CHemistry in the Arctic: Clouds, Halogens, and Aerosols (CHACHA)
University of Wyoming King Air Research

Summary

CHACHA is focused on studying interactions between reactive gases, particles, and clouds, combined with modeling of chemical and physical processes in the vicinity of oil and gas extraction activities and sea ice leads.

- UWKA flight planning and tracking tools
- EOL Field Catalog
- UWKA facility project summary
- UWKA facility flight level data description
- UWKA facility PCASP calibration summary

Date	Flight # (KML)	Status	Times (UTC)	Hours	Crew/Notes
17 Apr 2022	RF29b	Lead cloud flight with two dropsondes.	0047-0350	3.1	Tom Drew Anna Robertson Sarah Woods
16 Apr 2022	RF29a	Lead cloud flight with three dropsondes.	1909-2300	3.9	Tom Drew Anna Robertson Sarah

User Information

- Planning Chart
- EOL Facilities
- Software Repository
- Projects & Data Requests
- Planning and tracking tools
- Facility User's Guide

Facility Instruments

- In Situ
- Wyoming Cloud Radar
- Wyoming Cloud Lidar

					Woods
15 Apr 2022	RF28	Lead cloud flight with dropsondes.	1911-2135	2.5	Tom Drew Anna Robertson Sarah Woods
14 Apr 2022	RF27	Lead cloud flight with two dropsondes. Applanix lost connection and had to be restarted mid-flight; no direct Applanix measurements or derived parameters available from approximately 201100-201635 UTC.	1931-2237	3.2	Tom Drew Anna Robertson Sarah Woods
13 Apr 2022	RF26	CIMS flight to Deadhorse. Equipment issues precluded planned low approaches at PABR.	2134-0114	3.8	Tom Drew Anna Robertson Daun Jeong
12 Apr 2022	RF25	Flight to Point Lay lead with three dropsondes.	2211-0205	3.9	Tom Drew Anna Robertson Sarah Woods
12 Apr 2022	RF24b	Lead cloud flight north of Point Hope.	0107-0428	3.6	Tom Drew Anna Robertson Sarah Woods
11 Apr 2022	RF24a	CIMS flight with low approaches at Utqiagvik.	2017-2246	2.6	Tom Drew Anna Robertson Daun Jeong
		CIMS flight with low			

Contact

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Facility Manager:
Jeff French

9 Apr 2022	RF23	approaches at Atqasuk, Wainwright, and Utqiagvik. Turbulence probe measurements dropped out after ~2337 UTC.	2212-0206	3.9	Tom Drew Anna Robertson Daun Jeong
7 Apr 2022	RF22	Clear air flight with low approaches at Deadhorse, Nuiqsut, and Utqiagvik.	2210-0143	3.7	Tom Drew Anna Robertson Daun Jeong
7 Apr 2022	RF21b	Lead clouds flight. No flight data available after ~0255.	0106-0410	3.1	Tom Drew Anna Robertson Sarah Woods
6 Apr 2022	RF21a	Clear air flight with low approaches at Atqasuk and Utqiagvik. Turbulence measurements back online.	1909-2204	3.0	Tom Drew Anna Robertson Daun Jeong
2 Apr 2022	RF20	Lead cloud flight with dropsondes. Turbulence probe measurements having issues.	2010-0002	4.0	Tom Drew Anna Robertson Sarah Woods
1 Apr 2022	RF19	Prudhoe Bay flight with low approaches at Deadhorse, Nuiqsut, and Atqasuk. Turbulence probe measurements having issues.	2055-0048	3.9	Tom Drew Anna Robertson Daun Jeong
		Prudhoe Bay flight with low approaches at Deadhorse, Nuiqsut, and Utqiagvik.			

30 Mar 2022	RF18	UWKA flight-level measurements available only from 2354 UTC on; no PCASP or Weston, CPT 6140, CPT 9000 static pressure measurements available. Turbulence probe measurements having issues.	2322-0248	3.6	Tom Drew Anna Robertson Daun Jeong
30 Mar 2022	RF17b	Chuckchi lead clouds flight.	0132-0449	3.3	Tom Drew Anna Robertson Sarah Woods
29 Mar 2022	RF17a	Chuckchi lead clouds flight. Turbulence measurements dropped out until ~202530 UTC.	1937-2318	3.7	Tom Drew Anna Robertson Daun Jeong
28 Mar 2022	RF16	Chuckchi lead clouds flight with two dropsondes.	2115-0144	4.6	Tom Drew Anna Robertson Sarah Woods
27 Mar 2022	RF15b	Second of two paired flights (starting just after UTC day switchover), cloud flight approximately following RF15a.	0112-0403	3.0	Tom Drew Anna Robertson Sarah Woods
26 Mar 2022	RF15a	First of two paired flights, cloud flight involving vertical profiles	1941-2339	4.0	Tom Drew Anna Robertson

		and sondes.			Sarah Woods
24 Mar 2022	RF14	Short lead flight with low approach over PATQ.	2119-2246	1.6	Tom Drew Brent Glover Daun Jeong
24 Mar 2022	RF13	Lead flight with clouds, vertical profiles, and sondes..	0031-0359	3.5	Tom Drew Brent Glover Sarah Woods
23 Mar 2022	RF12	Lead flight with clouds, vertical profiles, and sondes..	0039-0311	2.6	Tom Drew Brent Glover Sarah Woods
21 Mar 2022	RF11	Transects and low approaches at PASC, PAQT, and PABR. Wind calibration maneuvers south of PABR.	2106-0120	4.3	Tom Drew Brent Glover Daun Jeong
19 Mar 2022	RF10	Transects and low approaches at PASC, PAQT, and PABR.	2104-0047	3.7	Tom Drew Brent Glover Daun Jeong
18 Mar 2022	RF09	Low approaches at PAWI, PATQ, and PABR, along with dropsonde and vertical profile.	2110-0005	3.0	Tom Drew Brent Glover Daun Jeong
17 Mar 2022	RF08	Transects and low approaches at PASC, low approaches at PAQT and PABR.	2221-0154	3.6	Tom Drew Brent Glover Daun Jeong
		Flight targeting lead			Ed Sigel

13 Mar 2022	RF07	clouds, sonde drop. (Note: data system recording starts on 12 Mar, prior to 00UTC)	0017-0307	3.3	Brent Glover Sarah Woods
10 Mar 2022	RF06	Low approaches over multiple local airports.	2254-0208	3.3	Ed Sigel Brent Glover Daun Jeong
9 Mar 2022	RF05	Clear air flight operating CIMS, sonde drops.	2253-0243	3.9	Ed Sigel Brent Glover Daun Jeong
5 Mar 2022	RF04	Racetracks and spiral profile downwind of Prudhoe Bay oil fields with sonde drops; low approaches at Deadhorse.	2025-2341	3.3	Ed Sigel Anna Robertson Daun Jeong
3 Mar 2022	RF03	Research flight to Deadhorse with coordinated ALAR measurements.	2149-0048	3.1	Ed Sigel Anna Robertson Daun Jeong
27 Feb 2022	RF02	Aerosol measurement and inlet testing, CVI measurements in lead clouds.	2254-0104	2.3	Ed Sigel Anna Robertson Sarah Woods
24 Feb 2022	RF01	Flight focusing on CIMS measurements.	2326-0112	1.9	Ed Sigel Anna Robertson Daun Jeong
Test Flights					
		Test flight focusing on			Ed Sigel

20 Feb 2022	TF09	transponder installation and Roger's inlet flow.	2000-2059	1.1	Anna Robertson Cory West
9 Feb 2022	TF08	Facility test flight with wind calibration maneuvers, speed tests, and a dropsonde.	2109-2237	1.5	Tom Drew Anna Robertson Brent Glover
9 Feb 2022	TF07	Short flight testing Roger's inlet, no system data recorded.	1024-1033	0.3	Tom Drew Anna Robertson Nick Mahon
8 Feb 2022	TF06	Short flight testing Roger's inlet, no system data recorded.	0943-0957	0.3	Tom Drew Anna Robertson Brett Spiker
6 Feb 2022	TF05	Evening test flight focusing on cloud payload.	0013-0126	1.4	Tom Drew Anna Robertson Sarah Woods
4 Feb 2022	TF04	Nighttime test flight focusing on low approaches at CYS.	0515-0635	2.2	Ed Sigel Brent Glover Daun Jeong
3 Feb 2022	TF03	Test flight focusing on the AVAPS system.	1857-2013	1.4	Tom Drew Anna Robertson Mack Goodstein
1 Feb 2022	TF02	Test flight focusing on clouds for CVI testing. POPS pump not stable in flight. Lukens pitot pressure transducer appears unusable and	1321-1532	2.3	Ed Sigel Anna Robertson Sarah Woods

		will need replaced.			
31 Jan 2022	TF01	First instrument test flight, focusing on clear air for CIMS and general facility instrumentation.	2155-2335	1.8	Ed Sigel Anna Robertson Daun Jeong
Flight Hours		As of Jul 29, 2022, 113.8 out of 120 research hours were flown, 6.2 remain.		Test and Ferry: 12.3	

CHACHA 2022 project summary

CHACHA is focused on studying interactions between reactive gases, particles, and clouds, combined with modeling of chemical and physical processes in the vicinity of oil and gas extraction activities and sea ice leads. The project was based out of Utqiagvik, AK, with research flights taking place between 24 February and 17 April 2022, with the deployment consisting of 35 research flights. The flight profiles used for the deployment were balanced between two primary objectives. Numerous flights sampled near ground facilities using a variety of profiles and low approaches at nearby airports, focusing on clear weather, with the remaining flights targeting clouds that formed over leads in the sea ice.

The UWKA facility webpage for the project, including general flight summaries and detailed flight notes, can be found here: http://flights.uwyo.edu/projects/chacha22/

Instrumentation:

Facility instrumentation:
Data from the following University of Wyoming instruments are included in this dataset.

Applanix AV 410 GPS/Inertial Measurement Unit
Reverse-flow static air temperature
Rosemount 102 static air temperature
EdgeTech Vigilant model 137 chilled mirror hygrometer
Rosemount 1501 HADS static air pressure
Weston static air pressure
CPT-6140 static air pressure
CPT-9000 static air pressure
Rosemount 1332 cabin air pressure
Rosemount 0858 for indicated airspeed, angle of attack, and sideslip angle to derive winds
Co-pilot indicated airspeed
King KRA 405 Radar Altitude (to 2000 ft AGL)
DMT Passive Cavity Aerosol Spectrometer Probe (PCASP-100X)

Further information on the King Air instrumentation, along with a summary list of variables in processed UWKA flight-level data, can be found at: https://www.uwyo.edu/atsc/uwka/in-situ-instrumentation.html

Instrument Notes:

Applanix: The Applanix IMU/GPS measurements and associated parameters (aircraft location and attitude, three-dimensional winds) were post-processed following the project using updated values for the instrument's installed location within the cabin. The post-processed dataset also incorporates reference values obtained during calibration maneuvers performed during the field deployment on 21 March 2022.

PCASP: The particle sizing for the PCASP employed for these flights (instrument serial number 39798-0200-26) was calibrated using laboratory-generated test particles before and after the project deployment. In this case, the size calibration changed between these testing periods. Both sets of calibrated bin sizes are included in the PCASP summary document. The initial bin sizes are retained in the post-processed data set, however the updated sizes are included in the PCASP summary document to help with calculating uncertainty estimates. Additionally, an independent flow measurement system was used to calibrate the instrument's sample flow rate in the laboratory before and after the project. The updated calibration values are included in the final project data release. These values are also listed in the PCASP summary document. Finally, no PCASP measurements were available for the flight on 30 March 2022 (RF18).

MRI turbulence sensor: Turbulence measurements were faulty for several flights between 29 March and 9 April 2022.

Topography: The topographic database used for the TOPO parameter features some missing values at extremely high latitudes encountered during some research flights.

Specific flight notes:

29 March 2022 (RF17a): The turbulence probe measurements dropped out prior to ~202530 UTC.

30 March 2022 (RF18): The general UWKA flight-level measurements are available only from 2354 UTC onward for this flight, due to data system recording issues. No measurements from the PCASP or the Weston, CPT 6140, or CPT 9000 static pressure measurements are available for this flight (the primary HADS static pressure measurement is available). The turbulence probe measurements were unusable during this flight.

1 April 2022 (RF19): The turbulence probe measurements were unusable during this flight.

2 April 2022 (RF20): The turbulence probe measurements were largely unusable during this flight.

7 April 2022 (RF21b): The general UWKA flight-level measurements are not available after ~0255 UTC for this flight, due to data system recording issues.

9 April 2022 (RF23): The turbulence probe measurements dropped out after ~2337 UTC during this flight.

14 April 2022 (RF27): The Applanix GPS/IMU unit lost its connection and had to be restarted mid-flight. No direct Applanix measurements or derived parameters are available from approximately 201100-201635 UTC.

Title: University of Wyoming King Air (UWKA) **Low-(High-)Rate** Flight Level Data from the 2022 CHemistry in the Arctic: Clouds, Halogens, and Aerosols (CHACHA) Project

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Description:
The CHemistry in the Arctic: Clouds, Halogens, and Aerosols (CHACHA) was focused on studying interactions between reactive gases, particles, and clouds, combined with modeling of chemical and physical processes in the vicinity of oil and gas extraction activities and sea ice leads. This dataset contains the navigation and state parameter data measured by the UWKA during the research phase of CHACHA in February - April 2022.

· Version: 1.0 (**2021-XX-XX**) processing release tag trans2am21_qc1

· Status: Final

· Time period: 2022-02-24 23:26 to 2022-04-17 03:50

· Physical location: 68.9 to 72.2 degrees North latitude, -165.5 to -147.5 degrees East longitude

· Data frequency: **1 Hz, 25 Hz**

· Project web site: http://flights.uwyo.edu/projects/chacha22/

· Data restrictions: none

Instruments:

· Aircraft position and attitude - Applanix AV-410

· Static Pressure - Rosemount HADS, Weston, CPT-6140, CPT-9000

· Air Temperature - Reverse Flow, Rosemount 102

· Air Flow - Rosemount 0858

· Water Vapor - Edgetech Vigilant 137

- Radar Altitude - King KRA 405B
- Cabin Pressure - Rosemount 1332
- Aerosol Sizes - PCASP SPP-100

Data Format:

- NCAR-RAF netCDF Conventions: https://archive.eol.ucar.edu/raf/software/netCDF.html

Remarks:

- Summary of each flight including instrument issues can be found at: http://flights.uwyo.edu/projects/chacha22/

The project consisted of 35 research flights, including 5 pairs of flights taking place on the same local day as each other. Flight numbers are included in the file metadata, with paired flights on the same day given identical flight numbers appended with *a* or *b*. Files are named by UTC date, as *YYYYMMDD.cX.nc*, where *X* corresponds to the processed data rate in Hz, and are appended with *a* or *b* where multiple files were recorded on the same date. Note that for flight RF12 (nominally occurring on 13 April 2022), the corresponding file is named *20220412b.cX.nc* as system data recording began prior to 00 UTC on 13 April.

Further information on the King Air instrumentation, along with a summary list of variables in processed UWKA flight-level data, can be found at: https://www.uwyo.edu/atsc/uwka/in-situ-instrumentation.html

GCMD Keywords:

Atmosphere, Aerosols, Aerosol Particle Properties, Altitude, Barometric Altitude, Atmospheric Pressure, Static Pressure, Atmospheric Temperature, Upper Air Temperature, Atmospheric Water Vapor, Dew Point Temperature, Humidity, Atmospheric Winds, Upper Level Winds, Flight Level Winds

Primary Contact Information:

- UWKA Project Management: atsc-kapm@uwyo.edu

PCASP Particle Sizing Calibration – CHACHA 20220517

PCASP-2 (aka, the NOAA PCASP)

Cai et al. (2013) and Snider et al. (2017) explain how the PCASP is challenged with laboratory-generated test particles. This is done in the laboratory before and after a deployment. The Table has channel sizing derived using polystyrene latex test (PSL) particles (refractive index = 1.59). Over the course of the project, there was a sizing shift. In terms of particle size, on average, the sizing shift is 10 %. In terms of bin thresholds, the shift corresponds to the PSL test particles being sized in a size bin that incremented by 1 from the beginning to the end of the project. The reason for this is not known. It is recommended that users of the CHACHA PCASP data develop an analysis method that acknowledges this variance of the sizing calibration.

