overpass of Ivanpah Playa



22:27 EarthCARE overpass



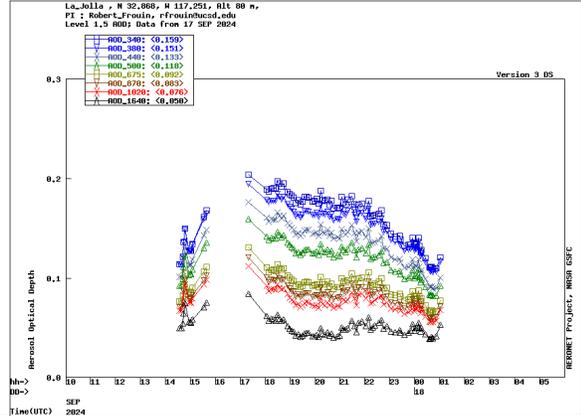
Ivanpah Playa sampling



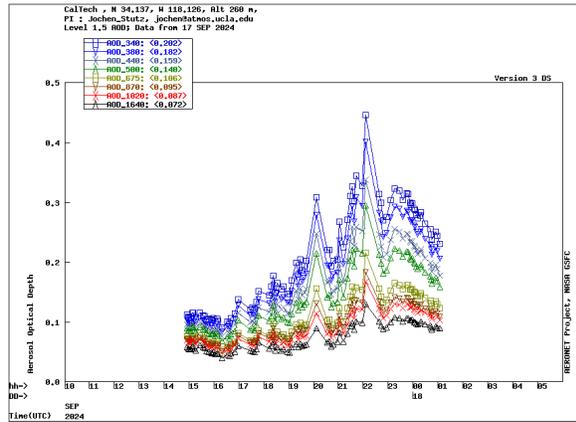
AERONET quicklooks

USC_SeaPRISM site inoperable

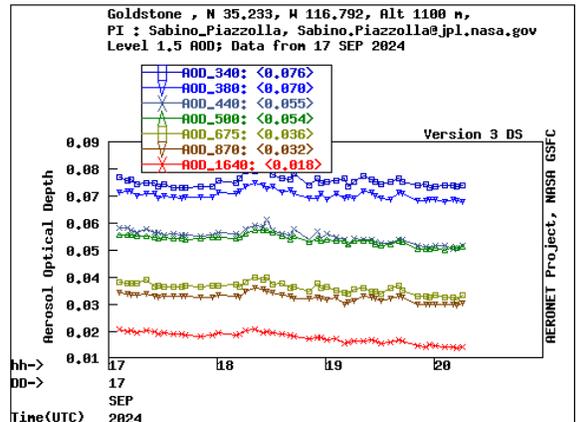
La_Jolla



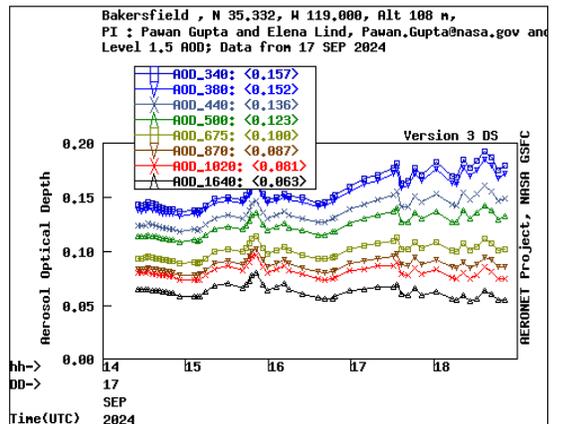
CalTech



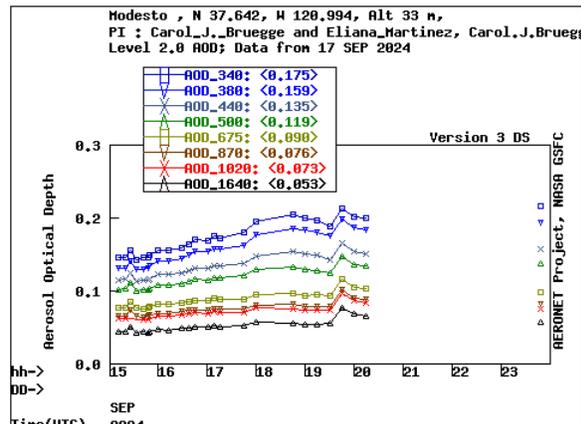
Goldstone



Bakersfield

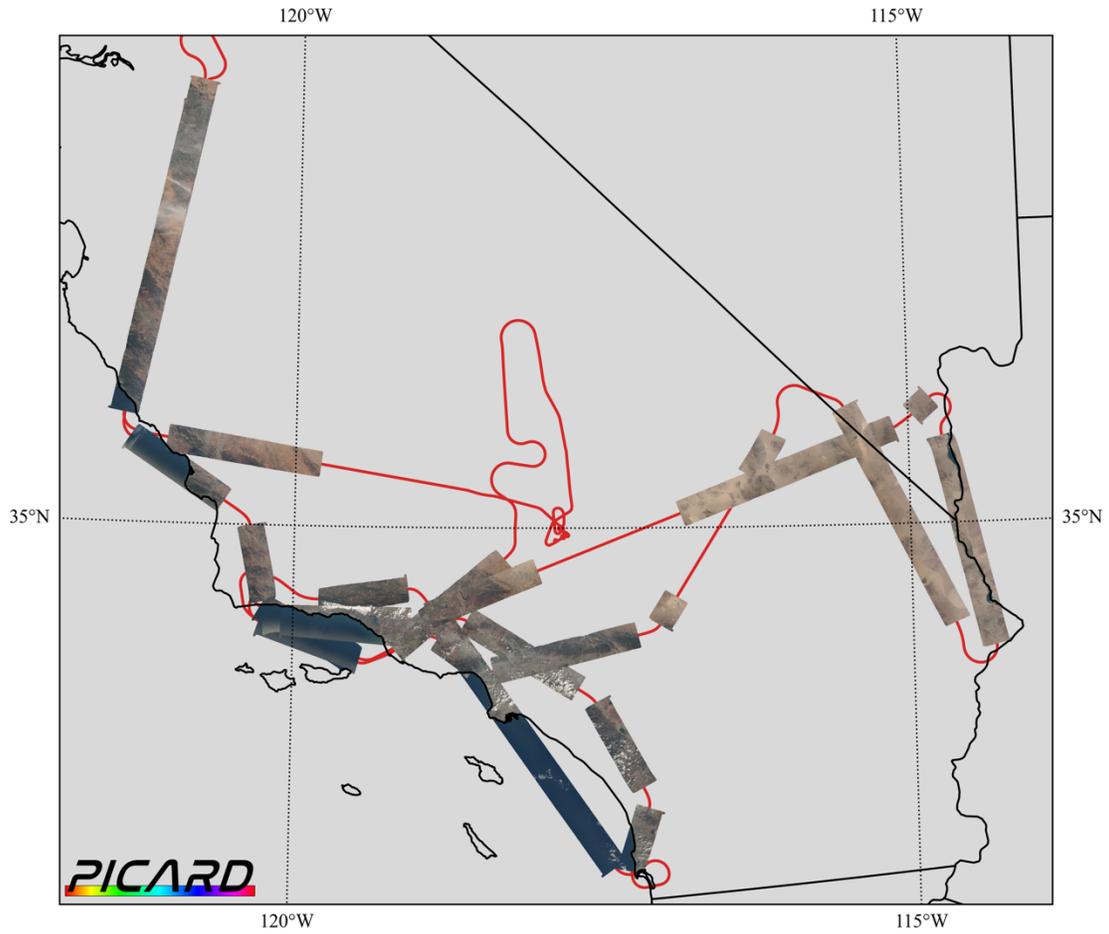


