

PACE-PAX research flight report 2024/09/12

Compiled by Kirk Knobelspiesse, Ivona Cetinić, Brian Cairns

2024/09/18

Reviewed by Samuel LeBlanc

Planned ER-2 activities cancelled due to an aircraft issue just prior to takeoff. Twin Otter, R/V Shearwater and R/V Blissfully activities commenced regardless. All performed measurements during the PACE overpass (20:39 UTC) regardless, in most cases within the SPEXone swath. The Twin Otter performed spirals over Turlock, Sacramento_River AERONET sites, and a missed approach at NASA Ames Research Center (aka Moffett Field), the location of another AERONET instrument (NASA_Ames). R/V Shearwater performed three stations, station #7 and #8 were within 30min of the PACE overpass and within the PACE OCI and HARP swaths. Similarly station RB_9 was sampled by the R/V Blissfully at the time of overpass in the OCI and HARP swaths.

ER-2

The ER-2 flight was scrubbed due to a pressure seal problem. This was resolved prior to the subsequent flight on 9/13.

Twin Otter

Takeoff: 18:59, Landing: 22:38, Duration: 3.7

Instrument status: Good

Manifest: Bryce Kujat (pilot), Jeff Martin (pilot), Luke Ziemba (QNC), Ed Winstead (QNC)

[See end for full Twin Otter report](#)

R/V Shearwater

Departure: 15:49, Return:, Duration: 23:45

Instrument status: good

Captain/Mission Scientist: Michael Ondrusek

[See end for full R/V Shearwater report](#)

R/V Blissfully

Departure: 15:59, Return: 23:35, Duration: 7.5

Instrument status: good

Captain/Mission Scientist: Bridget Seegers

[See end for full R/V Blissfully report](#)

PACE

Overpass at 20:39 within SPEX swath for Twin Otter and OCI/HARP swath for Shearwater and Blissfully