Cai, Y., J.R.Snider and P. Wechsler, Calibration of the passive cavity aerosol spectrometer probe for airborne determination of the size distribution, Atmos. Meas. Tech., 6, 2349-2358, 2013

Snider, J.R., D.Leon and Z.Wang, Droplet Concentration and Spectral Broadening in Southeast Pacific Stratocumulus, J. Atmos. Sci., 74, 719-749, 2017

Channel Number	Size Calibration Before Project	Size Calibration After project	Relative Difference, After - Before	Absolute Difference
	micrometer	micrometer	%	%
1	0.11	0.10	-10	10
2	0.12	0.11	-9	9
3	0.13	0.12	-8	8
4	0.14	0.13	-7	7
5	0.15	0.14	-7	7
6	0.16	0.14	-13	13
7	0.17	0.15	-13	13
8	0.18	0.16	-12	12
9	0.19	0.17	-11	11
10	0.21	0.19	-10	10
11	0.23	0.21	-9	9
12	0.25	0.23	-8	8
13	0.27	0.25	-8	8
14	0.29	0.27	-7	7
15	0.31	0.29	-7	7
16	0.45	0.35	-25	25
17	0.55	0.45	-20	20
18	0.65	0.55	-17	17
19	0.75	0.65	-14	14
20	0.85	0.75	-13	13
21	0.95	0.85	-11	11
22	1.05	0.95	-10	10
23	1.25	1.15	-8	8
24	1.45	1.35	-7	7
25	1.65	1.55	-6	6
26	1.85	1.75	-6	6
27	2.05	1.95	-5	5
28	2.35	2.25	-4	4
29	2.65	2.55	-4	4
30	3.05	2.95	-3	3

PCASP Sample Flow Calibration – CHACHA 20220517

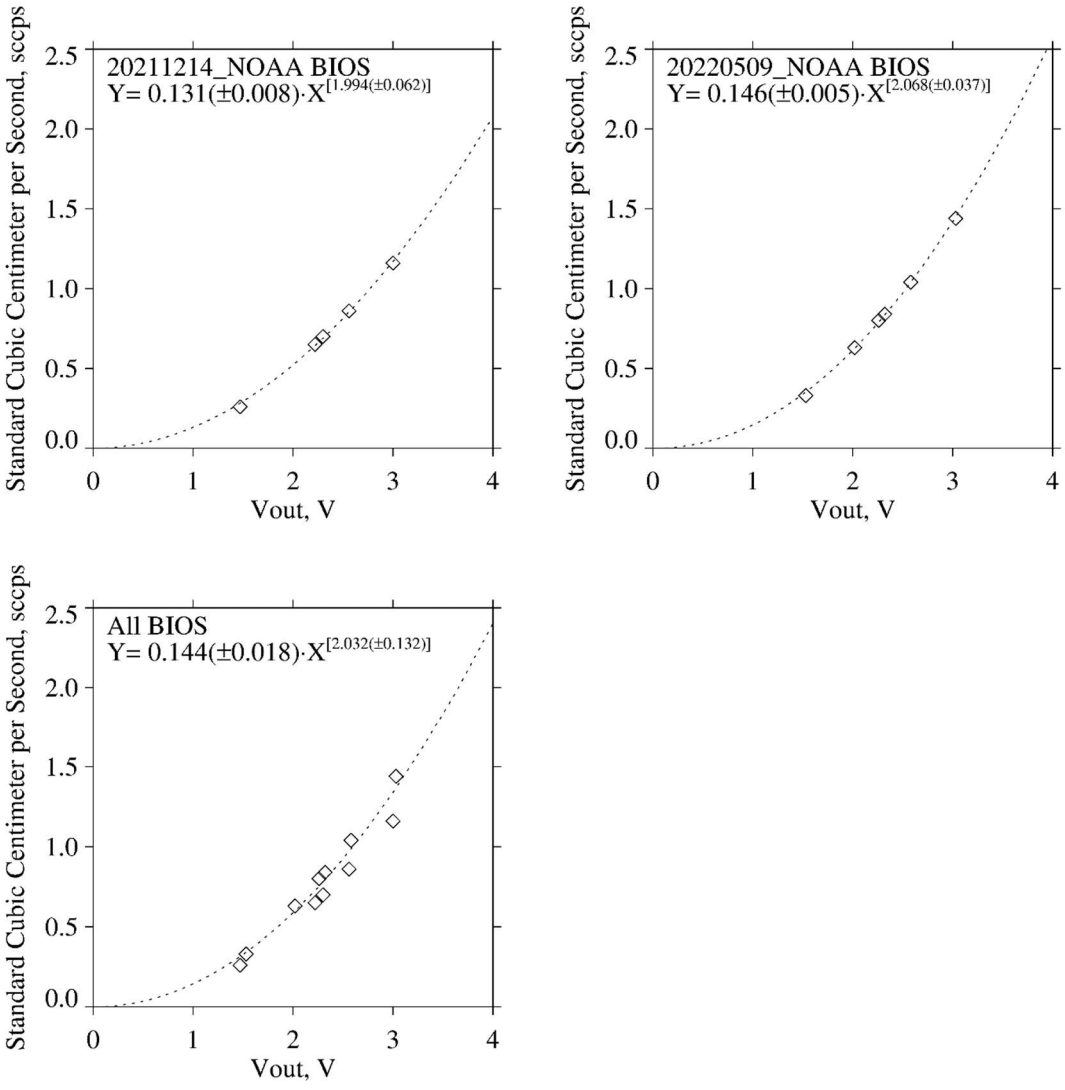
PCASP-2 (aka, the NOAA PCASP)

Cai et al. (2013) and Snider et al. (2017) explain how an independent flow measurement system is used to calibrate a PCASP's sample flow rate. This is done in the laboratory before and after a deployment. The measurements shown below indicate that the flow rate, at all sensor output voltages, increased from the beginning to the end of the campaign.

An averaged flow calibration is provided in the bottom-left panel with fit-coefficient uncertainties. The average and standard deviation of the "A" and "B" coefficients in the power law relationship $Y = A \cdot X^B$ are A = 0.144 $\pm$ 0.018 (sccps V^{-B}) and B = 2.03 $\pm$ 0.13 (dimensionless). It is recommended that users of the CHACHA PCASP data develop an analysis method that acknowledges this variance of the flow calibration.

Cai, Y., J.R.Snider and P. Wechsler, Calibration of the passive cavity aerosol spectrometer probe for airborne determination of the size distribution, Atmos. Meas. Tech., 6, 2349-2358, 2013

Snider, J.R., D.Leon and Z.Wang, Droplet Concentration and Spectral Broadening in Southeast Pacific Stratocumulus, J. Atmos. Sci., 74, 719-749, 2017



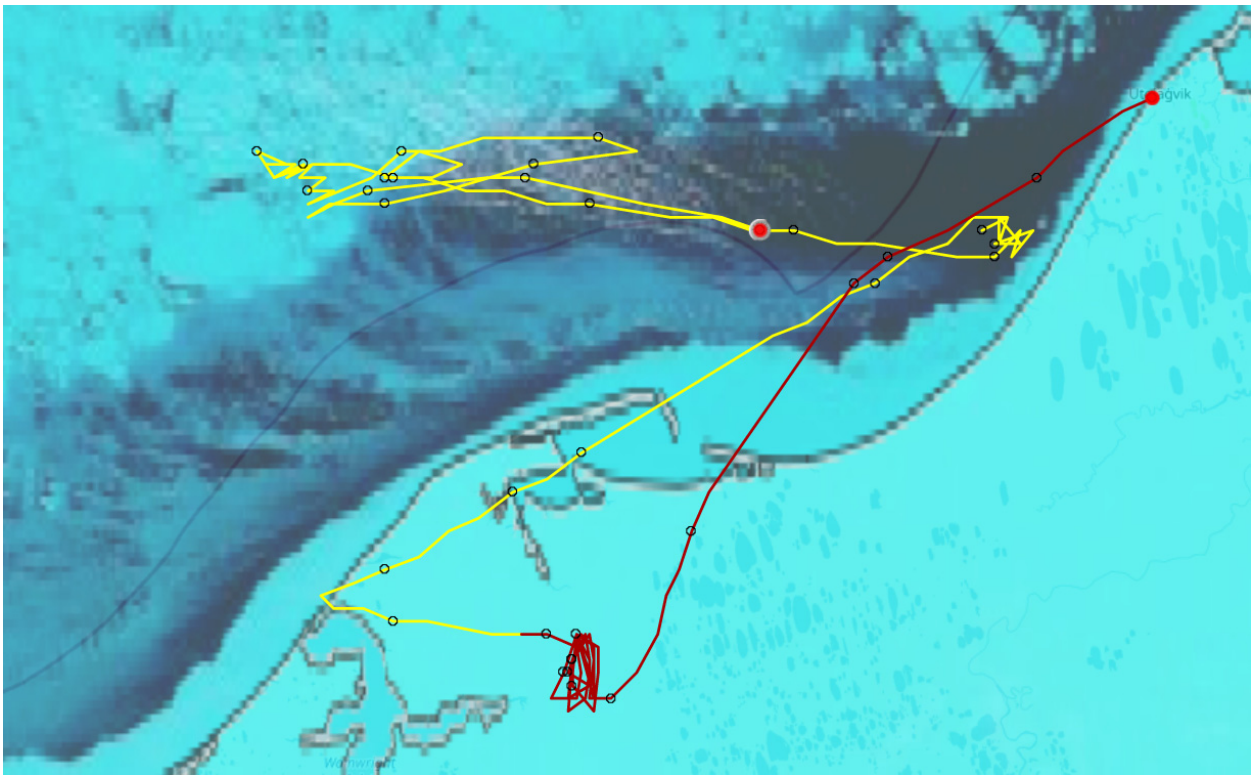
04/16/22 Pilot notes (CHACHA22 RF 29b)

Crew: Drew, Woods, Robertson

Flight Time: 3.1

Planned: Depart and climb to 3000 ft. followed by descent to approximate height of clouds direct to leading edge of the cloud field. Fly along the field to the tail end for about 30 minutes. Then spiral climb to 12,000 on leeward side to drop first sonde onto the ice just past open lead. Then fly upwind to second point over open lead and drop second sonde. Make a spiral descent 1000 fpm to 500 ft. and then fly to PAWI and make one low approach. Then fly to the point northeast of PAWI and fly racetracks at 300, 500, 1000, 2000, 3000 ft. AGL. Then fly for 30 minutes at 300 ft. over lead. Follow lead back to PABR.

Actual: Departed and climbed to 3000 ft. followed by descent to approximately height of clouds ~1000 ft. MSL. direct to leading edge of the cloud field. Flew along the field (E-W) with a couple reversals, to the lee tail for about 30 minutes. Then spiral climbed to 12,000 ft. MSL on leeward side and dropped the lee sonde onto the ice just past open lead, in the same location as the earlier flight. Continued upwind to second point over open lead and dropped second sonde, again in the same position as the earlier flight. Made a spiral descent at 1000 fpm to 500 ft. and flew to PAWI and made one low approach. Next, flew to the point northeast of PAWI and flew racetracks at 300, 500, 1000, 2000, 3000 ft. AGL. with the racetrack oriented perpendicular to the wind. Descended down to 500 ft. AGL and then later, down to 300 ft. AGL, headed for second drop point. However, once over the open lead proceeded direct to PABR.



2022-04-16b KA Science Flight for CVI (From PABR)

Config: Standard for CHACHA cloud flights: CIMS off, all others operational. Rogers for takeoff/landing, CVI for cloud sampling

Crew: Tom, Anna, Sarah

Obj:

1. Head straight to leading edge of cloud field in Barrow Lead
2. switch to CVI and sample in-cloud from tip to tail
3. spiral up to 10,000' and drop 1st sonde
3. head down spine of cloud and drop 2nd sonde into water
4. spiral down to 10,000'
6. switch to Rogers and head to PAWI
7. low approach at PAWI
8. head to 70° 35.76'N 159° 4.83'W and do parking garage at 300, 500, 1000, 2000 and 3000 ft (2 PILS vials per altitude)
9. head back to Barrow lead and sample sea spray over open water at 300'
10. Head back to PABR

Preflight Check Summary: No known issues. Andrea tended to PILS & Drum. Daun capped CIMS.

TRF -12C
Zrad 2.88ft
RH 59.3%
Pa -380kft

Conditions: still clear skies, less seasmoke/cloud visible from shore

0041 UTC Engine start

124632 Start PILS software, Run# 123, tip temp 100

0046 UTC taxi (1649 local PBAR)

0047 Takeoff UTC (on Rogers inlet)

Power cycle 2D-S, it didn't like being stopped and restarting from the GUI without a power cycle

CVI, 2D-S TAS tracking

0049 Drum advance after climb out

PILS tip temp 97, LFE flow 8.3

Head straight to leading edge of cloud field in Barrow Lead

Cloud field looks to have largely dissipated, but will see what we have when we get out there. Transiting at 1kft, -12C, RH sensor has weird spike, Anna says it sometimes does this with quick changes, should come back

0057 slight right turn as we try to get into clouds, scattered field, will assess if these wisps have enough size to warrant CVI – peak variable, 2-7um

Still decent sized ice on 2D-S, rimed pristine

Clouds are intermittent, and drops are small, so will stay on Rogers for 15 mins to survey interstitial aerosol

0108 rimed plates on 2D-S, 5-7um peak on CDP

0110 over some pack ice, little gap in clouds
0110 climb a tad to get back into clouds
Smaller & less ice in these clouds over the ice

0113 Turn up CVI de-ice to 50/40
Turn down counter flow to 2,
Open MFC valve
Switch to Rogers
Check inst flow ~14
Check pops flow

0114 couple good cloud passes – passes have a little less ice and slightly larger droplets out here, last one was a more juicy one
Tom: that last one was a dark one

0117 back over ice slicks now, waves on surface
Note: no visible seasmoke on this 2nd flight

0122 few more passes, clouds getting a bit scattered as we head back up wind.

0124 even clouds over open water are starting to lose their ice now – last pass or two was mostly small drops

0124 turn around so we can reach downwind side at 30 min mark to spiral up

0127 couple good passes, very smooth, lil higher drop conc, less ice, reminiscent of those stratus-like clouds we've seen downwind on some other flights

0129 little more gap between clouds, -11C, 900ft zrad, 58% RH, winds 25kt@104

0132 Jog Drum to conclude 30 mins in cloud sampling

0133 Switch to Rogers
Close MFC flow
Turn up counter flow
Turn down de-ice

0134 begin spiral up to 12kft

In spiral, can see the cloud shadows, but can't make out the clouds themselves from the white icesheet of a background

0151 Drop 1st sonde downwind over seaice – at location of the 2nd drop on this morning's flight. All data streaming by 8.9kft. Drop over ice, but not too far from open water, lead might've widened a bit more since this morning

RH spike at 800 ft to 95%, drop again below 300 ft

0158 continue upwind to location of 1st drop on morning flight.

At altitude: -14C, RH 8.95, winds 13kt@101deg, 11.6kft palt

0210 Drop 2nd sonde upwind over open water ahead of cloud field, same location as morning drop, all data streaming in by 11kft
0210 begin spiral down to 300 ft

RH spike at 600ft to 90%, drop below 300 ft

0221 nearing bottom of spiral, Jog drum, 500 ft, -13C, 80% RH
Surface looks ocean like. Still few very scattered, thin wispy clouds
0223 transit to PAWI at same altitude as blowing snow sampling from this morning: 500 ft
Still very few scattered clouds above

Occasional pristine ice on 2D-S – plates, dendrites

0227 over ice slick ahead of cloud field

0229 crossing landfast ice edge

Still occasional ice on 2D-S, smaller than what it was this morning though.

Tom: visibility better than usual here, but it does look worse to the south. It's very typically been worse to the south this whole project.

Thin haze layer out a ways off the rt wing, with thin lead cu field at the top of it, looks to be about where we were sampling earlier – see photo.

0234 lil increase in ice particles on 2D-S, tad bumpier too. Winds 22@100kt
0235 Crossing inner edge of peninsula near Wainright

0238 begin climb for low approach at PAWI
0239 jog Drum passing 1kft in climb

Only 1 hr left in flight. Will prioritize parking garage since the seaspray has been sampled on other flights, but the 2D-S has not been operational for other tundra parking garages.

0240-0243 Low approach at PAWI

0244 transit to waypoint at 500 ft, jog Drum
Head to 70° 35.76'N 159° 4.83'W for parking garage -2 vials each at 300, 500, 1k, 2k, 3kft

If need to modify waypoint because of Wainwright airspace, go further east toward Atqasuk. (Jog DRUM forward when ascending above 1000 ft, and then jog forward again after descending below 1000 ft)

0247 descend to 300 ft
Tad hazy out window, but not much

Parking garage:
0248 300 ft, vial 40, still 5 miles away from waypoint
0251 over point, so begin oval,
0251 300 ft, vials 41-42, no particles on 2D-S, -15C, 68%RH, winds 24kt@101deg
0258 500 ft, vials 43-44, no particles on 2D-S, -14.7C, 58%RH, winds 26kt@120deg

0304 1000 ft, vials 45-46, couple particles on 2D-S climbing btw 500-100 ft, but not many, -4C, 12.3%RH, winds 18kt@105deg
0310 Jog Drum
0310 2000 ft, vials 47-48, no particles on 2D-S, -3.5C, 8%RH, winds 19kt@122deg
0317 3000 ft, vials 49-50, no particles on 2D-S, --4.4C, 7%RH, winds 17kt@122deg

0323 head back to Barrow lead, descending en route.

0327 jog Drum descending below 1kft

0330 still nothing at 500 ft on 2D-S here, so descend on down to 300 ft for remainder of transit

0330 couple particles on 2D-S at 300 ft. -14C, 73% RH

0332 crossing land/landfast ice edge

0335 crossing landfast ice/lead edge, PILS vial 55

0335 Jog drum for seaspray sampling on transit back
Tom: this is kind of an ice debris field here
Lots of ice chunks and small pancake ice slicks. No seasmoke. Ripples, fewer whitecaps, water looks a bit calmer with lessening winds – 22kt@84deg

Very few scattered small cu still off left wing further out above lead, certainly smaller/thinner than before. 1 or 2 out right window as well.

0342 over more open water (less ice slicks, some little ice patches still), more whitecapping, stronger waves

Occasional ice particles on 2D-S

0345 Jog Drum for final approach (on Rogers)

0345 begin climb for final approach

0349 Gear down

0350 Landing
Turn off PILS & Drum pumps
Turn off PILS chassis

04/16/22 Pilot notes (CHACHA22 RF 29a)

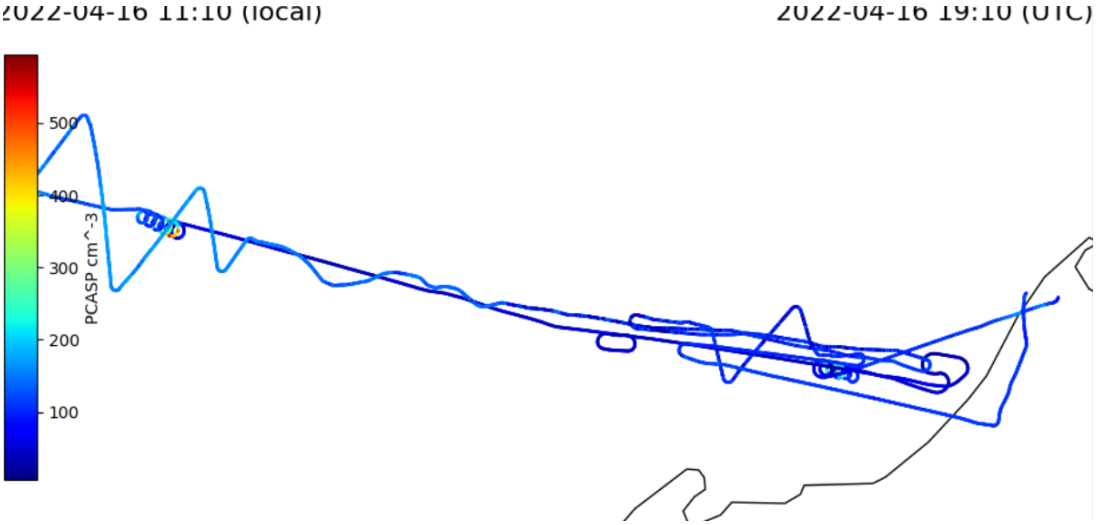
Crew: Drew, Woods, Robertson

Flight Time: 3.9

Planned:

1. Head out on Roger's inlet at 300' to start of the lead cloud, drawn at 71° 6.42'N 158° 8.98'W
2. Spiral up to 10,000', assessing cloud top/base on the way down
3. Release the 1st dropsonde over the water just upwind of cloud field
4. Head down center of cloud field (following a street if there are any) at 10,000 ft'
5. Release 2nd dropsonde at downwind edge of the open water, approx. 71° 10.64'N 159° 31.30'W
6. Release 3rd dropsonde at downwind edge of the cloud, approx. 71° 18.60'N 163° 45.02'W
7. Spiral down to 300', assessing cloud top/base on the way down
8. Continue downwind another ~20 miles, currently at approx. 71° 20.61'N 164° 10.72'W
9. Sample for 30min downwind of cloud field at altitude of the clouds
10. Switch to CVI and sample in-cloud through length of lead cloud (tail to tip), approx. 30min
11. Continue sampling in-cloud at upwind side over water for 30min
12. Switch back to Rogers inlet and head at altitude of the cloud to 70° 58.66'N 157° 8.21'W
13. Sample over land at altitude of the cloud on the way back PABR to assess blowing snow

Actual: Departed and climbed to 3000 ft. followed by descent to approximately 300 ft. to start of the lead cloud, drawn at 71° 6.42'N 158° 8.98'W. Spiraled up to 12,500 ft. MSL. Released the 1st dropsonde a little farther northeast of the coordinates to clear the scattered lead clouds over the water just upwind of cloud field. Flew down the center of the cloud field at 12,500 ft. Released 2nd dropsonde at downwind edge of the open water, approx. 71° 10.64'N 159° 31.30'W. Continued downwind, visually following the cloud field more to the north than as drawn/planned. Released 3rd dropsonde at downwind edge of the cloud. Spiraled down to 300', and continued downwind another ~20 miles. Climbed to approximate cloud altitude and flew downwind of cloud field at cloud altitude in zig-zag fashion. Then followed cloud field back to the first drop point and reversing course several times, and doing one zig-zag N-S. Headed to waypoint at cloud altitude and then flew over land at altitude of the cloud on the way back PABR to assess blowing snow.