Modesto



Turlock

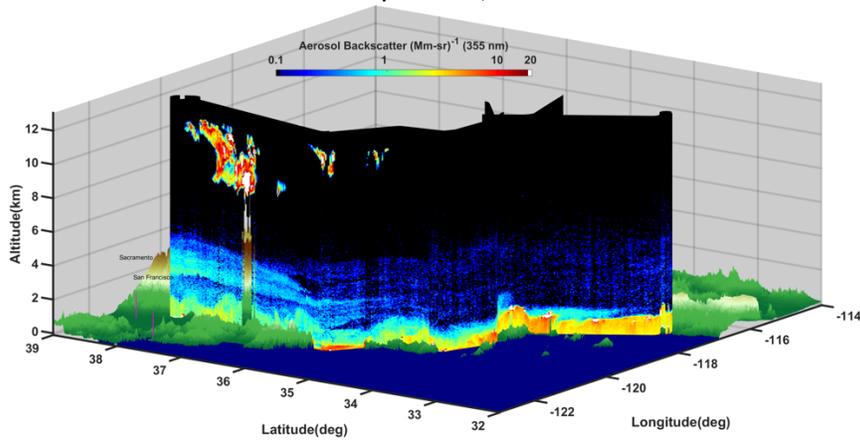
ER-2/PICARD, PACE swath



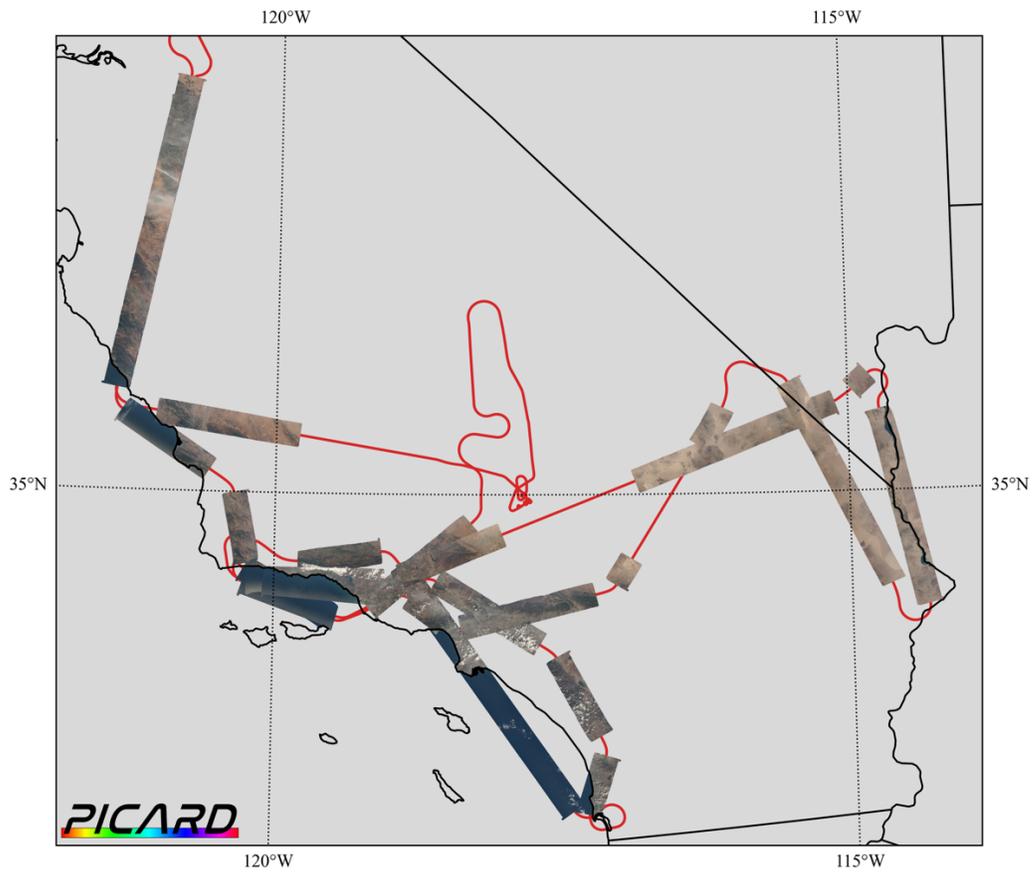
Pushbroom Imager for Cloud and Aerosol Research and Development
PACE-PAX, NASA Armstrong Flight Research Center
17 September 24

ER-2/HSRL

NASA/LaRC HSRL-2 September 17, 2024 PACE-PAX

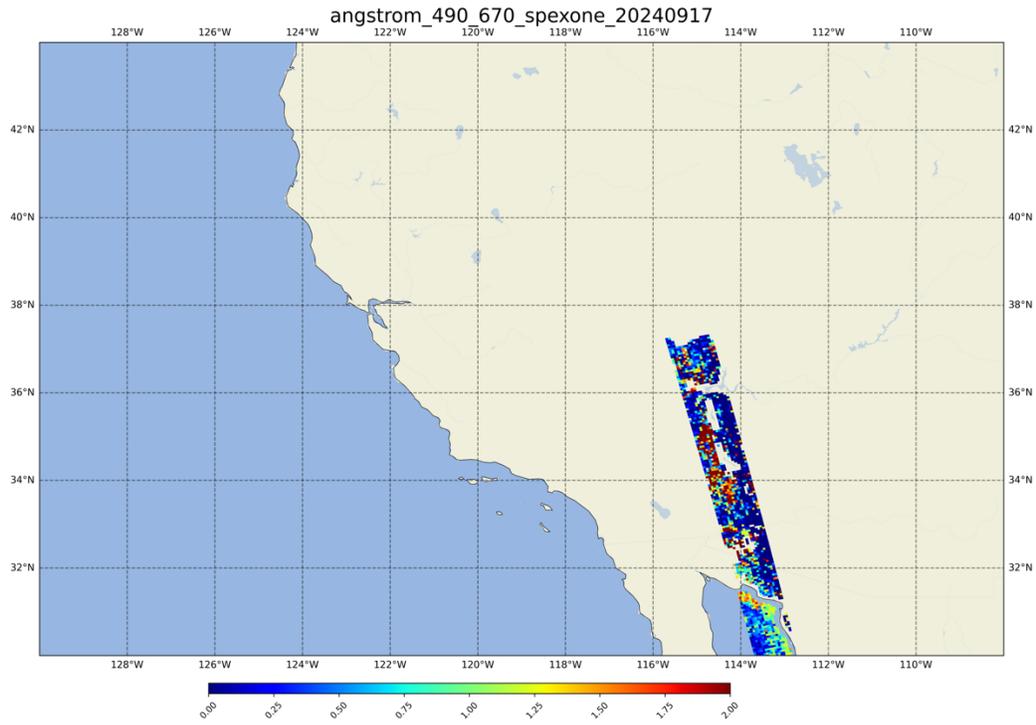
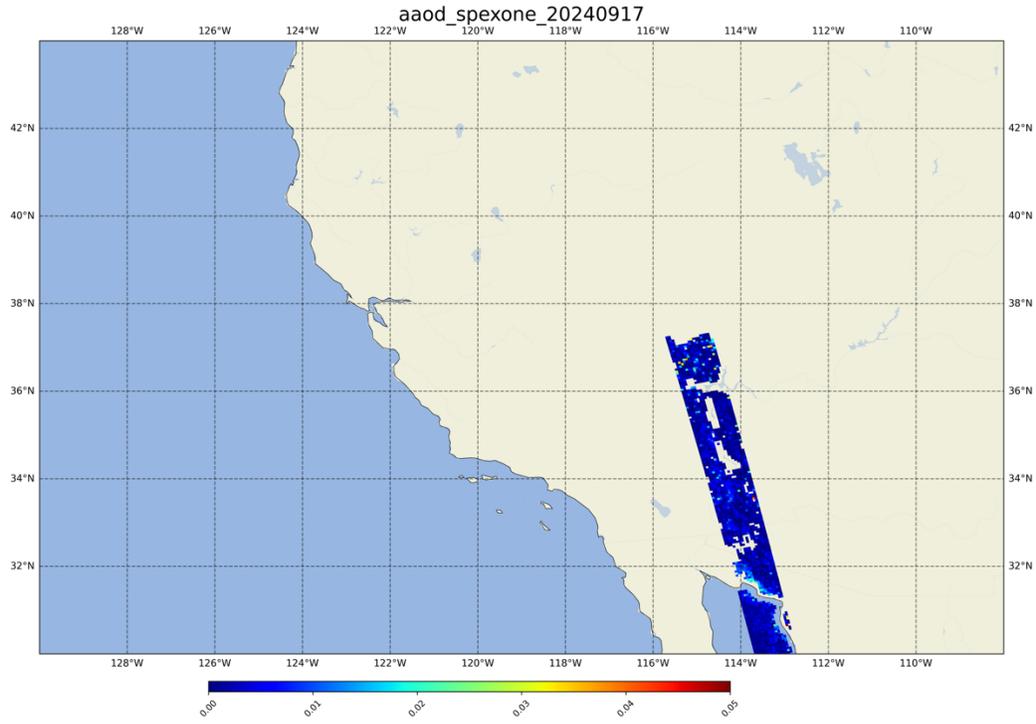