EarthCARE

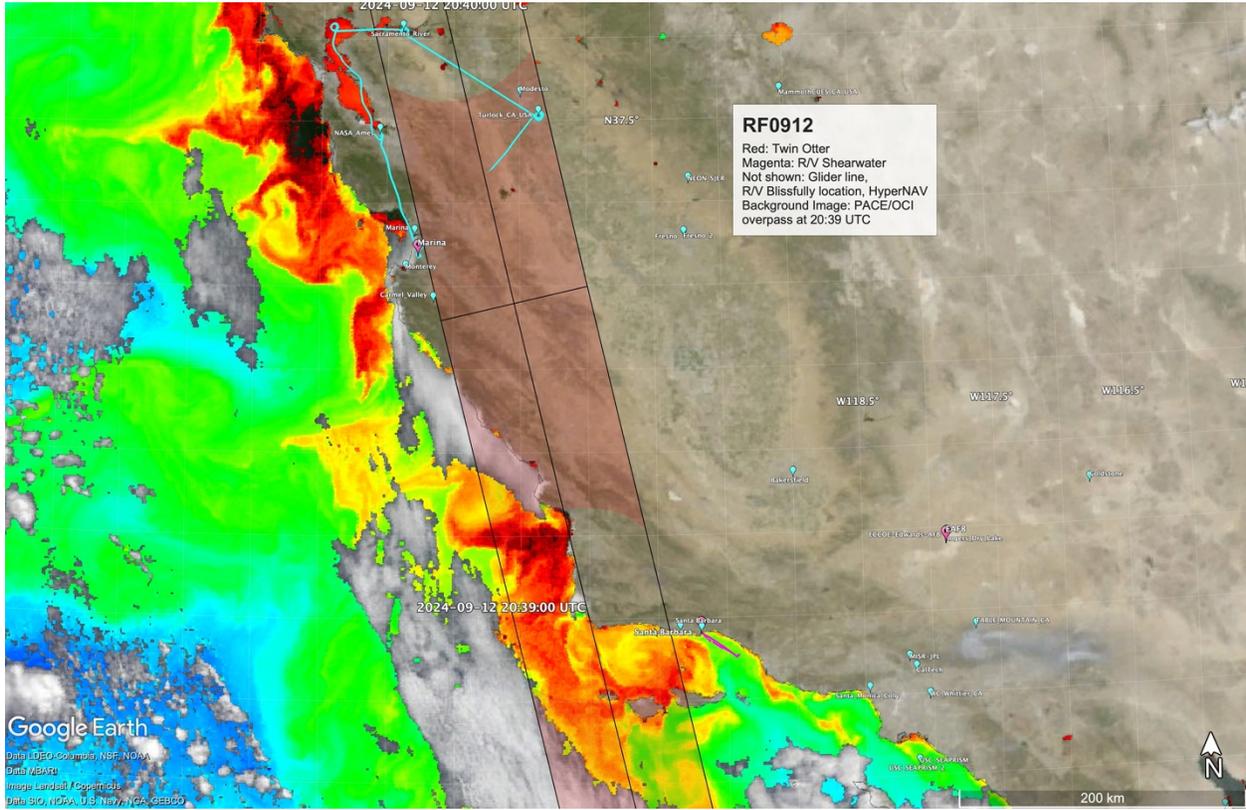
No underpass

Gliders

Operational

HyperNAV

Operational
Overall image summary



Validation Traceability Matrix itemized objectives

VTM elements in **black** satisfied, **blue** partially satisfied

Time UTC	Platform	VTM(hrs)	
15:49	RS		Departure
15:59	RB		Departure
18:59	TO		Takeoff
19:38	TO		Begin spiral down at Turlock AERONET site. AOD(500)=0.05
20:00	TO	1d(1.5*0.75), 3b(1.5*0.75)	Spiral ends at Turlock. Just outside ideal +/- 30 min PACE overpass window but probably ok since aerosol load is so small.
20:23	RB	1b(1.5), 1c(0.5)	R/V Blissfully station begins. Near USC_SeaPRISM Aeronet-OC site, and in PACE-OH swath. AOD(490)=0.13
20:37	RS	1b(1.5) 1c(0.5)	R/V Shearwater ends station #7 in PACE-OH swath. Station started at 18:49
20:39	TO		PACE overpass, TO @ Turlock and Sacramento River in PACE-OHS swath, Shearwater and Blissfully withing PACE-OH swath
20:39	TO	1b(1.5), 1d(1.5), 3a(1.5), 6g(1.5*0.75), 6h(1.5)	Start ascend over Sacramento_River AERONET-OC site. Water very turbid. Within PACE-OHS swath. Small amounts of dust in spiral. AOD(532)=0.04
20:38	TO		End spiral over Sacramento_River
20:39	PACE		PACE-OHS overpass
21:00	RS	1b(1.5) 1c(0.5)	R/V Shearwater starts station #8 in PACE-OH swath. Station ends at 22:54
21:15	TO		Spiral down over San Pablo Bay
21:39	TO	1d(1.5*0.75)	End spiral down over San Pablo bay, , then proceed at low level over San Francisco Bay southward to NASA_Ames/Moffett field
22:06	TO	1d(1.5), 1c(1.5*0.75), 6h(1.5*0.75)	Missed approach and ascend at Moffett Field, NASA_Ames AERONET site AOD(500)=0.04. Can extend this value using HSRL to validate over turbid water retrievals in SF bay.
22:38	TO		Landing
	RS		Return
20:23	RB		Return

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

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

TO: CIRPAS Twin Otter

RB: R/V Blissfully

RS: R/V Shearwater

Assessment:

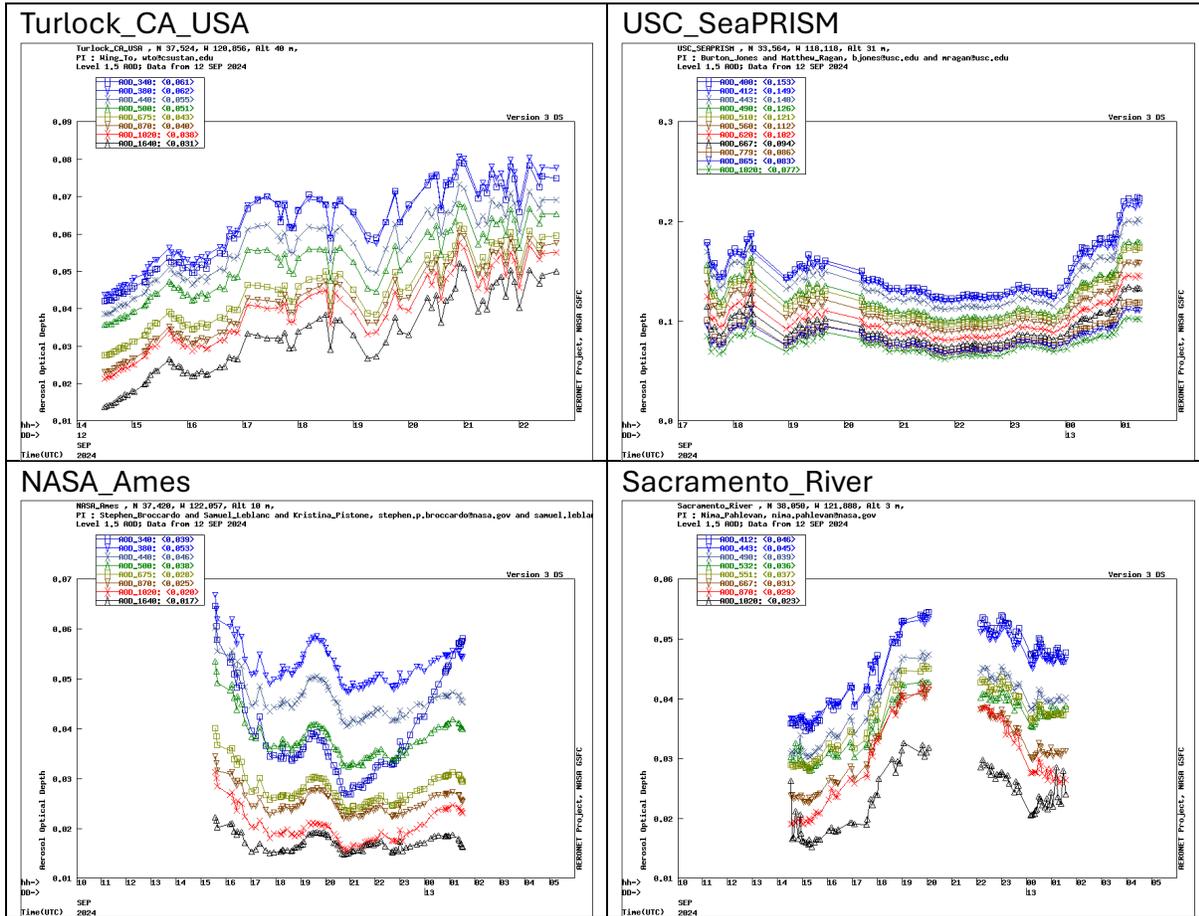
- 4.6% of objectives satisfied, despite lack of ER-2. Good use of satellite overpass, especially for TO observations over turbid water.
- Top remaining objectives (score above 6.0): PACE aerosol in narrow swath (3a,b), EarthCARE cloud (3e), land surface (1a)

