PACE-PAX research flight report 2024/09/08

Compiled by Kirk Knobelspiesse, Brian Cairns, Ivona Cetinic, Bridget Seegers, Michael Ondrusek, 2024/09/14 DRAFT
Reviewed by Samuel LeBlanc

Coordinated TO + ER2 + RS + RB + EarthCARE operations. PACE had an onboard anomaly preventing data collection/download early that morning, so planned activities at PACE/OCI (swath edge) overpass times were still flown, but are not scored as successful in the VTM. EarthCARE along track flight (22:39). Large AOD from fires in LA basin and offshore near USC_SeaPRISM site.

ER-2
Takeoff: 18:37, Landing: 23:56, Duration: 5.3
Instrument status: PRISM had a minor switch issue, RSP had data logger issue (no data?), HARP had minor error affecting depolarization measurement, all else good.
Mission Scientist: Kirk Knobelspiesse
Pilot: Tim Williams; Mobile: Kirt Stallings

Twin Otter
Takeoff: 21:13, Landing: 22:56, Duration: 1.7
Instrument status: Good
Manifest: Bryce Kujat (pilot), Jeff Martin (pilot), Adam Ahern (QNC), Edward Winstead (QNC)
See end for full Twin Otter report

R/V Shearwater
Departure: 16:05, Return 23:39
Instrument status: Hyperpro depth sensor problem. AERONET Cimel acquisition issues (TBC)
Mission Scientist: Michael Ondrusek
See end for full R/V Shearwater report

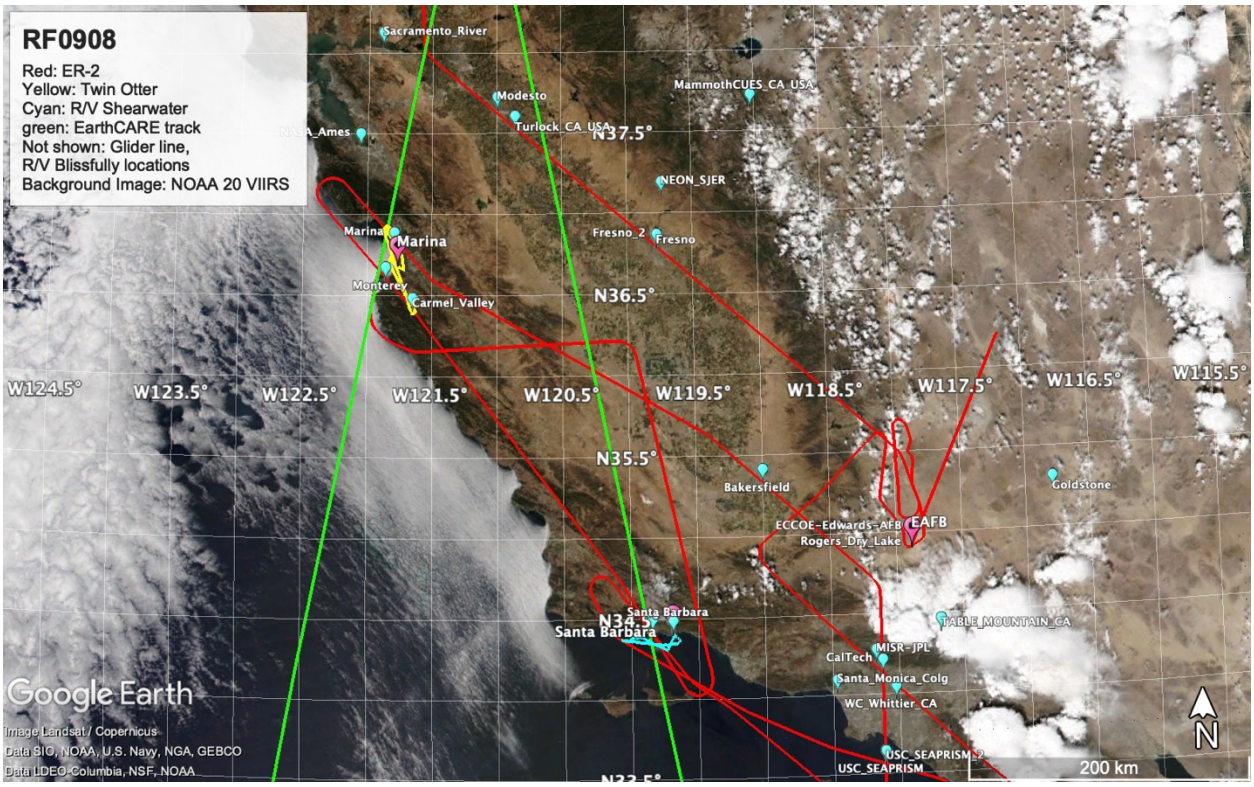
R/V Blissfully
Departure: 15:10, Return: 00:14 (09/09/24), Duration: 7.3
Instrument status: good, no time for microtops measurements
Captain/Mission Scientist: Bridget Seegers
See end for full R/V Blissfully report

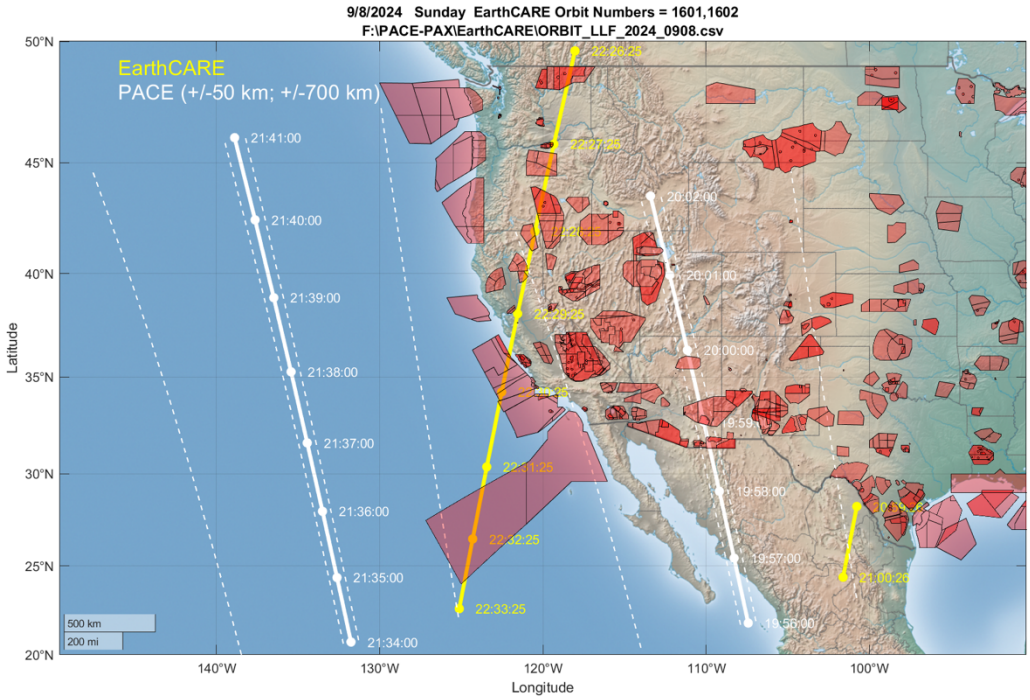
PACE
PACE has problem, Ka band not transmitting, no science data collection