PICARD

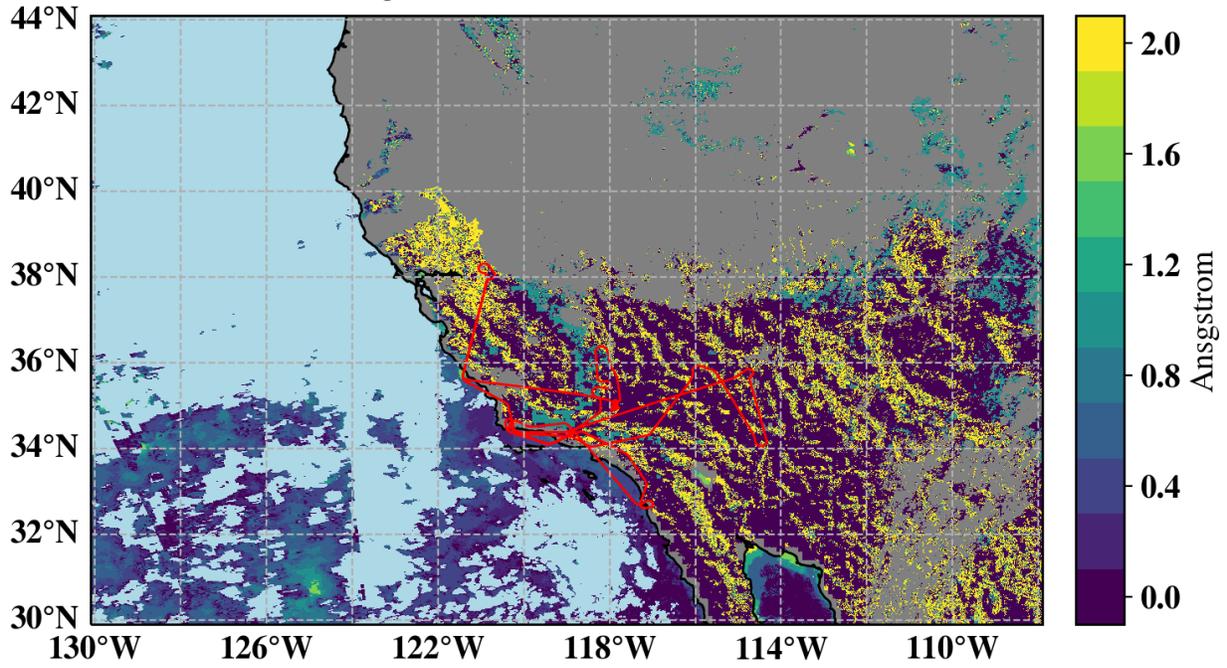


Pushbroom Imager for Cloud and Aerosol Research and Development
PACE-PAX, NASA Armstrong Flight Research Center
17 September 24