2022-04-16a KA Science Flight for CVI (From PABR)

Config: Standard for CHACHA cloud flights: CIMS off, all others operational. Rogers for takeoff/landing, CVI for cloud sampling

Crew: Tom, Anna, Sarah

Obj: Lead cloud sampling just SW of Utqiagvik. Lead reopened a few days ago, winds have been strong and cloud field has been dissipating before we can do much sampling.

Preflight Check Summary: No known issues. Andrea tended to PILS & Drum. Daun capped CIMS.

TRF -14.2C
Zrad 3.55ft
RH 52%
Pa -411kft

Conditions: Winds lighter than yesterday, still out of east. Still chilly. Lead smoke & some clouds visible to SW from shore. Generally clear skies

1903 UTC Engine start

070450 Start PILS software, Run# 122, tip temp 98

1905 UTC taxi (1105 local PBAR)

1907 Engine runups

1908 PILS & Drum pumps on

1909 Takeoff UTC (on Rogers inlet)

CVI, 2D-S TAS tracking

PILS tip temp 98, LFE flow 7.5-10

1911 Drum advance after climb out

Head out on Roger's inlet at 300' to start of the lead cloud, drawn at 71° 6.42'N 158° 8.98'W.

Some seasmoke on surface, not super thick. Surface ocean-like, waves, whitecaps, scattered ice chunks. Thin cloud field visible a ways off.

1914 still a tad bumpy today, 300ft, -15C, winds 25kt@77deg, 71%RH

1915 shallow, scattered thin cloud layer visible ahead on the rt.

1916 scattered clouds now overhead, ice fallout on 2D-S - pristine & irregular

1919 Drum advance prior to spiral, concluding clear air transit

1919 At P2, spiral up from lowest altitude to 10kft, confirming cloud top & bottom heights.
800-900 ft thin cloud layer Drops ~9um peak, mixed phase on 2D-S

Some ice slicks visible on water surface. Patchy lead cu field is the strongest it's been since the lead reopened.

1938 Drop upwind dropsonde into open water of lead, just upwind of lead clouds, from 12kft. All data streaming by 10.9kft. Winds aloft 20kt@87deg, -16C, 12.4kft, 16% RH

Sonde profile: RH quite low (5-25% aloft)

1000 ft, RH peak to 90% till 400 ft, then 95% sharp peak

PILS LFE 7-8.5 LPM, tip temp 94

Transit downwind over center of cloud field at 12kft, surveying cloud & lead extent, following a street if there are any.

Note: there look to be multiple haze layers aloft. It is very difficult to make out the cloud field once it extends over the seaice, beyond the lead edge.

1954 In transit, drop 2nd sonde at downwind edge of the open water, approx. 71^{o} 10.64'N 159^{o} 31.30'W, from 12kft, all data streaming in by 11.5 kft

RH quite low till 1kft, then RH spikes to 100% through clouds, then decreases again under 300 ft.

2000 continue downwind, correct slightly toward the north to follow the cloud field visually – they look to be dissipating/dissipated toward the south, though the winds also look slightly offset with changing altitude.

Note: visually, ice is much more broken up out here than it has been on previous flights

Cloud field definitely extends farther away from the lead than they do

2017 Release 3rd dropsonde at downwind edge of the cloud, approx. 71° 18.60'N 163° 45.02'W – dropped a bit before then, since we couldn't see anymore cloud beneath us. All data streaming by 11.3kft, winds 20 kt@93 deg at 11.6kft, -14C, RH 16 %
Begin spiral down with sonde

RH peak at 800 ft to 95% RH, falls off again below 300 ft – will aim for near top of this layer for our downwind leg

Surface out here consists of broken pack ice with patches of re-frozen lead, not much open water, but a pocket here and there.

2029 bottom of spiral at 300 ft, Jog drum for moving 20 miles downwind

Continue downwind another ~20 miles, flight plan was at approx. 71° 20.61'N 164° 10.72'W, but we will go 20 miles downwind of the 3rd drop point, transiting at 300 ft.

2032 -13C, 77%RH, winds 21kt@84 deg. Much smoother here at 300 ft than on upwind side.

2034 Jog drum for clear air downwind sample
2034 climb to 700 ft (just below RH peak, 1kft MSL) and sample for 30 mins downwind in clear air

2040 rt turn to head back S, zig-zagging back toward 3rd drop point.

2041 visually can see a hazy layer in the distance near our level off both wings.. – influenced by lead? Blowing snow?

Occasional ice on 2D-S, small particles and some dendrites or possible plates

2148 CPC counts creeping up. RH 80%, -13C, winds 30kt@83

2150 left turn to head back north

2153 RH dropped slightly from 80 to 65, try climbing 100 ft to see if we dropped below layer, doesn't look like it, so come back down. 770 zrad

2154 can just barely make out our cloud field off the rt wing as we cross the line back to the north

2158 rt turn to head back south toward line

PILS LFE 9.7-10, tip temp 99

2102 Tom: there's the 1st cloud I've seen down here, at 12 oclock

2103 left turn to head back toward line.
Can see clouds just at/above our level off rt wing as we head back north –very thin, very wispy

2104 Jog drum to conclude downwind clear air sample, in cloud sample #1

2106 Turn CVI de-ice up to 50/40
Turn CVI counterflow down to 2 LPM
Turn on dilution flow by opening MFC valve
Switch from Rogers to CVI inlet.
Check Inst flow near 14 – drop MFC flow by 1 LPM
Check Pops flow

Sample in-cloud through length of lead cloud (tail to tip), approx. 30min

2109 begin sampling very thin wispy clouds, look to be ice on 2D-S, very thin, very scattered out here.
Climb ever so slightly to try and visually place us in center of cloud layer

2112 brief blip on CDP, 7um peak, some large ice still on 2DS

2112 decent ice on 2D-S, 3-4 um droplet peak on CDP

Note: clouds are intermittent & patchy, no solid streets out here
Tom doing his best to make small adjustments to optimize sampling. Difficult to assess visually

2115 brief blip on CDP, 3-4um peak
Lots of pristine ice on 2D-S

2116 Must've found a street, little more continuous cloud for a few, tad bumpier.
Cloud streets stop & start, not continuous

2119 lil bigger peak on CDP, rimed ice on 2D-S

From the side, clouds look like continuous streets, but from shadows on the ice, can tell they are intermittent.

2121 lil better blip on CDP, 7um peak, big rimed ice on 2D-S

2123 slight rt jog to try and hit little more developed street, 7um CDP peak, still some big ice on 2D-S

2124 lil more persistent cloud, stronger street, bigger 5-7um peak in CDP

2127 still over patch ice, no big open water yet, but occasional patches. Clouds visually getting a tad thicker, can still see through them though.

Bob: you guys are working the only clouds we've seen in the area, and we went pretty far south. Low visibility down south over the tundra.

2130 nearing 2nd dropsonde point, still over ice though

2132 droplet peak a tad broader, 7-9um, as we continue further upwind, clouds visually getting thicker again, little deeper. Now obvious more liquid than ice on 2D-S. Ice rimed pristine

2134 Tom: over smaller patches of broken ice

2136 in and out of cloud a bit now, reaching little patchier cu field? Rolling tops out side window, can see street type patterning at times

2138 good 7-9um CDP peak, clouds still mixed phase

Note: no clouds overhead, so 2D-S ice likely either from blowing snow or lead cloud field

CPC still keeping up well with CDP

2142 Jog Drum for in cloud sample #2, *Continue sampling in-cloud at upwind side over water for 30 min*

2142 starting to get on top of clouds, descend slightly to keep with layer
Slight left turn

2144 lil juicier cloud, lots of ice though, -15C, 80%RH, winds 30kt@78deg
2146 Cool branched ice image on 2D-S

2147 lots of ice on 2D-S
Clouds visually thinning as we cross toward the upwind side of the lead

2148 just skirting bottoms, climb a tad to get back into the droplets

2149 cloud field thinning extensively on leading edge, turn rt to head back through juicy section

2154 getting back into thicker clouds, upwind edge they're so scattered

2155 good droplet peak, 7-9um

2157 mostly liquid pass on 2D-S

2158 long ice slick visible on surface out rt window, & left on slight left bank. Can also see chunks of ice on water surface that have leeward shadows without the ice slick.

2201 good pass, 7-9um, feel a little updraft, mixed phase still, over patchy ice, will turn around soon
2202 Dendrites on 2D-S

2202 big, gnarly looking piece of ice on 2D-S, stronger CDP peak, still 7-9um

2203 rt turn since we're now over more solid ice and clouds are looking slightly thinner. Good CDP peak in turn, still some big ice on occasion

2207 some big ice on 2D-S

2207 small, patchy pancake ice an ice slicks on surface beneath us

2209 we'll try a north-south zig-zag to make sure we're not missing a juicier street, descend a tad to keep with clouds

2211 several pristine ice crystals on 2D-S

2212 out of it, turn back north – note, this was the original crossing point from the satellite image, but it seems the cloud field has shifted north a bit

2213 Rimed columns and rosette-looking ice on 2D-S, CDP peak still around 7um

2215 slightly broader, but still low CDP distribution

2216 rosettes, rimed on 2D-S

Tom: over big island of ice, slight break in clouds, turn back south toward main line

2219 lot more ice on 2D-S, pristine

2223 Switch from CVI to Rogers inlet (check inst flow goes to 0), close MFC valve, turn down de-ice, turn up conterflow to 10

2224 jog Drum to conclude in cloud leg for upwind leg on return

2224 reverse course, transiting back just above cloud tops briefly to provide evidence all this ice is not coming from above, PILS vials 65 & 66

2230 climb slightly to keep above clouds

2231 finish PILS vial 66, turn toward Sara's last waypoint and descend to just below CB

2232 clip clouds on descent

2233 below CB at 500 ft, -12C, 81%RH, finishing Vial 67, ice fallout on 2D-S – plates, columns, rosettes, irregulars, all rimed

2233 jog Drum for below cloud

We just noticed: no seasmoke visible here, but we had seen it upwind of the clouds on the way out.

Anna: can see some diamond dust out there
..blowing in from upwind, or falling out of clouds?

2242 still quite a bit of ice on 2D-S, cloud field above getting much thinner & scattered – ice smaller, looks less rimed

2244 Just finished PILS vial 70, climb from 500 ft to cloud level (870 ft) for upwind of cloud sampling (still very occasional wisps)

Head at altitude of the cloud to 70^{o} 58.66'N 157^{o} 8.21'W

2244 jog Drum for upwind of clouds at-cloud-level sample – note, actual sampling was done just below cloud level

Sample over land at altitude of the cloud on the way back PABR to assess blowing snow

2246 Tom: last couple remnants of cloud going by left wing

Nothing on 2D-S so far upwind at 870 ft

Note: no seasmoke visible up landfast lead edge

2250 was nothing on 2D-S at cloud level (870 ft), so descend back to 500, where we were sampling at CB. Looked like top of this blowing snow layer was around 600 ft zrad. Note: we're now over tundra.

2252 left turn toward Barrow. Looks hazy out rt window.

2256 Jog Drum for final approach (on Rogers)
2256 begin climb for final approach

2258 Gear down

2300 Landing

Turn off PILS & Drum pumps

Turn off PILS chassis

04/15/22 Pilot notes (CHACHA22 RF 28)

Crew: Drew, Woods, Robertson

Flight Time: 2.5

Planned: Depart and climb to 3000 ft. followed by descent to 300 ft. AGL. Fly along downwind side of open lead above sea-smoke for 30 minutes. Then spiral climb to 12,000 on windward side to drop first sonde into the open lead. Then fly downwind to second point over ice and drop second sonde. Make a spiral descent 1000 fpm to 300 ft. Then fly for 30 minutes over ice along leeward side of open lead for 30 minutes. Then fly for 30 minutes at cloud level over lead. Follow lead back to PABR.

Actual: Departed and climbed to 3000 ft. followed by descent to 300 ft. AGL. Encountered very high turbulence and decided to climb to 700 ft. AGL to ensure a little more safety margin over the water in the strong turbulence. With such strong drops encountered, decided it would be prudent to fly above 1000 ft. AGL in such a strong turbulent environment. Encountered much smoother conditions over 1000 ft. AGL. so decided to continue sample. Flew along the open lead on the leeward side over the open water, above sea-smoke for 30 minutes. Then started spiral climb to 12,500 ft. MSL over first point over open lead. Dropped first sonde over that point, then flew downwind to second drop location over leeward ice and dropped second sonde from 12,500 ft. MSL. Because winds were much lower at altitude with no discernable vertical wave, decided to conduct the wind maneuvers. Then returned to drop point and spiraled down to 1000 ft. AGL (top of the turbulence). Flew north-south transects (later NE-SW) at about 1,100 ft. AGL over the leeside ice at approximate cloud level for 30 minutes. Started 30 minutes of flying at cloud level over lead, when PABR announced the airport went IFR reporting 2 nm visibility. With no alternate airports available on the North Slope (due to very low visibilities being reported) decided to return to PABR early.

No Image.

2022-04-15 KA Science Flight for CVI (From PABR)

Config: Standard for CHACHA cloud flights: CIMS off, all others operational. Rogers for takeoff/landing, CVI for cloud sampling

Crew: Tom, Anna, Sarah

Obj: Lead sampling between Utqiagvik & Wainright

Preflight Check Summary: No known issues. CPC was getting low on butanol, so topped off before the flight. Andrea tended to PILS & Drum. Daun capped CIMS.

TRF -16 C
Zrad 0.11 ft
RH 48 %
Pa -508 kft

Conditions: Chilly, very windy, rest of north slope is IFR, PABR forecast to stay VFR, but visible blowing snow around. Generally clear skies

1904 UTC Engine start

1907UTC taxi (1108 local PBAR)

070831pm Start PILS software, Run# 119, tip temp 98

1909 Engine runups

1910 PILS&Drum pumps

1911 Takeoff UTC (on Rogers inlet)

Barrow lead wide open, some seasmoke visible, no clouds

CVI, 2D-S TAS tracking well

PILS tip temp98, LFE flow 8-10

1913 Jog Drum after climbout

Sea spray sampling at ~300' for 30min on transit VFR from Barrow to approximate lat/long of nearest edge of cloud field determined by Sara Lance (P1)

1917 Jog Drum for 30 mins of lead seaspray sampling in transit

Can see targer cloud field, thin downwind over eaice. Very few clouds over open water, but trying, similar to yesterday. -18C, winds 35kt@75deg, lil bouncy today with winds, 67% RH. Surface has

1920 with up/down turbulence, climb to 700ft for safely sampling

1922 some blowing snow on 2D-S. 700ft zrad, -17C, 64%RH, winds 38kt@79deg

1923 clouds visbibly forming over open water off rt wing – see photo, tad thicker and dark

1925 rt turn around to head back north.

Ocean surface looks much more ocean like today, some rolling waves through the ice slicks. Whitecapping. Still lots of thin ice slicks on surface, aligned with wind.

1925 beneath some of the very wispy lead clouds

1934 climb for safety to 1200 ftzrad, Tom thinks we were right on the shear. Much smoother up here.

1935 left turn to head back SE

Very strong haze layer over the tundra with the strong winds and blowing snow. Freezing fog was also reported in places this morning.

2D-S has intermittent noisy pixel on V-channel

1941 left turn to head back south.

Visually, the lead cloud field looks to be similar to our level downwind. Occasionally see the thin wispy baby lead clouds, they look to be just below our level off the rt wing (downwind).

Can occasionally feel shear encroaching up on us.

1945 winds 51kt@91, -11C, 25%RH.

1947 Jog Drum prior to spiral, concluding clear air transit & upwind 30 min seaspray sample

At P2, estimated at 71° 5.12'N 157° 42.84'W, spiral up from lowest altitude to 12kft, confirming cloud top & bottom heights.
1947 Begin spiral up. Thin seasmoke visible.

1955 Visually getting harder to see our lead cloud field from up here. Might be dissipating. Winds lessening aloft, but still 27kt@73deg at 10kft, RH 5%, -15C

2000 Drop upwind dropsonde into open water of lead, upwind of lead clouds, all data streaming by 11.2kft. Circle while sonde descends. PILS LFE holding 5-7 LPM

RH begin increasing from really low level (10%) around 4kft, up to 25%, then back down to 10%, spike at 1300ft to 40%, 600ft climb to 80%

Transit downwind along spine of cloud field at 10kft, surveying cloud & lead extent.

2014 In transit, drop downwind dropsonde through thickest part of cloud field (P3) , estimated at 71° 5.01'N 159° 8.67'W. Make a slow circle at 10kft while waiting on data to stream in. Then continue transiting at 10kft to downwind edge of cloud field – no clouds really, so begin wind maneuvers, then descend.

2021 Wind yaw maneuvers

2024 transition back to drop point
2029 begin spiral down for aircraft sounding

2033 can see very small lead cloud family of lil puffy cu just downwind of the lead over seaice, upwind of sonde spiral. No extensive cloud field though. See photo.

