

CONvective Precipitation Experiment- Microphysics
and Entrainment Dependencies (COPE-MED)
University of Wyoming King Air Research

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Date/Gnd Notes	Flight # (*.kml)	Status	Times (UTC)	Hours	Crew/Notes
21 Aug	RF17	Test of CDP after fogging problem.	1100-1157	1.0	B Wadsworth J French L Oolman D Leon
17 Aug	RF16	Second flight of day, trying to catch fast moving convection associated with a frontal passage. CDP lens fogged for the entire flight.	1430-1602	1.7	B Wadsworth S Lasher-Trapp L Oolman J French
17 Aug	RF15	First flight of day. LWC100 slave coil broke at 1015.	0841-1055	2.3	B Wadsworth S Lasher-Trapp L Oolman J French
15 Aug	RF14	Mission targeting a line over Cornwall. Line moved to far east by the time we arrived. Flew isolated clusters with relatively warm cloud tops that were embedded in stratus.	1223-1505	2.8	B Wadsworth S Lasher-Trapp L Oolman D Leon





COPE-MED Data

- Flight Notes
- Order 1 Hz files
- Order high rate 25 Hz files
- Order particle image files
- Cloud Radar
 - Radar Quicklooks
 - Order radar data
- Downward Lidar
 - Lidar Quicklooks
 - Order lidar data

User

14 Aug	RF13	Warm rain case with cloud top temperature at -6 Celsius. No CIP data.	1133-1517	3.8	B Wadsworth J French L Oolman D Leon
07 Aug	RF12	Flight to Wales--non-precipitating clouds capped by inversion with -4C tops.	1231-1606	3.7	A Bandani S Lasher-Trapp D Leon J French
06 Aug	RF11	Weak convection suppressed by capping inversion worked mostly >0C.	1211-1449	2.8	A Bandani D Leon J French D Moser
03 Aug	RF10	Multiple cloud lines worked at cold temperatures inland over peninsula. Similar to yesterday but moister, although not as good as RF09.	1132-1525	3.9	A Bandani S Lasher-Trapp J French D Moser
02 Aug	RF09	Good flight (best thus far) over Davidstow with penetrations 0 to -12 degC.	1216-1558	3.8	A Bandani D Plummer J French D Moser
29 Jul	RF08	Worked around two storms, alternating working the smaller new turrets coming up to flight level. Second day in a row that the PXI came up with two amber lights.	1141-1518	3.7	A Bandani S Lasher-Trapp L Oolman D Moser
28 Jul	RF07	Isolated clusters of cells penetrating the -10 level.	1142-1529	3.9	A Bandani J French L Oolman D Plummer

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

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Jeff French

27 Jul	RF06	Hoping for convection on the west side of a MCS moving up from France. Ended up trying to fly a couple cells near Lands End that came up to the freezing level but did little else.	1148-1407	2.4	A Bandani J French L Oolman D Moser
25 Jul	RF05	Coordinated flight with the 146 through shallow convection.	1018-1354	3.7	A Bandani D Leon L Oolman D Plummer
18 Jul	RF04	First good case over Cornwall. All three aircraft participated. The Applanix failed on take off. A wire to one of the slave coils of the LWC100 pulled loose around 1413.	1200-1518	3.4	T Drew J French L Oolman A Korolov
10 Jul	RF03	Flight to Wales to fly isolated convection. Only a few clouds came through our level at 14,000 ft. Highly polluted air with droplet concentrations to 1500 cm ⁻³ . Lidar shows layering of aerosol.	1120-1426	3.2	T Drew S Lasher-Trapp L Oolman J French
09 Jul	RF02	Calibration flight with radar circles, wind calibration maneuvers, and constant altitude speed changes for the Nevzorov.	1023-1235	2.3	T Drew A Korolev L Oolman J French
		Post-frontal case with hopes to catch clouds. There were only low			T Drew

03 Jul	RF01	stratus. The 2D-P was connected to the incorrect port. The CDP was removed to repair loose mounting screws.	0804-0929	1.5	S Lasher-Trapp L Oolman J French
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Test Flights

13 Aug	TF07	Pilot familiarization flight. Did wind calibration maneuvers. CIP would not initialize. Radar was not run.	1202-1309	1.2	A Bandani B Wadsworth L Oolman J French
22 Jul	TF06	Pilot familiarization flight. Did radar circles.	1436-1533	1.1	T Drew A Bandani L Oolman D Moser
29 Jun	TF05	Test flight from Exeter. Aligned the lidar. No 2D-P data. Only a layer of thin stratus during the climb out and landing.	1137-1219	0.8	T Drew B Glover L Oolman Z Wang
17 May	TF04	Check the lidar computer and the alignment of the lidar. The Applanix failed on take off.	1542-1629	0.9	T Drew Z Little L Oolman B Liu
10 May	TF03	Test repaired FSSP and new lidar computer. FSSP resets look good. There is an issue with the averaging firmware in the GaGe card and the lidar returns look small. Flew some mixed phase clouds and low ice	1747-1900	1.3	T Drew D Leon L Oolman B Liu

		clouds to test the Nevzorov and radar depolarization.			
07 May	TF02	Tested the Nevzorov. Attempted to align the lidar. The nitrogen line was not connected and the window frosted over. A line to the driver for FSSP resets was broke.	2102-2240	1.7	T Drew A Korolov L Oolman B Liu
03 May	TF01	First test flight. The LWC100 was not turned on. The Gast pump did not work. No lidar or Nevzorov. Did radar circles and wind calibration maneuvers. The wind was too variable for a good calibration. The radar software crashed using the dual-polarization test mode.	1648-1733	0.8	T Drew Z Little L Oolman M Burkhart
Flight Hours		As of Aug 26, 49.9 out of 100 research hours were flown, 50.1 remain.	Test: 9.4		

COPE-MED 2013 RF-17 Post Mission Report

August 21, 2013

1. Crew: Wadsworth, French, Oolman, Leon.
2. Pre-Flight Brief: 1015ish
3. Planned T/O time: 1130
4. Flight Time: 1.0 Hrs
5. Weather: VMC for T/O, a few clouds NW of Barnstaple, VMC for landing.
6. Lowest cloud deck: 11000'
 - A. Brief:

Planned to head NW for something, anything.

B. Execution:

Took a NW departure then headed to Barnstaple. Climbed to FL 100. Found a few wisps of clouds off the coast, some icing. Little precip aside from some wet snow. Handed off to London Mil who gave us block altitudes to work, last one was FL 150-190. Danger areas were not active. London Mil handed us back to Exeter after giving us a descent to FL100. Took the visual approach.

Conclusion:

Not much weather happening in England today.

COPEMED13 (RF17) 2013-08-21

Crew: Brett Wadsworth, Jeff French, Larry Oolman, Dave Leon

Summary: Test of CDP to see if window fogs. There is a line of convection along the north coast. Fly them if they end up being of interest.

1101 Take off, Applanix failed. Climb to 10,000

1109 At 10,000 ft. T = 6 C. VDUMP = 3.7 V

1120 At 14,000 ft. T = -4 C. All ice particles.

1134 Found some embedded Cu with water drops. LWC100 ~ 0.3, droplet sizes small. CDP lwc significantly less than other probes (because of small drop sizes?) Concentration agrees well the FSSP.

1147 Head home

1158 Land

COPE-MED 2013 RF-16 Post Mission Report

August 17, 2013

1. Crew: Wadsworth, Lasher-Trapp, Oolman, French.
 2. Pre-Flight Brief: 1400ish
 3. Planned T/O time: 1500
 4. Flight Time: 1.7 Hrs
 5. Weather: IMC for T/O, broken & layers between ~2000 - 11000, IMC for Landing.
 6. Lowest cloud deck: 1000 broken
- A. Brief:

Planned to head westbound for anticipated buildups.

B. Execution:

Took a NW departure then headed westerly. Climbed to FL 140. There were some localized buildups that were up to ~17,000. The best ones were blowing rapidly into the controlled airspace, so we were unable to work them very long. Found others further to the SW which we were able to work. Found some ice, which excited Sonia. Much better flight than the first one today.

Conclusion:

Piece of cake. Walk in the park.

N2UW Daily Operations- COPE-MED

Date: 17 Aug 2013 (all times UTC); Flight Number: RF16

Name: Sonia Lasher-Trapp

Crew: (pilot, PI, system scientist, observer)

Wadsworth, Lasher-Trapp, Oolman, French

PLANS

Proposed takeoff 1330 UTC to study clouds developing ahead of or along the cold front. Cumuli are likely to be embedded in stratiform cloud again. We'll try to keep working at the eastern edge of the front, in hopefully a little more isolated clouds ahead of it. We sampled cloud bases earlier today, which had 200/cm³ in the warm sector, so we'll not do that again for this flight unless we see some surprising drop concns aloft.

Intend to transit toward Davidstowe at 14,000 ft to focus upon cumuli ascending up past the freezing level. The front is predicted to move eastward quickly, so we'll try to find isolated cells as soon as we can. Military area over Dartmoor is not active again today so that gives us a little more flexibility, but we'll be pushing up against the N-S airway that we can't pass through.

We have Davidstowe ground radar support, & 2-hourly Cambourne soundings today (none at Davidstowe), but again only a single aircraft study.

Summary: When we arrived near Davidstowe clouds were already developing above the freezing level. We found ice in these clouds with tops near -5 °C and worked some higher clouds that developed up to -9°C. They continued to develop but we couldn't stay with them because they were moving too quickly to the east into an unworkable airway. So we had to keep moving westward, and as we did, the cloud tops were increasingly lower. So we did some warm cloud top passes to document the productivity of the warm rain process, and then called it a day. Interesting that the max echoes at Davidstowe today were 40 dBZ—we've seen much greater echoes in warmer clouds.

FLIGHT NOTES

1430 UTC Takeoff. Davidstowe reporting cells in D1/2 and E2/3 with tops up to 5 km. Heavy rain showers in between our two flights here today in Exeter. Passing through stratus on ascent starting about 1500 ft (up to 350/cm³ in that) with a frontal inversion feature at 900 mb (not sure why).

143640 passing through another layer of stratus at 8500 ft

1439 coming out of that layer of stratus at 11.2 kft. 0°C at about 13 kft, and -1 °C at 14 kft. Very dry layer starting here at 14 kft.

1446 heading toward cloud complex at G4

144635 cloud pass at -5 °C near fuzzy cloud top—ice on CIP!

144700 passing through another cloud near its top with low lwc

145039 cloud pass with top pretty far overhead

145124 cloud pass with top pretty far overhead; all ice?