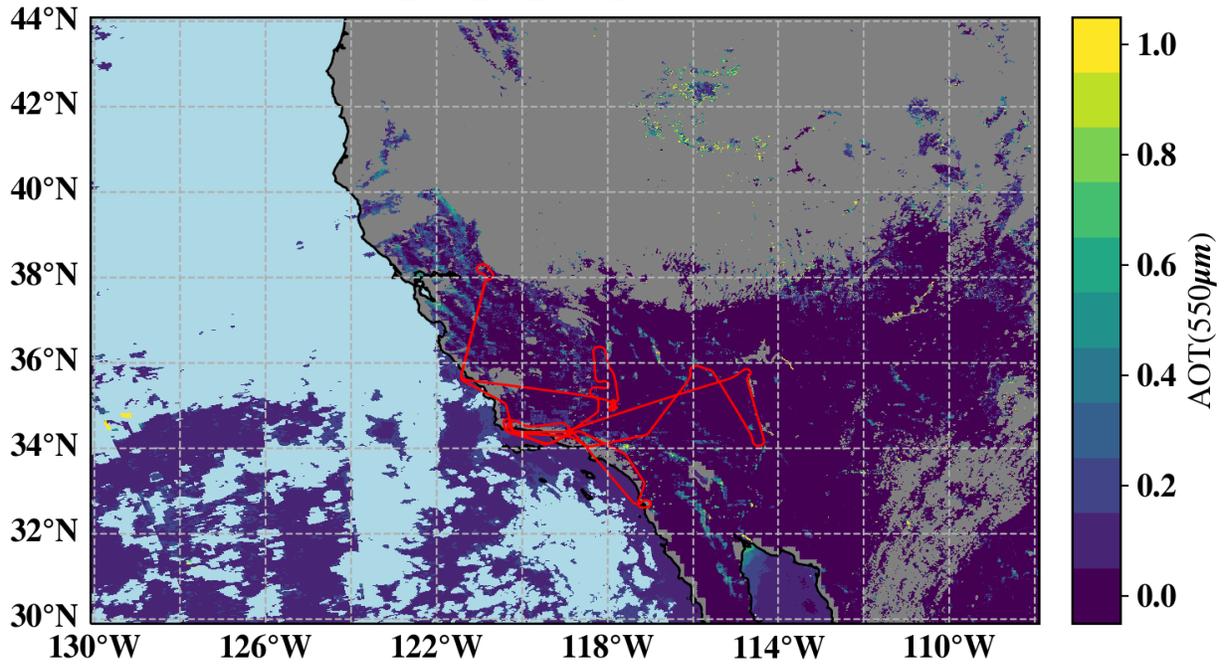
PACE Satellite products



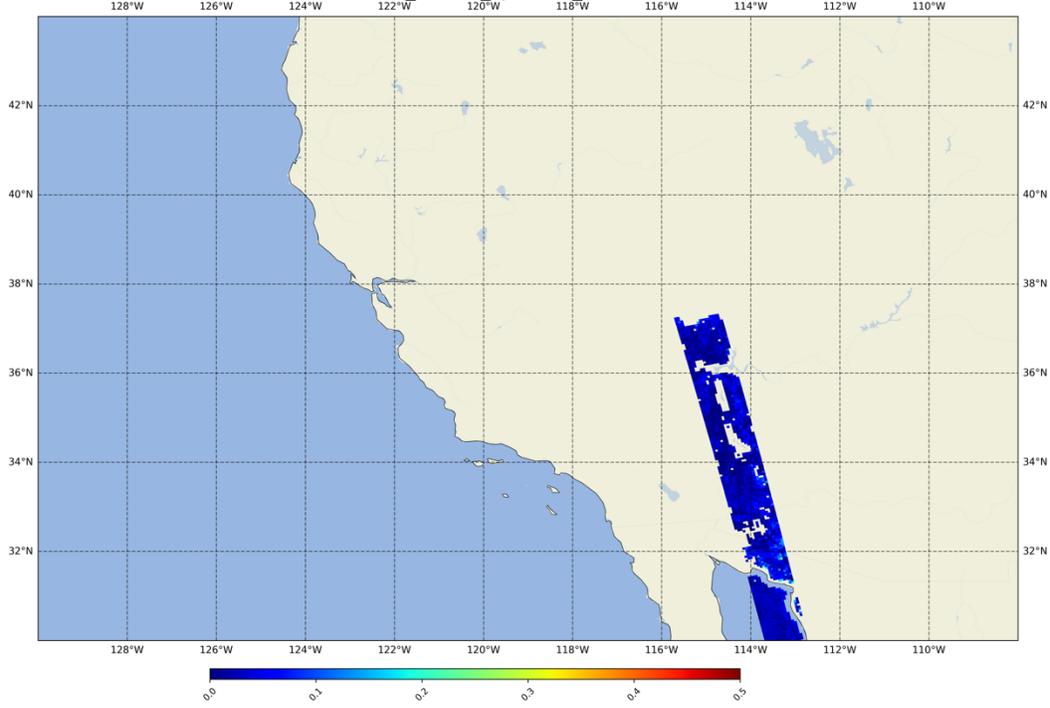
angstrom_db_OCI_20240917