PACE-PAX progress tracking														
Validation objectives	ID	Measurement objectives	Importance, w	Observation time, h (hours)	Total observed (hours)	Fractional success 9/9	Fractional success 9/10	Fractional success 9/11	Fractional success 9/12	Fractional success 9/13	Fractional success 9/14	Fractional success 9/15	Total success	Remaining score
1. Validate new retrieval properties	a	Land surface parameters	8	2.0	0.6	0.0%	4.8%	0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	6.0
	b	Ocean radiometric parameters	10	8.0	22.5	0.0%	3.6%	0.0%	6.7%	0.0%	0.0%	0.0%	94.0%	0.6
	c	Aerosol parameters over the ocean	12	8.0	16.4	0.0%	5.1%	0.0%	5.0%	0.0%	0.0%	0.0%	87.1%	1.5
	d	Aerosol parameters over land	12	8.0	27.2	0.0%	1.7%	0.0%	2.3%	0.0%	0.0%	0.0%	96.6%	0.4
	e	Cloud parameters	12	8.0	7.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	58.3%	5.0
	f	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
3. Validate in a narrow swath	a	Aerosol parameters over the ocean (PACE)	10	8.0	3.5	0.0%	0.0%	0.0%	13.3%	0.0%	0.0%	0.0%	35.4%	6.5
	b	Aerosol parameters over land (PACE)	10	8.0	2.1	0.0%	0.0%	0.0%	11.6%	0.0%	0.0%	0.0%	23.3%	7.7
	c	Cloud parameters (PACE)	5	2.0	1.5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	52.8%	2.4
	d	Aerosol parameters (EarthCARE)	8	4.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	46.5%	4.3
	e	Cloud parameters (EarthCARE)	8	4.0	0.5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.8%	7.1
4. Validate radiometric and polarimetric properties	a	Validate large reflectances	6	2.0	0.1	0.0%	6.1%	0.0%	0.0%	0.0%	0.0%	0.0%	6.1%	5.6
	b	Validate large reflectances with high polarization	6	2.0	1.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.3%	3.6
	c	Validate large reflectances with low polarization	6	2.0	2.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	63.2%	2.2
	d	Overfly vicarious calibration sites	6	4.0	1.3	0.0%	26.8%	0.0%	0.0%	0.0%	0.0%	0.0%	26.8%	4.4
6. Focus on specific processes or phenomena	a	High aerosol loads over land	4	2.0	3.3	0.0%	41.0%	0.0%	0.0%	0.0%	0.0%	0.0%	80.3%	0.8
	b	High aerosol loads over ocean	4	2.0	1.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	39.3%	2.4
	c	Multiple aerosol layers	1	2.0	4.1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	87.3%	0.1
	d	Aerosol under thin cirrus	2	2.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0
	e	Aerosol above liquid phase cloud	4	2.0	3.5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	82.6%	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%	0.0%	4.0
	g	Dust aerosols over ocean	4	2.0	1.1	0.0%	0.0%	0.0%	43.0%	0.0%	0.0%	0.0%	43.0%	2.3
	h	Aerosol and ocean parameters over turbid waters	2	2.0	3.1	0.0%	0.0%	0.0%	56.9%	0.0%	0.0%	0.0%	79.0%	0.4
	i	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
	k	Smoke aerosols over ocean	1	2.0	1.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	39.3%	0.6
	total:			150	98	102.7	0.0%	3.4%	0.0%	4.6%	0.0%	0.0%	0.0%	49.6%
				ER-2 flight hours	18.9	0	4.3	0	0	0	0	0	0	4.3
				TO flight hours	22.2	0	0	0	3.7	0	0	0	0	3.7
				Shearwater days	2	0	1	0	1	0	0	0	0	2
PACE-PAX overall objectives satisfied:			49.6%											

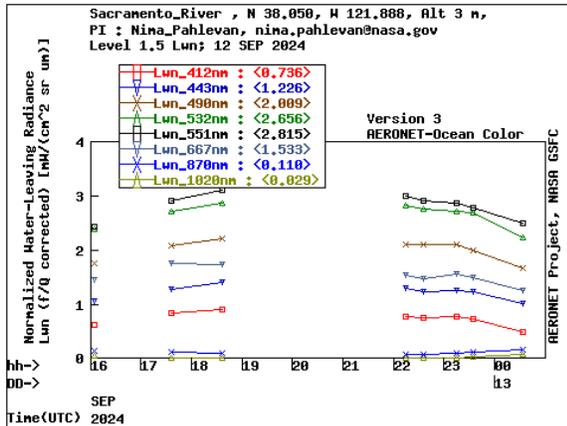
Note: images and data presented in this report are preliminary, and not for publication, presentation, or scientific use. The PACE-PAX data archive is:

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

AERONET quicklooks



Water leaving radiance



Twin Otter photos

Sacramento River at 20:37 UTC; photo taken by Luke Ziemba



Golden Gate Bridge at 21:13 UTC; photo taken by Luke Ziemba



San Pablo Bay at 21:37 UTC; photo taken by Luke Ziemba



Oakland and the bay taken at 21:47 UTC; photo taken by Luke Ziemba



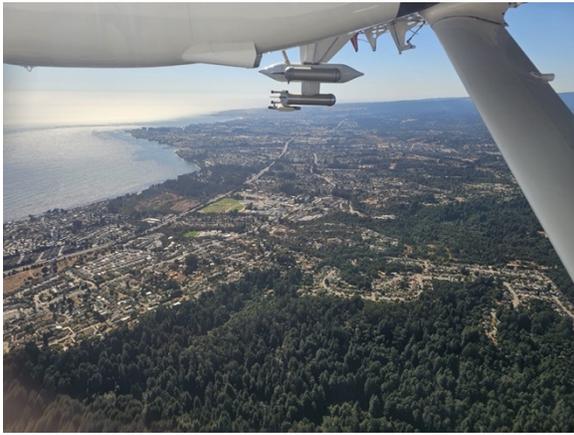
Approach for missed approach at Moffett Field taken at 22:03 UTC; photo taken by Luke Ziemba