EarthCARE
Overpass 22:39 from Monterey Bay NNE through California Central Valley, under-flight was priority of operations this day. **Orbit 1602**

Gliders
operational

Overall image summary





Validation Traceability Matrix itemized objectives

VTM elements in **black** satisfied, **blue** partially satisfied and **red** not satisfied

Time	Platform	VTM(hrs)	
15:10	RB		Departure
16:05	RS		Departure
18:37	ER2		Takeoff
19:10	ER2	1d(0.5), 6a(0.5)	Overpass CalTech Aeronet high AOD(500)=0.4
19:32	ER2, RB	1b(0.5+1.5), 1c(0.5), 6b(0.5), 6k(0.5)	Overpass USC_Seaprism Aeronet high AOD(490)=0.36; Blissfully on station with HyperPro, etc.
19:47	ER2,Gliders	1b(1.0)	ER2 overfly Glider line
19:48	ER2,RS	1b(1.5),1c(0.5)	ER2 overfly Shearwater with IOP and AERONET
19:59	ER2	1d(0.5)	Overpass UCSB Aeronet low AOD(500)=0.09
20:00	PACE		PACE-O overpass (pace not collecting data)
20:01	ER2,RS	1b(1.5),1c(0.5)	ER2 overfly Shearwater with IOP and AERONET
20:16	ER2, RB	1b(0.5+1.5), 1c(0.5), 6b(0.5), 6k(0.5)	Overpass USC_Seaprism Aeronet high AOD(490)=0.36; Blissfully on station with HyperPro, etc. mostly smoke
20:23	ER2	1d(0.5), 6a(0.5)	Overpass CalTech Aeronet high AOD(500)=0.26
20:36	ER2	1d(0.5)	Overpass Bakersfield Aeronet moderate AOD(500)=0.15
21:01	ER2	1d(0.5)	Overpass CEOBS Aeronet AOD(500)=0.035
21:13	TO		Takeoff
21:16	ER2		Overpass Carmel Valley with TO starting spiral in 15 min
21:31	TO	1d(1.5*0.9)	Spiral down over Carmel Valley AERONET-OC site (first data at 22:10, AOD(500)=0.025), spiral end at 21:31
21:38	PACE		PACE-O overpass (pace not collecting data)
21:38	ER2	1d(0.5)	Overpass UCSB Aeronet low AOD(500)=0.09
22:06	TO	1d(1.5), 3d(1.5)	Spiral(s) over CEOBS site with ER-2 and EarthCARE overpass. Top of spiral at 22:23, then spiral down ending at 22:43. AOD=0.045 (then interrupted).
22:17	ER2	3e(0.5), 4c(0.5)	Small section of ER-2 along EarthCARE track over clouds in Monterey Bay
22:21	ER2	3d(1)	Long track along EarthCARE line, mostly low AOD over California Central Valley
22:22	ER2	1d(0.5)	Overpass CEOBS AERONET AOD(500)=0.045
22:39	**EarthCARE**		**Overpass**
22.53	ER2	1d(0.5)	Overpass Modesto Aeronet AOD(500)=0.04
22.54	ER2	1d(0.5)	Overpass Turlock Aeronet AOD(500)=0.04
22:56	TO		Landing
23.03	ER2	1d(0.5)	Overpass Fresno Aeronet AOD(500)=0.04
23:56	ER2		Landing
23:39	RS		Return
00:14	RB		Return

PACE-OHS: within PACE OCI, HARP2 and SPEXone swath
SPP: Solar Principal Plane
ER2: ER-2
TO: Twin Otter
RS: R/V Shearwater
RB: R/V Blissfully

Assessment:

- 9.2% of objectives satisfied. First validation of EarthCARE
- Top remaining objectives: PACE aerosol in narrow swath (3a,b), EarthCARE cloud (3e) land surface (1e) large reflectances (4a), vicarious calib site (4d)