2038 50kt@87, passing 1500ft, -14C

Sample downwind of cloud field for 30 min at the level of the cloud

2040 Jog drum for clear air downwind sample at 1.6kft, level of clouds, -15C, 64% RH

2043 some haze/possible lead clouds to the SW off left wing, maybe off of next big water patch to the south? Still, cloud field looks minimal.

2046 a couple of very thin, wispy clouds off left wing, downwind of another patch of open water

2049 starting to get north of cloud field off rt wing, so rt turn to head back south, also somewhat far downwind of cloudfield, so will move closer to it on this downwind leg.

2053 rt turn – seals, fish, or a handful of something just below the surface in an open water patch.

2054 heading back directly south after cutting diagonal to get closer in to the clouds

2057 couple thin wispy clouds just above us, also at our level off left wing
Small blip on CDP

2100 rt turn to head back north, keeping downwind of the clouds

2103 few particles on 2D-S – quite small, and one large, doesn't really look like ice, 2 very small peaks in CPC

2107 rt turn to head back south

2110 jog Drum to conclude downwind transit, begin cloud sampling

Return back along cloud spine and sample within cloud for 30 min if possible, with repeat passes in adjacent cloud streets if necessary – no big cloud field, so will just punch whatever clouds we can

2111 left turn toward cloud field

2111 couple ice(?) particles on 2D-S, getting bumpy as we head upwind to clouds

2112 wispy cloud pass, all small, couple smaller ice, lil blip on CDP

2114 PABR went IFR and we have no viable alternate on N Slope, so RTB

2114 brief wispy cloud pass en route? Maybe just on edge

2118 upwind of cloud field, jog Drum for transit back

2133 Drum advance for final approach (on Rogers)

2133 Gear down

2135 Landing

2DS blowing snow below 300 ft

Turn off PILS & Drum pumps

Turn off PILS chassis

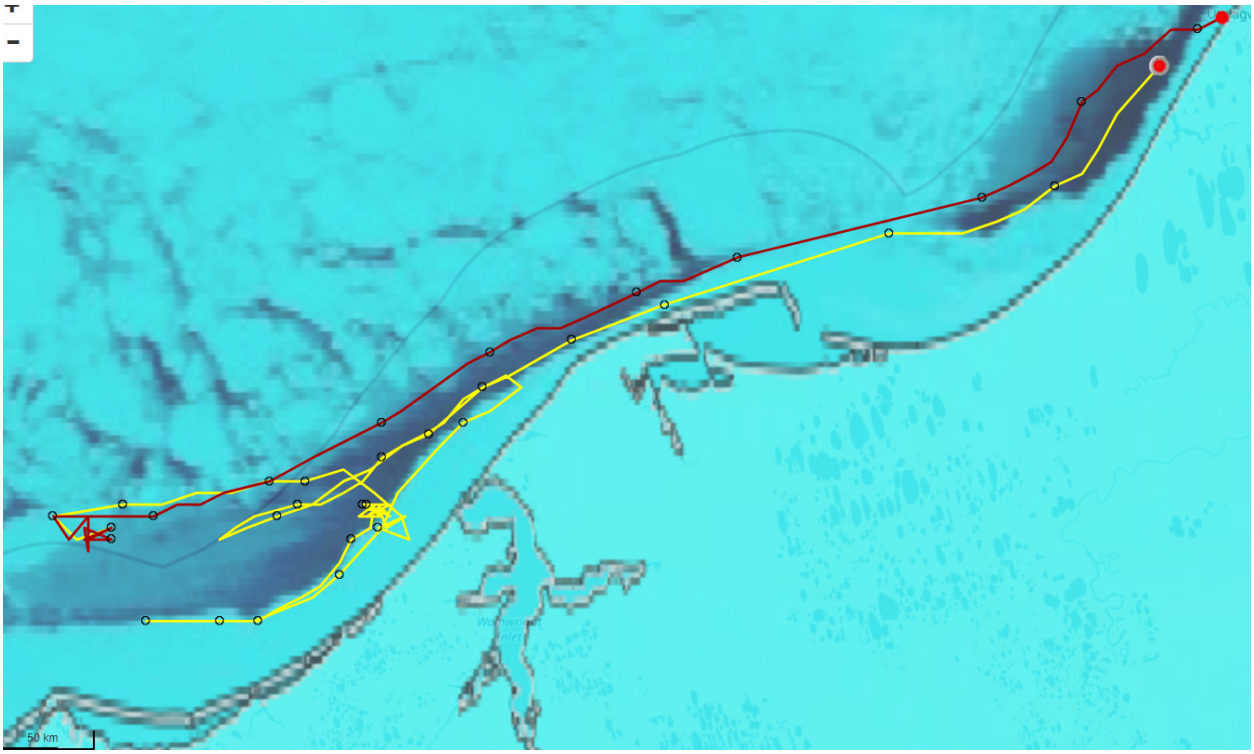
04/14/22 Pilot notes (CHACHA22 RF 27)

Crew: Drew, Woods, Robertson

Flight Time: 3.2

Planned: Depart and climb to 3000 ft. followed by descent to 300 ft. AGL. Fly along downwind side of open lead above sea-smoke for 30 minutes. Then fly for 30 minutes along windward side of open lead for 30 minutes. Then spiral climb to 12,000 on windward side to drop first sonde into open lead. Then move downwind over ice and drop second sonde. Make a spiral descent 1000 fpm to 300 ft. and then follow lead over the ice downwind of open lead back to PABR.

Actual: Departed and climbed to 3000 ft. followed by descent to 300 ft. AGL. Flew along the open lead on the leeward side over the open water, above sea-smoke for 30 minutes. Followed lead southwest until about 20 nm. west of Wainwright, turned around, and continued following lead back to the north of Wainwright. Turned around again and followed windward side of open lead, over the open water, close to windward ice edge down to west northwest of Icy Point. Turned back to the northeast and continued following the windward ice over the open lead, but slightly farther from the windward edge. Started spiral climb to 12,000 ft. MSL west of Wainwright. Dropped first sonde just over the windward ice/open lead edge because of the very strong NE winds (sonde drift). Then flew downwind (based on low altitude winds) over the leeside ice and dropped second sonde from 12,500 ft. MSL. Spiraled down to 300 ft. AGL and returned to PABR over the ice on the lee side of the open lead.



14 April 2022

RF27 System Scientist notes

Crew: Tom Drew, Anna Robertson, Sarah Woods

Objective: CVI lead cloud flight. Two dropsondes.

Instrument notes:

2015 lost connection with Applanix - restarted computer and restarted logging

- data back by 2019 but showing velocity inaccuracies (velocity back to normal around 2022)

- Double check connections

Adjust POPS flow down 1 cc/s before 2nd flight

Flight notes:

1931 wheels up

1934 at 300 ft

2107 starting spiral up to 12k ft for dropsonde launches (at 1000 fpm)

2117 increased POPS flow since it was dropping below 3 cc/s

2121 launching first dropsonde

2134 launched 2nd sonde

2134 starting spiral down

2146 at 300 ft

2230 ascending for approach to PABR

2237 wheels down

2022-04-14a KA Science Flight for CVI (From PABR)

Config: Standard for CHACHA cloud flights: CIMS off, all others operational. Rogers for takeoff/landing, CVI for cloud sampling

Crew: Tom, Anna, Sarah

Obj: Seasalt, seasmoke sampling of freshly re-opening leads between Wainright and Pt Lay.

Preflight Check Summary: No known issues. Andrea tended to PILS & Drum. Daun capped CIMS.

TRF -15.9 C
Zrad 0.14 ft
RH 30 %
Pa -650 kft

Conditions: Colder today, stronger winds out of the East, leads west of Barrow just starting to re-open, some seasmoke visible from shore, hazy to south

1924 UTC Engine start

1928 UTC taxi (1128 local PBAR)

072720pm Start PILS software, Run# 117, tip temp 98

1929 Engine runups

1930 PILS&Drum pumps

1931 Takeoff UTC (on Rogers inlet)

Some seaksmoke visible as nearing open leads by Barrow

1934 jog Drum after climb out, leveling off at 300 ft while transiting down toward wainright

CVI, 2D-S TAS tracking

PILS tip temp 97, LFE flow 7-13

Transit down to Wainright/Pt Lay lead at 300 ft, through middle of open leads, sampling seasmoke and seaspray on Rogers

1937 Surface crossing Barrow lead is small patches of open water amidst fairly fresh ice, seasmoke off open patches, -18C, 43%RH, wind 22 kt@84 deg

1942 lead is a bit narrower here, more thin ice

Seasmoke is not super tall yet, and no visible lead clouds. Some haze off toward both horizons.
Blowing snow visible on 2D-S, vnc connection still only intermittently updates, so not sure if that's been persistent since takeoff.

1944 over seaice for probably the next 10 miles or so, now south of the open part of the Barrow lead.

1951 Upon arrival at Wainright lead (beginning to widen), jog Drum and continue seasmoke sampling for 30 mins

1951 Visibly seems like wall of haze directly ahead, can't tell visually if seasmoke or blowing snow, -19C, 67%RH, winds 25 kt @80.

Slightly more turbulent today from the crosswinds

1956 water surface still has ice slicks & seasmoke, not fully open yet.
Quite a bit of blowing snow on 2D-S

1957 occasional seamoke reaching our level, but most still below us
1959 some thicker seasmoke patches on surface, resembling tufts of fur, amidst ice slicks – look like cotton puffs right above the sea surface. Some waves, whitecapping

2001 some seasmoke pillars reaaching our level

2003 couple of baby cloud puffs off rt wing, -17C, 67% RH, winds 30 kt@89 deg
Still quite a bit of blowing snow on 2D-S

2007 running out of seasmoke and open water, left turn to head back up same track to finish seasmoke sampling
Surface patchy ice with ripples & some whitecaps on open patches. Little seasmoke

Bob: Alar seeing 56 kt @ 1kft! No wonder it's so hazy with so much blowing snow..

2111 couple of lone little white wispy puffs off rt wing as we head back NE
Surface is patchy still with thin ice and ice slicks
Very hazy with blowing snow over landfast ice upwind of rt wing

2114 still occasional wispy puffs out right window, just above our level

2120 getting hazier with blowing snow again as we reach the northern extent of the lead again

2021 Jog Drum forward and continue for 30 minute upwind sample over whitecaps on upwind side of lead
2022 rt turn to head toward landfast ice edge for upwind, over open water sample

2023 visibly thickening layer off rt wing (over middle of lead) as we head back south on upwind edge – clouds are beginning to form!

2027 seasmoke definitely thinner on this upwind side, though it is still under us (pretty much all the way to the landfast ice edge)

Note: blowing snow throughout today's flight, but clear skies overhead

2036 continuing south past where we turned around previously because this narrower section is still open, and we are sampling the same fetch from shore as throughout this sample, note we are now south of the turnaround where the middle-lead seasmoke sampling was previously. Still ice slicks, ripples, and whitecapping on surface beneath.

2042 lead has narrowed and then widened a bit again as we head nearer Pt Lay. Still seasmoke, ice slicks, ripples, and whitecapping, less dense seasmoke down here though.

Looks like it continues pretty open down toward the south, seasmoke not as thick though – due to higher winds?

2044 left turn to head back north toward spiral location. Less seasmoke down here, but surface has decent waves, whitecapping, winds up to 42 kt at 75deg down here

2100 seaskmoke getting a bit thicker again, will continue on till thickest part of seasmoke with decently wide lead to spiral up. Can start to see a couple more lil lead clouds off left wing.

2103 winds 30 kt@80deg, -19C, 52%RH

2107 Jog Drum forward to end upwind leg

2107 Spiral up to 12kft at upwind side of widest part of lead/where thicker smoke, drop sonde

Adjust pops flow

2120 1st dropsonde – upwind of seasmoke, over open water/seaice edge (figure strong winds will push it over the water)

PILS LFE flow 7-8

Looks like there is a higher level aerosol layer out to the NW.. notice there was a spike in CPC at some point on the spiral up or orbit for sonde
Winds up here 6kt@344 deg (12kft, -15C)

2134 2nd drop, over patchy pancake ice on downwind side of main lead from 12kft, all variables streaming by 11kft
Lead sure looks a lot more covered in ice from up here. Note: still some decent sized patches of open water farther downwind of where sonde was dropped
Begin spiral down to 300 ft
Sonde peaks:
RH up to 75% <500 ft

Things looking more frozen.. not sure if it's the view and angle or if things really are looking worse

2144 winds back up to 45 kt, 90deg, -8C, 15% RH

2145 visible whitecapping on narrow opening of water

2146 Jog Drum forward and transit back towards PABR at 300 ft on downwind side of lead, over patchy ice

2149 visibly less whitecapping out here, still downwind a little ways of the main lead

2152 pretty good open patch of water off our left as we near the bottleneck where we turned around before.

2158 now paralleling near ice edge of open lead, over thinner/grayish ice (not solid packice, but not open water)
Can see seasmoke on main lead again, occasional shallow wispy puffs of cloud just above our level, but no cloud field developing yet – too windy? 30kt @83deg, 300 ft, -17C, RH67%

Still occasional blowing snow on 2D-S

2208 crossing little more open patch of water

2213 crossing open water finger of Barrow lead

2217 getting north of open water, another ice bottleneck

2220 parallelling long skinny stretch of lead that is almost parallel the wind – has pretty decent ripples

2223 crossing frozen section of Barrow lead, then back beside open water of Barrow lead
2228 Jog Drum for as we're hitting a little more open/patchy water as we near our approach

2230 nice plate on 2D-S

2230 Jog drum for final approach
2230 climb for final approach

2236 Gear down

2237 Landing

Turn off PILS & Drum pumps

Turn off PILS chassis

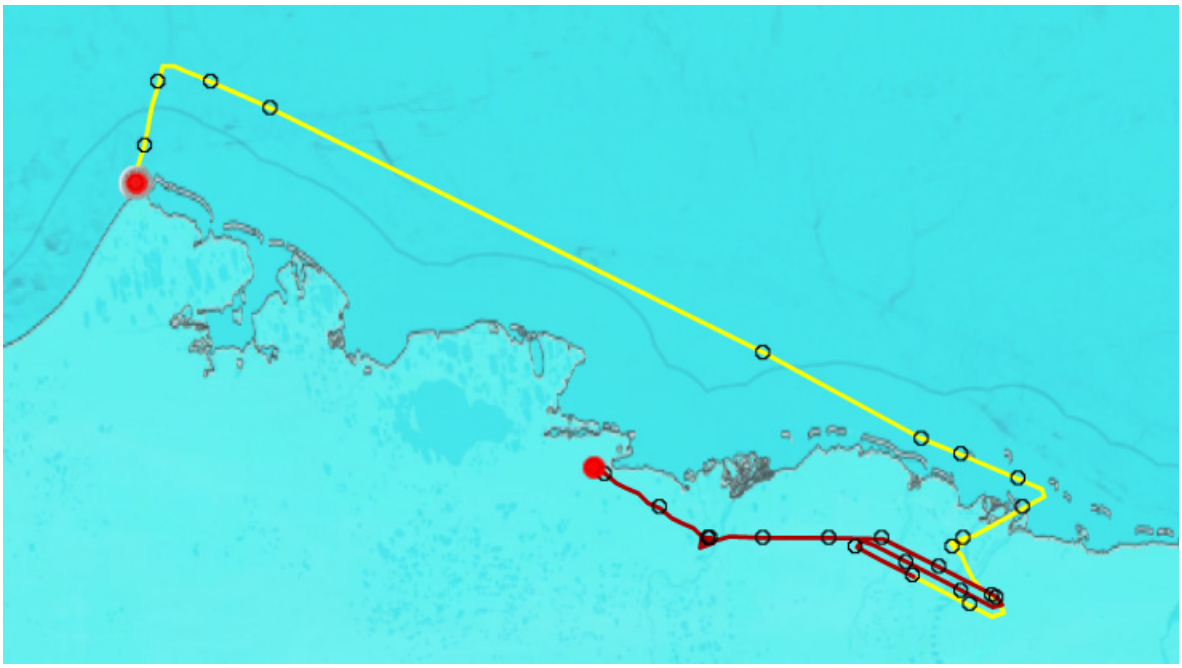
04/013/22 Pilot notes (CHACHA22 RF 26)

Crew: Drew, Jeong, Robertson

Flight Time: 3.8

Planned:
Depart PABR and head north over the Beaufort. After ascent to 3000 ft, descend and remain at 300 ft. for the duration of the mission (except for low approaches). From the northernmost waypoint, turn southeast in the direction of Prudhoe Bay. Make on upwind transect before going into Deadhorse for two low approaches. Resume 300 ft. and set up for the 3-leg downwind transect. After completion, head west for Nuiqsut for two low approaches and then back to PABR for two low approaches and landing.

Actual: After departure and initial climb to 3000 ft. MSL, descended to 300 ft. AGL enroute to point north of PABR. Continued southeast along the route at 300 ft. AGL to the waypoint on the northwest end of the upwind transect. Following the upwind transect, flew two low approaches at PASC and then proceeded to the southeast corner for the three downwind transects. After completing the transects flew to PAQT and made two low approaches there. Resumed 300 ft. AGL for the return leg to PABR. Decided not to make the two low approaches at PABR.



13 April 2022

RF26 System Scientist notes

Crew: Tom Drew, Anna Robertson, Sarah Woods

Objective: CIMS flight out to Deadhorse. Low approaches at PASC, PAQT, and PABR.

