PACE-PAX check flight report 2024/09/03

Compiled by Kirk Knobelspiesse, Brian Cairns, 2024/09/04, last update 2024/09/07
Reviewed by Samuel LeBlanc

Objectives: Profiles of aerosol scattering and absorption coefficients and size distributions together with scattering (polarized) phase functions above AERONET sites, with at least one spiral occurring during the PACE overpass for OCI and HARP2 aerosol retrieval algorithm validation. Spirals planned at Fresno, SJER and Turlock with the primary spiral in highest AOT at SJER.

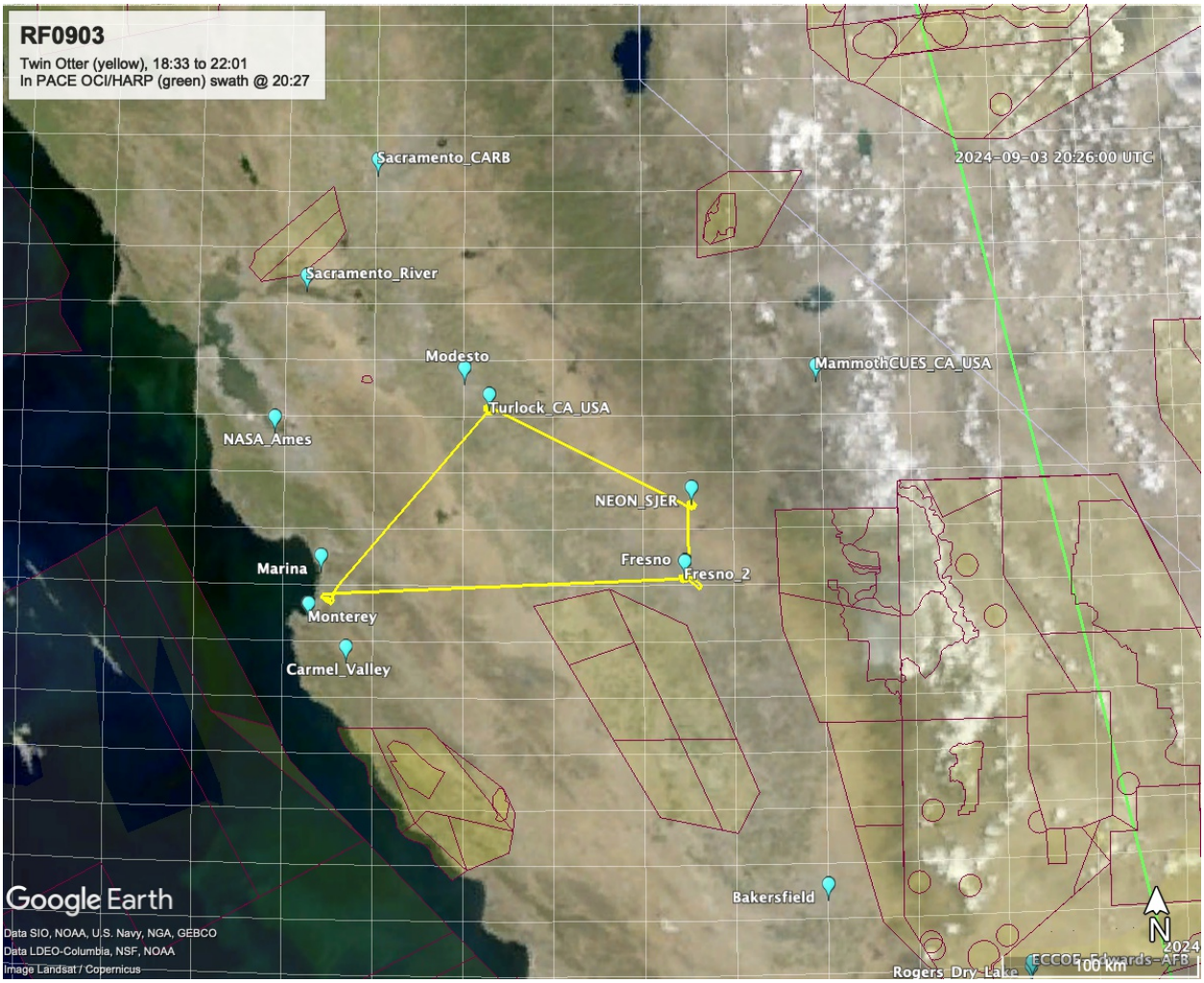
Summary: Instruments at nominal performance passing through 4 kft after takeoff. Ascended out of aerosol by 6 kft on the way to Fresno during which time the cabin temperatures were pleasant. The Fresno AERONET site was showing a mid-visible AOT of 0.12 shortly before the spiral down. Scattering coefficients of 6 Mm^{-1} were measured passing through first part of the descent (this value noted at 8 and 6 kft), and then a peak of 150 Mm^{-1} was observed at 3.6 kft in a very shallow layer at the top of the boundary layer. Scattering coefficients of 30-40 Mm^{-1} were measured at altitudes below this peak, with a well-mixed boundary layer, and the measurements were extended to the near-surface through a missed approach at 19:44 UTC. Transit to SJER in the "soup" at 3 kft but no significant scattering peak (e.g. 150 Mm^{-1} at Fresno) was observed during transit. Spiral at SJER started at 19:55 UTC with a slower ascent rate to ensure that we are in position during the PACE overpass. Very different vertical structure at SJER compared to Fresno with no peak at top of boundary layer and 6 Mm^{-1} scattering at 7 kft. SJER spiral ends at 20:27 UTC. Spiral down at Turlock started at 20:56 UTC, and a small agricultural fire was observed out of the window at 21:05 UTC. Back into (presumed) smoke during spiral at 5.7 kft with 270 Mm^{-1} scattering coefficient. Five distinct layers were observed down to 3.3 kft and quite clean (10 Mm^{-1}) at 2.5 kft (and below). Ascended up to 5 kft on the return to Marina to observe scattering layers with smoke again at 3.6 kft, but at much lower concentrations. During the missed approach at Marina to provide comparisons with tower measurements we observed a 15 Mm^{-1} scattering coefficient with agreement between tower and CIRPAS TO.