PACE-PAX progress tracking

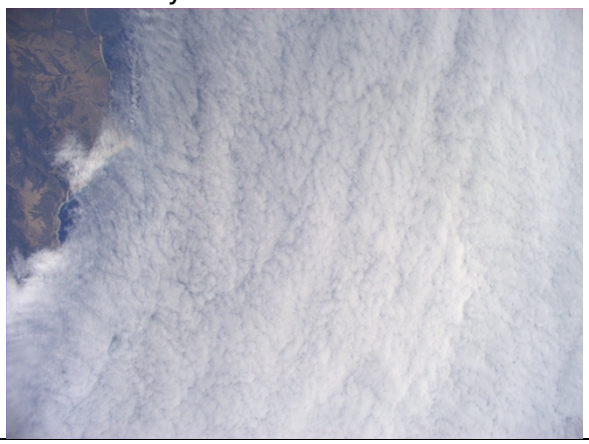
Validation objectives	ID	Measurement objectives	Importance, w	Observation time, h (hours)	Total observed (hours)	Fractional success 8/29	Fractional success 9/3	Fractional success 9/4	Fractional success 9/5	Fractional success 9/6	Fractional success 9/7	Fractional success 9/8	Total success	Remaining score
1. Validate new retrieval properties	a	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
	b	Ocean radiometric parameters	10	8.0	14.5	0.0%	0.0%	0.0%	0.0%	55.6%	0.0%	28.1%	83.7%	1.6
	c	Aerosol parameters over the ocean	12	8.0	11.8	0.0%	0.0%	6.1%	0.0%	64.4%	0.0%	6.5%	77.0%	2.8
	d	Aerosol parameters over land	12	8.0	21.4	39.3%	24.4%	8.0%	0.0%	8.8%	0.0%	12.1%	92.7%	0.9
	e	Cloud parameters	12	8.0	7.0	0.0%	0.0%	39.3%	0.0%	0.0%	19.0%	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	2.0	0.0%	0.0%	0.0%	0.0%	22.1%	0.0%	0.0%	22.1%	7.8
	b	Aerosol parameters over land (PACE)	10	8.0	1.0	0.0%	0.0%	0.0%	0.0%	11.8%	0.0%	0.0%	11.8%	8.8
	c	Cloud parameters (PACE)	5	2.0	1.5	0.0%	0.0%	39.3%	0.0%	13.4%	0.0%	0.0%	52.8%	2.4
	d	Aerosol parameters (EarthCARE)	8	4.0	2.5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	46.5%	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%	11.8%	11.8%	7.1
4. Validate radiometric and polarimetric properties	a	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
	b	Validate large reflectances with high polarization	6	2.0	1.0	0.0%	0.0%	0.0%	0.0%	39.3%	0.0%	0.0%	39.3%	3.6
	c	Validate large reflectances with low polarization	6	2.0	2.0	22.1%	0.0%	30.6%	0.0%	0.0%	0.0%	10.4%	63.2%	2.2
	d	Overfly vicarious calibration sites	6	4.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0
6. Focus on specific processes or phenomena	a	High aerosol loads over land	4	2.0	1.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	39.3%	39.3%	2.4
	b	High aerosol loads over ocean	4	2.0	1.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	39.3%	39.3%	2.4
	c	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
	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	22.1%	0.0%	0.0%	0.0%	0.0%	60.5%	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	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0
	h	Aerosol and ocean parameters over turbid waters	2	2.0	0.5	0.0%	0.0%	22.1%	0.0%	0.0%	0.0%	0.0%	22.1%	1.6
	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%	39.3%	39.3%	0.6
		total:	150	98	77.1	5.7%	2.5%	7.1%	0.0%	13.8%	3.1%	9.2%	41.6%	
					prior to this week									total
				ER-2 flight hours	1.3	2.8	0	4.7	0	6.1	0	5.3	0	18.9
				TO flight hours	0	2.4	3.4	3.8	0	7	3.9	1.7	0	22.2
				Shearwater days		0	0	0	0	1	0	1	0	2

PACE-PAX overall objectives satisfied: 41.6%

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

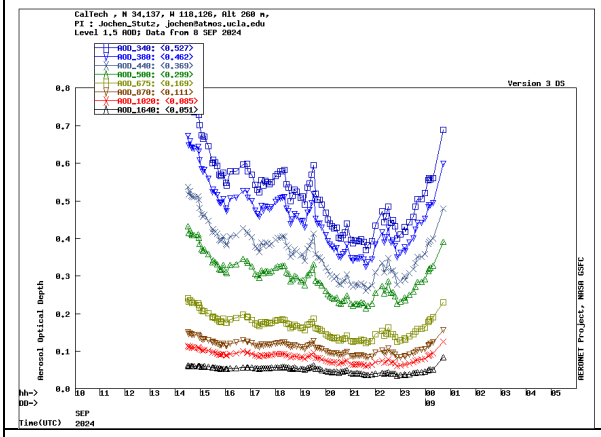
https://www-air.larc.nasa.gov/missions/pacepax/index.html

ER-2/MVIS images

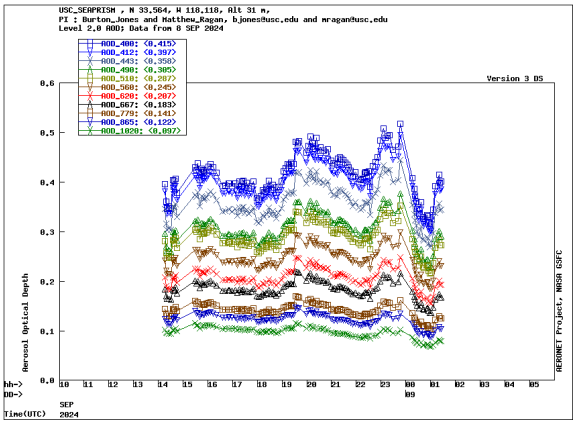
21:16 ER2+TO+Carmel Aeronet 	22:17 cloudy start of EarthCARE line 
22:22 second CEOBS overpass, EarthCARE cloud free line 	22:36 near end of EarthCARE line near Sacramento 