Moffett Field after the missed approach taken at 22:09 UTC; photo taken by Luke Ziemba



Flying by Aptos, California en route to Marina Airfield at 22:21 UTC; photo taken by Luke Ziemba

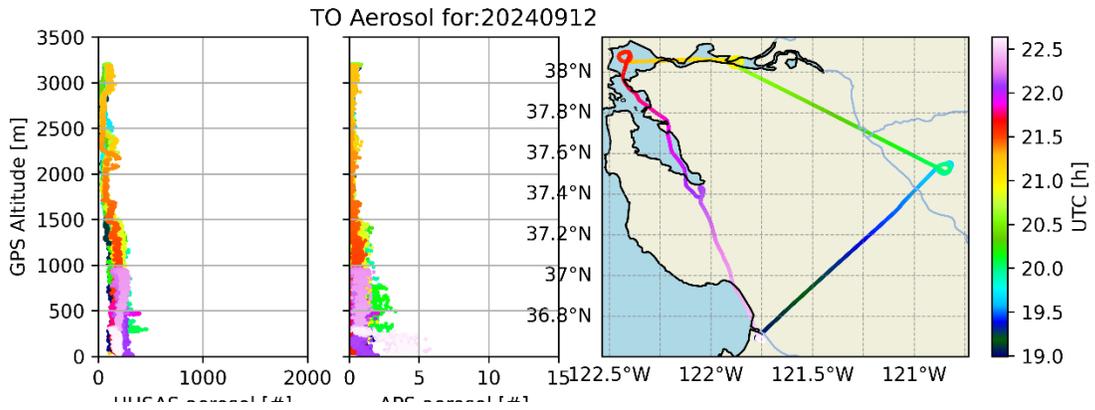
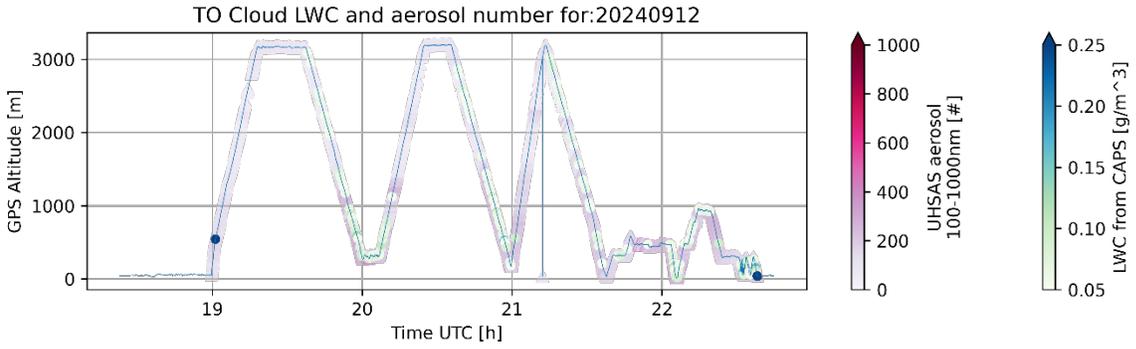