Overall, the flight plan was executed by the pilots and the science team extremely well. This flight provides examples of highly diverse vertical profiles of aerosol scattering coefficients that will be a good test to validate the capabilities of passive satellite remote sensing retrieval in the presence of complex detached layers versus well-mixed boundary layers.

Twin Otter
Takeoff: 11:33:10 (18:33:10 UTC)
Landing: 15:01:47 (22:01:47 UTC)
Duration: 3.4 hrs.
Instrument status: nominal

Manifest: Luke Ziemba (QNC), Adam Ahern (QNC)
Pilot: Bryce Kujat, Jeff Martin

PACE
Overpass: 20:27
Orbit track east on CA/Nevada border. Operations within OCI and HARP2 swath



All times are in UTC, VTM elements in **black** satisfied, **blue** partially satisfied and **red** not satisfied.

Time	Platform	VTM(hrs)	
18:33	TO		Takeoff
19:22	TO		Spiral down to Fresno2 AERONET site from 10kft
19:44	TO	1d, 6c(0.75) at 0.75 completeness due to time	Spiral down at Fresno2 AERONET site ending with touch and go at Fresno airport. AOD~=0.12

		difference from overpass	
19:48	TO		Transit to NEON SJER AERONET site in the 'soup' at 3kft. (over 1000 #/cm^2)
19:55	TO	1d(0.5)	Spiral down at SJER starts AOD~=0.08, multiple aerosol layers
20:27	**PACE**		**PACE-OH overpass**
20:27	PACE	1d, 6c(1.5)	PACE overpass, in OCI and HARP2 swath
20:27	TO		Spiral ends at SJER
20:56	TO	1d, 6c(1.5)	Begin spiral down at Turlock AERONET site AOD~=0.18
22:01	TO		Land

Assessment:

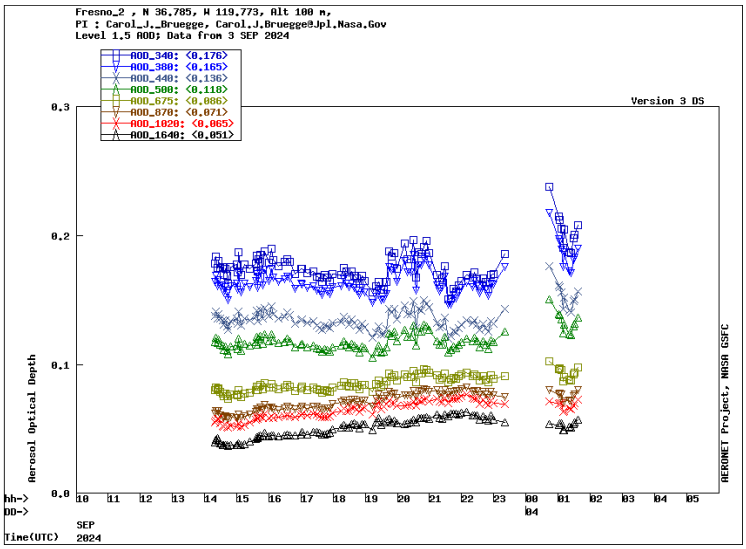
- Additional 2.5% validation objectives satisfied