AERONET quicklooks

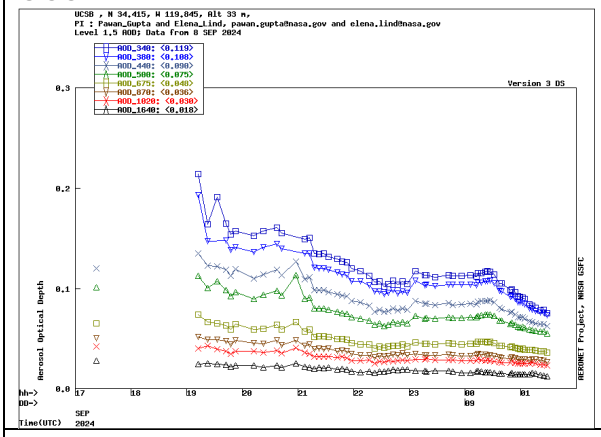
CalTech



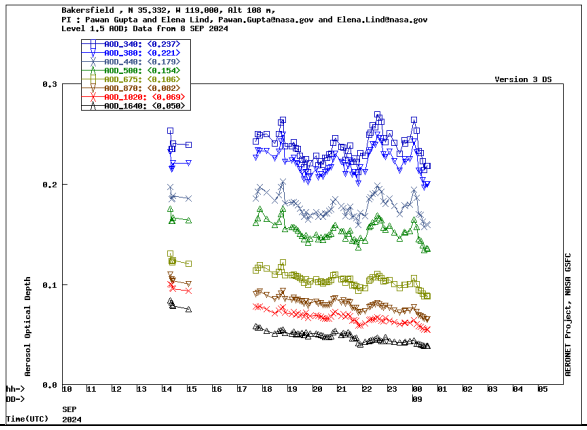
USC_SeaPRISM



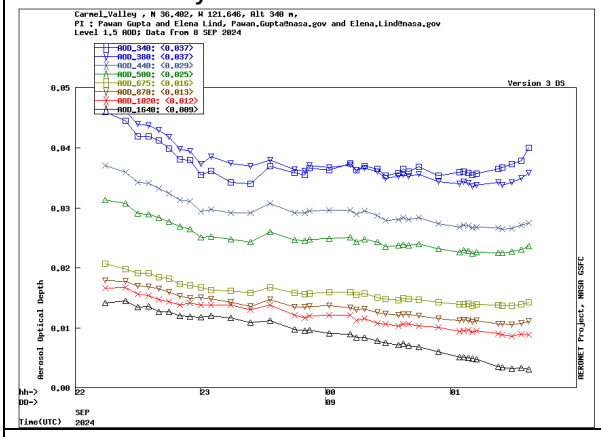
UCSB



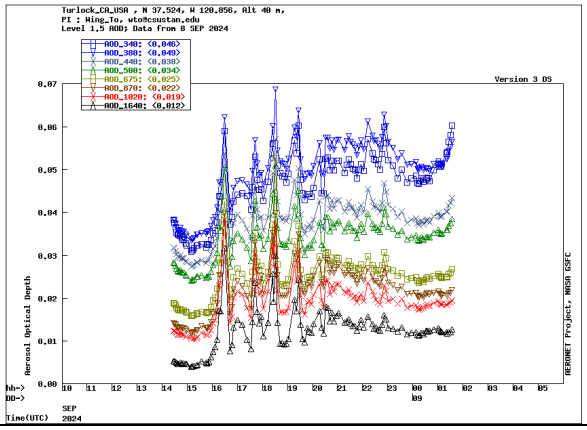
Bakersfield



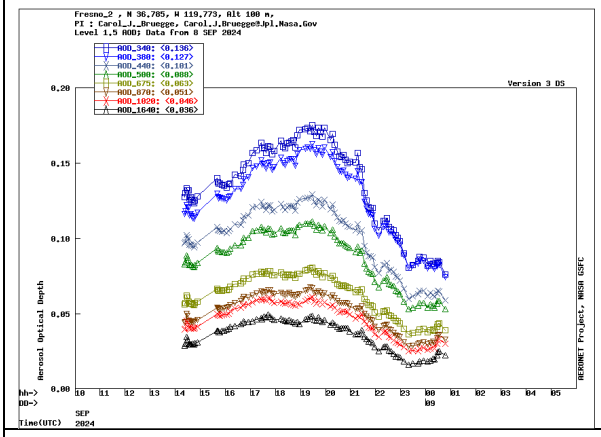
Carmel Valley



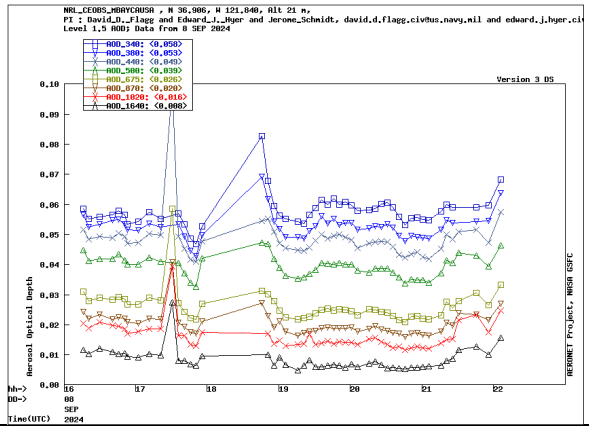
Turlock



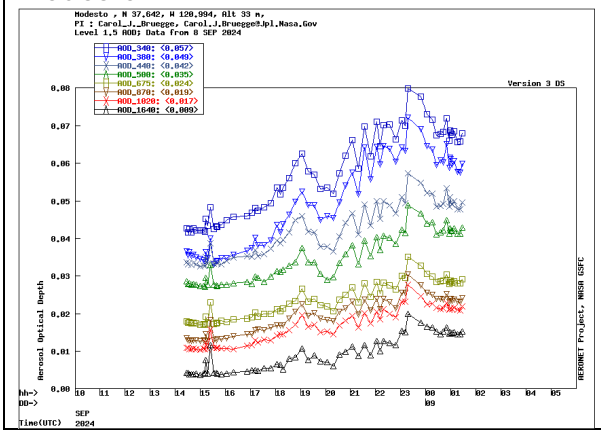
Fresno



CEOBS_NSRL

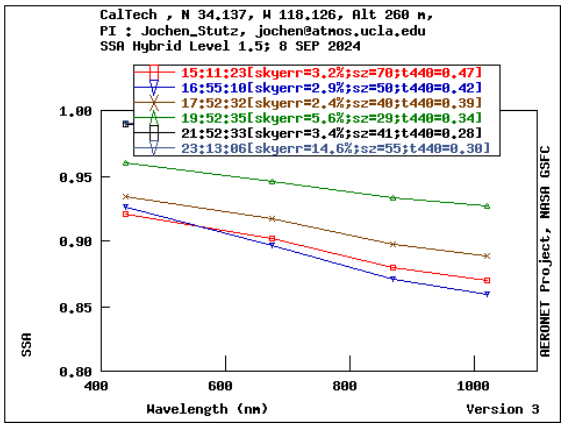


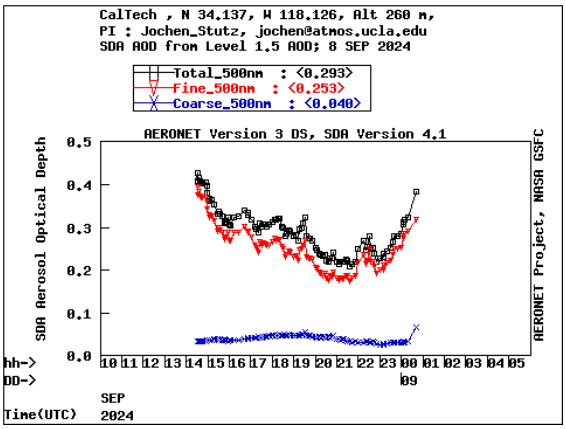
Modesto



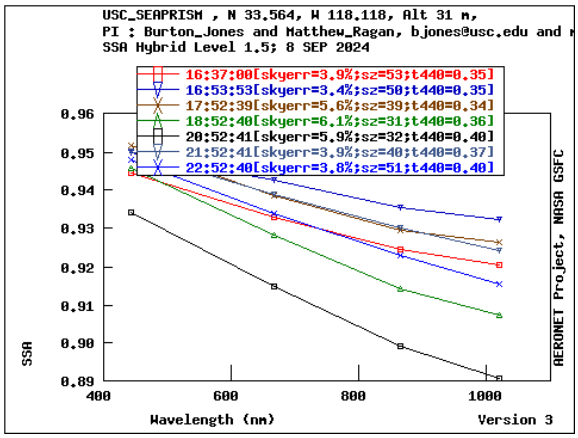
AERONET aerosol inversion

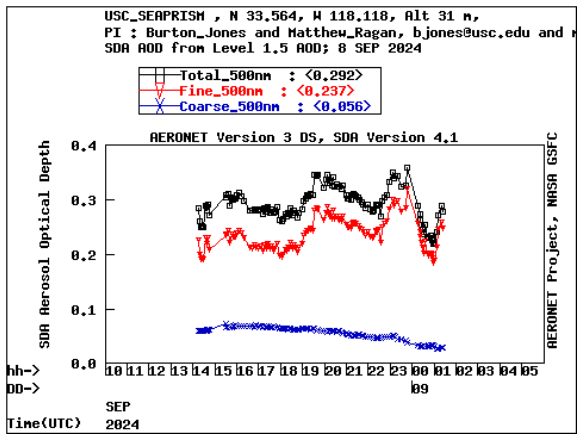
CalTech