145207 cloud pass with top pretty far overhead; ice and liquid

145218 cloud pass with top pretty far overhead; ice and liquid

145259 right at cloud top

145535 through turrets in that complex again but nearly dead now—needles on CIP

145740 another pass through that complex

150022 pass with cloud top pretty far overhead but looks pretty strong > 15 dBZ on WCR

150345 2nd pass through that at -6 °C; not much precip toward ground

150500 3rd pass at -7 °C (following tops)

151030 pass through top of a new cloud at -8 °C, along wind I think

151303 and 151307: passes through 2 clouds near tops at -9 °C

151450 passes through series of cells near tops. Lots of lwc, 7 m/s updraft. Clouds are popping up so quickly it's difficult to keep up with my notes.

151720 new turret we're sampling near cloud top at -8 °C; 10 m/s updraft.

Wanted to go through it again but had to bail out because getting too close to airway. Did some inadvertent passes through sides of clouds while doing that. Moving now to cells to our southwest, farther from airway but they're not as big.

152520 pass near cloud top at -6 °C

152550 pass near cloud top at -6 °C

152840 near cloud top at -6 °C. Now will descend to get some passes through tops at 0 °C to document warm rain process before all of the clouds around us die out.

153055 near cloud top -1 °C, all liquid with 5 m/s updraft

153333 2nd pass through that at -1 °C

1535 through a "mass" of cloud tops in a complex at -1 °C. See some ice here, but look like older turrets that may have collapsed since having higher tops

154122 ascending to new targets but tops not as high here—we keep having to work westward to avoid airway but clouds farther behind front are not developing as deeply. Several passes through top at +5 °C here.

1543-154533 2-3 passes at +5 °C through a turret

1547 heading back to Exeter—no new workable targets. These later clouds just didn't have hard tops or strong updrafts like we've seen on other days—maybe not enough forcing & instability here behind the front?

1600 landed.

COPEMED13 (RF16) 2013-08-17

Crew: Brett Wadsworth, Sonia Lasher-Trapp, Larry Oolman, Jeff French

Summary: Second flight for the day. Fly convection ahead along approaching warm front

- 1430 Take off, Applanix ok. Climb to 14,000, T = -1 C
- 1447 First pass through cloud. T = -5 C. Some ice particles.
- 1522 Cloud drifted into airway. Head south to find new one.
- 1537 Once again, head west away from flyway.
- 1547 Done.
- 1548 Scrambled beams
- 1602 Land

COPE-MED 2013 RF-15 Post Mission Report

August 17, 2013

1. Crew: Wadsworth, Lasher-Trapp, Oolman, French.
 2. Pre-Flight Brief: 0800ish
 3. Planned T/O time: 0930
 4. Flight Time: 2.3 Hrs
 5. Weather: IMC for T/O, broken & layers between ~2000 - 7000, IMC for Landing.
 6. Lowest cloud deck: 1500 broken
- A. Brief:

Planned to head westbound for anticipated developing line. Expected to work the eastern edge of the line as it continued to move east.

B. Execution:

Took a NW departure then headed westerly. Climbed to FL 70. That was just about the top of all clouds in the area. As we approached the coast, we descended into the clouds for a bit, then elevated again. Sampled a few, pitifully small buildups that were appearing, but it appears that it was a pretty poor day.

Conclusion:

Flight procedures were easy, science aspects pretty-much sucked.

N2UW Daily Operations- COPE-MED

Date: 17 Aug 2013 (all times UTC); Flight Number: RF15

Name: Sonia Lasher-Trapp

Crew: (pilot, PI, system scientist, observer)

Wadsworth, Lasher-Trapp, Oolman, French

PLANS

Proposed takeoff 830 UTC to study clouds developing ahead of a warm front. Cumuli are likely to be embedded in stratiform cloud again. We'll try to keep working at the eastern edge of the front, in hopefully a little more isolated clouds ahead of it. Anticipating a messy situation, though.

Intend to transit toward Davidstowe at 7000 ft to hopefully be able to see the situation better but not be too high, as we'll need to sample cloud bases first. The front is predicted to move eastward quickly so if we don't sample bases at the start, we'll probably not be able to do so at all. Military area over Dartmoor is not active again today so that gives us a little more flexibility.

We have Davidstowe ground radar support, & 2-hourly Cambourne soundings today (none at Davidstowe), but again only a single aircraft study.

Summary: Embedded weak convection formed some spotty showers that maybe produced a little precip on the ground that Davidstowe could see. We worked a few bases, did numerous passes near fuzzy cloud tops at +10 °C, and eventually -2 °C. The +10 °C tops had low-level bases (I think) but the colder cloud tops that we sampled later had elevated bases. There weren't many strong cumulus cells to work during this flight, so we ended up by making some constant altitude transects through the nimbostratus to provide data for an orographic precipitation project being conducted today near Davidstowe. A second flight is planned for later today, and if nothing else, we've documented the low drop concentrations in the warmer, shallower cumuli developing this morning. Cloud base thermodynamics will likely be very different associated with the cold front passing through later today but we don't expect the drop concentrations to be much different.

FLIGHT NOTES

0841 UTC Takeoff. Here at Exeter, breezy with stratus and a little drizzle. Warm front approaching peninsula. Davidstowe reporting small cells east of warm front moving 50 km/hr, with tops above 3 km. Leading edge of convection at 'A' oriented N-S.

0843 passed through a small stratus layer

0848 Transiting toward target area at 7000 ft. We have both a stratus layer overhead as well as beneath us.

0853 Heading toward cumuli at H6 to sample bases

0854 took 1 picture where you can see cumuli ascending through the stratus layers. These are the clouds whose bases we sampled, but their tops (sampled afterward) never ascended above the +10 °C level.



0858 Descending into stratus now; we can only go as low as 3500 ft

0901 Going through bases ~ 3500 ft; max drop concns 250/cm³

0903 pass through middle of cloud?

0905 cloud pass near top at 12 °C; drop probes show 200/cm³

090738 pass near fuzzy and weak cloud top

090750 pass near fuzzy and weak cloud top

090820 pass near fuzzy and weak cloud top

0909 pass near fuzzy and weak cloud top at 10 °C

090945 radar suggests looking at F6, but didn't see anything there so going back to G/H6 region. We can see rain falling from the stratus layer overhead into the stratus below; maybe this is the precip echo they're seeing at Davidstowe radar?

091924 pass through top of weak cloud. Not much to work with here.

0921 Heading toward a little taller clouds over the coast in H7. Precip falling from above us

(see drizzle on windscreen) but no much showing up on 2D probes.

092430 several cloud passes here at +10°C

092533 several cloud passes here at +10°C. We're working the tallest stuff around. Radar crashed.

092815 cloud pass

092930 cloud pass near cloud top. We're now working over the ocean, likely H7 or J8.

093323 2nd pass of that cloud.

Now headed to J/K4. Clouds not developing much here—don't seem to have very strong updrafts and tops are never crisp like on other days. Will climb to look around. Davidstowe reports cell up to 4 km at K4 (western edge of Dartmoor?) but was fuzzy both on top and at elevated base.

See cumuli near L/M 2/3 that we'll head towards. They see these at Davidstowe.

095417 climbing to 11 kft to look around.

0958 climbing to 14 kft to look around

100144 pass near fuzzy cloud top at -2 °C, 5 m/s updraft, elevated base ~ 6000 ft(?)

100510 2nd pass back through that cloud (I think), at same altitude

100600 some inadvertent cloud passes. We can see the ragged (& elevated) bases these clouds have; tops are coming up to our level at -2 °C.

101025 pass near cloud top at -2 °C

1011 Davidstowe requests out and back legs at 12 kft through the nimbostratus for an orographic precip project being conducted near Davidstowe today. First leg starts at L2 and goes to F4; then will head straight from F4 back to Exeter, maintaining 12 kft in the Ns for as long as we can.

101310 entering nimbostratus cloud—see irregular ice on CIP. We can see the precip racing past the window and the wings.

102716 Done with first leg to F4; now heading back to Exeter for another pass through the Ns. Lots of aggregates on 2DP.

1055 Landed.

COPEMED13 (RF15) 2013-08-17

Crew: Brett Wadsworth, Sonia Lasher-Trapp, Larry Oolman, Jeff French

Summary: Fly convection ahead of approaching warm front

0840 Take off, Applanix ok. Climb to 7000 ft, T = +8 C

0843 Loaded WCR H1V1 mode. Crashed shortly thereafter

0852 WCR restarted. On boot, did a fsck on /wcrdata2.

0857 Working shallow Cu off north coast at 3500 ft.

0919 Scrambled beams

0921 CABINP reading 1038 hPa

0926 WCR: '1 Command rejected'. Disconnect my displays but kept recording. Upward beam appeared scrambled.

0936 Climbing to 8000 ft and heading back onshore towards some possibly elevated convection.

0952 Scrambled beams

1017 Scrambled beams

1038 LWC100 has offset of 0.4

1041 Done with research, descending.

1055 Land

COPE-MED 2013 RF-14 Post Mission Report

August 15, 2013

1. Crew: Wadsworth, Lasher-Trapp, Oolman, Leon.
 2. Pre-Flight Brief: 1030ish
 3. Planned T/O time: 1230ish
 4. Flight Time: 2.8 Hrs
 5. Weather: VMC for T/O, broken & layers between ~2000 - 7000, VMC for Landing.
 6. Lowest cloud deck: 2000 broken
- A. Brief:

Planned to head northwest anticipated developing line. As takeoff delayed a bit, appeared that a line was developing parallel to the western shoreline.

B. Execution:

The Red Arrows bogarted the fuel trucks so we were unable to get fuel until nearly 1:00 pm. Fueled & departed Exeter soon after. Once clear controlled airspace started to climb initially to 9000'. Headed west as it appeared that some cells were developing west of the D-011. Made penetrations on several buildups at FL 090 up to ~110. Later descended to 3100' MSL along the north coast and remained at min IFR altitude for some time, sampling bases of clouds. Then climbed back up for sampling additional cloud tops.

Conclusion:

Marginal day.

N2UW Daily Operations- COPE-MED

Date: 15 Aug 2013 (all times UTC); Flight Number: RF14

Name: Sonia Lasher-Trapp

Crew: (pilot, PI, system scientist, observer)

Wadsworth, Lasher-Trapp, Oolman, Leon

PLANS

Proposed takeoff 1130 UTC to study line of clouds predicted to develop near North Devon coast. Model forecasts were for chances of showers there, with precip starting at 1300 UTC. Forecast soundings show strong cap at 0°C, much like yesterday, so we don't expect anything more than a warm rain case today. Cumuli are likely to be embedded in stratiform cloud again like yesterday too.