E-PAX progress tracking

Measurement objectives	Importance, w	Observation time, h (hours)	Total observed (hours)	Fractional success 8/29	Fractional success 9/3	Fractional success 9/4	Fractional success 9/5	Fractional success 9/6	Fractional success 9/7	Fractional success 9/8	Total success	Remaining score
Land surface parameters	8	2.0	0.5	**20.1%**	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**20.1%**	6.4
Ocean radiometric parameters	10	8.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0
Aerosol parameters over the ocean	12	8.0	0.5	0.0%	0.0%	**6.1%**	0.0%	0.0%	0.0%	0.0%	**6.1%**	11.3
Aerosol parameters over land	12	8.0	10.0	**39.3%**	**24.4%**	**6.2%**	0.0%	0.0%	0.0%	0.0%	**70.0%**	3.6
Cloud parameters	12	8.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12.0
Ocean surface parameters	1	8.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0
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%	0.0%	10.0
Aerosol parameters over land (PACE)	10	8.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0
Cloud parameters (PACE)	5	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.0
Aerosol parameters (EarthCARE)	8	4.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.0
Cloud parameters (EarthCARE)	8	4.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.0
Validate large reflectances	6	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0
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%	0.0%	6.0
Validate large reflectances with low polarization	6	2.0	0.5	**22.1%**	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**22.1%**	4.7
Overfly vicarious calibration sites	6	4.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0
High aerosol loads over land	4	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0
High aerosol loads over ocean	4	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0
Multiple aerosol layers	1	2.0	4.5	0.0%	**87.3%**	0.0%	0.0%	0.0%	0.0%	0.0%	**87.3%**	0.1
Aerosol under thin cirrus	2	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0
Aerosol above liquid phase cloud	4	2.0	0.5	**11.8%**	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**11.8%**	3.5
Broken clouds with complex structure	4	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0
Dust aerosols over ocean	4	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0
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%	0.0%	2.0
Aerosol and ocean parameters over biologically productive waters	4	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0
Smoke aerosols over ocean	1	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0
total:	**150**	**98**	**16.5**	**5.4%**	**2.5%**	**1.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**8.9%**	
												total
		ER-2 flight hours		2.8	0	0	0	0	0	0	0	**2.8**
		TO flight hours		2.5	0	0	0	0	0	0	0	**2.5**
		Shearwater days		0	0	0	0	0	0	0	0	**0**

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


Fresno_2 , N 36.785, W 119.773, Alt 100 m,
PI : Carol_J._Bruegge, Carol.J.Bruegge@Jpl.Nasa.Gov
Level 1.5 AOD; Data from 3 SEP 2024
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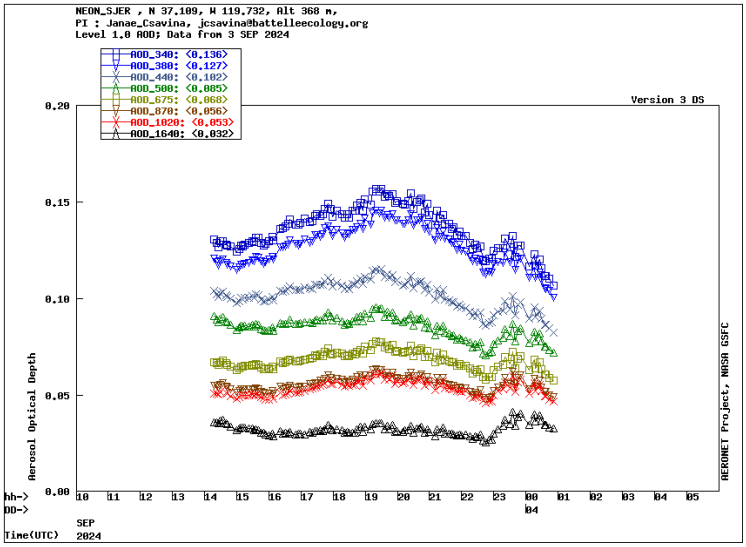
AOD_380: <0.165>
AOD_440: <0.136>
AOD_500: <0.110>
AOD_675: <0.086>
AOD_870: <0.071>
AOD_1020: <0.065>
AOD_1640: <0.051>
Version 3 DS
Aerosol Optical Depth
AERONET Project, NASA GSFC
hh->
DD->
Time(UTC)
SEP
2024