R/V Blissfully photos

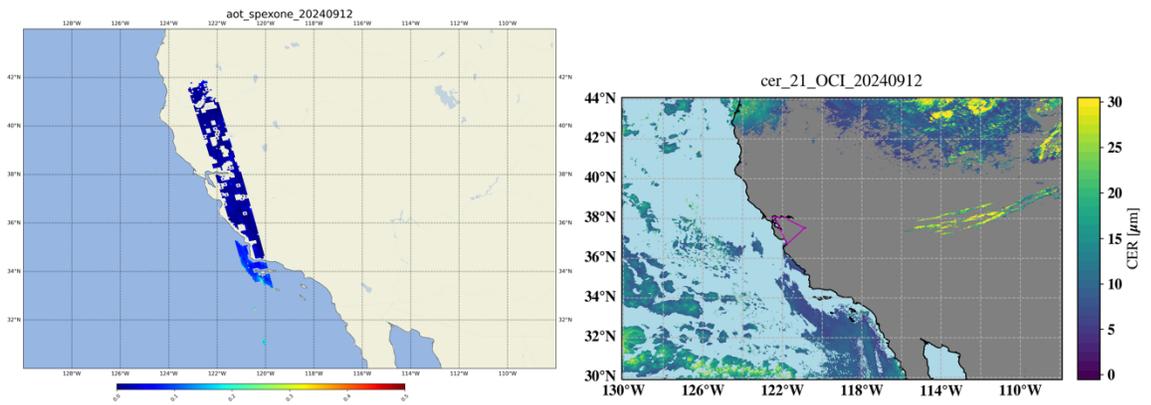
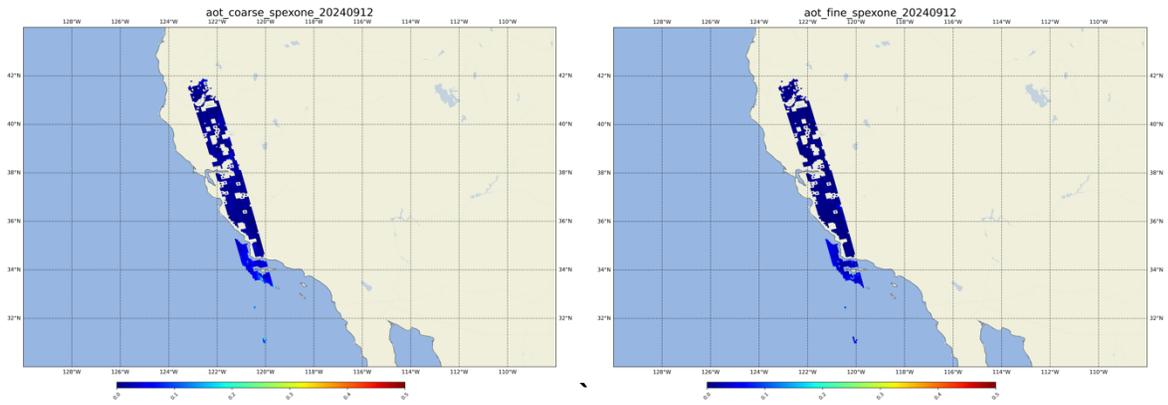
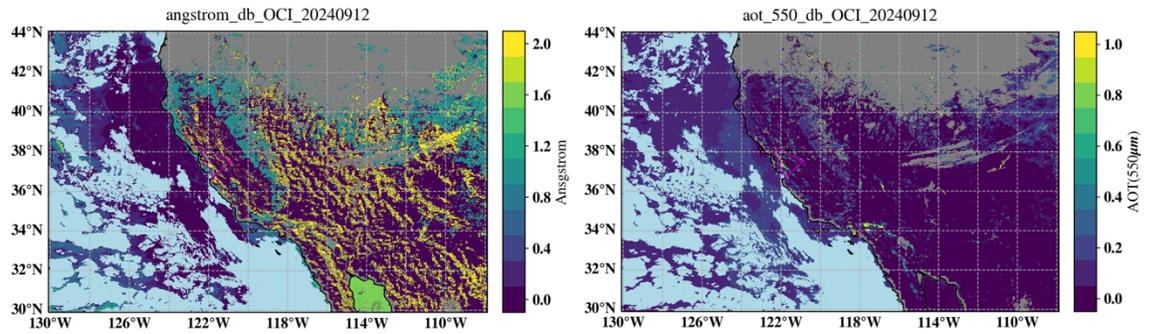
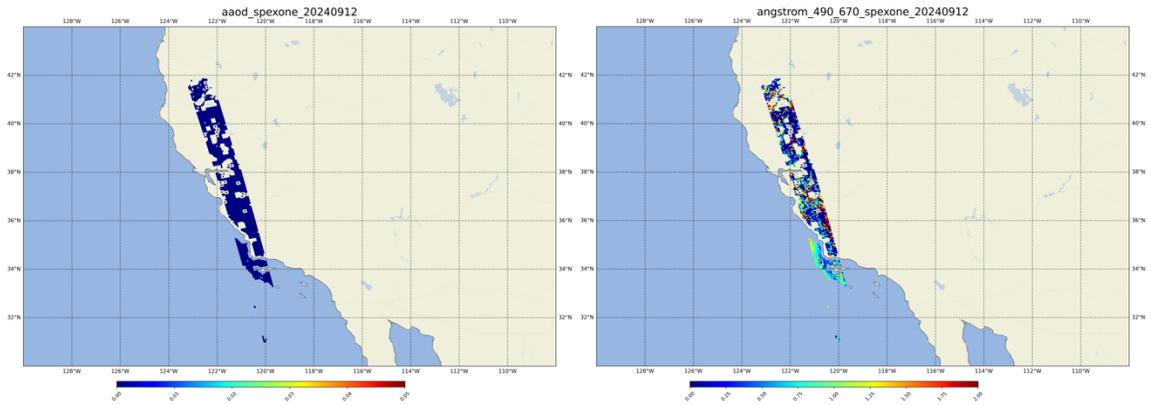
Station 2 (cruise station RB_9) 33° 35.858'N, 118° 7.047' W (33.59763, -118.11745), arrival at 20:23UTC (PACE overpass at 20:39UTC)