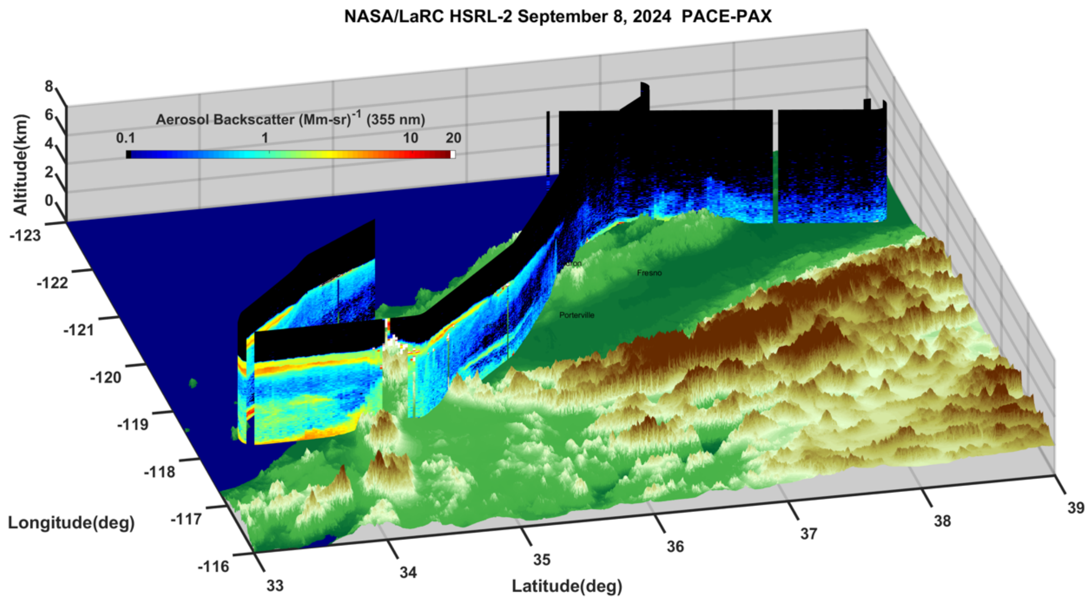


USC SEAPRISM

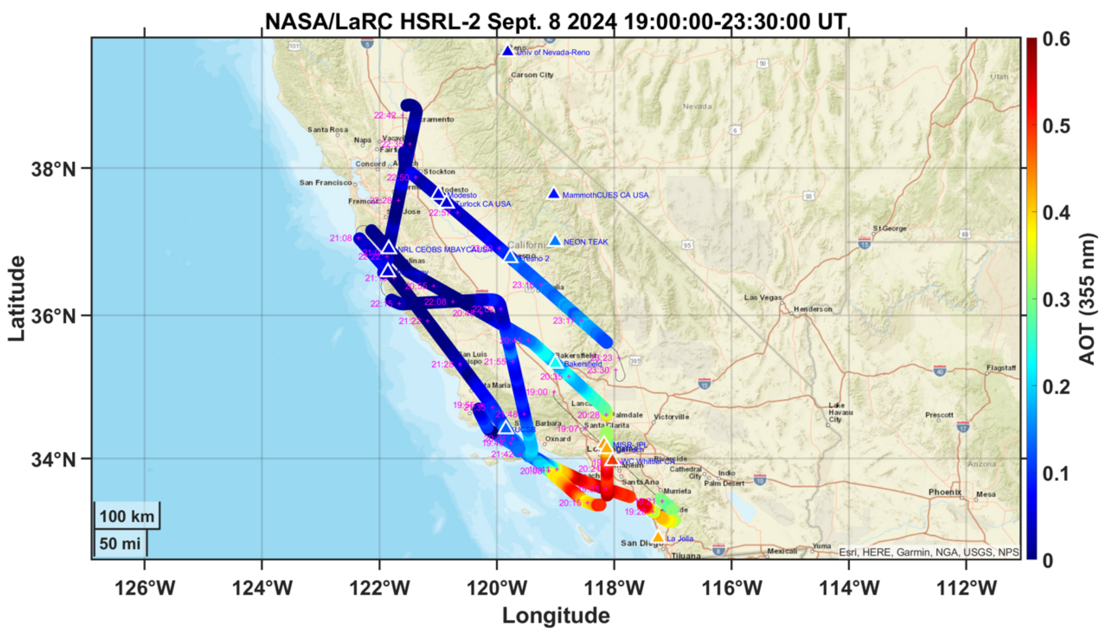

USC_SEAPRISM , N 33.564, W 118.118, Alt 31 m,
PI : Burton_Jones and Matthew_Ragan, bjones@usc.edu and
SSA Hybrid Level 1.5; 8 SEP 2024
16:37:00[skyerr=3.9%;sz=53;t440=0.35]
16:53:53[skyerr=3.4%;sz=50;t440=0.35]
17:52:39[skyerr=5.6%;sz=39;t440=0.34]
18:52:40[skyerr=6.1%;sz=31;t440=0.36]
20:52:41[skyerr=5.9%;sz=32;t440=0.40]
21:52:41[skyerr=3.9%;sz=40;t440=0.37]
22:52:40[skyerr=3.8%;sz=51;t440=0.40]
SSA
0.96
0.95
0.94
0.93
0.92
0.91
0.90
0.89
400
600
800
1000
Wavelength (nm)
Version 3
AERONET Project, NASA GSFC