Instrument notes:

2243 turned GPS power on (but GPS data seemed fine while it was off)

One of our emergency beacons was going off in one of the life vests, had to cut out low approaches at PABR due to S&R being called before we could confirm false alarm

Flight notes:

2134 wheels up

2256 light winds in Deadhorse (smoke stacks going almost straight vertically)

2303 end of upwind leg

2304 winds down to less than 2 knots at 300 ft

2305 ascending for approach to PASC

2310/2311 over PASC for first low approach

2314 over PASC for 2nd low approach

2323 starting downwind legs

2335 end first downwind leg

2337 start 2nd downwind leg

2349 end 2nd downwind leg

2350 start 3rd downwind leg

0001 end 3rd downwind leg

0013 ascending for approach to PAQT

0016 over PAQT for first low approach

0019 over PAQT for 2nd low approach

0114 wheels down

04/12/22 Pilot notes (CHACHA22 RF 25)

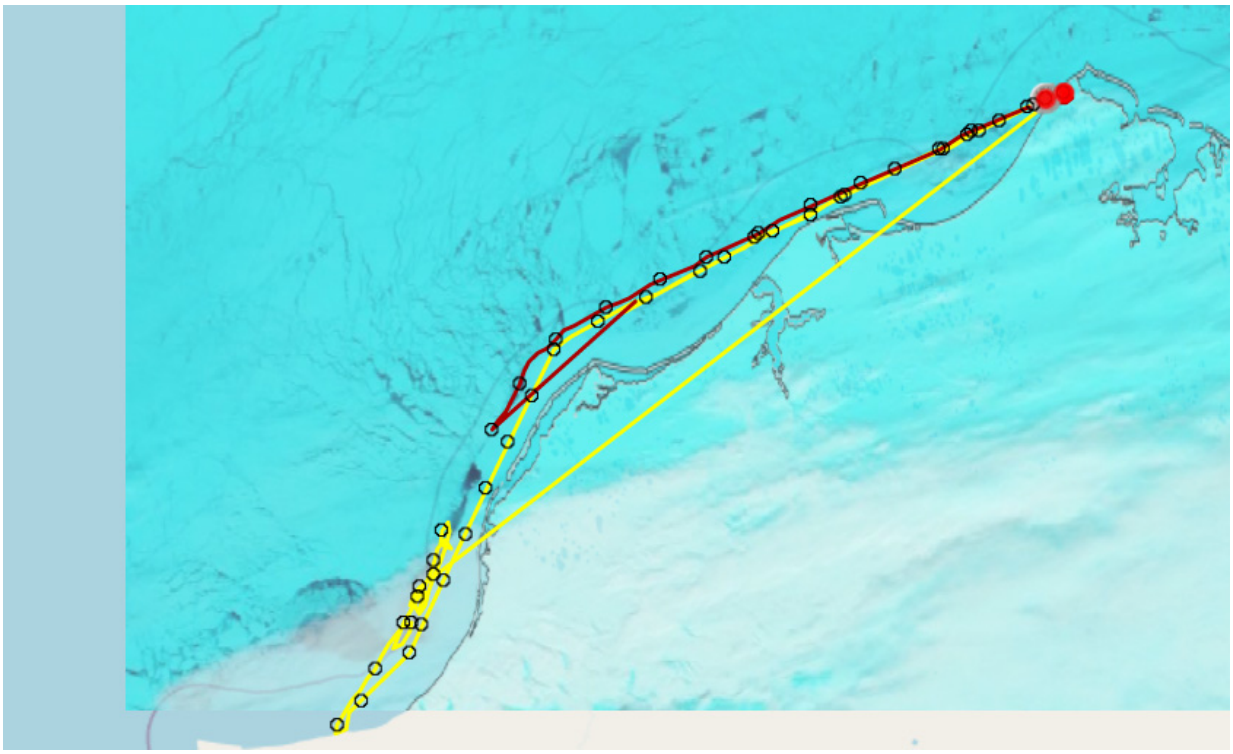
Crew: Drew, Woods, Robertson

Flight Time: 3.9

Planned: Depart and climb to 3000 ft. followed by descent to 300 ft. AGL. Fly direct to the first point abeam Point Lay and then follow the open leads to the south. Continue along the lead into the Ledyard Bay to southeast point. If there are clouds, drop three sondes: upwind, over the lead, and downwind. No aircraft sondings in order to save time. After dropping the sondes, descend to cloud level and fly for 30 minutes. Then return at cloud level along same route.

Actual: Departed and climbed to 3000 ft. followed by descent to 1500 ft. AGL. and made two speed runs varying indicated speed from 220 kts. – 120 kts. Continued descent to 300 ft. AGL. Flew direct to the first point abeam Point Lay and then followed the narrow open leads to the south towards Ledyard Bay.

Reaching about the middle of the largest lead in Ledyard Bay, made a 180 and started a rapid climb to 12,500 ft. MSL. Flew north over the lead, well north of the cloud deck and dropped the first sonde. After loitering continued south to drop the second in the cloud field over the open lead. Then continued south about 20 nm and dropped the third sonde a couple miles north of the southeast shoreline. Made a rapid descent to cloud level and made a porpoise to determine the levels. Flew for about 30 minutes at cloud level over mostly open lead. Then continued north along the same route at cloud level. Near Wainwright descended to 300 ft. AGL for the remainder of the transit.



12 April 2022

RF25 System Scientist notes

Crew: Tom Drew, Anna Robertson, Sarah Woods

Objective: CVI cloud survey flight down along western coast to lead between Point Lay and Point Hope.

3 dropsonde launches.

Instrument notes:

0054 system light blinking red intermittently but still updating file size ok - eventually switched over to sending file size update to back seat

- confirmed after the flight that data recording was fine

Flight notes:

2211 wheels up

2216 start speed tests (at 1500 ft)

- max speed first (max 108 m/s)

- 221832 started slowing down (min 60 m/s)

- 222020 started speeding up again

- 222148 started slowing down again

- 222255 done

2223 descending to 300 ft

2325 starting spiral up to 12k ft

2328 adjusted POPS flow up slightly so that it didn't go below 3 on spiral up

2332 end of spiral

2343 launched first sonde (upwind)

- received data around 11k ft

2356 launched 2nd sonde (in cloud field over open lead)

- received data around 11k ft again

0010 launched 3rd sonde (over shorefast ice)

0011 started spiral down

0018 back at 300 ft so adjusted POPS back down to about 4 cc/s

0022 switched to CVI inlet

- POPS flow increased to 7.5 cc/s - left it there

0056 switched back to Rogers inlet

- POPS flow back down to about 4 cc/s

0127 end of 30-minute upwind DRUM leg so descending to 300 ft

0158 ascending for approach to PABR

0205 wheels down

2022-04-12 KA Science Flight for CVI (From PABR)

Config: Standard for CHACHA cloud flights: CIMS off, all others operational. Rogers for takeoff/landing, CVI for cloud sampling

Crew: Tom, Anna, Sarah

Obj: Similar to yesterday – lead cloud sampling down near Pt Hope.

Preflight Check Summary: No known issues. Andrea tended to PILS & Drum. Daun capped CIMS.

TRF	-17 C
Zrad	3.55 ft
RH	39 %
Pa	-639 kft

Conditions: blue sky, lil cooler than yesterday, occasional high altitude streakers far above. Yesterday's funky winds have shifted to be mostly out of the north, parallel the shoreline from Point Lay south through Point Hope.

2250 UTC Engine start

2207 UTC taxi (1407 local PBAR)

2209 Engine runups

100958pm Start PILS software, Run#112 , tip temp 99, PILS LFE 8.6-9.2

2211 PILS & DRUM pumps

2213 Takeoff UTC (on Rogers inlet)
Few particles on 2D-S on takeoff

Northern end of Barrow lead mostly frozen ice, a few cracks that look recently re-frozen

2216 Drum advance after climb out

2216 KA Speed tests at 1500 ft

2216 CVI, 2D-S TAS tracking well

2217 PILS tip temp 99, LFE flow 9-10

Transit VFR at 3kft from Barrow to approximate lat/long of nearest edge of Point Hope Lead
2D-S V channel a little noisy at 108 m/s.. probably needs purged before next cloud flight

2223 higher level clouds getting denser out left window over land, still only a few streakers out right window over Chukchi

2224 Finished with speed tests, descend to 300 ft for transit

2225 jog Drum for clear air transit at 300 ft over seaice/open water where possible

2225 level at 300 ft, -19C, 46%RH, PCASP 120-180, CPC 130

Feathery looking high altitude clouds out right window, fewer of the thin streakers – growing wider/thicker as we head south

A few patches of open water here and there as we near Wainright, but no visible seasmoke or low level clouds. Surface is mostly thicker sea ice (not opaque like recently re-frozen ice).

Good description of the seaice fromTom: it's like a jigsaw puzzle that comes apart, and comes together, comes apart, comes together

2237 Skies are clearing overhead a bit more as we continue south, -18C, 61%RH, 300 ft, 5 kt winds, 350 deg
Less open water and less cloud cover than yesterday
Occasional patches of water that look freshly re-frozen

2243 lil patch of clear sky particles on 2D-S

2247 We've already passed the spots where the first 2 (of 3) larger open leads were yesterday, and haven't seen them. Occasional smaller patches of re-frozen openings, but nothing big

Tom: local told him the other day that the tide here plays a role in the refreezing of the ice. It's a small tide, but still plays a role.

Little ripples visible on surface of open water patches, no visible whitecapping though, and only small pockets of open water

2256 Tom spots open water slightly farther out to sea, jog right to catch it, as that looks to be in about the right place for our northern bottleneck off the Point Hope Lead seen from VIIRS

2258 slight left to parallel our open patches of water and continue south. Ripples on water and occasional whitecaps on these narrower, elongated openings.

Anna notes that in a lot of places where the ice is thicker and you can see the ridges of the ice sheets, they form gear type shapes

2301 possible seasmoke, very shallow rising off of the more frequent patches of open water, hard to tell though if it really is seasmoke or not, could be ice slicks with the sun glinting off at an odd angle

2304 left bank over larger open patch – very thin ice slicks that look almost like oil slicks, ripples, small ice off left wing, and slightly thicker re-frozen off rt wing

Tom, another local's 2-cents regarding the leads: we look for the dark clouds and we know where the open water (lead) is. Then we look for the white spot in the cloud, and we know that's where the ice edge is, so that's where we go to find the seafood (seals)

Cool burst of high altitude clouds out right window – see photo – featherlike at northern point

2310 -15C, 52%RH, 15 kt winds @ 45deg

2311 been over more ice for a few minutes, but coming up on a larger patch of open water. Out left window – large pile of rubbled seaice at water's edge, rather odd (see photo)

Starting to see some clouds up ahead – not clear yet if associated with land or water, also see bigger ice slicks out side windows, look brownish/briny

2316 larger open water, N-S elongated, see whitecapping and ripples on surface. 18 kt winds @ 55deg

2317 starting to see occasional little puffs just above our level, very wispy. Still no real clearly visible seasmoke though

2320 staring to see little thicker clouds at a mid-level, higher than the wispy puffs we saw, but not too high, maybe a couple thousand

2321 spider-looking ice on 2D-S

Upon arrival at lead sampling area (visual: cloud field), spiral at upwind side of lead, noting altitude of cloud top & bottom.

2328ish begin spiral

2332 jog Drum, concluding clear air transit – was late, at 11kft, got distracted jumping on pre-conditioning the sondes

2344 Drop 1st sonde upwind into open water of lead, upwind of cloud field – into bottleneck on VIIRS imagery, from 12kft.

Winds at 12kft, 14 kt at 260, -17C – temp up here is practically what it was at the surface!

RH on 1st sonde: all data in by 11kft, near 2nd dropsonde from yesterday!, aim for area where we just started to see the thin wispy ones at 300 ft
RH peaks:
1st peak 4000, up to 95%,
2nd peak 3k, 95%,
1500ish 95%,
600 ft 85% - several humid layers

PILS LFE holding 6-8

2357 2nd drop, into middle of open lead (hard to assess visually, basing on yesterday's modis), all data streaming by 11kft, just south of where we spiraled up

Occasional ice crystals on 2D-S

Sonde 2 RH:
Humid layer ~9kish 90% RH
Dry layer at 6kft 20% RH
4500 ft RH 80%
3000-2000 ft – 100% RH
1200-500 95% RH

2411 drop 3rd sonde, downwind, over land fast seaice near shore

Can visually see tops of upper cloud layer lifting up as they hit shore & Brooks range – very prominent

Begin descent to 300 ft, following sonde
RH sonde peaks:
Humid layer 90% ~9kft
5000-4600 ft, 90%
2500-1700 ft, 100%
500-300 ft, 95%

2416 into cloud layer

2418 jog Drum

2420ish Turn CVI de-ice up to 50/40

Over ice when we get to bottom of spiral

2420ish Turn CVI counterflow down to 2 LPM
Turn on dilution flow by opening MFC valve
Switch from Rogers to CVI inlet
Check pops flow

2423 jog Drum for in cloud leg

2423 climb up through both cloud layers

2424 upper layer has larger drops > 15 um mode
2D-S gui/vnc a bit slow to update again

2424 out of cloud by 3000 ft, descend back through upper layer – big drops, 20-30um mode, occasional big ice, -10C, 94% RH

2426 below cloud at 1600 ft, over landfast ice
Left turn

2428 in cloud layer at 1500 ft zrad, 7um peak, very thin layer

2430 descend to get into lowest layer – multiple layers out here, lowest level looks to be forming streets

Anna spots darker clouds off to the right – head westward across broader extent of lead to run cross wind

2432 ice & droplets on 2D-S, droplets 7-9 um

2433 mixed phase on 2D-S – rimed pristine crystals, -15C, RH 79%.
These lower level clouds are puffy and dark out window, patchy so in & out of cloud

2435 climb a tad to stay above bottoms
Tom: visually more ice below us, so rt turn to head back across lead. Surface below has very small ice on it, in a big slick – see photo

Tom: I think the lead is a lot narrower than it was yesterday

2438 good lil pocket of liquid

2440 about out of time on station – begin working our way back north

2442 clouds a tad thicker as we turn back north along our track – rimed pristine ice and droplets ~7um

2444 thicker pockets of cloud – mixed phase

2446 climb to sample in upper layer – climb all the way through it to assess best altitude 1800 – 2600 ft

2448 descend back into cloud
PILS: vial 51 starts sampling of upper cloud layer

2449 level at 2400 ft zrad, broad droplet distribution

2450 climb a tad to stay above bottoms

2452 out tops, descend a tad – clouds are thinning as we reach the northern edge of the cloud field
Still broad droplet peak, more liquid in this upper layer than the lower layer

2454 very thin layer, almost back to upwind dropsonde

2456 Switch from CVI to Rogers inlet (check inst flow goes to 0), close MFC valve, up counterflow & down deice, check pops flow

2457 jog Drum for clear air upwind transit at cloud level, vial 54
Still over open bottleneck of lead

2512 lead growing very thin, inconsistent now, with patches of ice. Clear skies, only a few thin streakers high overhead. -14C, winds 12 kt@7 deg

2524 re-frozen Wainright lead visible off rt wing

2527 finish 30 min upwind at cloud level sample, so Jog Drum

2528 descend back to 300 ft for final transit back, vial 64

2541 huge blob on 2D-S Vchannel – shedding ice?

2552 passing near freshly-refrozen patch of Barrow lead off rt wing

2558 jog Drum for final approach (on Rogers)

2558 climb for final approach

2600 Lead nearest Barrow looks to be somewhat re-frozen/briny ice. No seasmoke (as elsewhere today)

2603 Gear down

2604 passing over cakeeater

2605 Landing

Turn off PILS & Drum pumps

Turn off PILS chassis

04/11/22 Pilot notes (CHACHA22 RF 24b)

Crew: Drew, Woods, Robertson

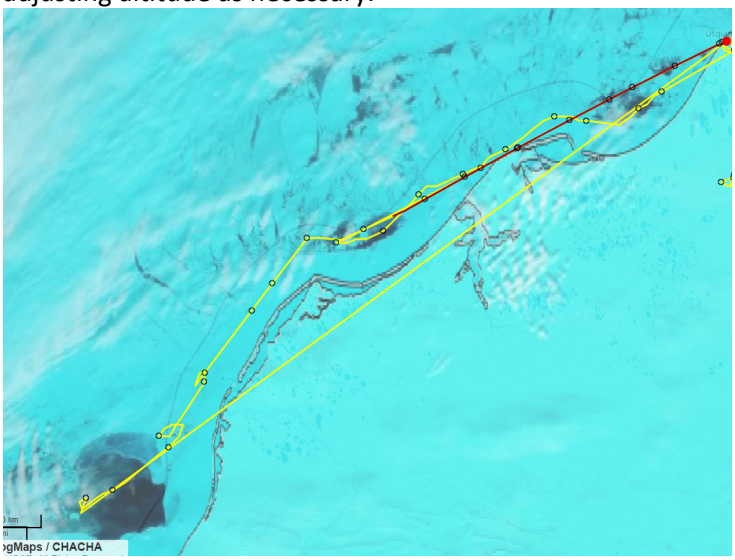
Flight Time: 3.6

Planned: Depart and climb to 3000 ft. followed by descent to 300 ft. AGL. Fly offshore to first point abeam Point Lay following open leads to the south. Continue along the shoreline edge of the lead in the Ledyard Bay to southeast point. Then turn northwest over center of lead through lead clouds and return back to southeast point upwind. Ferry north following the same route with a turn at Point Lay at cloud level back to PABR, sampling clouds as possible. Due to the long ferry times, not planning to drop any sondes.

Actual: Departed and climbed to 3000 ft. followed by descent to 300 ft. AGL. Attempted to fly southwest along open leads visually and using satellite image. Encountered the first northeast of Wainwright (Peard Bay) then another north of Point Lay. Between the two leads climbed to see what the cloud levels were at and returned back to 300 ft. AGL. Abeam Point Lay turned more southerly, targeting the center of the larger lead in Ledyard Bay rather than the shoreline edge of it as first planned.

Decided to make a rapid climb/descent (no aircraft sounding) to drop at least one sonde in the lead and another through the deepest part of the cloud field (downwind). At most southern point, over broken ice, and south of the lead by satellite image, made a rapid climb to 12,000 ft. MSL climbing back to the the open lead northbound. Noticed that the northerly winds turned back southwesterly by 5000 ft. MSL. Dropped first sonde into the open water. After flying an orbit (for the sonde) continued northeast to northern edge of the lead and dropped second sonde. With the loss of the first portion of the sonde data, decided to drop a third sonde, and moved about 12 nm northeast where the cloud field was a little thicker while the sonde was getting ready. After dropping third sonde, descended rapidly back to the southwest to the northern edge of the open lead, descending to 300 ft. AGL.

Once reaching the open leads northern edge, made a 180 turn to the north and porpoised to identify the cloud base and tops. Followed cloud layer, which was very thin at times, back along our ferry route adjusting altitude as necessary.



12 April 2022

RF24b System Scientist notes

Crew: Tom Drew, Anna Robertson, Sarah Woods

Objective: Cloud scouting for CVI down western coast to Point Hope

Ended up launching 3 dropsondes near lead north of Point Hope (2nd one didn't get signal until 4k ft)

Instrument notes:

0226 at TFOM 6

PILS flow was fine up to 12k ft

Turbulence probe worked again

Forgot to check on POPS flow in ascent to 12k ft - probably dropped below 3 cc/s (invalid data)

Flight Notes:

0107 wheels up

0125 ascending to check cloud height

- then back down to 300 ft after a little cloud sampling

0222 over Point Lay/Hope lead

- winds northerly here, were westerly at Wainwright

0235 starting spiral up for first dropsonde

- PILS flow fine up to 12k ft

0243 launched first sonde

0256 dropped second sonde

-but data didn't come in until 4000 ft, so going to drop the spare one as well

0308 dropped 3rd sonde

- data came in above 10k ft

0309 descending back down to cloud level

- PCASP counts up to 1000, CPC up to 700 in layer above clouds (up to about 7-8000 ft)

0315 back down to 300 ft

0317 switched to CVI inlet

- POPS flow increased to 7 cc/s - left it there

0323 porpoises through cloud to find best sampling height

0338 droplets getting out to 30 um

0426 descending out of cloud

0428 switched back to Rogers inlet

- POPS flow at about 4 cc/s

2022-04-12 UTC (20220411b local) KA Science Flight for CVI (From PABR)

Config: Standard for CHACHA cloud flights: CIMS off, all others operational. Rogers for takeoff/landing, CVI for cloud sampling

Crew: Tom, Anna, Sarah

Obj: Not much in the way of open leads with satellite-visible cloud fields. Sample what seasmoke and mid-level clouds we can find.