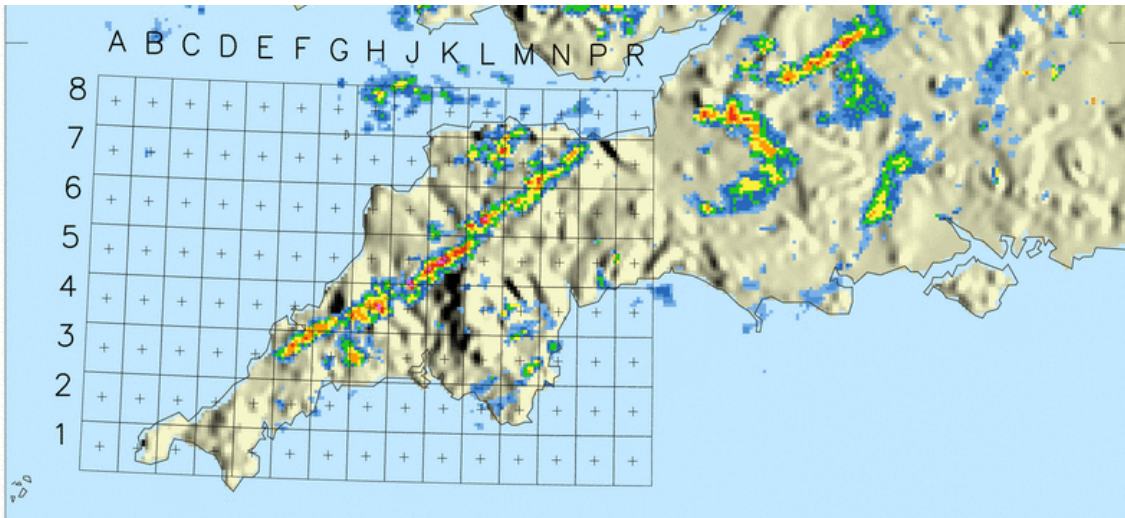
Intended to transit to Eaglescott at 9000 ft (as they did 14 Aug, to get above the stratiform layer and see what breaks through) to position us near forecast position of convective line.

We'll start by seeing if any cloud tops are ascending above the stratiform layer, and sample them if so. If there is a cloud line today, we'll try to focus on doing several passes along the line, getting radar info on cloud tops that are beneath us as well as penetrating the clouds along the line coming up to our level, trying to stay at the altitude where the max cloud top heights occur.

If the clouds are not arranged in a linear fashion, we'll do the "butterfly" pattern they used yesterday and try to get more passes per cloud again. No sounding as we should be covered by the Cardington crew. We'll try to find a time to sample cloud bases today, but they may again be too low to get very close to cloud base, and will have to seize any opportunities to do that if any clear slots occur.

We have Davidstowe ground radar support, Davidstowe & extra Cambourne soundings today, but again only a single aircraft study.

Summary: At 1030 UTC a nice SW-NE line from New Quay over Eaglescott towards southern edge of Exmoor area, with echoes > 50 dBZ but tops < 3 km. Snapshot below is from 1100 UTC. Due to a delay from the fuel truck, we were not able to takeoff until 1223, by which time the line was breaking down. Cumuli were again growing up through a stratiform layer today, but there was no “clear area” around the taller turrets as had been witnessed the day before. Had a few good cloud passes early on, up to -2 C or so (but no ice entire flight), things started to die down so we did some cloud base passes (they were higher than we had expected), and after that cloud tops continued to -1C or so, but later were limited to about 6 °C. We worked those clouds for a while longer then headed home. Not a stellar mission but might produce some nice measurements to compare or group together with yesterday’s flight.



FLIGHT NOTES

1223 UTC Takeoff. Davidstowe reporting 60 dBZ in isolated cell H3/H4, and that the line may be redeveloping to the south. Few intercepts of clouds as we climbed after takeoff.

1229 passed through a small stratus layer; see cumuli emerging from it ahead

123550 cloud pass near top at 6°C en route to cell in H4. Cloud top was far overhead, but seeing as strong of precip on WCR as the previous day. Drop number concentration at this level was 100/cm³.

Another cloud pass here with very broad DSDs.

1237 pass near cloud top with 350/cm³ on drop probes and much less precip below us

1239 pass about 200 m below cloud top; strong attenuation of WCR with 5 m/s updraft and less than 200/cm³ on drop probes

1240 another cloud pass at this altitude; echoes below us as we try to go along the line

1242 climbing to 10 kft to be near cloud top

1244 flying over the “spine” of the cloud line with most of the cloud tops below us, but should be getting good WCR data on them

1246 performing 90/270° turn to reverse course along the line again. Will fly over the tops of many of these again, but intend to hit deeper ones near end of this line

1248 took two pics of higher turrets along the line that we’ll be passing through

1251 passing near several cloud tops at +3°C

1252 this cloud pass was not as close to cloud top and had lots of precip?

1254 cloud pass near top

1255 cloud pass at +1°C but top still pretty far overhead

Climbing 2000 ft to hit the cloud tops ahead. After passing through those, we’ll reverse course and go through them again.

125740 as we turn around we pass through a very thin stratus layer at about 12 kft

1259 pass right at cloud top at -2 °C; not sure if it was the same turret as before?

1302 another pass through the cloud sampled at 1259, at cloud top but it was mostly dead. We've not seen any ice on the CIP yet today.

1304 cloud pass at -1 °C

1305 cloud pass at top of new turret with 5 m/s updraft

130720 passing through the previous set of turrets again

1310 cloud pass right at cloud top at 0°C

131230 2nd pass through that cloud right at cloud top (barely skimmed it)

131355 hitting detrainment layer here as we turn around

1315 cloud pass right at cloud top; had some drizzle

131648 cloud pass near top?

131859 2nd pass through that cloud but it's very fuzzy now and we just skimmed the top (collapsing?)

131948 heading to new area with new development

1323 Descending but still over cloud tops in this area. We see deeper cells to the east but can't work them because they're in the airway.

1324 trying to find some new targets north of us, as can't fly any further east

132745 passes near cloud top at -1 °C

132952 2nd pass through that cloud "mass", seeing larger mm drops

1332 3rd pass through that cloud mass, right at the fuzzy cloud top; had lots of precip

133436 4th pass through that cloud mass—seems dead now

134246 no targets to work. Will descend to do some cloud base passes.

134430 Granted permission to fly MSA at 3100 ft. As we descend, Dave noticed a strong cap at +5°C which is probably limiting development now.

135103 cloud base pass; 300/cm³ and 0.5 g/m³

135246 ragged cloud bases ~ 300/cm³

135405 right at cloud base

135547 another cloud base pass

1358 done with cloud base work. Ascending towards cell in G4 area. Passed through some clouds a little higher above cloud bases (3500 ft) as we transit.

140235 Better cells now H/J4 says Davidstowe, so heading there. In transit, now the cell is in J5.

140610 picture of the J5 cell. Not real deep, but the best cell around to work

140812 near dead cloud top at +5°C

140955 hit side of cloud?

141005 pass near cloud top at +2°C that had more turrets behind it

141133 pass near ascending cloud top

141250 pass near cloud top +1 °C

141454 2nd pass through that cloud near its top

141638 3rd pass through that cloud at same altitude, was really two clouds?

141715 pass through new cloud, near its top. See several turrets that are at this level, so we're setting up to do a transect along the line through all 3.

141900 pass near fuzzy cloud top; heading SW down this line

142100 pass near cloud top on that line. Now turning around to go back through that line of turrets in opposite direction. Descending a little so we're at the cloud tops.

142415 pass near cloud top at +1 °C

142525 couple of passes near cloud tops. After this inadvertently hit a few dead clouds.

142744 pass near cloud top

142840 pass well below the cloud top

143055 pass with cloud top farther overhead

143155 pass near cloud top

143403 pass through fuzzy (dead?) cloud top

1437 WCR crashed. Heading to new target area while they restart it.

143913 WCR back up. Lining up on 2 turrets.

144150 just skimmed a descending cloud top. We'll go lower to be farther beneath the tops.

144405 pass with cloud top farther overhead

144559 pass with cloud top well overhead

144830 near fuzzy cloud top at +7 °C

145005 pass with cloud top farther overhead

145116 pass with cloud top farther overhead; this one's a little stronger?

145151 pass with cloud top father overhead

145330 and 145359 passed through those previous 2 cells again

Deciding to call it a day. Much less precip in these later cells we were working than earlier in the flight.

145600 final 3 pictures of cloud tops poking through the stratiform cloud.

1500 landed

COPEMED13 (RF14) 2013-08-15

Crew: Brett Wadsworth, Sonia Lasher-Trapp, Larry Oolman, Dave Leon

Summary: Fly line of convection in Cornwall

1223 Take off, Applanix ok. Climb to 9000 ft, T = +4 C

1230 Torque not working

1242 Climb to 10000 ft along line of convection.

1257 Climb to 12,000 ft, T = -2 C

1315 Scrambled beams

1351 Lower level passes at 3100 ft

1357 Scrambled beams

1407 At 9000 ft

1435 WCR crashed

Error 23 occurred at Sealevel.lvlib:Read.vi:2 > Sealevel.lvlib:read_all.vi:1 > CIP Grayscale 1.vi Other image card error: 23 Possible reason(s): LavVIEW:
Bad external code format.

1455 Head home

1505 Land

CONvective Precipitation Experiment- Microphysics
and Entrainment Dependencies (COPE-MED)
University of Wyoming King Air Research

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Summary

The CONvective Precipitation Experiment-Microphysics and Entrainment Dependencies (COPE-MED) examined the dependencies of convective rainfall upon the productivity of the warm rain process, its importance to primary and secondary ice generation, its influence on the riming growth of ice particles, and the effect of entrainment upon each of these steps. The COPE-MED project was part of the larger, UK led COPE project over southwest England in the summer of 2013.

Principal investigators

Sonia Lasher-Trapp (Purdue University - now at the University of Illinois at Urbana-Champaign)

Jeffrey French (University of Wyoming)

David Leon (University of Wyoming)

Alexei Korolev (Environment Canada)

Temporal coverage

Begin: 3 July 2013

End: 21 August 2013

Geographic coverage

Minimum latitude: 49, Maximum latitude: 54

Minimum longitude: -6.0, Maximum longitude: -3.0

References to the data [Digital Object Identifiers (DOI)]

University of Wyoming. Research Flight Center., 2016: Flight Level Data from the University of Wyoming King Air during the Convective Precipitation

COPE-MED Data

- [Flight Notes](#)
- [Order 1 Hz files](#)
- [Order high rate 25 Hz files](#)
- [Order particle image files](#)
- [Cloud Radar
 - \[Radar Quicklooks\]\(#\)
 - \[Order radar data\]\(#\)](#)
- [Downward Lidar
 - \[Lidar Quicklooks\]\(#\)
 - \[Order lidar data\]\(#\)](#)

User

Experiment- Microphysics and Entrainment Dependencies (COPE-MED),
Version 1.0. [doi:10.15786/M2MW2S](https://doi.org/10.15786/M2MW2S).

University of Wyoming. Reseach Flight Center., 2016: Wyoming Cloud Radar
data from the University of Wyoming King Air during the Convective
Precipitation Experiment- Microphysics and Entrainment Dependencies
(COPE-MED), Version 1.0. [doi:10.15786/M2H598](https://doi.org/10.15786/M2H598).