USC_SEAPRISM , N 33.564, W 118.118, Alt 31 m,
PI : Burton_Jones and Matthew_Ragan, bjones@usc.edu and
SDA AOD from Level 1.5 AOD; 8 SEP 2024
Total_500nm : <0.292>
Fine_500nm : <0.237>
Coarse_500nm : <0.056>
AERONET Version 3 DS, SDA Version 4.1
SDA Aerosol Optical Depth
0.4
0.3
0.2
0.1
0.0
hh->
DD->
10 11 12 13 14 15 16 17 18 19 20 21 22 23 00 01 02 03 04 05
09
SEP
Time(UTC)
2024
AERONET Project, NASA GSFC

ER2/HSRL2

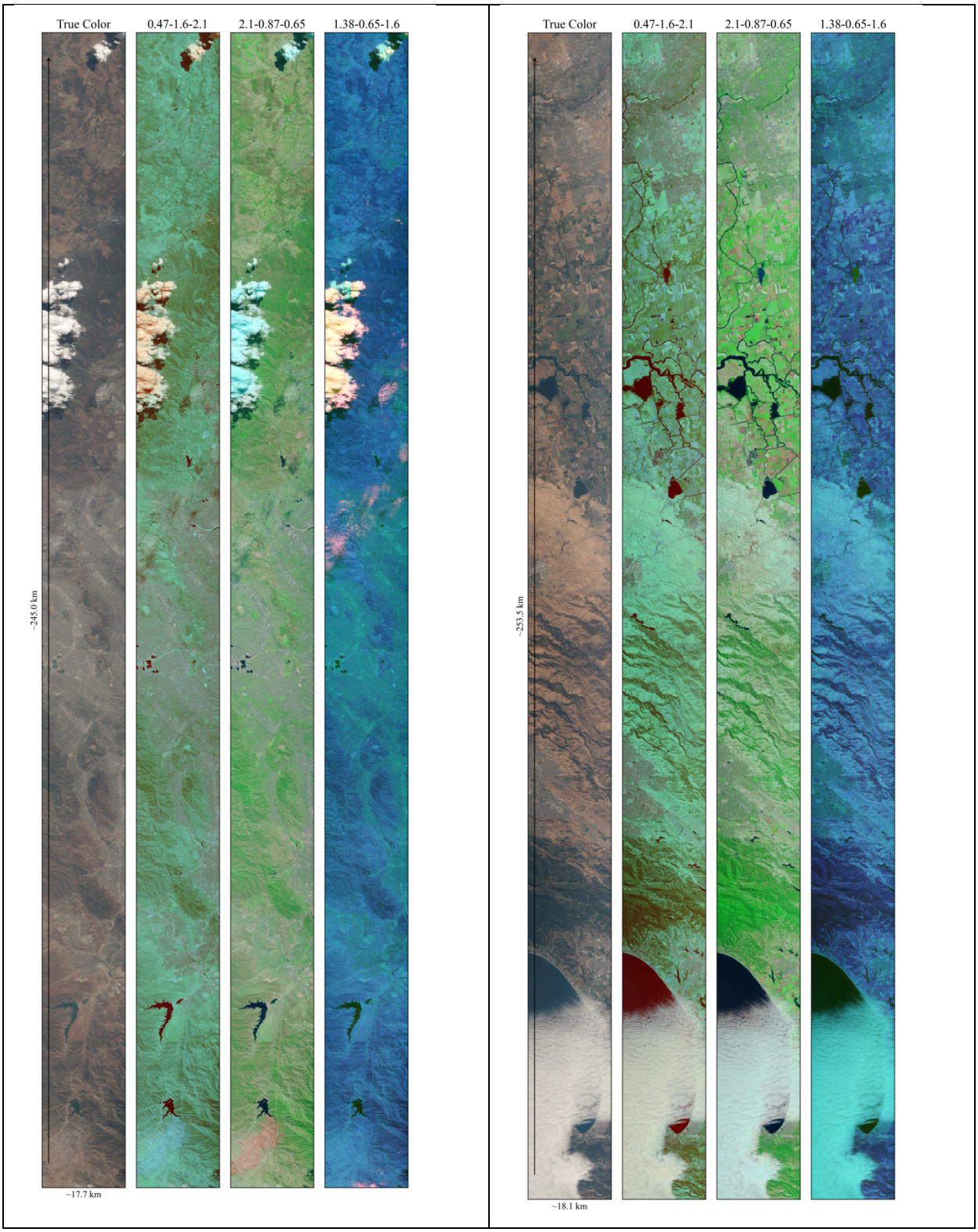


NASA/LaRC HSRL-2 September 8, 2024 PACE-PAX
Aerosol Backscatter (Mm-sr)$^{-1}$ (355 nm)
0.1
1
10
20
Altitude(km)
Longitude(deg)
Latitude(deg)
Fresno
Porterville



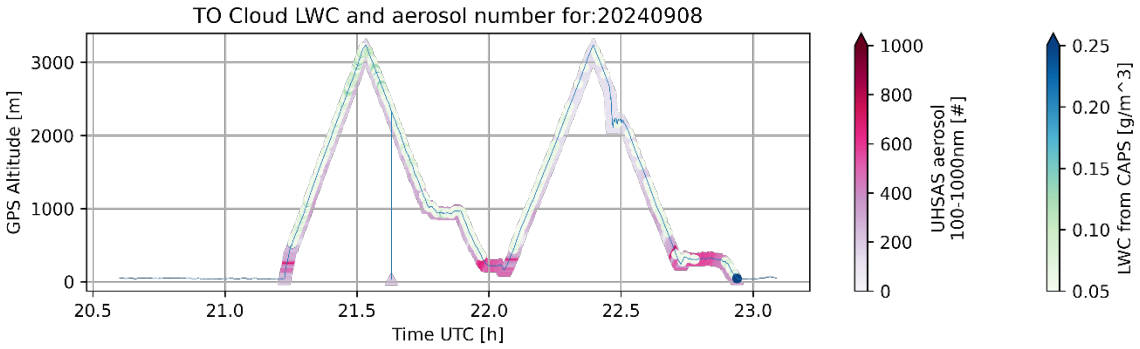
NASA/LaRC HSRL-2 Sept. 8 2024 19:00:00-23:30:00 UT
Latitude
Longitude
AOT (355 nm)
38°N
36°N
34°N
126°W
124°W
122°W
120°W
118°W
116°W
114°W
112°W
100 km
50 mi
Esri, HERE, Garmin, NGA, USGS, NPS