Preflight Check Summary: No known issues. Andrea tended to PILS & Drum. Daun capped CIMS.

TRF 0.25 C
Zrad 4.17 ft
RH %
Pa kft

Conditions: Overcast toward the south, was overcast over Utqiagvik early morning, but burned off. Noticeably warmer today - ~20-30 degF warmer than usual

0103 UTC Engine start

010412 Start PILS software, Run#110 , tip temp 98

0104 UTC taxi (1704 local PBAR)

0106 PILS&Drum pumps

0107 Takeoff UTC (on Rogers inlet)

0109 CVI = 10 – will verify settings on chassis in transit, 2D-S TAS tracking ok

0110 Drum advance after climb out

PILS tip temp 98, LFE flow 9-11

Transit VFR at 300 ft south toward open lead near Pt Hope, staying over any open water en route to sample seaspray and assess any clouds.

0111 crossing patch of open water just south of Barrow – small ripples, but no smoke or clouds, no visible whitecapping, winds 15 kt

0113 Cross another patch of open water – floating ice, ripples, no seasmoke

0115 CVI TAS caught up, so both CVI & 2DS tracking real time

0118 begin crossing larger patch of open water. Ripples, Tom notes sparse whitecapping. Some ice slicks. -4.5C, 300 ft, 1m/s vav, cpc 218, PCASP 90, winds 15 kt

Note: thicker looking/darker cloud field above lead, Tom guesses maybe 2-3 kft.

Lil ice fallout on 2DS briefly

0123 slight right to keep over thinning width of lead.

0124 lil more ice fallout

CPC creeping up in counts

0125 back over ice - jog Drum before porpoising up to check out cloud deck

Tom: visibility behind us and to the SE looks obscured

0128 zrad 3600 ft for bottom, CDP 8-9um, nothing on 2D-S? oh, was a time lag on the gui? Or vnc connection?..small droplets and occasional rimed pristine ice

0129 briefly out, then back in, bigger drops on CDP, broad peak out past 15um

0130 out of tops at 5kft
0130 porpoise back down to water level, into it at 5500 ft – big droplets, then nothing, out of it? 4900 ft

0133 continuing to descend, see extensive deck ahead of us, low – lead clouds maybe? 1000-1100 ft, 6-8um

0136 continue down to 300 ft, from MODIS image, looks like these might be streaming off of the open lead near Wainright? Will assess.. Note: higher clouds above still, though sparse

0140 we have lost the thin cloud layer that was right above us, but there is a bit of a darker patch off the right wing, still heading toward Wainright lead

0141 More thin clouds just above us (~1kft level).. -4C, 300 ft, 1m/s vav, 80% RH

Lil patch of ice falling out on 2D-S
2D-S data is still slow to update occasionally..

0144 Tom notes cloud layer above us has sharper edges to the left and right, looking lead-cloud-ish

0146 jog Drum – forgot to jog it after descending from the cloud for low level/seaspray

0149 reach Wainright lead – all frozen over on north end! We really thought it'd be open. Still dark & ominous cloud layer overhead, they must be coming from Point Hope lead… continue on to try and get upwind of cloud field

0151 farther south over lead, some small sections of open water

0153 bit more open water with thin ice slicks, darker clouds out window, still Wainright lead on MODIS image

0154 lil more ice fallout – rimed graupel
Tom: winds are more westerly down here: 278

0212ish Tom: winds have transitioned: 340!

0216 Pre-condition 2 sondes. Will transit to farthest side of lead, speed-spiral up, drop 1 upwind sonde, 1 downwind sonde into cloud deck, then descend and transit home in cloud layers

0220 Nearing Pt Hope, northern end again looks frozen, occasional open patches of water down here, still no seasmoke

0222 Tom notes winds now 350 deg
Ice out window much patchier-looking, newly frozen, not thicker pack ice

0223 reaching Point Hope Lead – looks more like open ocean, ice flow on northern edge looks like a beach with fresh snow. Visible whitecapping, small waves. Cloud deck looks darker overhead. Can't tell how wide lead is, extends to near horizon on the landward side, can barely make out ice-shore on seaward side.

0228 patches of sunshine hitting water occasionally, so some breaks in the overhead cloud decks

0230 occasional ice slicks on surface now, seaice coming in closer on wing edges.

0234 Tom: winds are now due north.

Can't get upwind of cloud field, so will spiral and drop one into open water of lead, 2nd back to the north, into cloud field

0236 Jog Drum prior to spiral, concluding clear air transit

At P2, spiral up from lowest altitude to 12kft, confirming cloud top & bottom heights.

0239 tops were 1100 and 5500 ft (2 levels). Droplet mode 7-9um on lower level, was busy w dropsonde on 2nd

0241 Tom: another layer maybe here at 9.8kft
Visually clearer air ahead, will drop the "upwind" in the region with minimal clouds

0244 Drop upwind dropsonde into open water of lead from 12kft, in clearest sky, still lots of clouds, all data streaming in by 10.6kft
RH peak: ~9kft, 95%,
~4800 – 4kft
~700-300ftish
Still other cloud layers further above us
Very hazy up here…

PILS LFE looks a little more stable, but still varying 9-11, occasional spike as low as 2

0249 2D-S ice crystals

0255 drop 2nd sonde, lat long good, but gps not coming in right away .. winds in at 4kft.. will prep 3rd

Rimed columns

0307 reaching hole in cloud field, turn back toward lead to drop 3rd sonde in juicy cloud field. Visible edge of cloud field out left window where land starts

0308 3rd drop (farthest to the north), all data by 10.7kft! begin descending with sonde
Brief gps drops around 5-6kft on sonde
RH peaks:
~4800 – 3300 ft, 95%, (Tom: 4700-370)
~1100 – 500 ft

0311 Anna: seeing some of our highest PCASP counts: 900

0317 Turn CVI counterflow down to 2 LPM
Turn on dilution flow by opening MFC valve
Switch from Rogers to CVI inlet.
Bump up MFC flow to bring CVI inst flow down
Check pops flow

0311 Jog drum for in cloud sample on transit home

Transit back to open edge of lead at 300 ft, sampling virga just below CB – ice? 2D-S gui slow to update again

0322 hit edge of lead, turn 180 and climb to porpoise cloud layer

0323 climb through lower cloud deck, 700 ft bottoms, 7-8um peak, 1000 ft tops

0325 into cloud – bimodal droplet distr, peaks: 7-8um, and ~20ish, LWC 0.05, skimming just at tops maybe, -8C, 900 ft zrad

0328 descend just a tad to try and get into a little thicker part of cloud, still broad droplet conc – bimodal, 5 & 18ish um

0329 single mode on CDP briefly, then back to bimodal

Very smooth in cloud, no noticeable large ice on 2D—S

0332 briefly out bottom of cloud – small single mode at cloud bottom, then back to bimodal as we climb slightly..

Tom notes: definitely bigger drops than we've been flying recently, you can see icing back farther on the frame

0334 droplet peak continues to be largely bimodal, hardly anything on the 2D-S?, LWC 0.03-0.1

0337 droplets large on CDP – out to 30+um.. small mode lower in counts, LWC up to 0.14, variable. -8C

0339 go up a tad to get above bottoms.

0340 climb with clouds a little more
CPC keeping up well with CDP

0341 break out bottom again, climb slightly to stay in it

0342 single mode 8um

0342 climb a tad again to stay in it, punch out top – really thin layer
0344 layer breaking up, can see it barely off the wings, but we seem to have hit a little hole, see more cloud ahead

0347 jog left slightly to try and find layer off wing, can't quite get there, so climb to get into layer slightly above us. Very hard to see out windows – it's all white, with false horizons..

0348 back into it, low concs on CDP

0351 back to a very broad droplet distribution, -8C, 84%RH, winds 16 kt, 285deg. 1m/s up – pretty consistent

0354 ice beneath looks patchy, with occasional open patches of water

0355 over open Wainright lead – brief break in cloud layer, then spot 2 lower layers – descend to lowest

0356 back into lower layer, briefly bimodal droplet distribution, then largest peak ~20, but still very low conc, very thin layer

0358 broken pancake ice beneath us, but mostly open. -8C, 960ft zrad

0400 descend a bit to get back into it, again bimodal, low concs -9C, winds 11 kt, 330deg

0402 Can just barely make out gently rolling cloud tops of our layer out rt window, 800 ft zrad
LWC up to 0.15 g/m3, still broad droplets out to 20-30 um
Tom can feel prop vibrating w 30 um drops and -9C
CPC still keeping up with CDP
2D-S sizes out to 100um

0409 pretty consistent LWC for a bit, up to 0.2, consistently 0.15. Consistently broad droplet distribution

PILS LFE flow consistently 8-9, tip temp 98

0414 pop boots: half on left wing, none on right
Anna: Rogers inlet doesn't look to be icing up at all, nor pcasp

0418 droplet distr getting a bit narrower, stronger peak at 13, max ~60um
Tom: might be coming out bottoms, climb a tad

0422 Tom: we're back over the open part of the lead nearest Barrow, can see open water on surface

0423 remarkably consistent droplet concentration up here farther north. Less variable

0424 1 large ice on 2D-S: 1st I've seen in some time

0426 descend below clouds, open water below, some ice, ice chunks flying off frame

0428 Jog Drum for final transit back

0430 Switch 3way to Rogers, close MFC valve
Turn CVI counterflow back to 10
Turn down CVI de-ice

Socked in at Utqiagvik, below clouds at 600 ft

0435 Drum advance for final approach (on Rogers)

0435 Gear down

0437 Landing

Turn off PILS & Drum pumps

Turn off PILS chassis

04/11/22 Pilot notes (CHACHA22 RF 24a)

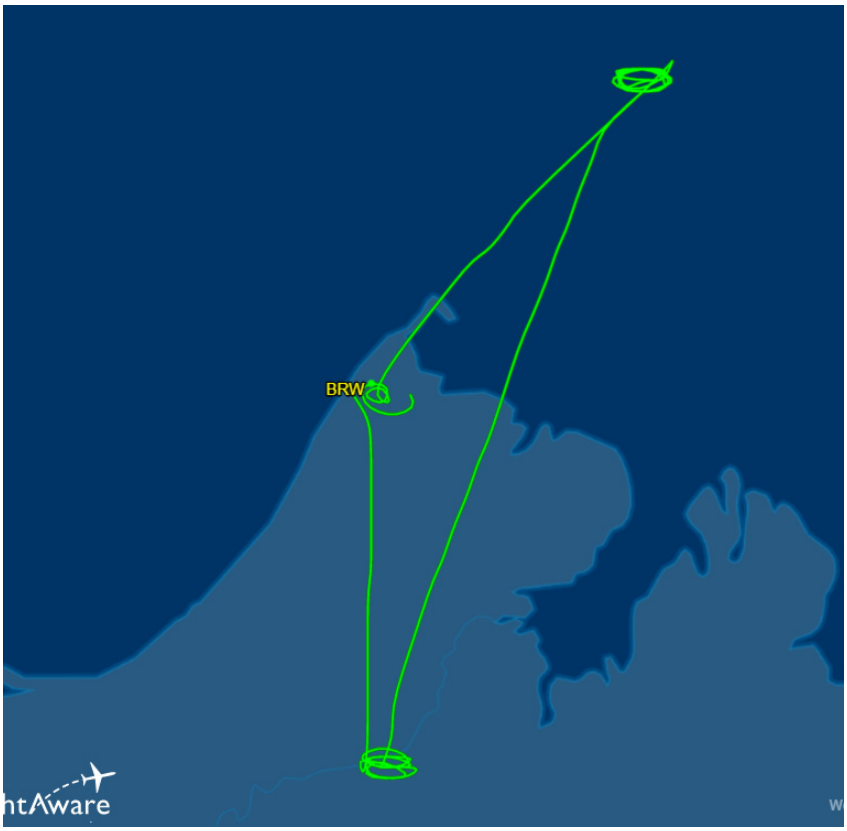
Crew: Drew, Jeong, Robertson

Flight Time: 2.6

Planned:
Depart PABR. Ascend to 3000 ft. Descend to 300 ft and head south to approximately 70°42.00'/-156°48.00' to set up a three-level racetrack over the tundra. The tundra racetrack will consist of three levels (300/1000/3000 ft) oriented in an eastwest oval pattern (see Figure below). Upon completion, resume an altitude of 300 ft and turn north to cross over the open lead on the Beaufort.

In the vicinity of approximately 71°43.85'/-155°37.15, set up an east-west oval racetrack with five levels (300/700/1000/1500/3000 ft). The racetracks should to be the north of the open water and over sea ice. Monitor the ice and cloud conditions to inform the later cloud flight. Upon completion, return to PABR and prepare for the cloud flight. No low approaches.
Est. total time with racetracks: 2 hrs 20 min.

Actual: After departure and initial climb to 3000 ft. MSL, started along the route at 300 ft. AGL to approximately 70°42.00'/-156°48.00' and flew a three-level racetrack at 300 ft. /1000ft. /3000 ft. AGL. oriented east-west. Spiraled back to 300 ft. AGL and then flew to North waypoint in the vicinity of approximately 71°43.85'/-155°37.15. Flew an east-west oval racetrack with five levels 300ft. /700ft. 1000 ft. /1500ft. /3000 ft. AGL. over sea ice. Spiraled back to 300 ft. AGL and then proceeded back to PABR and decided to make two low approaches before landing.



11 April 2022

RF24a System Scientist notes

Crew: Tom Drew, Anna Robertson, Daun Jeong

Objective: CIMS flight with parking garages over tundra and Beaufort sea ice (downwind of lead)

Low approaches at PABR if time

Instrument notes:

Turbulence working today

2140 TFOM reached 6

Flight notes:

2017 wheels up

2020 down to ~300 ft

2034 starting 300 ft leg

- from Kris: surface layer up to 800-1000 ft, residual layer up to about 2500 ft, free trop above

2042 ascending to 1000 ft

2043 starting 1000 ft leg

2051 ascending to 3000 ft

2053 starting 3000 ft leg

2101 start spiral down

2105 done with spiral, transiting to waypoint downwind of Beaufort lead

2128 starting 300 ft leg

2135 ascending to 700 ft (above the sfc BL)

2136 starting 700 ft leg

2144 ascending to 1000 ft

2146 starting 1000 ft leg

2154 ascending to 1500 ft

2155 starting 1500 ft leg

2204 ascending to 3000 ft

2205 starting 3000 ft leg

2213 starting spiral down

2216 done with spiral, heading back to PABR

2229 ascending for approach to PABR

2236/37 over PABR for first low approach

2240 over PABR for 2nd low approach

2246 wheels down

04/09/22 Pilot notes (CHACHA22 RF 23)

Crew: Drew, Jeong, Robertson

Flight Time: 3.9

Planned:
Depart PABR 1 hour after N762JT. Ascend to 3000 ft and then descend to a steady altitude of 300 ft AGL. Turn south for Atqasuk. Do two low approaches at PATQ and then resume 300 ft AGL. Continue south toward the Brook's Range. A primary objective is to perform a "racetrack" over the tundra. The location of the racetrack will be determined by either ALAR monitoring BrO or the science team on N2UW calling the location based on high Br2 and/or low O3.

If no location is determined by either team, the default location for the racetrack will be in the vicinity of 70°06.44'/-161°21.50' (marked as "last gasp" on the map below). The racetrack parameters are to fly level circuits for 10 minutes each at the following altitudes: 300/500/700/1000/1500/3000 ft.

Upon completion of the racetrack, resume 300 ft AGL and continue the plan if there is time. If time is running long, omit waypoint 71°36.90'/-157°58.92 over the Chukchi and do low approaches at Wainwright and PABR. If there is enough time, continue flying the plan as given doing two low approaches at Wainwright, flying over the Chukchi, and finishing off with two low approaches at PABR.

Actual: After departure and initial climb to 3000 ft. MSL, started along the route at 300 ft. AGL to Atqasuk. However, received word from ALAR that the sounding racetrack stack should be completed closer to PABR. We turned around to resample the area, then decided about 18 nm southwest of PABR would be the location for the stack. Flew the stack level at each height (300/500/700/1000/1500/3000 ft.) for the duration determined by the flight scientist. Decided to fly an additional level at 4000 ft. AGL. Spiraled back to 300 ft. and continued to PATQ. Climbed to pattern altitude and made two low approaches at PATQ. Then continued south-southwest toward the Brooks Range, staying at 300 ft. AGL. Terrain height rose slowly and steadily along the southern transect raising the MSL altitude from ~500 ft. MSL to around ~1000 ft. MSL in order to maintain ~300 ft. AGL. in somewhat "hilly" terrain. ALAR warned the visibility was poor near the southeast waypoint and we encountered the same conditions starting about 20 nm north of the waypoint. Decided to bypass the southeast waypoint and head directly for southwest waypoint near the coast. However, the visibility improved as we continued flying west, so decided to rejoin the original route. Upon reaching the southwest waypoint, turned north staying at 300 ft. AGL, to PAWI. Climbed to pattern altitude and made two low approaches at PAWI then continued to the northwest waypoint at 300 ft. AGL. After reaching the northwest waypoint returned to PABR at 300 ft. and conducted two low approaches after climbing to pattern altitude.

No Image

9 April 2022

RF23 System Scientist notes

Crew: Tom Drew, Anna Robertson, Daun Jeong

Objective: CIMS flight over the tundra. Low approaches at Atqasuk, Wainwright, and Utqiagvik.