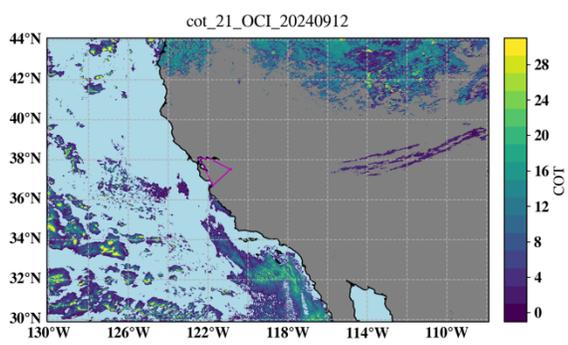
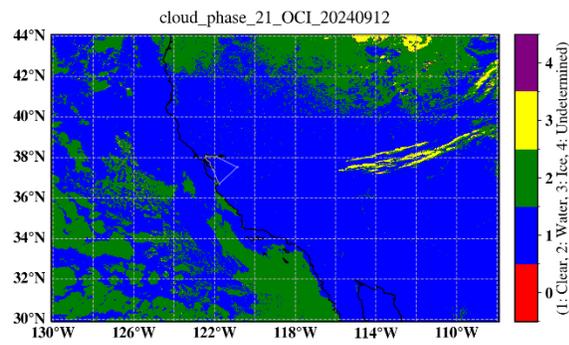
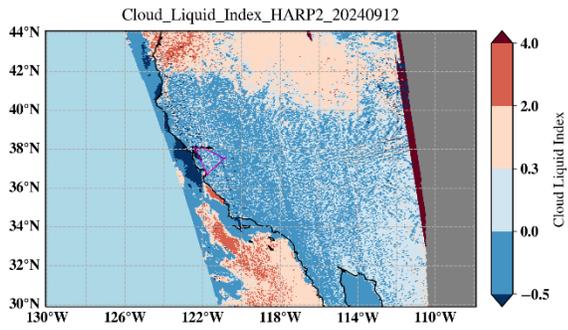
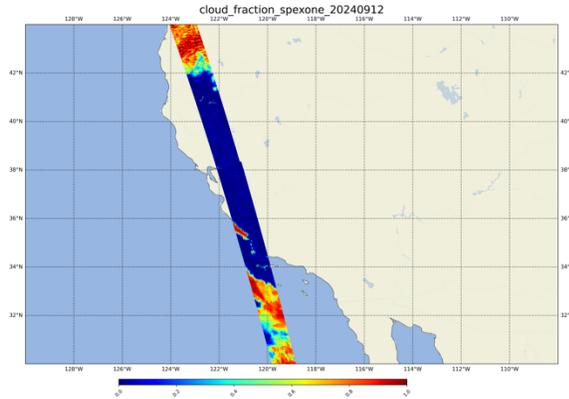
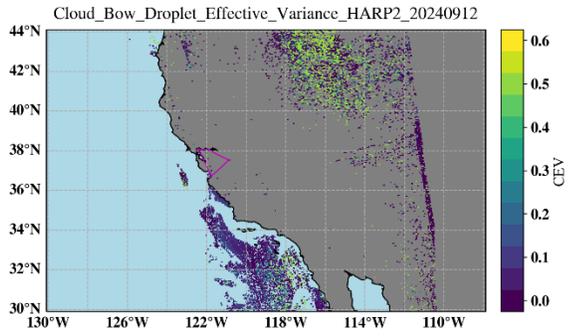
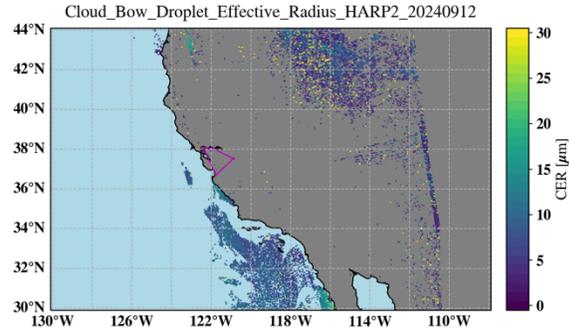


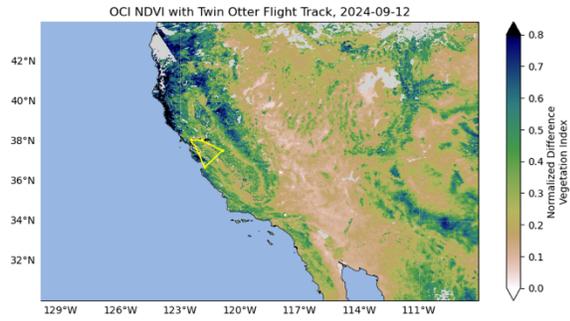
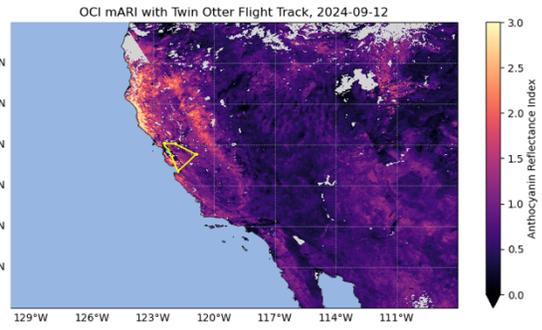
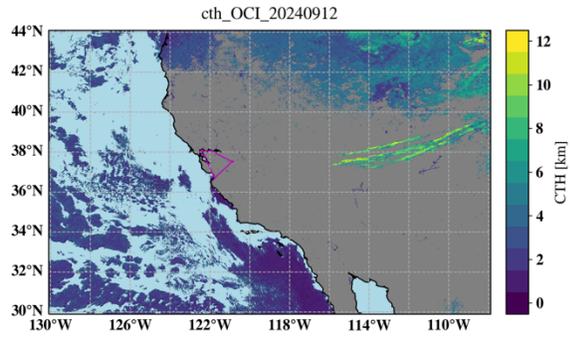
TO Quicklooks



PACE Satellite products







Twin Otter report

PACE-PAX Research Flight report 2024/09/12

Twin Otter Flight

Manifest:

Bryce Kujat (pilot)

Jeff Martin (pilot)

Luke Ziemba (QNC)

Ed Winstead (QNC)

Take off: 11:59:37 (18:59:37 UTC) Marina Airport (OAR)

Landing: 15:38:12 (22:38:12 UTC) Marina Airport (OAR)

Duration = 3.6 hrs.

Objectives: Profiles of aerosol scattering, absorption coefficients, and size distributions together with scattering (polarized) phase functions of optically thin aerosol over AERONET sites. Coordinated PACE overpass with spiral close in time to Turlock and during Sacramento River spiral. An additional spiral at San Pablo bay, low-level run over San Francisco Bay, and a missed approach at Moffat Field completed the flight objectives.