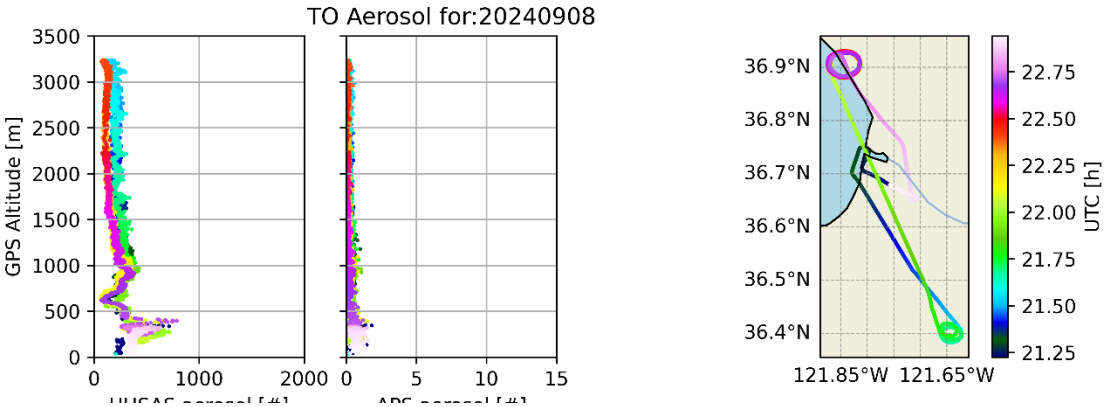
ER2/PICARD


True Color
0.47-1.6-2.1
2.1-0.87-0.65
1.38-0.65-1.6
~245.0 km
~17.7 km
True Color
0.47-1.6-2.1
2.1-0.87-0.65
1.38-0.65-1.6
~253.5 km
~18.1 km

ER2/PRISM

TO Quicklooks





Twin Otter flight report

PACE-PAX Research Flight report 2024/09/08

Twin Otter Flight

Manifest:

Bryce Kujat (pilot)

Jeff Martin (pilot)

Adam Ahern (QNC)

Edward Winstead (QNC)

Take off: 14:13:30 (21:13:30 UTC) Marina Airport (OAR)

Landing: 15:56:24 (22:56:24 UTC) Marina Airport (OAR)

Duration = 1.7 hrs.

Objectives: Profiles of aerosol scattering, absorption coefficients, and size distributions together with scattering (polarized) phase functions of optically thin aerosol over two AERONET sites. Coordinated spiral profile with PACE (Ka band not transmitting, no science data) overpass at Carmel Valley and EarthCare at CEOBS site at 22:29 UTC. ER-2 will overpass Carmel Valley at 22:16 UTC, 15 minutes before Twin Otter is on site. ER-2 will overpass CEOBS at 22:22 UTC while Twin Otter is spiraling.

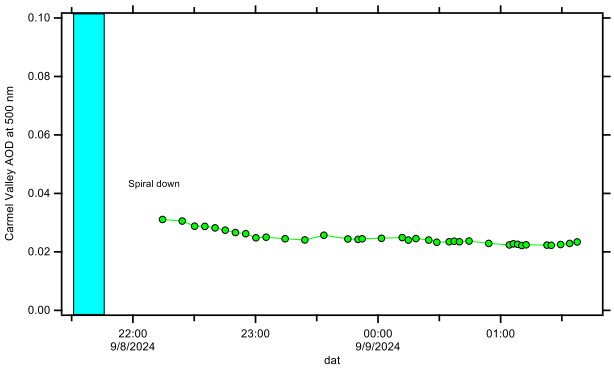
Summary:

Less than 5 Mm^{-1} scattering during takeoff at 21:16 UTC, consistent while climbing out to Carmel Valley AERONET site. Spiral down started at 21:31 UTC in clear sky. Bottom of spiral was 21:31 UTC at 3200 ft due to terrain limitation with a maximum of 6 Mm^{-1} of scattering. Transit to CEOBS at minimum safe altitude, ~1000 ft after clearing the mountains. Observed clouds underneath the plane starting at 21:55 UTC, ~20 Mm^{-1} scattering, potentially the same old smoke that was sampled 2024/09/07. 20:03 UTC clear of clouds, descend to 500 ft. Aerosol scattering drops to 10 Mm^{-1} over

land at 22:05 UTC. Start spiraling up at 22:06 UTC, full spiral up to 10,000 ft ending at 22:23 UTC, immediately begin spiral down. ER2 overpass at 22:22. EarthCARE overpass at 22:29. Bottom of spiral was at 500 ft at 22:43 UTC, at which point we climbed to ~1000 ft for return to base via Spreckler. No tower fly-by was attempted due to limited visibility caused by fog. Landing was at 22:56:24 UTC. All instruments aboard the Twin Otter were operating nominally throughout the flight.

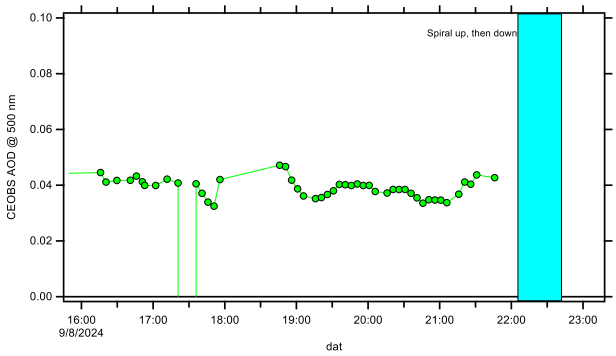
Unfortunately, the Carmel Valley AERONET was not sampling during our spiral down and the CEOBS AERONET shows no data in the level 1.5 product during our spirals, suggesting contamination by clouds. Coincidence with EarthCARE and ER-2 were successful.

21:43 UTC – Spiraling down over Carmel Valley AERONET. (Photo = Ahern)



Carmel Valley level 1.5 AOD @ 500 nm shows very low AOD after spiral.

22:10 UTC – Mid spiral showing partial incursion of clouds. (Photo = Ahern)



CEOBS level 1.5 AOD @ 500 nm shows very low AOD before spiral and cloud contamination after 22:00.

R/V Shearwater report

PACE-PAX R/V Shearwater day report

Date: 09/08/2024

Creator: Michael Ondrusek

Cruise ID: RF0908-RS

Sailed out: 1605 UTC (0905 PST)

Back in port: 2339 UTC (1639 PST)

Today, the ship occupied three stations.