University of Wyoming. Reseach Flight Center., 2016: Wyoming Cloud Lidar data
from the University of Wyoming King Air during the Convective Precipitation
Experiment- Microphysics and Entrainment Dependencies (COPE-MED),
Version 1.0. [doi:10.15786/M2CC7B](https://doi.org/10.15786/M2CC7B).

Information

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-  [EOL Facilities](#)
-  [Software Repository](#)
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-  [Facility User's Guide](#)

Facility Instruments

-  [In Situ](#)
-  [Wyoming Cloud Radar](#)
-  [Wyoming Cloud Lidar](#)

Contact

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Fax: (307)766-2635**

Facility Manager:

Jeff French

COPE-MED Data

- **Flight Notes**

Format: Microsoft word (.docx), Adobe acrobat (.pdf)

- **Order 1 Hz files**

Format: netCDF (Network Common Data Format), RAF/Nimbus Conventions

- **Order high rate 25 Hz files**

Format: netCDF (Network Common Data Format), RAF/Nimbus Conventions

- **Order particle image files**

Format: NCAR-RAF OAP

- **Cloud Radar**

- **Radar Quicklooks**

Format: PDF

- **Order radar data**

Format: netCDF (Network Common Data Format)

- **Downward Lidar**

- **Lidar Quicklooks**

Format: JPG

- **Order lidar data**

Format: netCDF (Network Common Data Format)

COPE-MED Data

- Flight Notes

- Order 1 Hz files

- Order high rate 25 Hz files

- Order particle image files

- Cloud Radar

- Radar Quicklooks

- Order radar data





- Downward Lidar

- Lidar Quicklooks

- Order lidar data

User

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Fax: (307)766-2635**

Facility Manager:

Jeff French

COPE-MED 2013 RF-11 Post Mission Report

August 14, 2013

1. Crew: Wadsworth, French, Oolman, Leon.
 2. Pre-Flight Brief: 1030ish
 3. Planned T/O time: 1200ish
 4. Flight Time: 3.8 Hrs
 5. Weather: IMC for T/O, fairly solid between ~1000 - 7000, IMC for Landing.
 6. Lowest cloud deck: 800 broken
- A. Brief:

Planned to head west towards Davidstowe for anticipated buildups. If necessary, we would work off the west coast.

B. Execution:

Departed Exeter at about 12:40 and once clear controlled airspace started to climb initially to 9000'. Approaching the coastline in the vicinity of Newquay, encountered a number of buildups which topped out around 9500' MSL. We made multiple entries into these buildups during the growth, maturation, and collapse of several of these. New COPE record number of penetrations of a single buildup achieved (13 or so on a single cloud). Executed a descent to 3500' MSL to attempt to work below the base of a buildup, but could not get below it, although did make a penetration at 3500'. Climbed back to block FL080-110, made additional penetrations through the tops of more buildups and then RTB'd to Exeter.

C. Conclusion:

Relatively painless to work the area.

COPEMED13 (RF13) 2013-08-14

Crew: Brett Wadsworth, Jeff French, Larry Oolman, Dave Leon

Summary: Hoping for embedded convection out of a stratus deck. CIP would not come up initially. Tested fine earlier but powered it down and then attempted to bring it back. No CIP data recorded, failed to hit record button.

1133 Take off, Applanix failed. Climb to 11,000 ft. Stratus to about 8,000 ft.

1153 Midlevel deck ended. Cloud top around 5000 ft.

1200 Starting to hit cloud tops at 8300 ft. T = +7 C. Concentration around 200 cm⁻³. LWC around 2.5 gm m⁻³.

1221 Background noise in up beam higher. Beam scrambling?

1226 Can see ground through breaks in the clouds

1243 Scramble?

1254 New cluster, start at 8000 ft. LWC100 has been significantly higher than the PVM today.

1257 Two passes and seek another cluster to west.

1327 Radar server crashed. Reboot.

1330 Drop to 3500 ft to study lower part of cloud. Drop further to 3000 ft once away from Dartmore.

1349 2D-P buffers that take a long time to fill may have disappearing bits.

1354 Climb to 9000 ft

1405 Diverting for traffic. In clear layer, clouds above have bubbly tops and flat bottoms. The clouds below have flat tops and are bubbly below.

1419 Scrambled beams

1429 New cloud

1458 Head home

1517 Land

COPE-MED 2013 RF-12 Post Mission Report

August 07, 2013

1. Crew: Bandani, Lasher-Trapp, French, Leon.
 2. Pre-Flight Brief: 1200
 3. Planned T/O time: 1330
 4. Flight Time: 3.7 Hrs
 5. Weather: VMC for T/O, Layered deck between 4500'-FL115, VMC for Landing.
 6. Lowest cloud deck: 3000'.
- A. Brief:

Briefed mission for the Flight in Wales.

B. Execution:

Departed Exeter at 13:30 and once clear controlled airspace started to climb initially to 6000'. Clear of controlled air space climbed to FL85. Enroute did a LIDAR clear air check over the Bristol Channel. Once cleared the air way north of Bristol Channel started the work at FL95. Few cumulus runs complete climbed to FL220 and commenced sounding down to 1500' AGL. Complete with sounding descended to FL40 and commenced base of cloud runs. Worked block 40-60, followed by block 60-80, and then block 80-120. Continued with Cumulus runs, once complete descended to FL70 and headed back home for a visual to runway 8.

Discussion:

Happy PI, good science day, and a satisfied customer. So it was a good day!

N2UW Daily Operations- COPE-MED

Date: 7 Aug 2013 (all times UTC); Flight Number: RF12
Name: Sonia Lasher-Trapp

Crew: (pilot, PI, system scientist, observer)

Bandani, Lasher-Trapp, French, Leon

PLANS

Proposed takeoff 1330 UTC to study deeper clouds in Mid Wales. Model forecasts were for chances of showers there, with bigger cells in S Wales but those would be unworkable due to an airway there. Max cloud development predicted to be around 1500 UTC, heading to just East of Aberstwyth in Wales.

Intend to transit to Wales at 8500 ft to stay beneath airways, and also to do some alignment testing of the radar over the Bristol Channel (about 20 min in clear air needed). We'll do some cloud base sampling, and do a sounding either before or after working the clouds, in addition to working our 0 °C and -5 °C levels (don't expect anything much colder than that).

We'll also try to do 2 passes on a single cloud if it's really developing, having the first very near cloud top, and the subsequent pass at the same altitude so that it'll be closer to the max updraft speed.

For Wales no ground radar support, no local soundings, single-aircraft study. Daniel was feeding us some info over chat from the Met Office radar network. Not expecting that heavy precip will develop, but may be a good warm rain study, a chance to sample cloud bases well to resolve any precip shattering issues causing high drop concentrations on CDP and FSSP, and precipitation formation may occur. Only prospect for today and next several days.

Summary: We arrived and there was a mid-level layer cloud in most of our study area except for a small region. There wasn't much to work upon arrival, so we did an ascent and then spiral descent sounding in the clear air region. By then clouds were starting to develop on the boundary of the clear air region. We did several ascents from beneath up through cloud bases for sampling of the drop concentrations there. We then worked near the 0 to -2 °C region as cloud tops were developing that high, with some as cold as -4 °C. High droplet concentrations appear to have slowed the warm rain process significantly in the clouds we were sampling, as we never saw above a 0 dBZ echo on the WCR and no raindrops on the 2D probes despite sampling some high liquid water contents. No ice.

On the way home, we went through some thicker stratiform cloud (tops at 11-12 kft) with cumulus embedded and found precip (1 mm drops) and more substantial echoes (5-10 dBZ). Some larger complexes in Southern Wales produced heavy precipitation at the ground.

FLIGHT NOTES

1232 UTC Takeoff. Field of fair weather cumuli at Exeter. Winds light and slightly northerly. Higher clouds to north of Exeter with varied bases ~ 3700 ft. Several accidental cloud passes as we ascend to transit altitude.

1237 We're at 8000 ft and a few cloud tops are making it up to this level; still in transit.

1242 accidental cloud passes at 8500 ft (0 to -1 °C), some through the cloud tops but the tops look rather dead. Measuring more than 1000 /cm³ on drop probes and no rain on CIP, and no large drops. Weak updrafts, and cloud tops are right below a detrainment layer likely occurring at the bottom of a stable layer. Can't see much as we're right at the base of the stratiform layer at this transit altitude.

1250 heading over Bristol Channel during our transit; will try to do a clear air segment over it for testing the lidar. I see a big cloud complex to the NE, in an unworkable area due to the airway there. It's got a top clearly above -5 °C. Dave notes specular reflection from WCR as we pass over the channel, and Jeff sees a little layering in aerosol from lidar (so not good for the test).

1255 Another accidental cloud pass—few drizzle drops.

1257 streamers on wind screen. Now crossing into S. Wales, here a few clouds up to 0 °C but mostly fair weather cu.

1300 50 miles yet from target area; Daniel reports stronger cells in our target area from weather radars.

1304 accidental cloud pass near cloud top.

1310 Daniel reports nice target just E of Aberstwyth.

1312 we may be in it right now, but it's just a big blob. Measuring drop concns 800-1000/cm³.

1315 cloud pass at -1 °C near fuzzy cloud top; weak echo on WCR and 800/cm³ on drop probes. Lots of mid-level cloud here making it difficult to work.

1317 2nd pass through that cloud but cloud top was beneath us now. Only -20 dBZ.

1319 climbing 2000 ft to emerge above midlevel cloud and look around for new targets.

1321 heading North where there are some big clouds emerging above the midlevel layer cloud which is all around. Took a picture of those clouds ahead. Turns out they were in another unworkable area due to airways.

1326 found a clear area within the midlevel cloud layer with hints of development at the edges of the clear region. We'll do a sounding in this area and give those clouds some time to develop. 1000 ft climb rate up to 22 kft then descend spiral to 1000 ft AGL—should take ~ 30 min.

1336 see some clodus to our west but need to do sounding first. Will see some ice on WCR now as we accidentally pass through some as we climb.

1338 Still climbing. Pondering what influence this midlevel detrainment layer has on the cumuli that emerge through it.

1342 Starting sounding descent in the only small clear air region around.

1345 Took 4 pics as we spiral around of the midlevel detrainment layer cloud and the turrets coming up through it.

1349 Another picture.

1350 Another picture.

1355 See clouds to southwest that might be workable. Sounding shows a “monster” inversion at -5 °C.

1359 Picture of terrain—it will prevent us from getting a sounding below 3500 ft. Took another picture of fair weather cumuli here.

1404 Some nice flat and dark cloud bases on edge of clear area here—we'll do climbs through some to get drop activation profiles. Seeing 1000/cm³ and 0.1 g/m³ lwc.