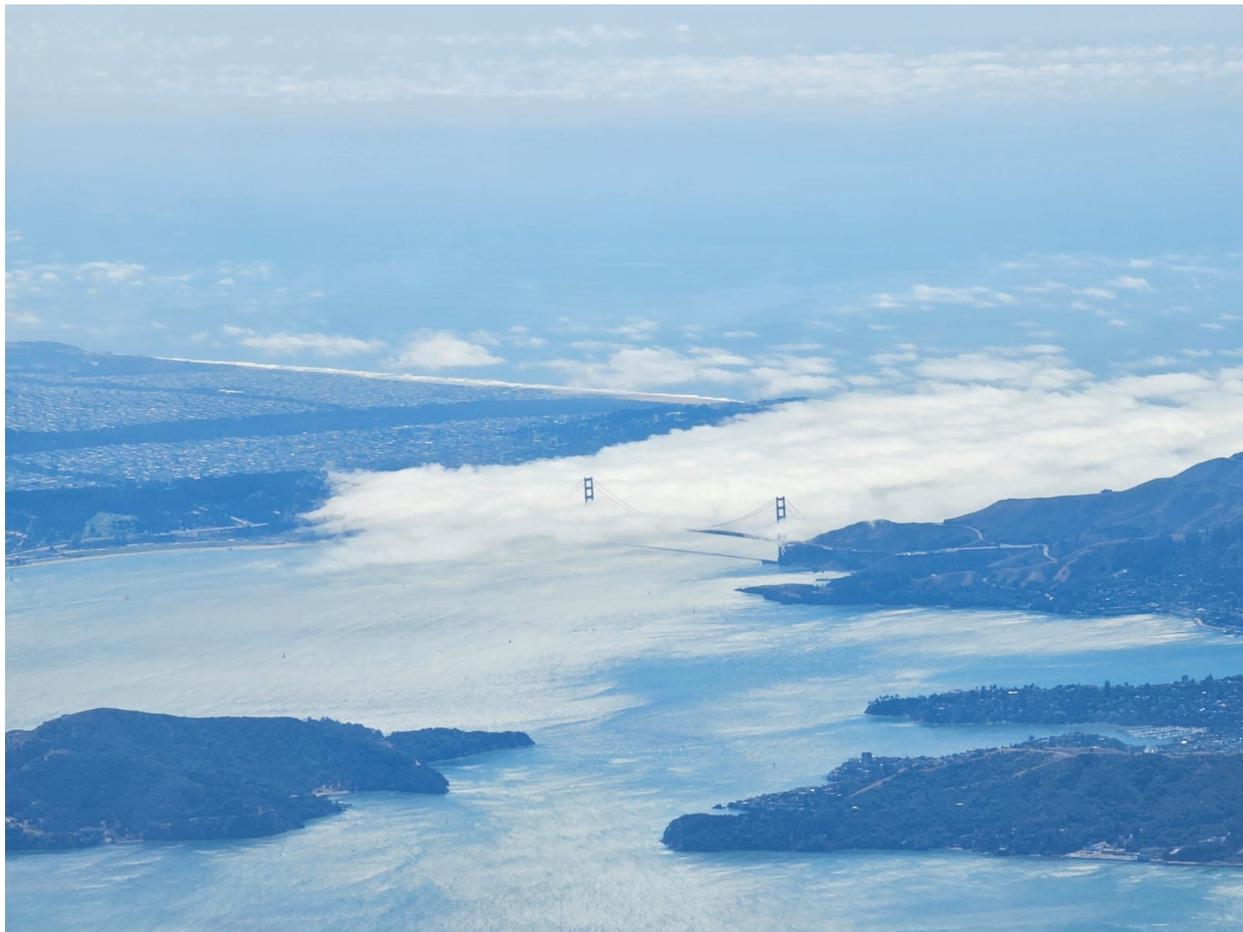
Summary:

Clean at the surface and then 3 Mm^{-1} scattering coefficient passing through 3 kft at 19:40 UTC. Level at 10 kft at 19:18 UTC with no scattering through the profile up. Spiral down at Turlock started at 19:38 UTC. Aerosol Optical Depth (AOD) at the Turlock AERONET site was 0.045 at 500 nm. A scattering "layer" with 2 Mm^{-1} scattering coefficient was detected at 8.5 kft. Scattering increased to 4 Mm^{-1} scattering coefficient at 4.5 kft, and 8 Mm^{-1} scattering coefficient at 3 kft with some structure below 3 kft and 12 Mm^{-1} scattering coefficient at 1 kft. It looked dusty at the surface with tractors visibly kicking up aerosols with particles out to $7 \mu\text{m}$ diameter. Spiral complete at 20:00 UTC. Aircraft stayed low for a five minutes to sample dusty air before starting to ascend at 20:09 UTC for Sacramento River spiral at PACE overpass time. Out of aerosols at 3 kft with interesting dust in the spiral and with a scattering Angstrom exponent close to zero. Over Sacramento River at 20:38 UTC

with complex (very green) waters. During spiral down scattering coefficients of 1, 5 and 8 Mm^{-1} at 5.5, 4 and 2 kft respectively with spiral complete at 20:58 UTC. Golden Gate bridge was in sight at 21:04 UTC with clouds spilling into the bay. San Pablo spiral down starting at 10 kft at 21:15 UTC with a few small aerosol layers observed during the descent, 4-6 Mm^{-1} scattering coefficient through 3 kft and spiral completed at 100 ft at 21:39 UTC. Proceeded down the bay under Air Traffic Control at 1 kft then up to 2.5 kft over Oakland Coliseum then passing directly over Oakland Airport with the bay still looking pretty green before doing a missed approach at Moffett field. Scattering coefficient of 10 Mm^{-1} at 50 ft during the missed approach. AOD at the Moffett Field (NASA Ames Research Center) AERONET site was 0.04 at 500 nm. After the missed approach at Moffett Field the aircraft returned to Marina Airfield via Santa Cruz. At Marina Airfield two missed approaches were performed to compare with measurement being made in the control tower. Aircraft and tower measurements agreed on 15 Mm^{-1} scattering coefficient with coarse mode aerosols out to 5 μm diameter which is good for evaluating inlet efficiency.