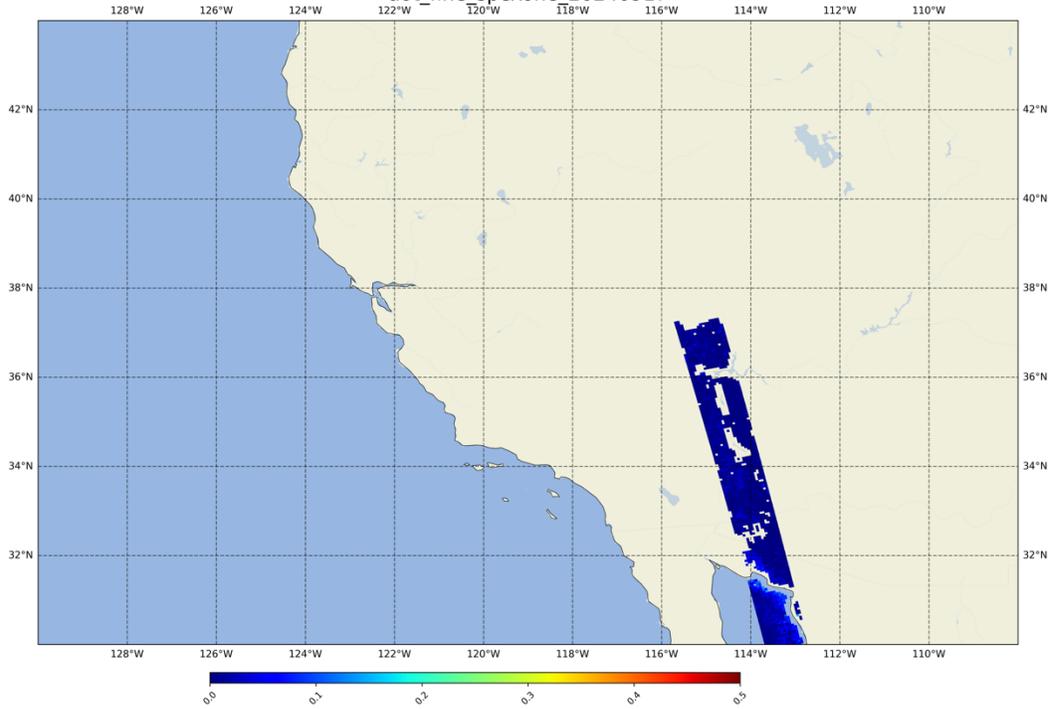
aot_550_db_OCI_20240917

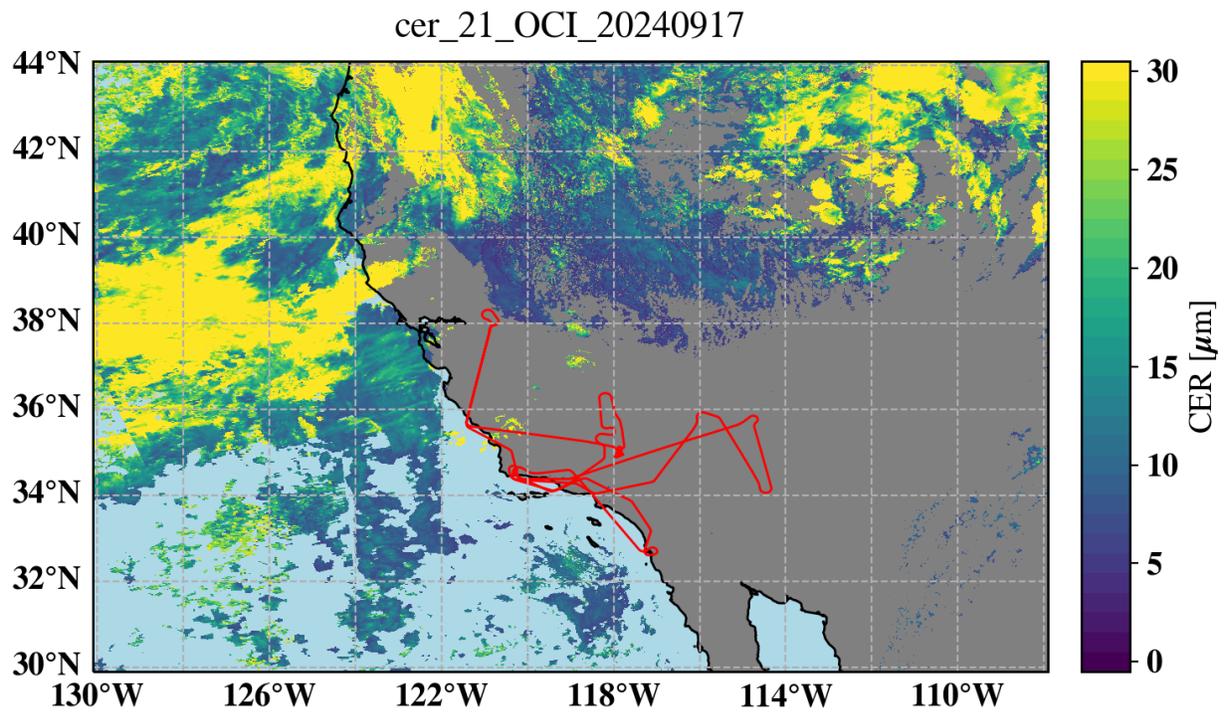
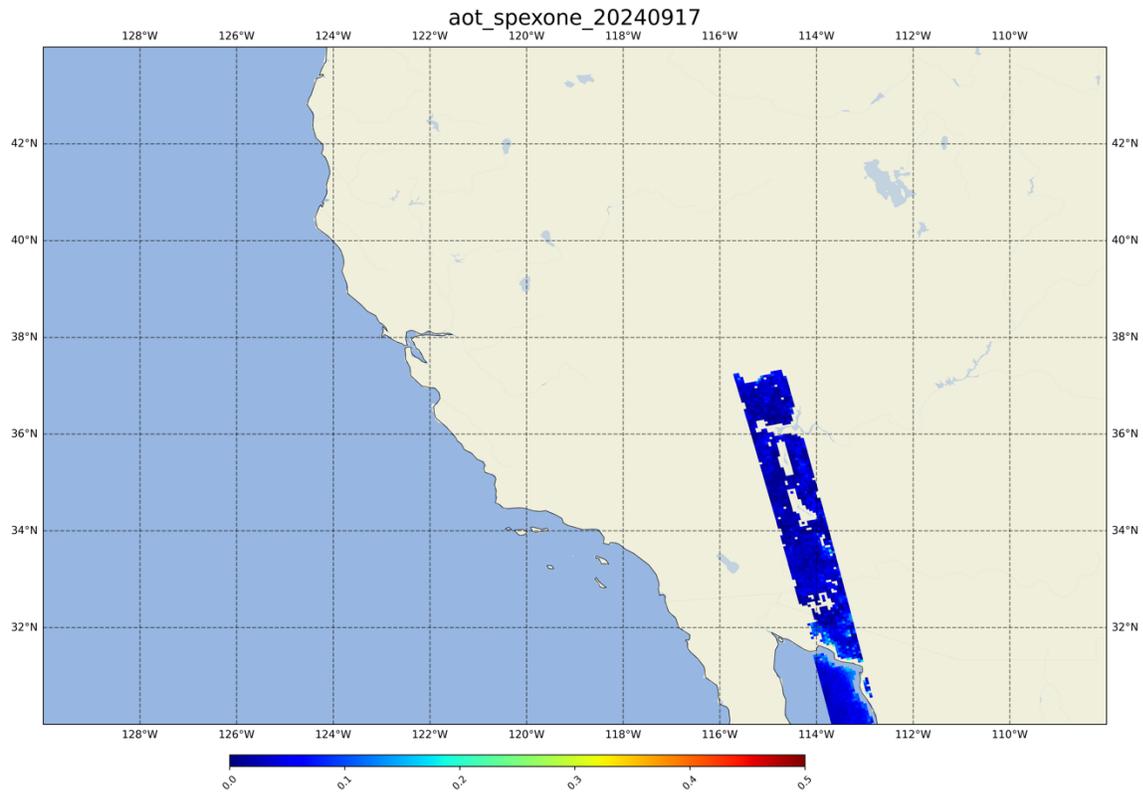