1406 another cloud base sample

140930 another climb from beneath through cloud base up to 6000 ft. Drop concns 800-900/cm³ and updraft 3-4 m/s.

1413 Another cloud base sample—strongest one yet. 1800/cm³ on drop probes.

1414+ accidental cloud passes as we ascend to work the tops of the clouds now—climbing to 0 °C.

1416 cloud pass significantly below cloud top

1419 cloud pass very near cloud top at -3 °C, and another near cloud top

1420 nice pass near cloud top—will go through it again

1422 2nd pass through that cloud at same altitude so a little lower in the cloud to sample max updraft speed

1423 new clouds near cloud top with streamers on wind screen

1428 just skimmed cloud top at -4 °C. No sign of precip.

1430 2nd pass through that cloud at same altitude so farther from cloud top. Drizzle on CIP?

1431 new cloud pass with top far overhead; again streamers on wind screen. No ice.

143415 right at fuzzy cloud top

1436 cloud pass near its top at -2 °C with streamers on wind screen.

1437 cloud pass near top at -2 °C

1440 cloud pass near fuzzy cloud top

1441 heading toward bigger cloud. Took a picture of it ahead—emerging through detrainment layer as shown below.



144230 cloud pass right at cloud top at -2 °C.

144444 2nd pass through that cloud at same altitude. Need to move to another area due to flight restrictions.

144820 cloud pass near cloud top at -2 °C. Tried to do a second pass on it, but think we

instead hit a cloud near it that was developing more, but not same cloud.

145334 cloud pass a little farther below cloud top to sample max updraft

145550 same as above but a new cloud

1458 2nd pass through the previous cloud but higher at -4 °C.

150120 cloud pass near top of fuzzy complex

150240 cloud pass right at cloud top.

150552 2nd pass through that previous cloud.

Now heading to cloud complex nearer to coast that Daniel had reported as precipitating, since we've not seen any precip up to this point. It's near Aberaeron on Wales coast. Hit another cloud near fuzzy top on way to this new cloud complex.

151113 took 3 pictures – 2 off right wing, and the 3rd of the cloud complex that we'll pass through next.

151220 pass through a mostly dead fuzzy cloud top

1513 picture of cloud complex that we will work because it's precipitating. Requested higher block, but can only get up to 12.5 kft.



151650 cloud pass at -4.5 °C, finally see 0 dBZ on WCR, and a few 0.5 mm drops on CIP.

1519 passing through that cloud complex again—several turrets with one being pretty strong (5 m/s updraft) and again see 0 dBZ on WCR.

1522 passing through that same complex yet again (this is the 3rd pass).

Now headed south toward the cloud complex that Daniel had been talking about, but we couldn't work it because it was in a restricted area.

1525 calling it a day and heading home to Exeter.

1534 going beneath "Daniel's" cloud complex?

1607 Wheels down.

COPE-MED 2013 RF-11 Post Mission Report

August 06, 2013

1. Crew: Bandani, Leon, French, Moser.
 2. Pre-Flight Brief: 1100
 3. Planned T/O time: 1300
 4. Flight Time: 2.8 Hrs
 5. Weather: VMC for T/O, Layered deck between 3000'-FL95, VMC for Landing.
 6. Lowest cloud deck: 3000'.
- A. Brief:

Briefed mission for the Flight within 51N and 51.30N between 004W and 00430 W.

B. Execution:

Departed Exeter at 13:00 and once clear controlled airspace started to climb initially to 6000'. Approaching the planned working area climbed to FL100. Headed SW and worked few Cumulus (stratocumulus) in the west and south west IVO EGHQ. Once complete at FL100, descended to FL40 and made few base of the cloud runs. Then climbed to FL90 block FL120 and did our runs at what Cloud Gods had made available to us. They were not very kind today. Once runs complete descended to FL40 and headed home for a visual straight in runway 8.

Discussion:

Cloud Gods not on our side today.

References were made to "moppet noises in the back" and "melting lines"!

COPE-MED 2013 RF-10 Post Mission Report

August 03, 2013

1. Crew: Bandani, Lasher-Trapp, French, Moser.
 2. Pre-Flight Brief: 1000
 3. Planned T/O time: 1230
 4. Flight Time: 3.9 Hrs
 5. Weather: VMC for T/O, Layered deck between 2500'-FL220, VMC for Landing.
 6. Lowest cloud deck: 2500'.
- A. Brief:

Briefed mission for the Flight within 51N and 51.30N between 004W and 00430 W.

B. Execution:

Departed Exeter at 12:30 and once clear controlled airspace started to climb initially to 6000'. Approaching the planned working area climbed to FL100. Headed SW and worked numerous Cumulus in the west and south west IVO EGHQ. Established in the working area continued the runs in conjunction with the FAAM jet C/S "Metman1". Runs were done between FL100 and FL170. Once runs complete at FL170 descended to FL60 and headed home for an ILS 26 recovery.

Discussion:

Good science today but we weren't punching 15m/s updraft.

Good contrast with clouds we worked yesterday.

N2UW Daily Operations- COPE-MED

Date: 3 Aug 2013 (all times UTC)

Flight Number: RF10

Name: Sonia Lasher-Trapp

Crew:

Bandani, Lasher-Trapp, French, Moser, Dave L at Davidstowe

PLANS

Proposed takeoff 1130 UTC, transit at 10,000 ft toward Davidstowe, working lines of clouds at the newer end of any cloud lines between there. BAE takeoff at same time, but we'll do few cloud base passes before they arrive to intercompare drop concns there, at 3000-4000 ft or so. Then we'll immediately ascend to -5 °C level first near cloud tops, then upward to -8 °C, -10 °C, -12°C, etc. near newer cloud tops. BAE will sample 0 °C level well today so no need for us to sample there. Winds are WSWly with random clouds forming before takeoff, and clouds starting to bubble at Exeter as well.

BAE ended up taking off early, and we tried to take off at 1115 UTC accordingly, but we had problems with the CIP (just needed a reboot) that delayed takeoff till 1131. WCR briefly went out once we were in the air but power source restart fixed the problem.

Radar guidance upon takeoff was to head to E2, with line starting to form there and reaching to H3, but other cells in vicinity randomly spaced. BAE was working cloud bases when we arrived—1000-1200/cm³. 2UW starting sampling at the -5 °C level as approached E2, kept drifting NE to follow the tops, then headed back SW to catch younger clouds and repeated this several times. Later in the flight (~ 1448 ?) we were working the tops of the same clouds that the BAE was sampling beneath us, particularly some of the late cloud complexes we were sampling.

FLIGHT NOTES

1131 Takeoff. Radar reports nice line of clouds between E2 running to H3, so we'll head there.

1135 passing through some clouds as we ascend; cloud bases near Exeter about 2900 ft and ~ 11°C. Many clouds in all directions during our transit. Near Eagle Scout tops reaching above 0 °C.

1140 another cloud pass during our transit, with top likely around -5 °C. Heading to E2.

1147 Requesting block 10-15 kft at E2.

1148 Climbing to 11.5 kft T= -5 °C. Davidstowe radar says tops in E2 near 15 kft. Climbing

to hit cloud tops at 13 kft ~ -8 °C.

1200 Skimmed cloud top.

1201 cloud passes at 14.5 kft

1202 cloud pass with lots of small (200 um) ice and a little graupel, 3 m/s updraft. We see some ice remnants from other clouds off our left wing that may be contaminating this cloud.

1204 cloud pass near cloud top at -10 °C. Lots of WCR attenuation below indicating high liquid water content below; 5 m/s updraft.

1207 Lining up on next cloud at -10 °C. BAE reports cloud base number concentrations 1000-1200/cm³ in this area.

1208 2nd pass through that cloud perpendicular to first, on upwind side.

1216 at 15 kft to hit cloud tops at -12 °C. Worked here a little while, but then clouds quit rising to our altitude, so descended to 13 kft at -8 °C.

1224 cloud pass at 13,000 ft near fuzzy cloud top. Had lost of 100-200 um ice particles.

1226 cloud pass right at cloud top

1227 another cloud pass at -7 °C.

1230 cloud pass through isolated turret along direction of wind at -12 °C.

1233 2nd penetration of that cloud again at -12 °C, but now perpendicular to wind

1235 skimmed cloud top of new cloud at -10 °C

1236 requesting 13-15 kft block

1238 tried to pass through that cloud again but top fell below us (will see it on WCR)

1240 cloud pass along the wind right along fuzzy cloud top

1242 cloud pass with 3 pictures as we approached it, one shown below (not positive this pic was of this cloud—check against 2UW video later):



1247 2nd pass through that cloud with top overhead—10 m/s updraft

1249 we've been following the cloud tops and thus working our way NEward. Davidstowe guidance suggests going back to D2 where BAE is working so we'll go that direction.

1254 passes right at fuzzy cloud tops in transit to D2 with line heading toward F3.

1302 cloud pass at -8 °C about 1000 ft below cloud top, heading NE along line

1307 pass 1000 ft below cloud top at -8 °C with no ice and 2.5-3 g/m³ lwc

1309 near top at -8 °C with no ice or graupel

1310 pass near cloud top at -9°C, some graupel, 3 g/m³ lwc, likely 1000 ft below cloud top

1313 cloud pass ~ 500 ft beneath cloud top at -11 °C with lots of graupel

1315 cloud pass near cloud top; older and higher reflectivity below than previous cloud

1320 pass near fuzzy cloud top

1322 pass near fuzzy cloud top

1324 lots of ice blowing around near clouds, so moving toward SW (D2 area) toward younger clouds. Took 3 pictures of the cumulus field here.

1330 right at cloud top at -11 °C; over 2 g/m³ of lwc here

1335 right at fuzzy cloud top

1337 near fuzzy cloud top

1339 cloud pass at 15 kft probably 1000 ft below cloud top at -11 °C

1340 cloud pass near cloud top; 3 mm graupel. Requested block 13-16 kft.

1343 cloud pass at -12°C probably 1000 ft beneath cloud top; 4 mm graupel and 10 m/s updraft

1349 cloud pass at -10°C near cloud top

1351 cloud pass at -11°C right at cloud top. Picture of this one, perhaps?



1353 cloud pass at -11°C right at hard cloud top

1354 cloud pass at -12°C right at fuzzy cloud top

1357 cloud pass at -11°C near cloud top. BAE wanting to work higher, so we released lower part of our block and now can only work 15-16 kft.

1400 cloud pass near fuzzy cloud top

1403 cloud pass right at cloud top. Bimodal drop size disbn- peaks at 5-10 μm and 40 μm .

1407 requested 16-18 kft block so BAE can continue to work up to cloud tops. We'll do radar study over the tops of the clouds for entrainment data

1412 cloud pass of very isolated cloud at -14°C right at cloud top but it may be collapsing. Graupel signature on radar and lots of attenuation.

Now lining up and flying above cloud tops forming the line to get good data for cloud top entrainment.