Station #3 34.369073°, -119.638635°, arrival 1656 UTC

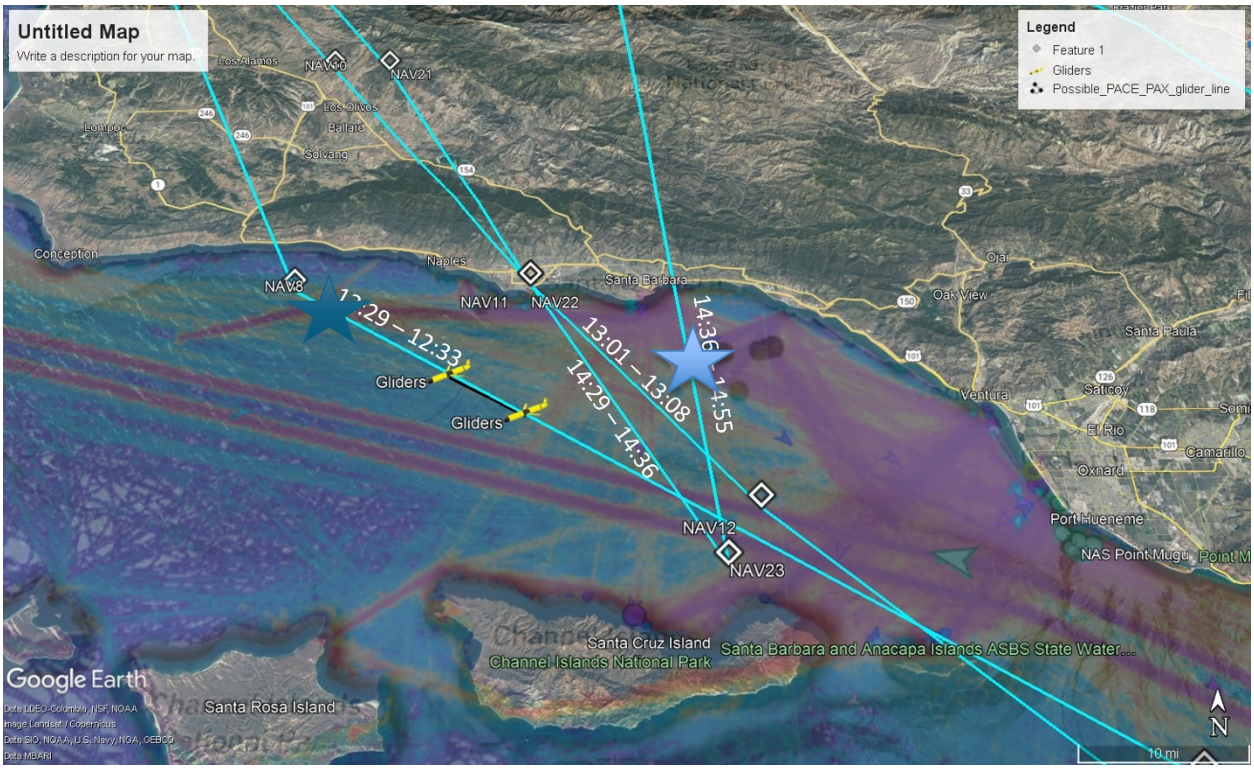
The first station was approximately 10 nm off shore. We conducted IOP profiles under cloudy conditions then decided to steam 1.5 hours west to 12:29 to 12:33 ER2 line where skies were clear (see stars on figure below).

Station #4 34.377946°, -120.077298°, 1900 UTC

We conducted a full station including AOPs, IOPs, and water filtrations. We were able to get out of the clouds to the east and had clear skies during the entire station. ER-2 o verflight at 17:50

Station #5 34.369073°, -119.638635, 2323 UTC

After the station #4, we had just enough time to get back to the 4th ER-2 overpass (14:36 to 14:55) line about 7 Nm offshore, same location as station #3. This location now had clear skies and again a complete station was run.



The Shearwater did not go out on the 9th or 10th due to high winds. We plan to go out on the 11th but will most likely stay near shore due to high swells.

System Status: New Hyperpro cable was delivered and will be replaced to see if it resolves the depth sensor problem. If not, will use the second Hyperpro in float mode only. Will be making adjustments to Aeronet on boat for better reception at dock.

Group Status: All groups were operating as expected.

R/V Blissfully report

PACE-PAX R/V Blissfully day report

Date: 09/08/2024

Creator: Bridget Seegers

Cruise ID: RF0908-RB

Sailed out: 15:10

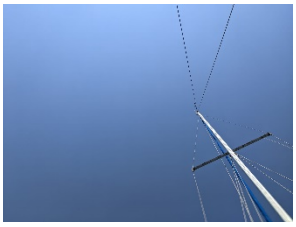
Back in port: 00:14 (09/09/2024)

Today, the ship accomplished….

Collection of vertical radiometry profiles and discrete sample collection (HPLC + ap) on 3 stations in proximity of SeaPRISM site. Each station has three sets of 5 HyperPro profiles to 20m and a single deep cast to 60m. Each station discrete water samples include triplicate HPLC + ap and duplicate community composition Lugol's preserved and paraformaldehyde samples for flow cytometry.

Station 1 (campaign station 4);

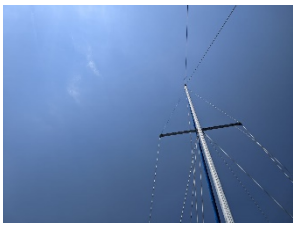
- arrival 17:17, 33° 33.74' N, 118° 7.18' W , clear skies



- ER-2 overflight 19:33

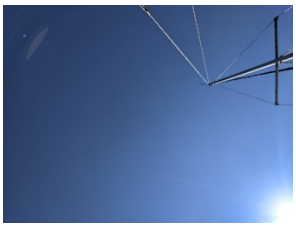
Station 2 (campaign station 5):

- Arrival 19:10 same location as station 1 17:17, 33° 33.74' N, 118° 7.18' W , clear skies



Station 3 (campaign station 6):

- Arrival 20:40 at 33° 34.12’ N. 118° 6.96’ W, about one km north of SeaPRISM site, clear skies
- PACE overpass 20:20
- ER-2 overflight 21:17



Tomorrow,

the R/V Blissfully will not sail.

Ship plans through the next 3 days…

Sail on the next ER-2 flight day

System Status…

All operational, no time for microtops measurements.

Group Status…

Pirate life for me.