NEON_SJER , N 37.109, W 119.732, Alt 368 m,
PI : Janae_Csavina, jcsavina@battelleecology.org
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AOD_440: <0.102>
AOD_500: <0.085>
AOD_675: <0.068>
AOD_870: <0.056>
AOD_1020: <0.053>
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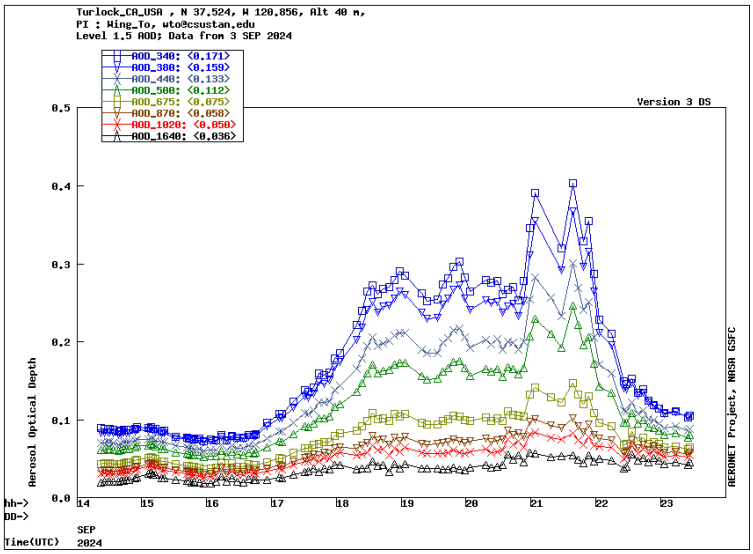
Version 3 DS
Aerosol Optical Depth
AERONET Project, NASA GSFC
hh->
DD->
Time(UTC)
SEP
2024