1417 took picture of BAE outside our window and beneath us (time approximate):



1423 flying over the tops of nice new cloud complex to get radar data on it

1426 now back through the tops of that complex, right at cloud top!

1428 back through that complex a second time, but just skimmed the cloud top as it was collapsing. Another picture here (I think it was this cloud).



1430 back through that complex again (3rd pass)

1432 cloud pass through new turret at -13 °C

1434 back to that old complex with fuzzy tops (*note: not sure if this is with respect to the pass at 1432, or 1430*)

1438 back to that old complex again with **very** fuzzy tops

1439 we've worked our way NE again chasing the cloud tops ascending to our level, so

we'll move SW again to catch some new turrets. Alan B notes that latest sonde shows more stable layer at -10C, which may be why we're not getting many new turrets here.

1443 passing through old ice en route to new turrets

1444 cloud pass near fuzzy cloud top

--passing over cloud tops while scanning with WCR—

1448 cloud pass right at cloud top through cloud previously scanned – think BAE was working this cloud or one near it below.

1450 2nd pass through that cloud at right angle to 1st pass

1455 pass through fuzzy (dead) cloud tops

1458 no more suitable targets and nearly out of time, so heading back to Exeter. Took two cloud pics as we were leaving... showing how “messy” it was getting up there.



COPE-MED 2013 RF-09 Post Mission Report

August 02, 2013

1. Crew: Bandani, Plummer, French, Moser.
 2. Pre-Flight Brief: 1100
 3. Planned T/O time: 1300
 4. Flight Time: 3.8 Hrs
 5. Weather: VMC for T/O, Layered deck between 2500'-FL220, VMC for Landing.
 6. Lowest cloud deck: 2500'.
- A. Brief:

Briefed mission for the Flight within 51N and 51.30N between 004W and 00430 W.

B. Execution:

Departed Exeter at 13:15 and once clear controlled airspace started to climb initially to 6000'. Approaching the planned working area climbed to FL100. Headed SW and worked numerous Cumulus in the west and south west IVO EGHQ. Established in the working area continued the runs and then descended to FL40 for multiple base of cloud runs. Once complete worked our way up to FL 150 for multiple runs between FL100 and FL150. Once runs complete at FL150 descended to FL70 and headed home for a visual 26 recovery.

Discussion:

“Best day yet!” Ice must be a good thing...

COPE-MED 2013 RF-08 Post Mission Report

July 29, 2013

1. Crew: Bandani, Lasher-Trapp, Oolman, Moser.
 2. Pre-Flight Brief: 0900
 3. Planned T/O time: 1100
 4. Flight Time: 3.7 Hrs
 5. Weather: VMC for T/O, Layered deck between 1500'-6000', VMC for Landing.
 6. Lowest cloud deck: 1500'.
- A. Brief:

Briefed mission for the Flight within 51N and 51.30N between 004W and 00430 W.

B. Execution:

Initial take off time was pushed to the right for a 1230 take off. Departed Exeter at 12:40 and once clear controlled airspace started to climb initially to 6000'. Approaching the planned working area climbed to FL170. After finding the 0 degree isobar descended to FL 95 headed SW and worked numerous Cumulus in the west and south west IVO EGHQ. Continued the runs and work our way up to FL 155. Once runs complete at FL155 descended to FL70 and headed home for a visual 26 recovery.

Discussion:

PI's comment "Great Science day!"'nough said.

N2UW Daily Operations- COPE-MED

Date: 29 July 2013 (all times UTC)

Flight Number: RF08

Name: Sonia Lasher-Trapp

Crew:

Ahmad, Lasher-Trapp, Oolman, Moser, Dave L at Davidstowe

PLANS

Proposed takeoff 1130 UTC, transit at 17,000 ft via North of Dartmoor (because of danger area over it) and go toward Davidstowe, working lines of clouds at the newer end of the cloud lines between there and Fowey. Because our takeoff is earlier than BAE, work at 0°C level first near cloud tops, then ascend to -5 °C, -8 °C, -10 °C, -12°C, etc. near newer cloud tops. BAE wouldn't be on station for cloud work until 1300 UTC (and this was actually delayed too). Winds are W/SWly with cloud lines forming SW-NE. Lightning was deemed a threat because several of the lines had had a history of lightning strikes earlier in the day.

Davidstowe radar provided guidance and BAE was working similar clouds about the last hour of our flight. Clouds continued to develop along the line with its spine over the peninsula but random clouds developed into big storms, so we ended up flying a "figure 8" for a while around two storms, penetrating the smaller clouds in between them. Aircraft maneuverability was an issue as we couldn't go but a mile or two off the Southern coast due to ATC restrictions.

Should be a good COPE case! Unsure at this point of how much precip was falling at the ground, but never saw/experienced any lightning. The two storms around which we were circling were very persistent and appeared to be rather stationary from the air. Note too how low the freezing level was on this day-- ~ 9300 ft, compared to two weeks ago during high pressure when this level was at least 2000 ft higher (and those clouds then had much higher lwc at freezing level).

FLIGHT NOTES

1138 Radar reports nice line of clouds between E2 running to K6 with new cells SW of E2, so we'll head there.

1142 UTC takeoff and ferry toward E2 at 17,000'. Radar reports echo heights in E2 about 12,000' and we'll make our target now D2.

1200 requested and granted 9500'-11,500' block over D2. Descended to 9500 ft (0°C) to pass through about 5 cells that were shallower on the SW edge of the line. Drop number concentrations ~ 300-400/cm³, 150 mm drops on CIP, 5 m/s updrafts and max L ~ 2

g/m³. Took two pics of leading edge of line in D2 (one shown below).



1218 Cloud passes through this same area at 11,000 ft (-3°C) along spine of line. Some had updrafts 11 m/s with lwc exceeding 3 g/m³.

1224 Ascended to 11,500 ft to be right at cloud tops (-4°C). Several cloud passes at this altitude right at cloud tops, but last one at 1228 might be about 1000 ft below. I think we're in section E2.

1232 Requested altitude block 11.5-13.5 kft and ascended up to 12.5 to make a pass near cloud top in our area.

1237 Passed again through that same cloud at 13.5 kft (-8°C) and found ice.

1240 Nice pass right at cloud top at -8°, 12 m/s updraft. Now requesting block 13.5-15.5 kft.

1245 ascent to 15 kft (-12 °C)

1247 cloud pass at 15 kft (-12 °C)

1251 BAE takeoff and will do 30 min of aerosol work.

1300 descended to 14 kft to hit cloud top but turret was rather dead at -9 °C. Now granted block 11.5-15.5 kft.

1313 cloud pass at -8 °C

1321 several passes near cloud top at -7 °C (12,000 ft)

1325 through some more cloud tops at -7°C but these are mostly dead

1335 lining up to do along wind transect of several clouds at -5 °C level, heading west

1337 the along wind transect didn't quite work out; maybe got one turret pass along wind, but second at this time was cross-wind instead.

1342 cloud pass right at cloud top at -6 °C

1348 cloud pass right through a fuzzy (mostly dead) cloud top at -6 °C, by the time we reached it. Been doing this "figure 8" pattern to circumvent the two big storms along this line, working patches of ascending turrets in between.

1354 flying East along line of clouds with tops mostly below our level, but should yield some good radar/dual-Doppler info for entrainment

1400 ascending up to 13 kft to hit cloud tops of new cluster

1406 cloud pass at -8 °C but cloud was growing so quickly that we hit it maybe 1000 ft below top

1410 good cloud pass right at top at -9°C

1412 released lower part of our block so BAE can ascend when they want to—we'll work 13.5 to 15.5 kft. Ascending up to 14.5 kft for the next cloud pass at -10 °C.

1420 ascending up to 15.5 kft for this next cloud pass at -12 °C

1430 descending down to 14 kft as no new turrets to work at -12 °C. Some turrets are going much higher than this but we don't want to work them due to lightning threat, as well as our scientific objectives are met by working clouds with max tops ~ -12C.

1433 Flying at -9 °C level but this is right above cloud tops. Not much coming up to -12C level right now.

1435 Heading to F2 on grid, as development looks more favorable there for our sampling

1439 cloud pass right at cloud top at -9 °C

1440 right at hard cloud top at -9 °C

1444 Planning to pass through that same previous turret at 15.5 kft. took 3 pictures as we approached it, one shown below:



1448 Cloud pass through it at -12 °C level but cloud top was far above by the time we got there. This pass had lots of ice and 15 m/s updraft.

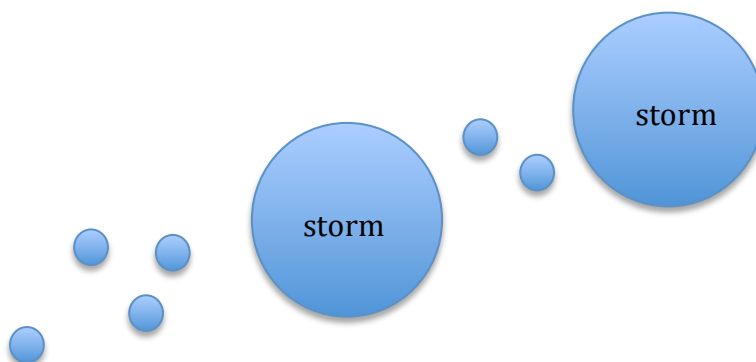
1450 Now moving to K5/L5 because clouds along the line were either too small or too big to sample.

1454 cloud pass near cloud top at -12.5 °C

1456 lining up for final cloud pass at this level, but ATC made us divert off of it.

1500 Out of time and heading home.

During much of this flight, we were working around two storms, alternating working the smaller new turrets coming up to our level, kind of like this I think:



COPEMED13 (RF08) 2013-07-29

Crew: Ahmad Bandani, Sonia Lasher-Trapp, Larry Oolman, Daniel Moser

Summary: Looks like a good day for convection. Mission with the 146. This is the second day where the PXI came up with two amber lights for the user status. Cycled the power.

- 1142 Take off, Applanix failed. Climb to 17,000 ft
- 1152 0.2 gm/m³ noise on lwc100, slave coil or beta?
- 1207 At 9,500 ft, T = -1 C, winds 245 @ 28 knots. 200 m above a thin stratus layer
- 1217 At 11,500 ft. T = -4.
- 1233 Climb to 12,500 ft
- 1235 Climb to 13,500 ft, T = -8 C, winds 245 @ 32 knots
- 1247 At 15,500 ft
- 1257 Descend every few passes.
- 1258 Switched to H1V1 radar mode
- 1336 At 11,500 ft. Start working up again
- 1421 At 15,500 ft.
- 1500 Head home
- 1503 Turn off radar and lidar
- 1519 Land

COPE-MED 2013 RF-07 Post Mission Report

July 28, 2013

1. Crew: Bandani, French, Oolman, Plummer.
 2. Pre-Flight Brief: 1100
 3. Planned T/O time: 1230
 4. Flight Time: 3.9 Hrs
 5. Weather: VMC for T/O, Layered deck between 1200'-6000', VMC for Landing.
 6. Lowest cloud deck: 1200'.
- A. Brief:

Briefed mission for the Flight within 51N and 51.30N between 004W and 00430 W.