BLH around 4000 ft today

Instrument notes:

IRS switch was not on at takeoff so had some errors in boom variables for first 45 min of flight

Turbulence probe zeroed out again

Flight notes:

2212 wheels up

2232 start 300 ft level for racetrack, roughly 15-18 miles south of PABR

2327 done with original racetrack, climbing to 4000 - it seemed like we might still be in the boundary layer

2335 starting spiral down

2352 ascending for approach to PATQ

2356 over PATQ for first low approach

2359 over PATQ for 2nd low approach

0023 cutting south leg short (by about 12 miles) since visibility dropped (very hazy)

0031 out of thick haze layer so heading back to southernmost track

0110 ascending for approach to PAWI

0113 over PAWI for first missed approach

0116 over PAWI for 2nd missed approach

0152 ascending for approach to PABR

0156 over PABR for first missed approach

0200 over PABR for 2nd missed approach

0206 wheels down

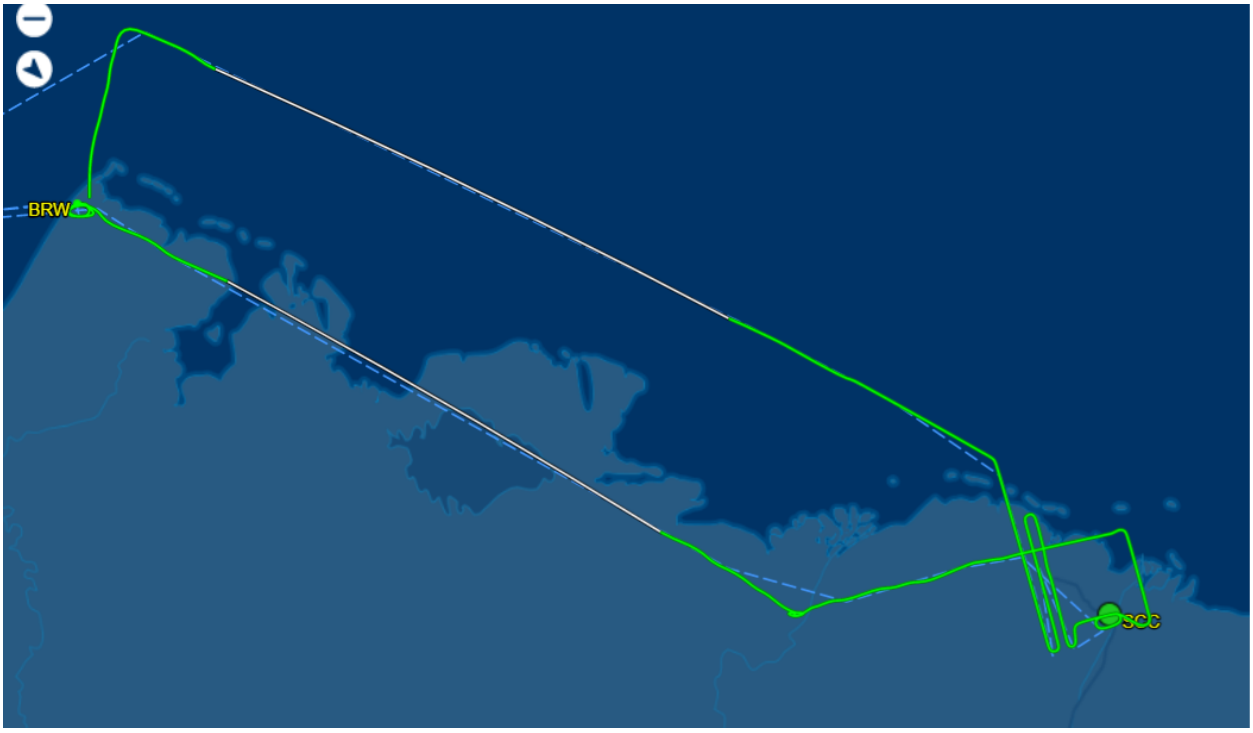
04/07/22 Pilot notes (CHACHA22 RF 22)

Crew: Drew, Jeong, Robertson

Flight Time: 3.7

Planned:
Depart PABR ~30 minutes after N762JT. Ascend to 3000 ft, then descend to 300 ft. Head northeast over the Beaufort and then southeast over the Beaufort towards the PB area. Downwind of the oil production facilities, N2UW will transect three times at 300 ft. Make two low approaches at PASC. Resume 300 ft and fly the upwind leg at 300 ft. Turn southwest toward PAQT for two low approaches. Resume 300 ft and head for PABR for two low approaches.

Actual: After departure and initial climb to 3000 ft. MSL, descended to 300 ft. AGL to enroute to point north of PABR and continued southeast along the route at 300 ft. AGL to the waypoint on the north end of first downwind transect. Flew three downwind transects and then climbed to pattern altitude and made two low approaches at PASC. Then descended back to 300 ft. AGL and few a single upwind transect before heading to PAQT. Flew two low approaches at PAQT and returned to 300 ft. AGL for the return flight to PABR. Made two low approaches at PABR before landing.



7 April 2022

RF22 System Scientist notes

Crew: Tom Drew, Anna Robertson, Daun Jeong

Objective: CIMS flight over Beaufort and out to Prudhoe Bay oilfields. Low approaches at three airports: PASC, PAQT, and PABR.

Instrument notes:

KADS software glitching out, seemingly sending many strings every second but only actually updating once ever 20 seconds

- started with just a couple repeating numbers then became more and more

- 'kB on data disk' froze and is red

- After flight, Dave confirmed data recording was okay

Flight notes:

2210 wheels up

2324 started downwind legs

- winds 15 knots from NE

2356 ascending for approach to PASC

0000 over PASC for first low approach

0004 over PASC for 2nd low approach

0007 started upwind leg

- 2411 passed downwind of point source

0013 end upwind leg, heading to Nuiqsut

0032 ascending for approach to Nuiqsut

0035/36 over PAQT for first approach

0039 over PAQT for second approach

- wind speed near 0 at surface

0128 ascending for approach into PABR

0133 over PABR for first approach

0137 over PABR for second approach

0142 pumps off

0143 wheels down

04/6/22 Pilot notes (CHACHA22 RF 21b)

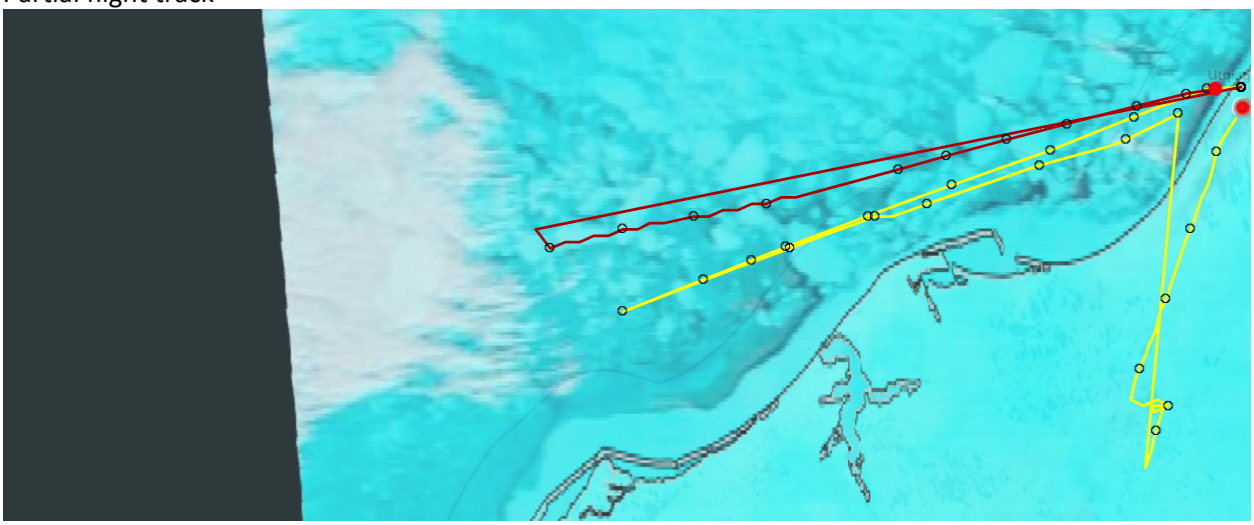
Crew: Drew, Woods, Robertson

Flight Time: 3.1

Planned: Depart and climb to 3000 ft. followed by a descent to 300 ft. AGL. Fly to the windward waypoint and then fly to southwest end of cloud field waypoint. Fly through the cloud field to the north for about 30 minutes. Exit the cloud field on north side and proceed back upwind in clear air at cloud level to sample clear air upwind of cloud field. Then maintain that altitude and follow clouds back to PABR.

Actual: Departed and climbed to 3000 ft. followed by a descent to 300 ft. AGL. Flew to the windward waypoint and then to waypoint southwest of cloud field. At low altitude the clouds above looked very thin and hard to judge height. Once reaching the waypoint, profiled up to determine cloud height and thickness. Clouds were very thin and sparse in that area while heading to the north. Decided to turn south into thicker looking clouds. Following the thicker looking clouds, meandered back to the north side of the cloud field to achieve the 30 minutes. Eventually exiting the north side of the field and proceeding upwind, although still encountering clouds. Well upwind of expected cloud field location, turned back south, still encountering scattered clouds. About two-thirds the way south, turned back towards windward waypoint at cloud level, following clouds when able back to PABR.

Partial flight track



7 April 2022

RF21b System Scientist notes

Crew: Tom Drew, Anna Robertson, Sarah Woods

Objective: CVI flight targeting developing clouds over newly open Chukchi lead and stranded cloud field far downwind. No dropsondes.

Instrument notes:

Error with data system

- last available timestamp was 03:12:07

Flight notes:

0106 wheels up

0113 adjusted POPS flow to 3.5 cc/s, hoping that it will stay within range when switched over to the CVI from that level

0159 switched to CVI, POPS flow only jumped to 7 cc/s so left it

0203 on N-S leg heading north and ascending to cloud level

0207 heading back south because clouds have dissipated a lot to the north

0251 switched back to Rogers inlet

- POPS flow dropped back to about 3.5 cc/s

0312 data system unhappy

- seemed to have lost time/GPS signal ?

0404 climbing up for descent into PABR

0410 wheels down

2022-04-07 UTC (20220406b) KA Science Flight for CVI (From PABR)

Config: Standard for CHACHA cloud flights: CIMS off, all others operational. Rogers for takeoff/landing, CVI for cloud sampling

Crew: Tom, Anna, Sarah

Obj: Lead cloud sampling – aged, disconnected lead cloud downwind in Chukchi and fresher, lead cloud sampling in Bay south of Utqiagvik, largely filled back in with ice.

Preflight Check Summary: Andrea tended to PILS & Drum. Daun capped CIMS.

TRF -19 C
Zrad 2.24 ft
RH 34 %

Conditions: blue skies, lightly overcast to the south. Weak lead clouds due to shifting winds around the Barrow lead

0103 UTC Engine start

010222 Start PILS software, Run# 102, tip temp 98

0105 UTC taxi (1707 local PBAR)

0107 Takeoff UTC (on Rogers inlet)

0109 Jog Drum after climb out

CVI, 2D-S TAS tracking

Transit VFR at 3kft from Barrow to approximate lat/long of of cloud field determined by Sara Lance (P1)

0110 descending into very wispy puffy cu 766 ft

PILS tip temp 98, LFE flow 7-9

0116 pretty frozen over, with very large patches of ice, and some smaller patches of re-frozen water. Occasional thin streets of clouds out rt window, a bit further away from shore. Thin, higher altitude layer off in the distance.

0118 lil ice fallout from some thin wispy clouds above? -21C, 300 ft

0120 some thin lines of cloud out left window too, closer to shore

0123 lil more ice crystals in clear air.
PCASP 80-120, CPC 145

0124 lil bigger ice – seeing a little layer of cloud above us.. maybe descending to our level

0128 In transit, turn up CVI de-ice to 55C on cone, 35 on pylon

0129 cross small patch of open water

0130 pass by another lil open patch – bigger out both windows, bottlenecked where we crossed. -21C
0130 more ice on 2D-S.
looks a little hazier out windows: steam coming off pockets of open water, or ice? Pristine plates on 2D-S.. -21C, 66% RH
0134 lots of vapor grown plates on 2D-S

0137 coming under a higher layer of ice clouds. From Utqiagvik, Tom & I both thought these were high alt cirrus, but from here, they look much lower, Tom estimates 2-3kft above us.
Also some scattered clouds maybe 1kft above us.
Likely sources of the ice we're seeing right here, but did the earlier ice grow in situ??
Surface still patchy, lots of ice cover, occasional little pools of open or re-frozen water

0141 ice fallout getting thicker, cloud above us visually getting thicker also. Still some lower lead clouds slightly above us off to the right – see photo.

0143 several patches of open water off to the right, with steam, but no visible lead cloud field, could be hard to see with higher layer though (casting shadows)

0145 layer above us a bit more broken up now, can see stretches of blue sky
Still some pristine ice on 2D-S

0148 still some lead clouds over open pockets of water, south of wainright

0150 lower clouds just overhead briefly

0152 more pristine/vapor grown ice on 2D-S
Scattered low clouds just a bit above us still

0154 lil puffier, scattered streets growing above us now. -18C, 67% RH, 300 ft

0158ish Turn CVI counterflow down to 2 LPM
Turn on dilution flow by opening MFC valve
Switch from Rogers to CVI inlet.
Check CVI inst flow < 14
Check POPS flow

0201 some rimed & irregular ice fallout

0203 Jog Drum for in cloud sample
30 min of in cloud sampling (3x10 min legs or 6x5 min legs, etc, to maximize time in cloud).

0203 rt turn upon reaching Sara's waypoint, climb to assess cloud field
Porpoise through cloud field to determine altitude with max liquid
0204 lil ice, 1500 ft for bases (1300 zrad), out of tops at 2200 ft (2000 ft)
0205 descend back to 2kft, where there was a little liquid, lil lower
0207 out of cloud, see some a ways to the north, but decide to work the cloud field we have here, so turn around to head back southward

0207 bump dilution flow back down to bring CVI inst flow up btw 13-14.

0209 slight left turn to get back into cloud, heading south

0211 Clouds are bit broken, not solid deck, so in and out. Mixed phase, irregular ice and drops ~7-9um. Zrad1600 ft, -22C, 78% RH

0211PILS LFE 8-9, tip temp 97
CPC tracking CDP in conc
LWC of CDP 0.01-0.02

0215 Tom noticed cloud shadows look a little thicker downstream, turn to rt to try and find thicker, more consistent clouds

Air very smooth in these, not at all bumpy. CDP sometimes has very prominent peak in 7-8um bin

0217 pocket of big ice

0217 rt turn to start working way back to north. See patch of re-frozen water on surface. Not solid ice, but not visibly open either.

0218 light winds: 8 knots out of north.

0219 climb a bit to see if keep with liquid, still mixed phase, peak ~8 um in droplets. Patchy cloud shadows on ice below, -22C, 1700 ft zrad
0221 some bigger ice on 2D-S

0221 climb a little bit more to keep above bottoms, 1900 zrad, -22C, drop peaks >9um, smaller ice

0223 climb a tad more, drop peak~9um, lil more liquid, but patches of more ice

0226 climb a bit to keep in
Better liquid, but then reach northern patchiness again, patch of clear air
0228 back into layer, sharp peak at 8um, still mixed phase, but mostly liquid
0229 able to continue farther north in cloud on this transect

0231 sharp CDP peak at 9um, smaller ice, CPC still keeping up with CDP

0233 clouds again getting patchy at our level, in and out of cloud

0234 more ice, less liquid, then into clear air patch, -23C, RH 70%

0234 back into cloud, mixed, but more ice here. Strong droplet peak at 8um

0236 bigger patch of clear sky, then back into cloud. Drops ~8 um, ice

0237 another decent sized patch of clear sky

0239 rt turn as we meander toward northern edge of cloud field, heading back toward upwind side of cloud field to make sure we have time for an upwind leg, stay in clouds en route

0240 mostly ice here, lil liquid

0241 better liquid cloud, peak ~9um, still quite a bit of ice, lil broader droplet peak

0244 big patch of clear sky

0245 descend a little to keep with the clouds as we get back into them. They're patchy on this NE side
0246 another lil pass, lot of ice on 2D-S, but still good counts on CDP, peak ~8um

0248 step down a little more to keep with clouds, seem to be maybe thinning out a little

0251 Jog Drum for upwind of cloud deck sample, still kind of in and out of cloud

0252 Switch to Rogers

Close MFC valve
Check CVI inst flow goes to 0
Check Pops flow

0253 hard to get back completely upwind of clouds since they're so intermittent
0255 just above cloud deck, descend to get back at same level as patchy deck

0256 slight rt turn, still patchy clouds
Once we get full infront of cloud field, will head back south a bit. Descending with clouds as they do at this leading edge.
CPC >1000, Pops closer to PCASP, <100

0258 brief cloud pass
0300 still in and out of thinner clouds

0303 can make out higher layers to the SE

0304 descending further with clouds, still in & out, droplet peak ~3-4um
Thinning out, just taking a long time on this northern side

0305 coming up under a large cloud deck.
0306 turn south for upwind in&out of cloud leg. Can now see that the higher layer has been intermittently above us for awhile. Maybe a couple more thousand feet above us.

0307 couple brief cloud passes, 5-6 um peak

0309 descend 200 ft to get more at the cloud level right out the window (clouds further downstream slightly above our level)
Surface below is still frozen with patches of re-frozen
Less cloud upwind here, but still patchy at times

0312ish KADS display stopped updating

0314 clip cloud, very thin & wispy

0317 clip cloud, wispy

0319 left turn to head back upstream toward Utqiagvik, staying at cloud level ~1200 ft

0320 some rimed ice fallout from layer above

0321 jog drum for heading back upstream at cloud level leg

0323 pass between 2 leads with shallow puffy lines of lead clouds. Not worth deviating for, but if we see any longer lines en route back, ask Tom to deviate for them

0325ish into hazy ice layer

0328 more ice

0333 still in haze layer at level of lead clouds, transiting upwind. KADS display still not updating, but says it is recording still

0335 clipping thin lead cloud layer? Seen on 2D-S, mixed phase, mostly liquid. Very thin layer. Still mostly ice beneath us, occasional patches of open water.

0337 into thicker haze layer, bigger ice

0339 more liquid in this slightly thicker cloud deck.

sample in near-shore lead clouds as possible

0343 slight right to try and get on spine of lead clouds streaming to our right

0343 into clouds, left turn to keep on spine
0345 climb ever so slightly to get wing probes up into thin cloud layer. Mixed phase on 2D-S, thin, small droplets (don't have CDP)

0345 Jog Drum for near-shore puffy cu clouds

0346 lots of ice on 2D-S, 1400 ft, 1200 zrad, just below tops

0349 popped out, descend just a little to get back into it, Tom notes cool glory just infront of us.