Turlock_CA_USA , N 37.524, W 120.856, Alt 40 m,
PI : Wing_To, wto@csustan.edu
Level 1.5 AOD; Data from 3 SEP 2024
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AOD_440: <0.133>
AOD_500: <0.112>
AOD_675: <0.075>
AOD_870: <0.058>
AOD_1020: <0.050>
AOD_1640: <0.036>
Version 3 DS
Aerosol Optical Depth
AERONET Project, NASA GSFC
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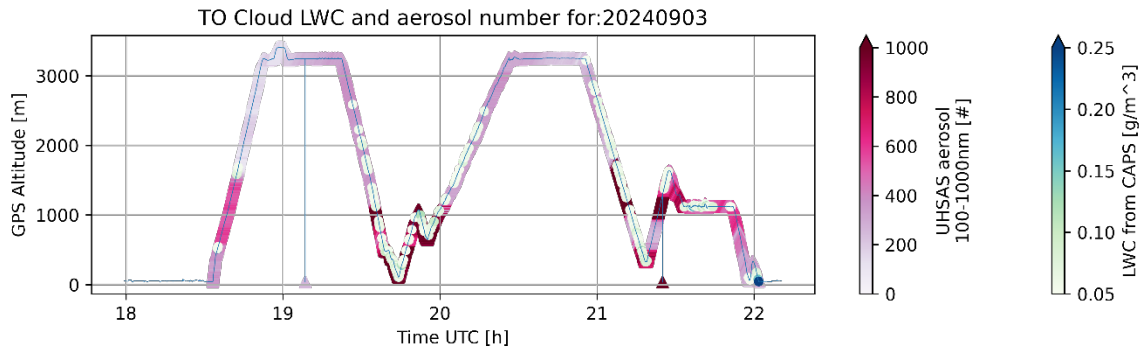
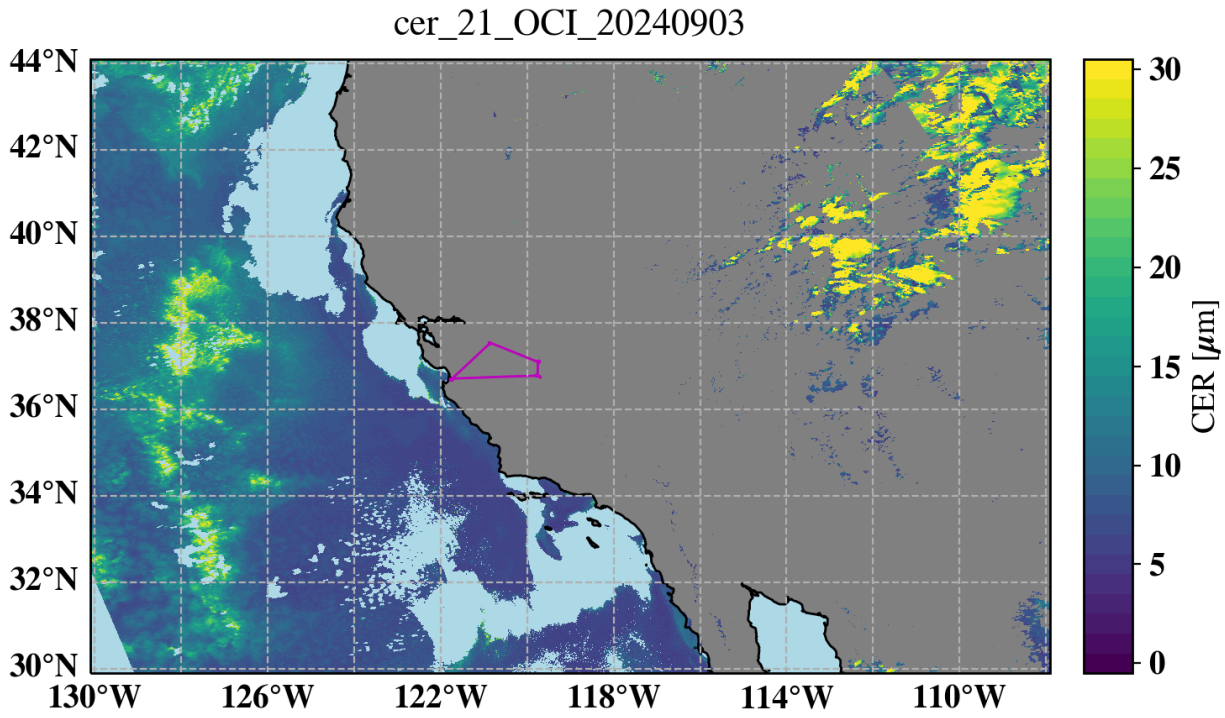
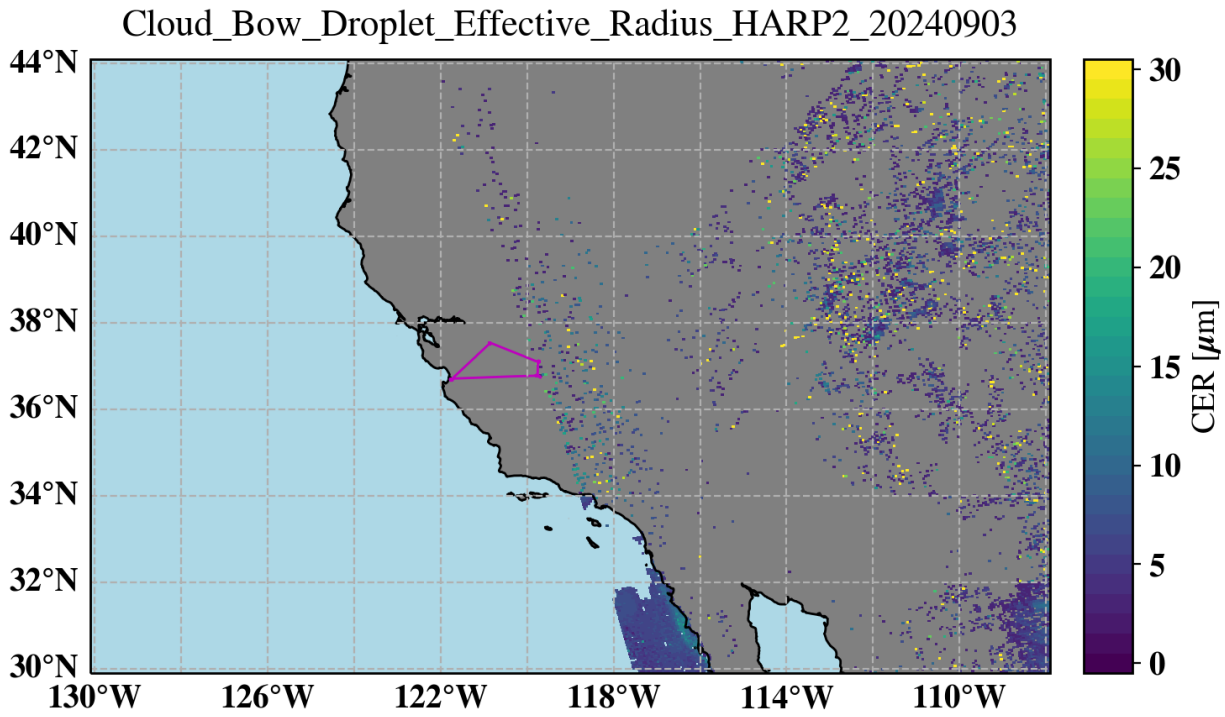
Time(UTC)
SEP
2024