B. Execution:

Departed Exeter at 12:40 and once clear controlled airspace started to climb initially to 6000'. Approaching the planned working area and while climbing to FL170 it became apparent the clouds were not the right Cumulus. So we tracked SW for better Cumulus. Once we found the right Cumulus commenced our runs at FL170; IVO EGHQ at first and then tracked NW towards CVR VOR. Following that once again we tracked back SW and worked along the coast and few miles off shore. Runs were made between FL090 and FL150 throughout the SW portion of the working area. Once runs complete at FL150 descended to FL70 and headed home for an ILS 26 recovery.

Discussion:

PI made the following comments;

-“First time seeing non-vigorous Cumulus but very good science day.” We did however pick up ice at FL120!

-“Best flight to date!!”

COPE-MED

RF07 (July 28) Flight Notes-Jeff French

Crew- A Bandani, J French, L Oolman, D Plummer

Prior to flight:

Forecast is calling for convection through the peninsula—weak in the morning but becoming organized and stronger by the afternoon. UKV suggests clouds will form on south to north lines—and individual clouds should advect to the north. UKV also suggests several lines, greatest convection over center of peninsula, clouds grow deeper and more precip as they advect north.

Plan to takeoff at 1130 Z and -146, after re-fueling first at Exeter will take off at 1200Z. We should have ~45 minutes on station to work clouds prior to arrival of -146

10Z sounding from Davidstowe shows much lower significant levels (more along the lines with climatology) with 0C at 9 kft, -5 at 11.5 kft, -10 at 14.5 kft.

11Z radar hsd showers over all of Peninsula, showing little or no organization. Davidstowe folks estimate the highest tops to about 6 km, -20C.

Plan is to take off to west, towards Davidstowe, climbing to FL170—get look around and guidance from Davidstow then descend to about 9 kft (0 C level) to begin targeting clouds. Davidstowe suggests we may be working in SW region again.

Flight: (all times in this section are UTC – ALSO all altitudes are **pressure altitude and will be different than gps altitude in data file**)

1143Z Wheels up

Pass through cloud on ascent out of Exeter, before reaching Dartmoor. Convective cloud base is about 2500'

On climb out, 0 C level appears to be at about FL096.

1203 at FL170—Davidstowe suggests working cells in F3 grid—we transit over at FL170 then descend once we arrive in grid.

On descent, note a thin stratus layer around FL095/FL100, decide to say at FL105 to keep above stratus and improve visibility. This corresponds to about -2C.

1215 Pass1a at -2C, no very vigorous, 1-2 m/s, 1-1.5 g/m3

1218 Pass1b (same cloud) at -2C, less vigorous, mostly down, slightly less LWC – decide to target different turret

1224 Pass 2a, -2C, 1.5-2 g/m³, solid 5 m/s updraft, no step in T trace. Some rain?

1228 Pass 2b, -2C, same CLWC and updraft, again no step in Temperature. Move to new turret

1234 Pass 3a, -2C, 1.5 to 2 g/m³, ~3 m/s updraft, sharp entry edge to the cloud, T is negatively buoyant?

1237 Pass 3b, -2C, slightly less lwc and weaker vertical velocity

1238 clouds are a bit higher, we are under tops of most, climb to FL120, -4C

1240 Pass 1a (at new level), cloud top a bit above us (no good estimate...), vertvel mostly down, ~1 g/m³

1244 Pass 1b (same cloud), half the LWC as last pen, weak vertical (some up...) graupel on CIP?

Work new cloud

6 passes through same cloud with quick turnaround between

1256 Pass 2a 2 m/s up, 2.5-3.0 g/m³

1258 Pass 2b 4 m/s up, 3 g/m³

1300 Pass 2c 4 m/s up, 2.5 g/m³—negative buoyant in T

1301 Pass 2d looks like cell may be dying? 2 m/s, 2.5 g/m³,

1303 Pass 2e, definitely dying, all downdraft, still 2 g/m³

1305 Pass 2f, last pass through, 5 m/s down, spike of 1 g/m³

Work new cloud—move to gridpoint J4 (we end up working in that general area rest of the day)

3 passes through same cloud—first is right at top

1321 Pass 3a, 1 m/s in center, -2 m/s in both edges, lwc ~1.4 g/m³

1322 Pass 3b, 1.5 m/s in center, -2 m/s in both edges, lwc ~1.2

1324 Pass 3c, vertical vel mostly down, still 1.25 g/m³

Move to new cells

3 passes through same cloud/cluster of turrets...

1330 Pass 4a, 1.5 m/s up, 2 g/m³

1332 Pass 4b, more turbulence, maybe a couple of turrets together? 1 m/s up, 2 g/m³

1334 Pass 4c, 2.5 m/s, 2.5 g/m³

Decide to step up to -6C (FL135)

1340 Pass 1a- isolated turret, all down, 1.5 m/s, 0.5 g/m³ – look for another target

1347 Pass 2a 1.5 m/s up, about 1 g/m³ lwc – maybe ok, near top

1349 Pass 2b dying on this pass, all down -2 m/s, <1 g/m³ –look for another target

1358 Pass 3a 2.5 m/s up, 1.4 g/m³, good penetration

1401 Pass 3b two turrets together? Down draft in one (-2 m/s) updraft in other (+5 m/s) w/ 1.5 g/m³ in strongest updraft.

1403 Pass 3c still two turrets or up/down couplet..., +5 m/s and -3 m/s, lwc ~1 g/m³

1406 Pass 3d cloud is a mess, several 3-4 m/s up, several spikes of lwc ~1 g/m³

Climb up to FL 150 (highest for the day), -9C, end up working several clouds—at this time clouds are drifting to the north very quickly—and as they move north they move into a broad shield of ice stratus (blow off from higher clouds way off? Advecting in? try to look for clouds south of this stratus, but not a lot of targets---this will make analysis difficult—but hopefully ice stratus will show up on WCR?)

1409 Pass 1a (same cloud as last four pens below), completely glaciated, virtually no lwc, very weak vertical motion

1413 Pass 2a, some up, right at top, very little lwc

1416 pass 2b, still some up, mostly ice, very little lwc

1424 – 1433 several penetrations in and around turrets in the same general cluster—all have weak vertical motions +/- 1 m/s, generally <0.5 g/m³—tops ~500 ft above us

1436 penetrate fairly vigorous turret, 1 g/m³, glaciated when we turn back

1435 – 1600 generally wallow around looking for targets, see a few things penetrating our altitude but almost everything is well below us. We hit a few cloud, but nothing with much vigor—clouds are glaciating very quickly once they get to this level—or maybe even as they get to this level.

1508 decide to head back for the day.

1530 wheels down

Post flight:

No known instrument problems.

A decent data set—reasonable (loose) coordination with the -146; at times we were in the same cluster, at other times not.

There was no organization in the convection at all. This made things difficult, especially higher up where there were significantly fewer targets to choose from. Clouds were not vigorous at all—you could not visually see clouds rising, they all looked a bit soft—even the “growing” turrets. They seemed to glaciate quite fast above -8 C or so, I think.

COPEMED13 (RF07) 2013-07-28

Crew: Ahmad Bandani, Jeff French, Larry Oolman, Dave Plummer

Summary: Looks like a good day for convection. Mission with the 146.

1143 Take off, Applanix good.

1159 At 17,000 ft

1210 Descend to work cluster that was reaching about 16,000 ft.

1215 At 10,500 ft, just above a diffuse stratus deck. T = -2 C, winds 200 @ 28 kt.

1219 Cloud pass, weak vertical velocities.

1234 Move back on shore. Cloud with 2 gm/m³

1238 Climb to 12,000 ft.

1245 Seeing ice in cip images. LWC < 1gm/m³

1257 New cloud to north in K7

1258 Updraft to 8 m/s, lwc to 3 gm/m³. T = -4 C, 12,000 ft.

1319 New cloud at 12,000 J4/5

1336 Climb to 13,500, T = -6.5 C, winds 200@30 kt

1347 Continuous radar echoes up to 4 km above us. Seeing splashes for ice particles on cip

1348 Move out from under upper stratus deck

1407 Climb to 15,000 ft, T = -10 C, winds 200 @ 35 kt

1505 Heading home

1511 Turn off radar and lidar.

1529 Land

COPE-MED 2013 RF-06 Post Mission Report

July 27, 2013

1. Crew: Bandani, French, Oolman, Moser.
 2. Pre-Flight Brief: 1130
 3. Planned T/O time: 1300
 4. Flight Time: 2.4 Hrs
 5. Weather: VMC for T/O, Layered deck between 1500'-6000', VMC for Landing.
 6. Lowest cloud deck: 1500'.
- A. Brief:

Briefed mission for the Flight within 51N and 51.30N between 004W and 00430 W.

B. Execution:

Departed Exeter at 12:50 and once clear controlled airspace started to climb initially to 6000'. Once established in the working area climbed to FL220 to start the sounding and descended to 1000' (below FL40 in VMC) at 1000fpm in the working area. Sounding complete climbed to FL105 and started to do the Cumulus run throughout the working area, shortly thereafter was directed by ground based researchers to head for Newquay and few miles off shore to chase Cumulus. Once runs complete at FL105, descended to FL40 and made couple of passes at FL40 w/in the same Cumulus. Once complete climbed back to FL 105 and headed home for an ILS 08 recovery.

Discussion:

Weekend flying is like night flying....very quiet!

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RF06 (July 27) Flight Notes-Jeff French

Crew- A Bandani, J French, L Oolman, D Moser

Prior to flight:

Forecast is calling for MCS to advect from S to N across eastern portion of peninsula. Earlier forecasts were calling for system to be too far to the east, but forecast issued evening before and morning of had a lot of disagreement in models. Timing, however, was pretty consistent in models. We expect (hope?) that we can target western edge of MCS, maybe hitting new growth on far western side. This is NOT a good COPE case, but possible target of opportunity. BAE-146 is sitting this one out.

1130Z – load onto aircraft in light to moderate rain. Lighter skies can be seen to the west and darker to the east. Radar echoes are suggesting that movement maybe further to the east that what we can work (up against flyway and farther east).

Plan for takeoff at 12Z, but we are ready to leave so roll out just a bit early.

LWC100 was 're-fixed' prior to flight. Several loose/bad connections within housing and the element was changed.

Flight: (all times in this section are UTC – ALSO all altitudes are **pressure altitude and will be different than gps altitude in data file**)

1149Z Wheels up

On climb out of Exeter it appears the convective cloud base is between 4500 and 5200 ft, a lot of variation with some scud clouds, raining heavily at points.