aot_coarse_spexone_20240917

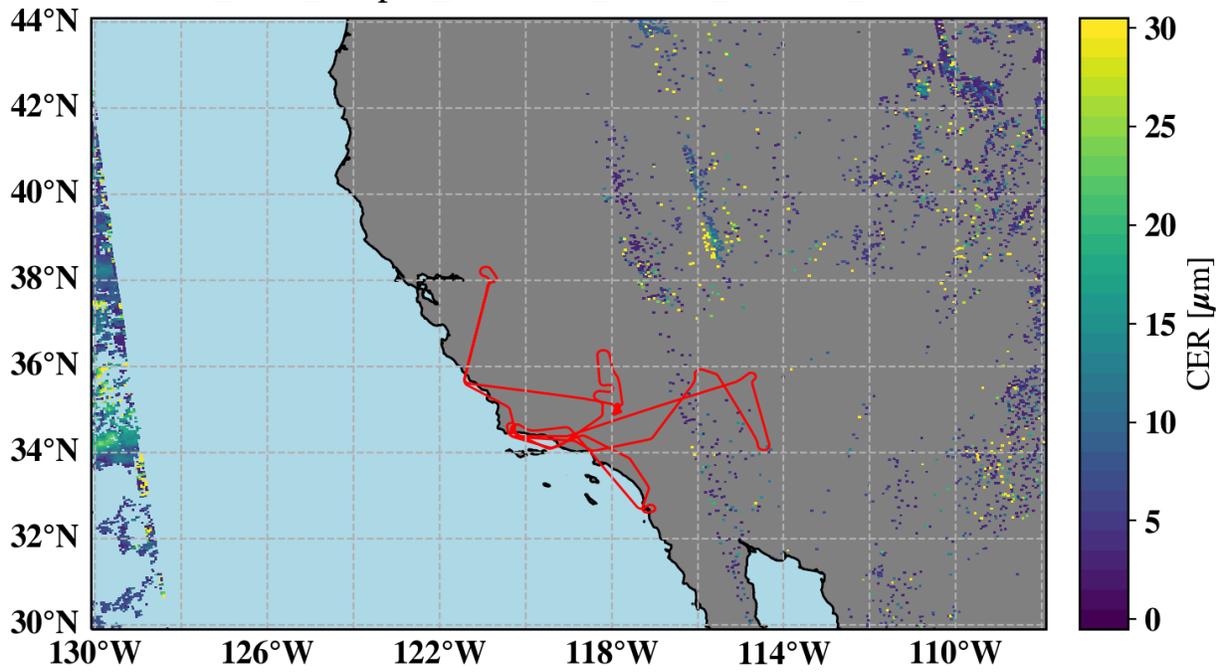


aot_fine_spexone_20240917

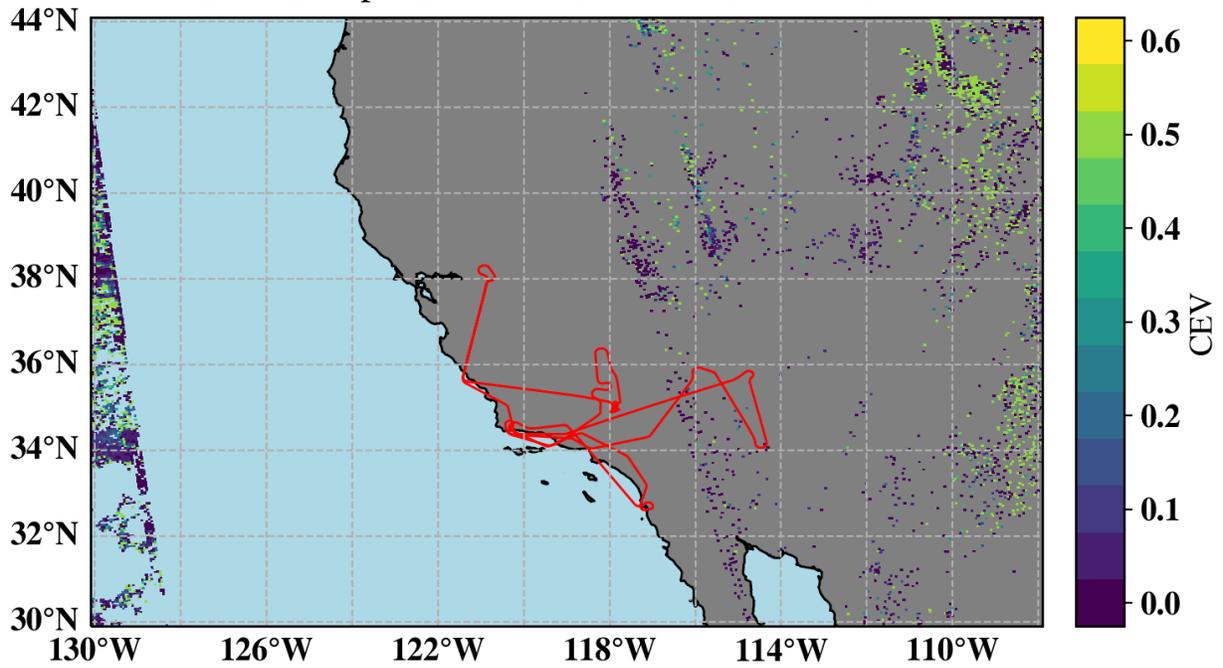


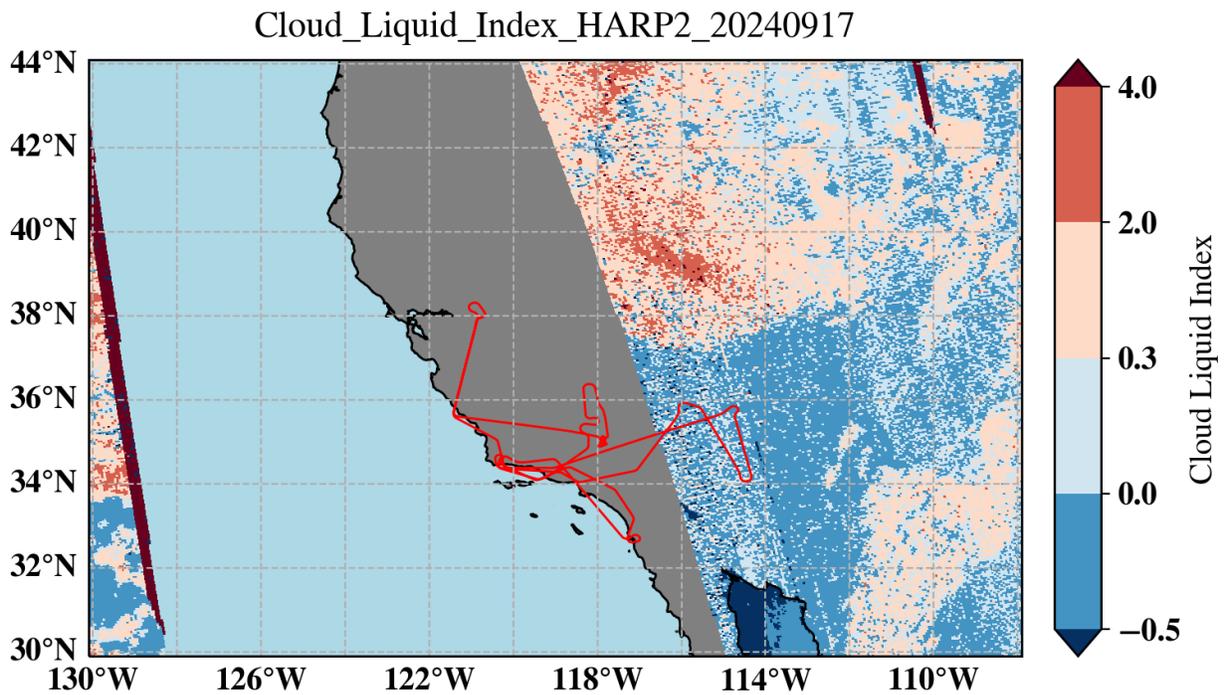
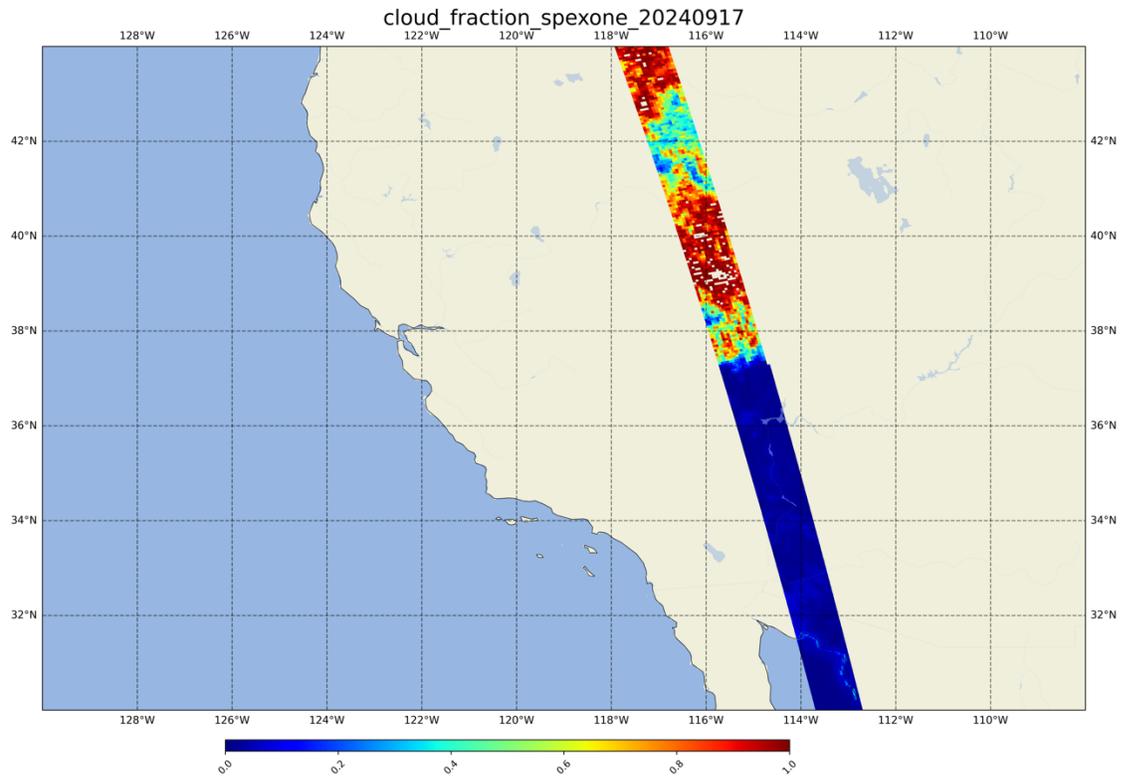