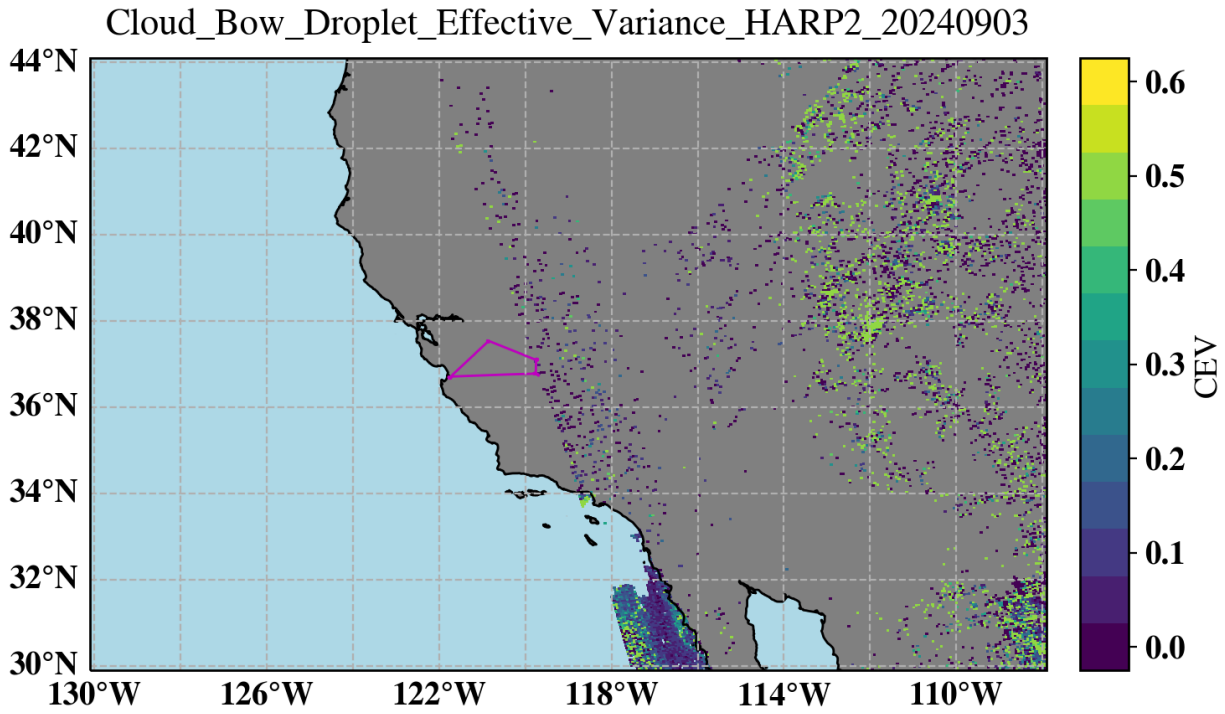

TO Cloud LWC and aerosol number for:20240903
GPS Altitude [m]
3000
2000
1000
0
18
19
20
21
22
Time UTC [h]
1000
800
600
400
200
0
UHSAS aerosol
100-1000nm [#]
0.25
0.20
0.15
0.10
0.05
LWC from CAPS [g/m^3]

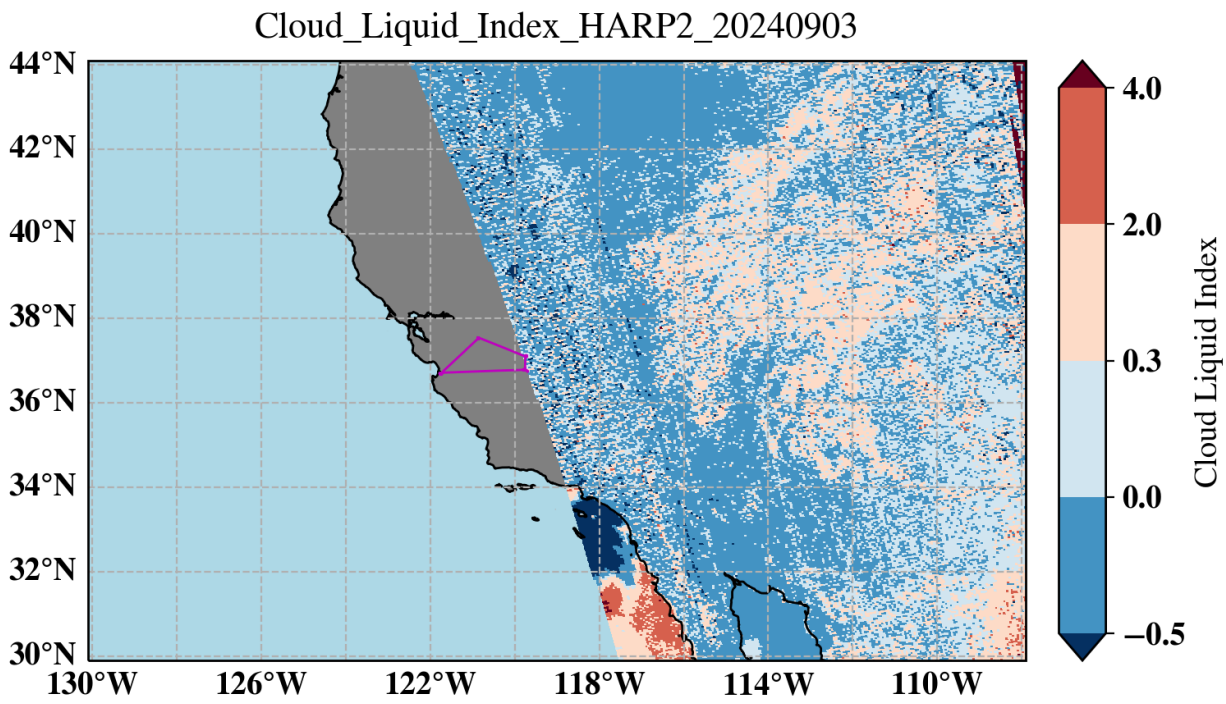
PACE quicklooks

Note: PACE quicklooks include data that are not officially released and may have errors. They are included for illustrative purposes only and are not for use elsewhere