Sacramento River at 20:37 UTC; photo taken by Luke Ziembra



Golden Gate Bridge at 21:13 UTC; photo taken by Luke Ziembra



San Pablo Bay at 21:37 UTC; photo taken by Luke Ziembra



Oakland and the bay taken at 21:47 UTC; photo taken by Luke Ziemba



Approach for missed approach at Moffett Field taken at 22:03 UTC; photo taken by Luke Ziemba



Moffatt Field after the missed approach taken at 22:09 UTC; photo taken by Luke Ziembra



Flying by Aptos, CA en route to Marina Airfield at 22:21 UTC; photo taken by Luke Ziembra

R/V Shearwater report

PACE-PAX R/V Shearwater day report

Date: 09/12/2024

Creator: Michael Ondrusek

Cruise ID: RF0912-RS

Sailed out: 15:49 UTC (8:49 PST)

Back in port: UTC (PST) 23:45

Today, the ship occupied three stations.

Station #6 34.357533°, -119.624300° arrival 16:14 UTC (9:14 PST) à departure 1829 UTC (11:29 PST). Occupied west ER2 line. Wind 10 to 12 kts. Swells less than 1m. IOPs, profiles, then Polarimagers.

Station #7 34.377946°, -120.077298,° arrival 1849 UTC (11:49 PST) à departure 2037 UTC (16:37 PST) Occupied along same line. Start with IOPs, then polarimagers, then profiles. Only C-OPS and one hyperpro. MPR 86 run as float for 5 min after profiles due to pressure problems at sta 6. Clear skies, 1 -2 ft seas, 3kt winds.

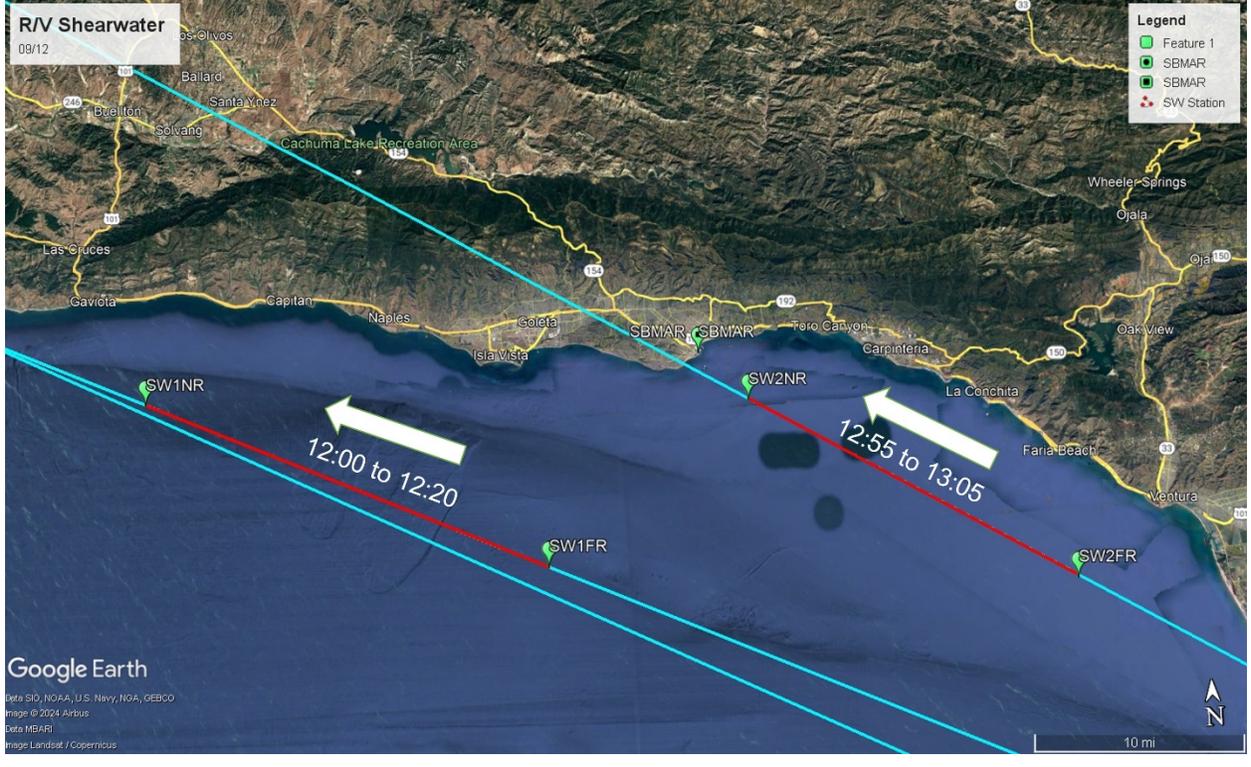
Station #8 34.260800°, -119.439533°, arrival 2100 UTC (14:00 PST)à departure 2254 UTC (15:54 PST). Clear skies, 0.5 ft seas, 3 kt winds. Profilers, floater, polarimager, then IOPs.

System Status:

Issue with tracker – restarted at 11:34 PST

No ER-2 overflight

Group Status: Good day.



R/V Blissfully report

PACE-PAX R/V Blissfully day report

Date: 09/10/2024

Creator: Bridget Seegers

Cruise ID: RF0912-RB

Sailed out: 15:59 UTC

Back in port: 23:35 UTC

Today, the ship accomplished....

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

Station 1 (cruise station RB_8) 33° 34.376'N, 118° 7.085'W (33.5729, -118.11808), arrival 18:43UTC



Station 2 (cruise station RB_9) 33° 35.858'N, 118° 7.047' W (33.59763, -118.11745), arrival at 20:23UTC (PACE overpass at 20:39UTC)



Tomorrow, RV Blissfully

Ship plans through the next 3 days...

Sampling in coordination with rest of the experiment

System Status...

All good

No ER-2 overflight

Group Status...

All great