Cloud_Bow_Droplet_Effective_Radius_HARP2_20240917

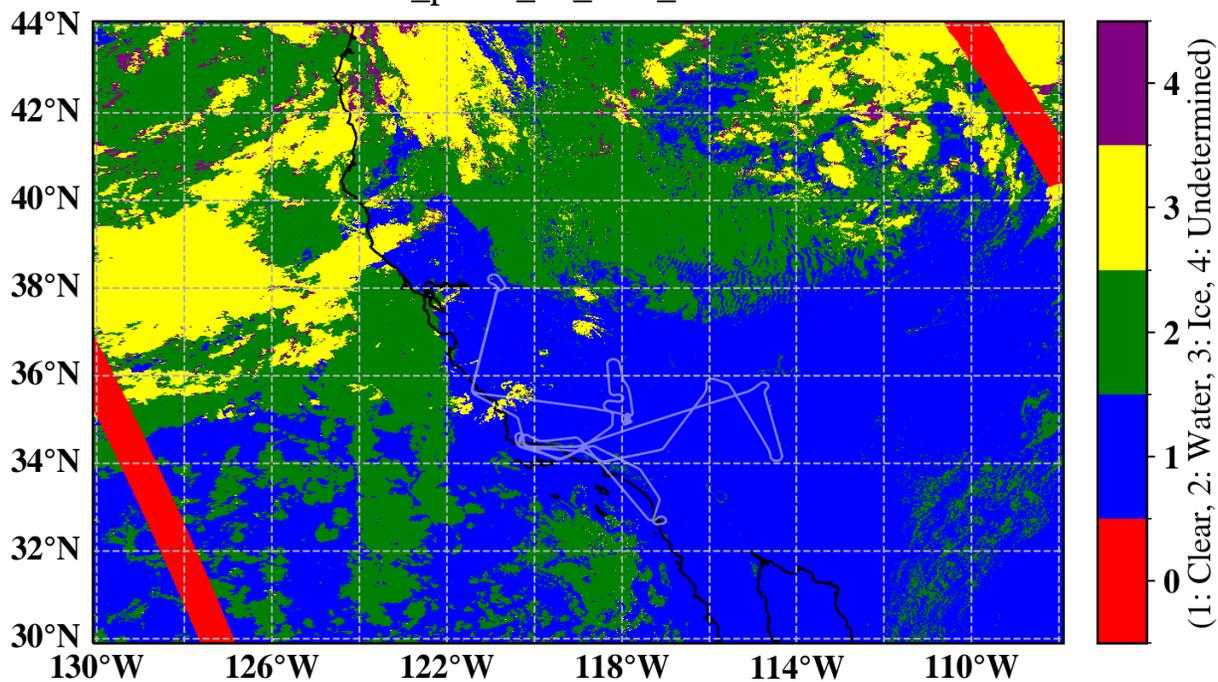


Cloud_Bow_Droplet_Effective_Variance_HARP2_20240917

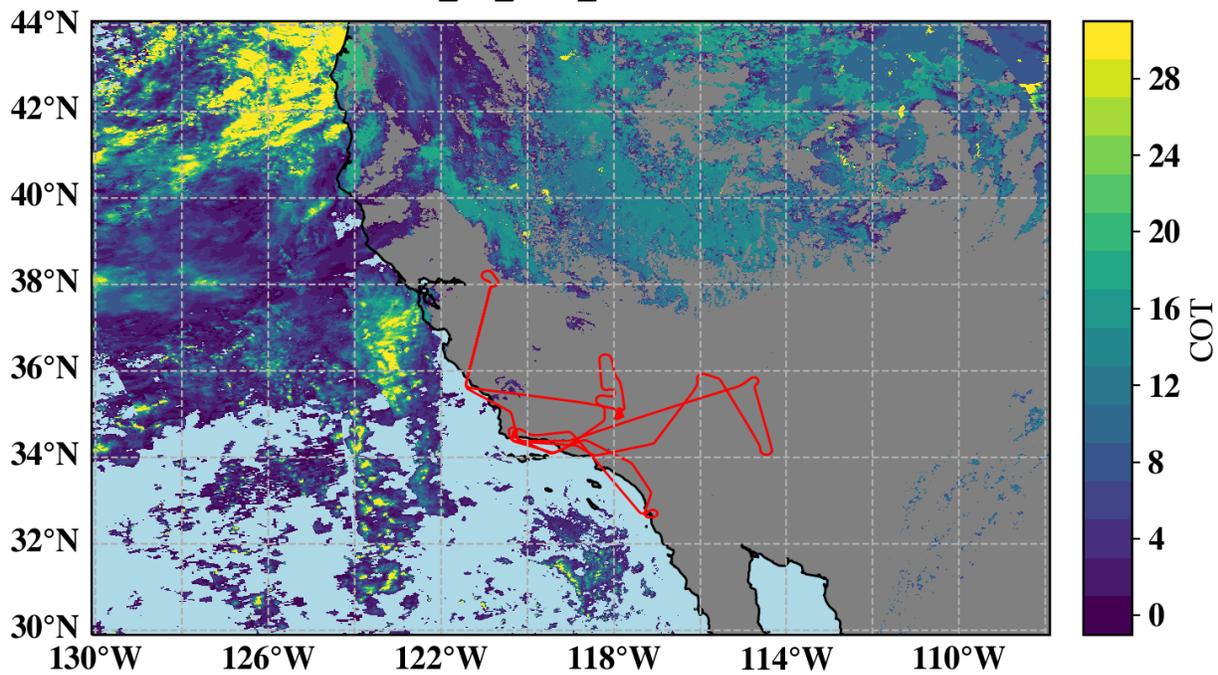




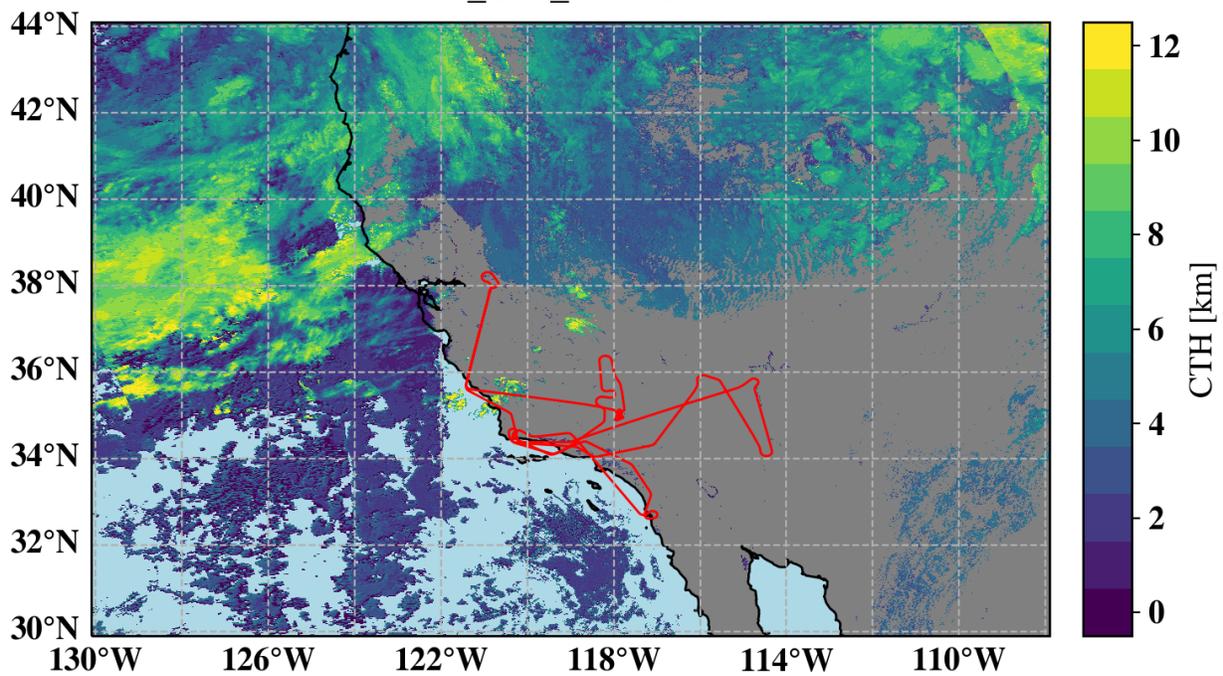
cloud_phase_21_OCI_20240917



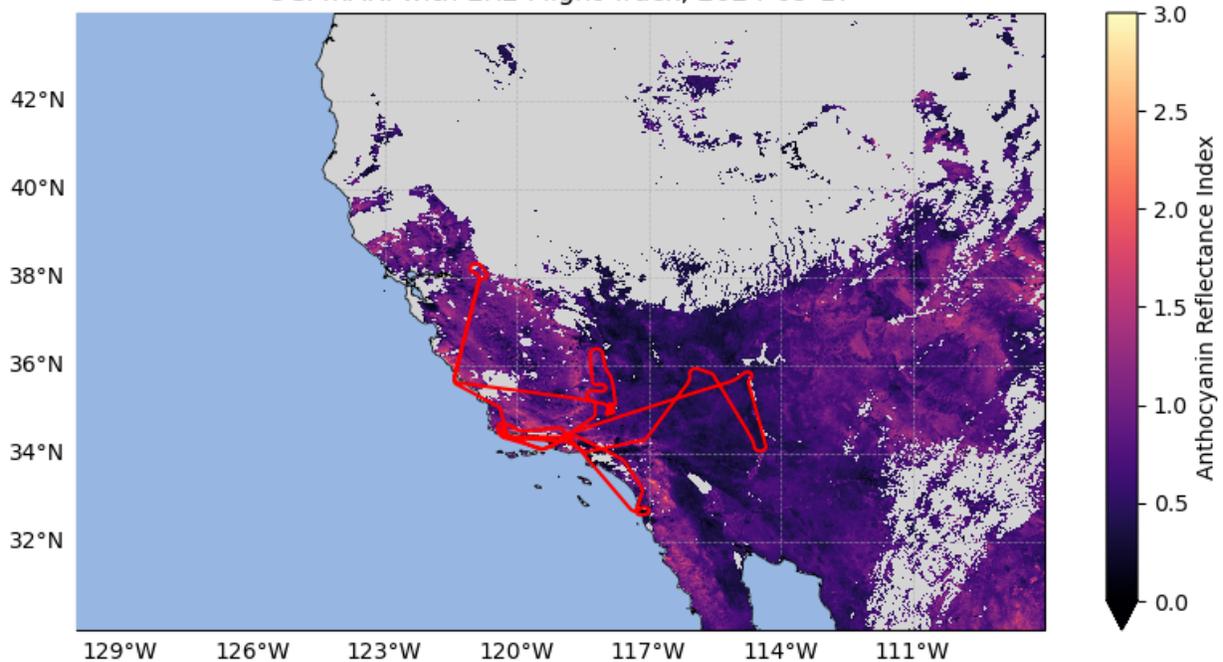
cot_21_OCI_20240917



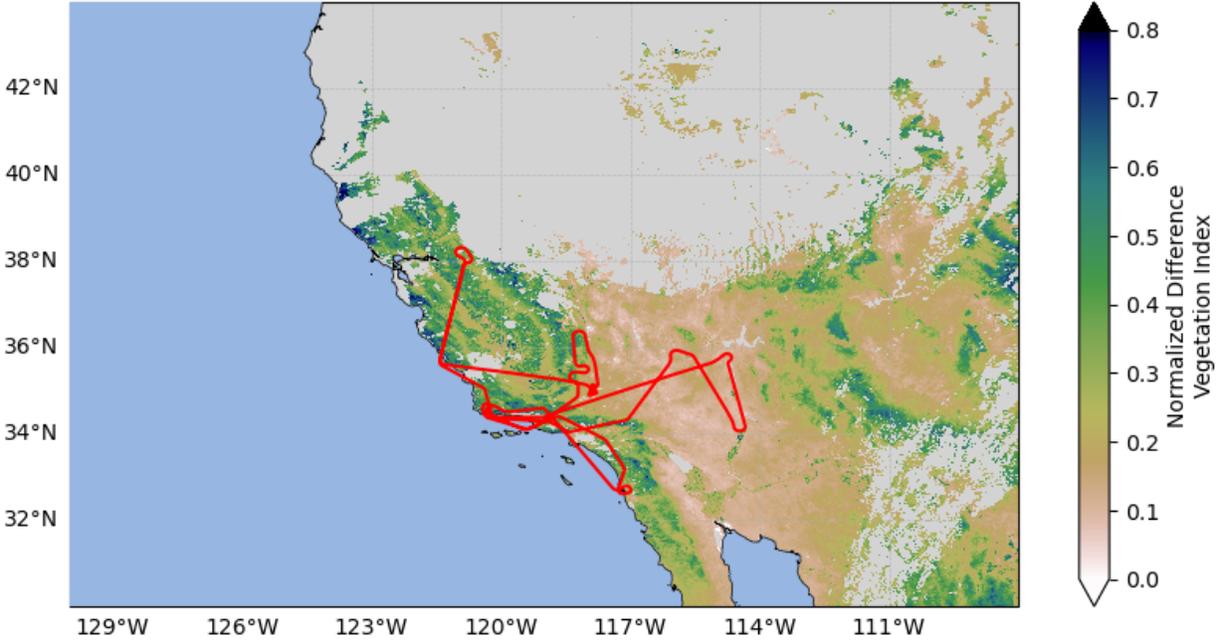
cth_OCI_20240917



OCI mARI with ER2 Flight Track, 2024-09-17



OCI NDVI with ER2 Flight Track, 2024-09-17



R/V Shearwater report

PACE-PAX R/V Shearwater day report

Date: 09/17/2024

Creator: Michael Ondrusek

Cruise ID: RF0917-RS

Sailed out: 0842 PST

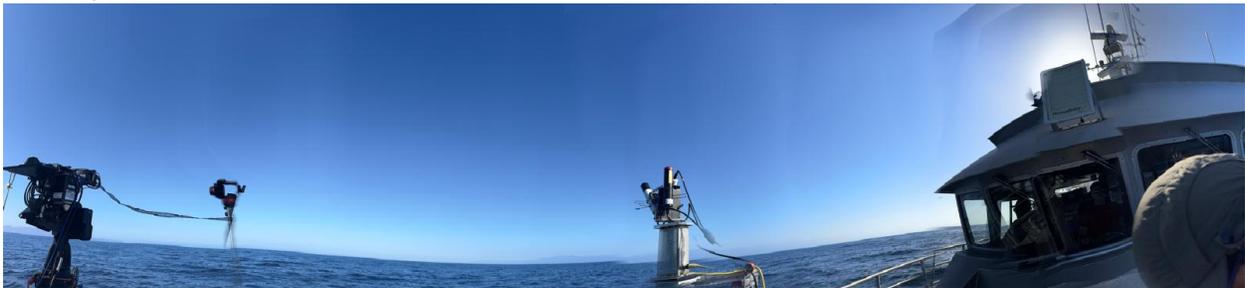
Back in port: 1600 PST

Today, the ship occupied four stations:

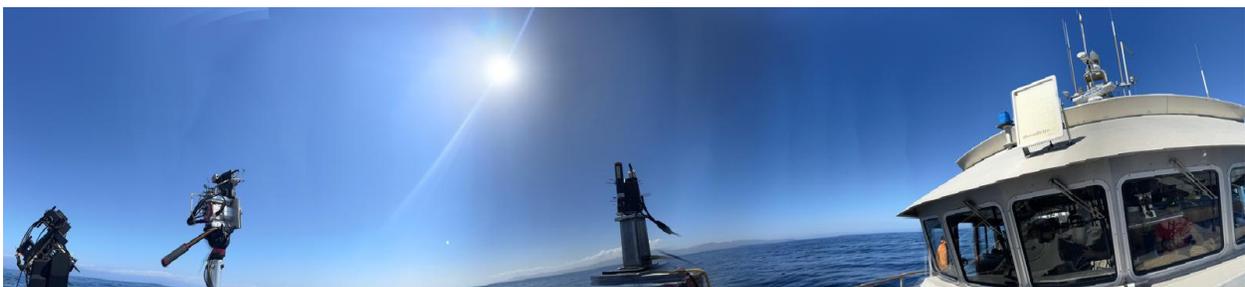
Station #16 $34^{\circ} 13.557'$, $-119^{\circ} 46.505'$ arrival 16:31UTC → departure 18:15 UTC

ER-2 overflight at 18:00. Clear skies, 3 to 4 ft. swell. Polarimager, IOPs then profiles. Clear sun for all cast.

Arrival photo:



Departure photo (departure location - $34^{\circ} 13.600'$, $-119^{\circ} 46.400'$)



Station #17 $34^{\circ} 10.816'$, $-119^{\circ} 39.920'$, arrival 18:39 UTC → departure 20:00 UTC

ER-2 overpass at 19:12 Hit the 1209 ER2 line approximately 5 Nm from Sta. 16. Clear skies, calm seas and 1 to 2 ft. swells. Profiles, polarimagers then IOP's.

Arrival photo:



Departure photo: (34° 11.026', - 119° 39.425')



Station #18 34° 15.586', 119° 37.214' arrival 20:18 UTC → departure 20:39 UTC

PACE overpass at 20:14. This is halfway to ER2 line so stopped to do profiles and pigment only. Seas 1-2m, winds 8 -10 kts., and clear skies.