0350 we think we're over open water, maybe a thin layer of ice, but Tom notes waves, less patchy cloud here
0351 Tom: now we're over full open water

0354 descend a bit to keep with the clouds

0355 clouds patchy, surface still has some ice slicks

0356 ice fallout from thin layer higher above on 2D-S

0359 turn CVI counterflow back to 10
Turn CVI cone de-ice back down to 10C

0400 back over patchier ice and re-frozen water, out of cloud street we were in, thinner, patchier ones out window again

0404 Jog Drum for final approach
0404 Climb for final approach

0408 Gear down

0410 Landing

Turn off PILS & Drum pumps

Turn off PILS chassis

04/06/22 Pilot notes (CHACHA22 RF 21a)

Crew: Drew, Jeong, Robertson

Flight Time: 3.0

Planned:
Departing PABR, climb to 3000 ft then descend to 300 ft AGL. Make for Atqasuk. After two low approaches at PATQ, return to 300 ft AGL and continue south-southwest toward the Brooks Range, staying at 300 ft AGL, as possible, while the terrain rises to ~2200 ft AMSL.

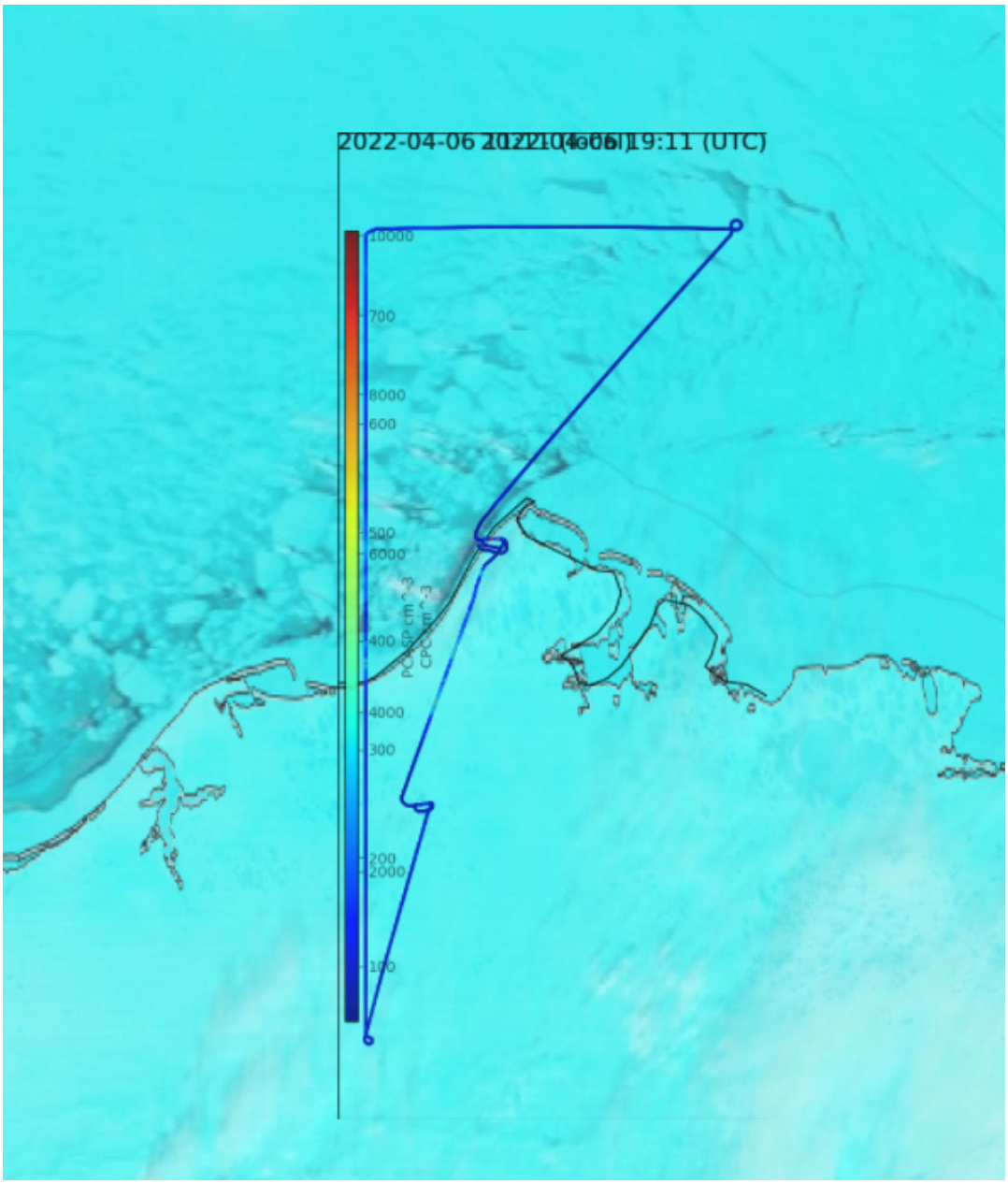
Upon reaching 69.734N/158W, turn north, staying at 300 ft AGL, as possible, and proceed over the Barrow lead to 72.2N/158W. If clouds are encountered over the Barrow lead, ascend as needed to stay out of cloud and then descend back to 300 ft AGL.

Upon reaching this northernmost point, head due east to sample over the Beaufort to 72.2N/154.5W. This leg is roughly 23 minutes long which should be long enough for the CIMS to get a good signal and at least 7 PILS vials. Turn southwest for PABR, making two low approaches before landing.

Actual: After departure and initial climb to 3000 ft. MSL, continued along the route at 300 ft. AGL to Atqasuk. Climbed to pattern altitude and made two low approaches at PATQ. Then continued south-southwest toward the Brooks Range, staying at 300 ft. AGL. Terrain height rose slowly and steadily along the southern transect raising the MSL altitude from ~500 ft. MSL to around ~1000 ft. MSL in order to maintain ~300 ft. AGL.

Upon reaching 69.734N/158W, turned north, staying at 300 ft. AGL, to the north point 72.2N/158W. Climbed to 1000 ft. MSL over the Barrow lead to avoid the clouds, but then descended back to 300 ft. AGL. once clear.

Upon reaching the northernmost point, headed due east to sample over the Beaufort to 72.2N/154.5W. Then turned southwest for PABR, making two low approaches before landing.


2022-04-06 19:11 (UTC)
10000
700
8000
600
500
6000
400
4000
300
200
2000
100
PCASP cm^-3
CPC cm^-3

6 April 2022

RF21a System Scientist notes

Crew: Tom Drew, Anna Robertson, Daun Jeong

Objective: CIMS tundra survey flight. 2 low approaches each at PATQ and PABR

Instrument notes:

Turbulence probe worked!

Flight notes:

1909 wheels up

1916 POPS flow at max, adjusted down to 5 cc/s

1930 started climb for approach to PATQ

1934 over PATQ for first low approach

1937 over PATQ for 2nd low approach

1957 reached southernmost waypoint

2000 may have intercepted own exhaust plume during turnaround (spike seen on CPC)

2024 crossed the Chukchi coast

2027 climbing slightly to get above clouds, to 700 ft

2029 descending back down to 300 ft between cloud sets

2038 end of lead? Difficult to define today since several cracks starting to open up and no single large body of water

2151 climbing for approach to PABR

2155 over PABR for first low approach

- CPC maxed out, PCASP up to concentration of 2500

2159 over PABR for 2nd low approach

- CPC maxed out again but PCASP only up to 1000

2204 wheels down

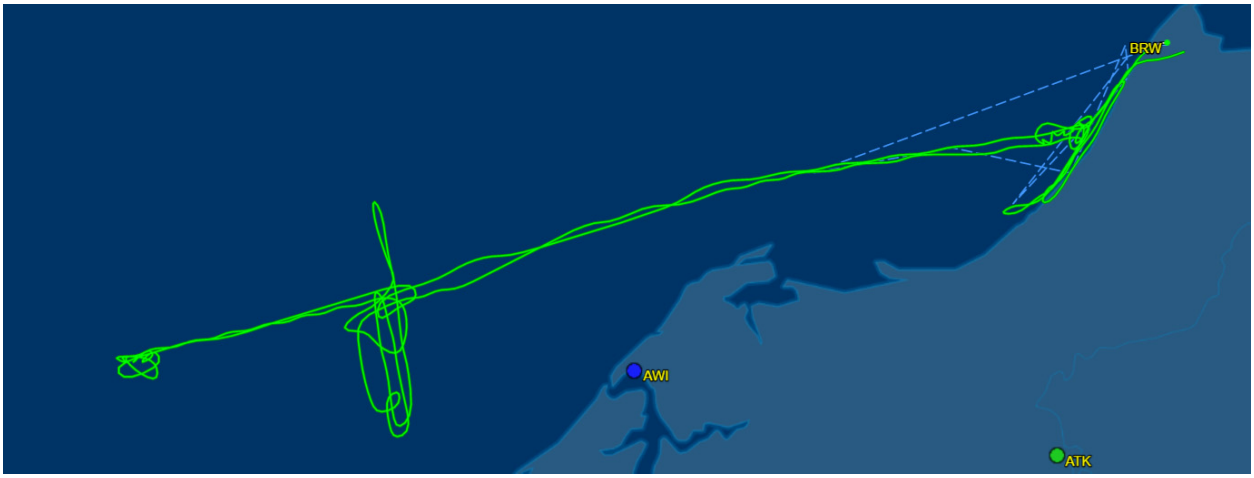
04/2/22 Pilot notes (CHACHA22 RF 20)

Crew: Drew, Woods, Robertson

Flight Time: 4.0

Planned: Depart and climb to 3000 ft. followed by a descent to 300 ft. AGL. Fly to the windward waypoint following along the shore over the open water of the lead at 300 ft. for 30 minutes. Upon reaching the first point spiral up to 10,000 ft. MSL. Drop a sonde then move over the cloud field (downwind) to second point and drop another sonde. Transit to third waypoint and drop third sonde. Spiral down at third waypoint and fly NW-SE in-cloud samples. Then fly along the cloud axis to second waypoint and fly NW-SE transects in that location. Then follow the axis back to first waypoint and back to PABR.

Actual: Departed and climbed to 3000 ft. followed by a descent to 300 ft. AGL. Flew to the windward waypoint following along the shore over the open water of the lead at 300 ft. Made four transects mostly towards the southwest to avoid the airport area, in order to achieve needed time. Once over the waypoint on the upwind side of the lead, spiraled up to 12,000 ft. MSL. to ensure full dropsonde data from 10,000 ft. MSL. then descended to 10,500 ft. MSL for the transit to the second point. The second point visually looked to be on the north edge of the cloud field, so moved the second point southwest five nm. Again dropped the sonde from 12,000 ft. MSL to get the full data. Descended back to 10,500 ft. MSL for the transit to the third point. Decided to move the third drop about 10 nm southwest, visually centered over the cloud spine. Dropped from 12,000 ft. MSL and spiraled down to 2000 ft. MSL. Made a couple of very short northwest/southeast cloud transects before following the “cloud spine” back to the second point. At the second point made a northwest transect and encountered just small scattered clouds, so then made four transects on the southeast side of the spine where there were more clouds. Tried to sample the extremely thin cloud layer about 1000 ft. above main clouds, but it was difficult to intercept and stay in. Then roughly followed the “cloud spine” back to the first point. About ten miles before reaching the point descended to 300 ft. AGL until reaching the point. Made a 360 turn for traffic spacing and then returned to PABR.



2 April 2022

RF20 System Scientist notes

Crew: Tom Drew, Anna Robertson, Sarah Woods

Objective: CVI flight targeting the lead clouds over the Chukchi sea. 3 dropsondes.

Instrument notes:

Still having issues with turbulence probe zeroing out

** look into some way to support lowest denuder connection on PILS

2nd dropsonde failed to acquire winds/alt until around 5000 feet (Sarah noticed plastic end cap wasn't on it)

Flight Notes:

2010 wheels up

2017 adjusted POPS flow up slightly to 4.5 cc/s

2033 spike in CPC downwind of Utqiagvik

2045 start spiral up

2055 PILSLFE dropping to near-zero again at 10k ft

2057 climbing to 12k for dropsonde launch again in case it takes a few seconds to lock on to GPS

2101 launched first sonde

2104 had Sarah support tubing/denider connection from bottom and PILS flow looked better (fairly steady around 7-9 lpm)

2106 sonde on the ground, transiting to second drop point

2118 shifting 5 miles south to stay over thicker region of cloud (spine)

2127 climbing to 12k to prepare for 2nd launch

2131 dropped 2nd sonde, aiming for cloud spine since thickest part of clouds today

- didn't get winds/alt until 5000 ft

2136 sonde on the ground, heading to 3rd drop point

2143 climbing to 12k to prepare for drop

2146 dropped 3rd sonde

- picked up everything at 10k ft

2152 spiraling down

- IFR clearance down to 2000 ft

2153 3rd dropsonde on ground

2159 done with spiral down to 2k ft

2200 switched over to CVI

2201 POPS flow adjusted to 5 cc/s

2223 back to second drop point

2345 dropping down to 300 ft for near-surface transit back to PABR over the open lead

2354 switched over to Rogers inlet

2355 adjusted POPS flow to 6 cc/s

0002 wheels down

04/01/22 Pilot notes (CHACHA22 RF 19)

Crew: Drew, Jeong, Robertson

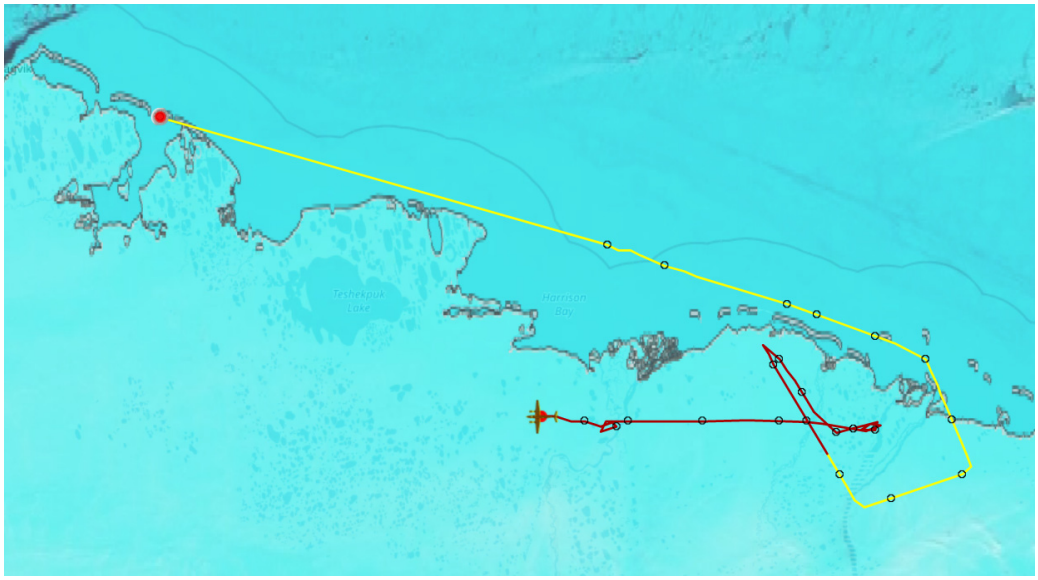
Flight Time: 3.9

Planned:
This flight consists of a survey over the Beaufort while traversing to PB, one upwind transect of the PB region, one downwind transect of the PB region, and one low approach at PASC, PATQ, and PABR.

After ascending to 3000 ft, descend to 300 ft and head southeast over the Beaufort toward the PB oil production fields. Will first make an upwind transect from 70°25.01'N/147°58.63'W to AXCUP. From there, head west to lower corner of downwind transect. After completing the transect, advance toward PASC for a low approach if the airport is still VFR. After the low approach, turn west for a low approach into Atqasuk (PATQ) if conditions allow. Resume 300 ft altitude. Head for PABR doing one low approach before landing.

Actual: After departure and initial climb to 3000 ft. MSL, continued along the route at 300 ft. AGL.

At the south end of the upwind transect, encountered a long band of haze with reduced visibility that extended well to the east and west. Terrain height increased fairly rapidly along the southern transect raising the MSL altitude from ~500 ft. MSL to over ~1000 ft. MSL in order to maintain ~300 ft. AGL. Shortly after turning north on the downwind transect the visibility improved dramatically and the terrain dropped quickly. Offset once on the downwind transect to avoid oil production structures. On the return transect south to start low approach at PASC, offset for several structures and ALAR heading northbound at approximately the same altitude. Climbed to pattern altitude and made two low approaches at PASC and continued to PAQT at 300 ft. AGL. Climbed to pattern altitude and made two low approaches at PAQT. Then continued to PATQ at 300 ft. AGL. However, turned north to PABR when reaching 5 nm east of PAQT due to the field reporting IFR conditions. Finally, conducted another two low approaches at PABR and landed.



1 Apr 2022

RF19 System Scientist notes

Crew: Tom Drew, Anna Robertson, Daun Jeong

Objective: Clear air/CIMS flight to Prudhoe Bay oilfields. Low approaches (1) at PASC, PATQ (if VFR), PABR.

Modified: Performed two low approaches at each airport since had enough time. Also, since PATQ low IFR, did two low approaches at PAQT instead.

Instrument notes:

Double-check turb to make sure it makes sense - red again at -0.07

POPS has drifted about 30 seconds - fix it or just keep track of it?

Flight notes:

2055 wheels up

2119 very clear conditions today over the Beaufort. Winds 25 knots from 045

2147 particle concentrations are lower today over the Beaufort to the W/NW of Deadhorse than on the last flight (180 today versus 2000 on RF18)

2151 Tom just checked Nuiqsut weather - good to go

2215 start upwind leg

2223 can see shallow line of low vis/haze to the south extending from west to east of visual range

2224 end of upwind leg

2225 diverted left to avoid large gravel hill

2232 starting downwind leg

- seeing lower pollution levels today - CPC at 300 - winds at 25-30 knots from 045

2238 starting to see some higher CPC counts, could just be a narrow plume with the higher winds

2241 can see faint yellow/brown haze layer above Deadhorse

2244 looks like we're mostly out of the main plume (according to the CPC)

224730 large point source (aerosols)

2250 end downwind leg

2253 slight diversion to avoid ALAR flight path

2259 ascended to set up for missed approaches at PASC

2303 over PASC for first missed approach - RALT 30

2307 over PASC fir 2nd missed approach - RALT 30

2310 back at 300 ft for transit to PAQT

2311-2319 in downwind Deadhorse plume

2326 Ascended for low approaches at Nuiqsut

2328 over PAQT for first low approach - RALT 30

2332 over PAQT for 2nd low approach - RALT 30

2334 back at 300 ft for transit toward PATQ

0016 diverting around PATQ IFR airspace

0018 heading back to PABR

0033 ascending to setup for low approaches at PABR

0038 over PABR for first low approach - RALT 30

0042 over PABR for 2nd low approach - RALT 30

- maxed out CPC during both low approaches

0048 wheels down