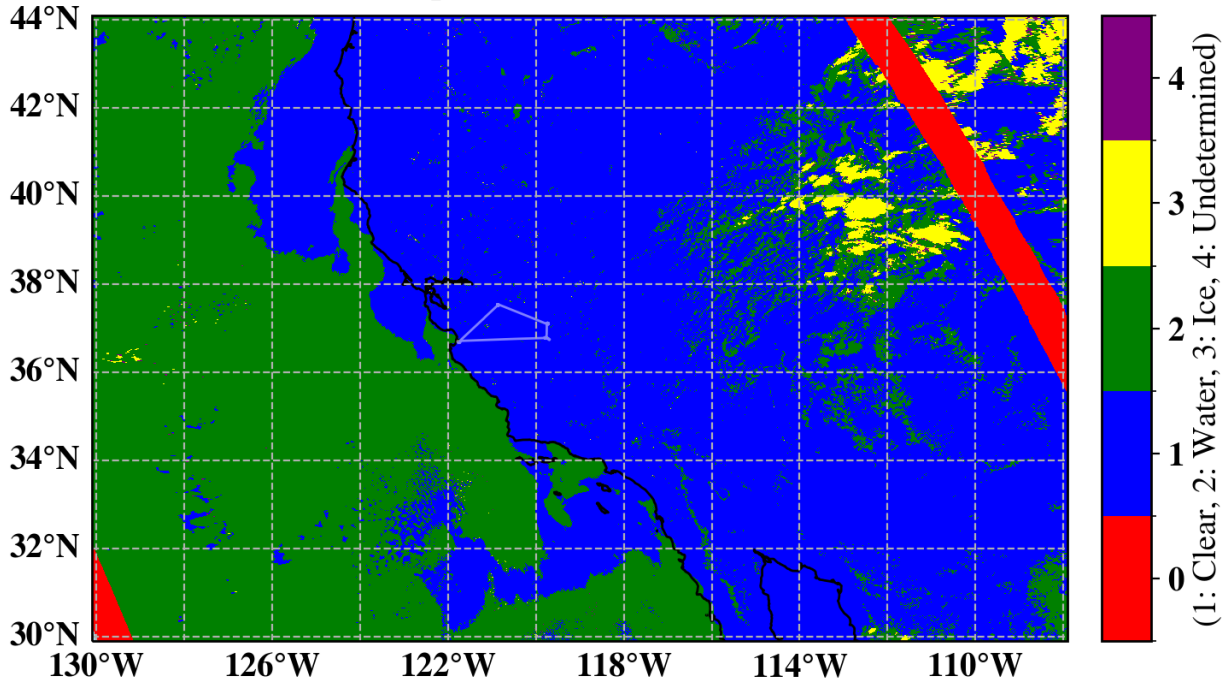




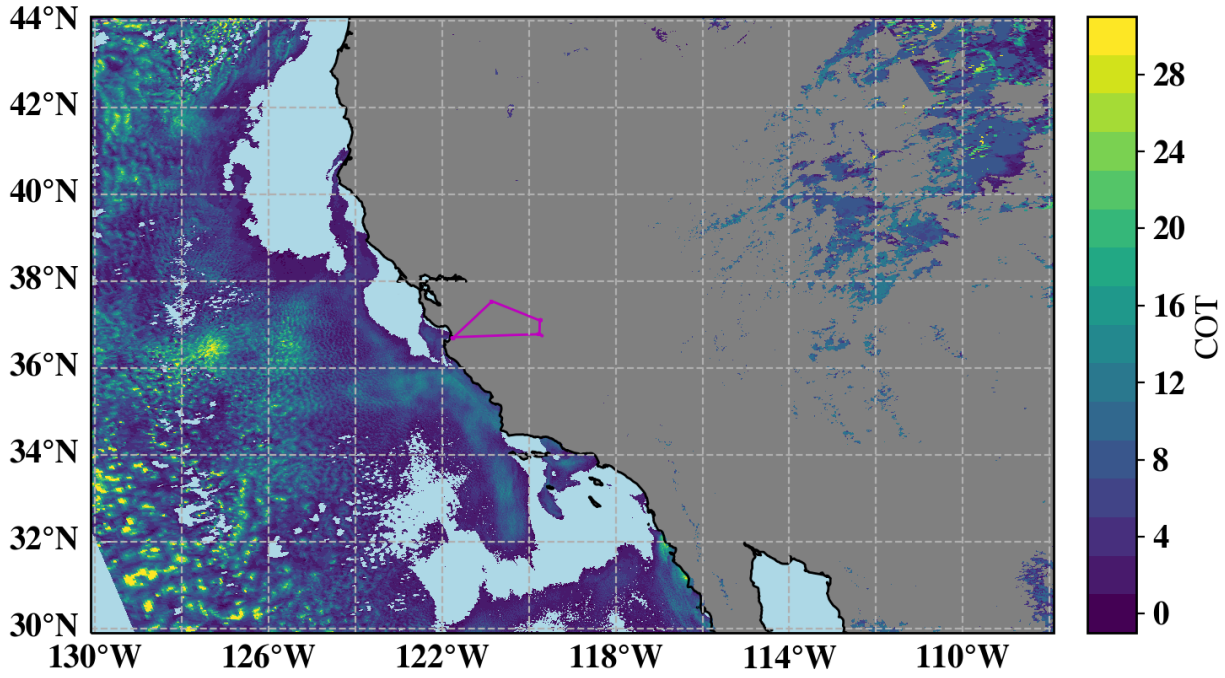

Cloud_Bow_Droplet_Effective_Variance_HARP2_20240903
44°N
42°N
40°N
38°N
36°N
34°N
32°N
30°N
130°W
126°W
122°W
118°W
114°W
110°W
0.6
0.5
0.4
0.3
0.2
0.1
0.0
CEV

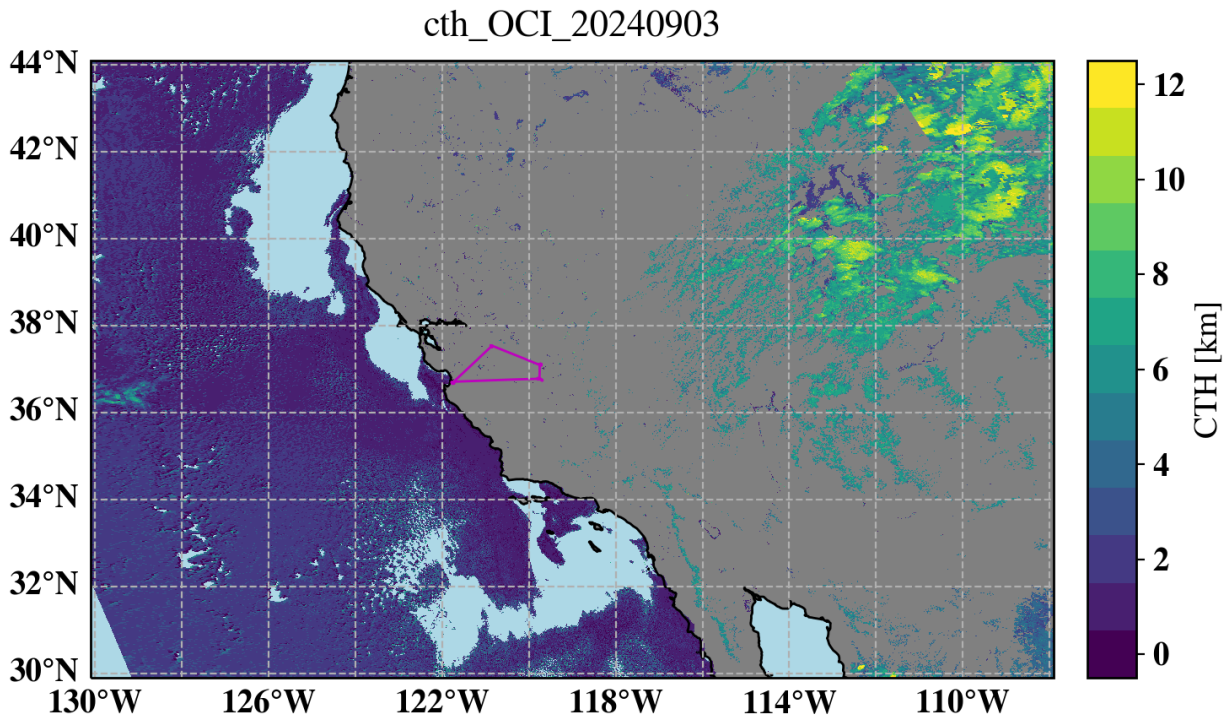

Cloud_Liquid_Index_HARP2_20240903
44°N
42°N
40°N
38°N
36°N
34°N
32°N
30°N
130°W
126°W
122°W
118°W
114°W
110°W
4.0
2.0
0.3
0.0
−0.5
Cloud Liquid Index

cloud_phase_21_OCI_20240903



cot_21_OCI_20240903




cth_OCI_20240903
44°N
42°N
40°N
38°N
36°N
34°N
32°N
30°N
130°W
126°W
122°W
118°W
114°W
110°W
12
10
8
6
4
2
0
CTH [km]