Arrival photo:



Departure photo (34° 15.914' -119° 37.402'):



Station #19. $34^{\circ} 19.581'$, $-119^{\circ} 35.363'$, Arrival 20:51 UTC → departure 22:21 UTC. Sample on 1420 ER2 line. Just East of SB Harbor. Polarimager, profiles, then IOPs.

Arrival photo:



Departure photo ($34^{\circ} 19.559'$, $-119^{\circ} 33.723'$)



Group Status: No issues.

R/V Blissfully report

PACE-PAX R/V Blissfully day report

Date: 09/17/2024

Creator: Bridget Seegers

Cruise ID: RF0917-RB

Sailed out: 16:08 UTC

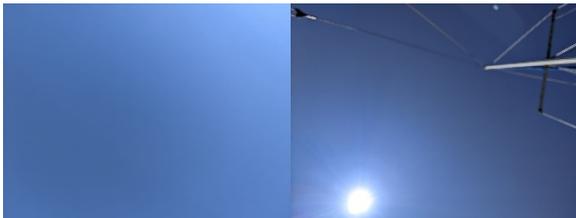
Back in port: 00:26 UTC

Today, the ship accomplished....

Collection of vertical radiometry profiles and discrete sample collection (HPLC + ap) on three stations in proximity of SeaPRISM site. The stations had three sets of 5 HyperPro profiles to 20m and a single deep cast to 60m. Station discrete water samples included triplicate HPLC + ap and duplicate community composition Lugol's preserved and paraformaldehyde samples for flow cytometry.

Stations:

Station #RB_14 - 33.5943, -118.1177°, arrival at 18:26 UTC, ER-2 overflight 18:26 UTC



Station #RB_15: 33° 33.859', -118° 7.275', arrival 19:58. PACE overflight at 20:14



Station #RB_16: 33° 34.96548', -118 7.06062' arrival 21:08



Tomorrow, RV Blissfully will sample for PACE overpass

Ship plans through the next 3 days... RV Blissfully will continue to sample to support overpasses until Sept 19. Then, will head back to home harbor in San Diego.

System Status...

All good

Group Status...

All great