In stratus clouds at 6000 ft

Climb up to point east of Davidstowe, then in race track pattern conduct a sounding from FL220 down to lowest possible. We were able to hit 1000 ft AGL at bottom of sounding as we could do the lowest part in a cloud 'hole'. Sounding looked significantly different (for moisture profile) than ascent out of Exeter. Maybe in part because we were going out of our way to avoid clouds, maybe because a lot of horizontal variability?

OC level is about 10500' from sounding, -6C is 13000'

Two stratus layers noted in sounding—one between 6 and 8.5 kft, and another from 15-16 kft to ~33kft (based on WCR). Lots of ice hanging around up high.

1240 sounding complete, decide to climb to FL105 and look for targets. Davidstowe suggests targeting cells to SW—clouds back towards Exeter are generally too far east, too messy, and larger ones contain lightning.

1300 – 1320 made several (7 -8) passes at OC level in cloud that was north of coast (3-4 miles offshore?). Cloud tops were just at this level. Clouds were not very vigorous—look to be negatively buoyant (or only very weakly positive at best)—but plenty of LWC ~ 2 -3+ g/m³

1325 drop down close to cloud base to penetrate and measure droplet concentrations.

1325 – 1332 make 2-4 penetrations a bit above cloud base (at 4 kft—actually 1500' *above* base).

1333 Decide to give up and go home. These clouds are not vigorous, not growing, moving to far off shore and no other targets from Davidstowe.

Post flight:

LWC100 data looks good. Apparently that problem is fixed. No other known instrument issues.

A bust of a flight for the project. MCS was too far east and it was too messy to work around anyways. No other convection in area. We knew this was marginal going in and it didn't disappoint.

COPEMED13 (RF06) 2013-07-27

Crew: Ahmad Bandani, Jeff French, Larry Oolman, Daniel Moser

Summary: Western periphery of MCS moving up from France.

1148 Take off, Applanix good. Climb to 22,000 ft.

1213 Start down sounding

1236 At 1500 ft, done with sounding.

1246 At 10,500 ft. Temperature is 0 C.

1300 Start cloud penetrations. Droplet concentrations around 350 cm^{-3} . LWC up to 2.5 gm/m^3

1320 Descend to 4000 ft for cloud base runs

1325 Cloud penetration. From lidar, cloud base about 500 m below.

1333 Climb to 10,500 ft and head back.

COPE-MED 2013 RF-05 Post Mission Report

July 25, 2013

1. Crew: Bandani, Leon, Oolman, Plummer.
 2. Pre-Flight Brief: 0930
 3. Planned T/O time: 1100
 4. Flight Time: 3.7 Hrs
 5. Weather: VMC for T/O, Layered deck between 3500'-6000', VMC for Landing.
 6. Lowest cloud deck: 3500'.
- A. Brief:

On 07/24/2013 met with BAE-146 crew call sign "Metman1" and discussed in detail our game plan to de-conflict while conducting simultaneous flight profiles within and above the same Cumulus cloud. Altitude separation and radio communication was the method chosen for our purpose and with all parties clear and satisfied concluded our brief. This morning briefed mission for the Flight IVO Davidstow airfield.

B. Execution:

Departed Exeter at 11:15 and once clear controlled airspace started to climb initially to 6000'. Once in the working area chased the Cumulus throughout the working area between 6000' and 11000'. With guidance from the researchers at Davidstow through our chat line performed multiple runs above and through Cumulus in the working area. Once "Metman1" was established in the working area through our previously briefed altitude de-confliction arrangement and once inter plane communication was established we started our multiple runs through and above the cumulus working with our good friends from Canfield. PI satisfied; departed the area and returned to Exeter.

Discussion:

Satisfied Customer!

Good to be back flying in 'ol Blighty again.

Our mighty stead N2UW is tired.....but some TLC should do the trick, I hope!

-

COPEMED13 (RF05) 2013-07-25

Crew: Ahmad Bandani, Dave Leon, Larry Oolman, Dave Plummer

Summary: Fly shallow convection over Cornwall.

- 1018 Take off, Applanix good
- 1030 LWC100 looks mostly good, but has spikes to 0.3 gm/m^3 . Beta?
- 1041 Cloud passes at 8,000 ft
- 1052 Climb to 10,000 ft
- 1103 Heading to F2, climb to 10,500 ft to get over danger area.
- 1127 At point F2
- 1213 Scrambled beams for unknown time.
- 1225 Turning to SW
- 1229 Cell through our altitude (10,500 ft) off left wing
- 1235 Turning 180 towards NE and offsetting to SE over taller clouds
- 1308 Climb to 11,000 ft
- 1354 Land

Date: 07/19/13

Flight: Flight 4

Crew: Drew, French, Oolman, Korolev

Flight time: 3.4

Objective: Work developing clouds near Davidstow.

Planned: 11:30Z takeoff. Climb to FL 120 for transit to the area. Then pick out a work area and sample clouds. No need for sounding. Planned key altitudes are FL120, FL150, FL170. Many military exercises taking place (Thursday War). Most danger areas in vicinity were active except the big ones off the north coast. London Mil advised they may not be able to handle us above FL 190 after Western Radar closed.

Actual: Decided to delay the departure (awaiting cloud). Departed EGTE climbed to FL 120 was handed off to Western Radar. Found isolated cloud area just northwest of D11A/B/C danger areas. Started working area FL 120-160. BAE-146 was right behind us working lower. We requested FL 160-FL200 then asked for FL 180-220 and the BAE 146 used the block up to FL 150. Western Radar handed us off to London Mil right before they closed. BAE 146 did ask London Mil if he could talk to us on the frequency which he agreed (No air-to-air). They asked us if we could move our block up to allow them to get higher. London Mil tried made several traffic calls about each other and then just asked us if we needed them. We replied we did not and they were happy with it. Later, we used chat to ask the BAE146 to allow us to come back down. They gave up the top end of the block so we dropped down to FL 160 - FL 190. Clouds stopped growing so we returned to Exeter.

Tom Drew

University of Wyoming

760-7620

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RF04 (July 18) Flight Notes-Jeff French

Crew- T Drew, J French, L Oolman, A Korolev

Prior to flight:

Forecast shows a few isolated showers over SW peninsula—model suggests location around Davidstowe and around Barnstaple. Plan is to have -146 takeoff at noon local (11 Z) to conduct aerosol run and some cloud base work and for King Air to take off at 1230 local. Timing is a bit uncertain—forcing is rather weak so difficult to predict when things will really get going. In the end, we ended up dealying until 1 PM, in part because not much for clouds, in part because of Mocca aircraft (see note in next paragraph). In retrospect, taking off at 1230 probably would have been good, but either way it worked out OK.

Mocca aircraft was planned to takeoff at noon (local)—turns out it will base at Capital Air to pre-flight etc which created some problems for us. They were utilizing the power cart we needed for pre-flight and stacking planes was quite difficult. In the end we delayed which was good because with the Mocca issues we likely would not have been able to get off the ground by 1230 (local) anyways.

Weather at airport at time of takeoff—clear, hazy—no visible convection. HOT (around 27 C based on TRF during takeoff roll). 8 AM (local) sounding from Davidstowe suggests altitude of 12.3 kft for 0C, 14.8 kft for -5C, 17.2 kft for -10C, and 19.7 kft for -15C

Davidstowe radar reporting small cloud about half hour prior to takeoff—I think they switched to cloud mode on the radar around 1230 local.

No known instrument issues going into the flight.

Flight: (all times in this section are UTC – ALSO all altitudes are **pressure altitude which was up to 500 ft {or more} different than gps altitude**)

1200 Z Wheels up

On climb out note cap and dry air inversion at ~10 kft (around +5 C)

Transit over towards Davidstowe at ~0 C level (12 kft)—upon arrival in grid area note several clouds growing through this level—about 2-3 clusters to choose from—target one cluster and make several passes through the turrets that are growing through our level—

1214 to 1221 make 5 penetrations at 12 kft (~0 C); note 1200+ /cm³ droplet, a few grams liquid, Alexei reports no larger particles on the first few penetrations (maybe some on later???—need to check data—my notes are fuzzy on this....)

After 1221 decide to climb up to ~-5C level as cloud tops are growing a few thousand feet above us—ascend to 15 kft

1225 to 1230 make three penetrations in clouds, right at tops, T~ -6.5C—second pass measure ~18 m/s updraft.

1232—WCR goes down following particularly bumpy penetration (related???) circle out of cloud while Larry works to bring radar back to life (about 10 minutes)

1243 – WCR is alive again!

1246 penetration within about 1000 ft of cloud top—but note that remnants from the earlier growth that we were penetrating 10-15 minutes ago went up quite high (20 kft? Or more??) and glaciated and blew off to side (don't remember direction)—at 1247 we passed through ice particles falling out of blow off cloud...I wonder if any of these are making it into the growing turret. Visually-these ice particles are hard to note—it almost looks like clear air...Can we see them on the WCR?? I suspect so-As Alexei notes them on the CIP and 2DP

1252—penetrate isolated growing cu—near top

Climb 1000 ft in turn to 16 kft. (-9C???? according to my notes—but this seems too cold compared to notes of temperature at 15 kft---need to check data)

1254 – 2nd penetration in same cloud—edges of cloud just beginning to look fuzzy—Alexei notes needles on CIP!!!

1256 – 3rd penetration, cloud is dead and has become fuzzy (wow, that was fast...)

Off to target new growth

125925 – Just over top of growing cell (then through a few others that were behind)—we will try to hit first one on the second penetration as it passes our level

130130 – 2nd penetration; significant growth since last penetration

1305 – 3rd penetration—cell is starting to die—next target will be new growth on 'shoulder' of this cell

130640 Pass over top of growing cell—cells in this cluster are not making much beyond (or even to) this level—decide to try next cluster over....

131230 make pass right at top (still at 16 kft)

After last pass, -146 asked if we would go higher so we grab block 18-22 kft and climb to 18 to work while they work up to 17 kft.

T at 18 kft about -12.5C (check this in data....)

1315 – 1335 NOTES go fuzzy—busy making penetrations (?) and not taking notes

1337 pass through very top of cloud

1339 2nd pass through new growth

1341 Pass over new growth “shoulder”, within about 500-1000 ft of cloud top—should be a nice penetration

1345 pass through same growth as last penetration, definitely weaker vert. velocities—need to continue to target new growth on should in later penetrations if possible.

1348 pass through new growth (graupel!!)—ice coming from above earlier clouds?

1351 2 passes—first is in new growth, 2nd in ‘old’ growth; graupel in both—must have been initiated from above—ground radar reports high Z’s

1358 lots of ice—large echo in WCR; wx avoidance showing ‘yellow’ echo (moderate)

Cell/cluster is iced out—no apparent new growth coming through—decide to switch to new cluster....

1405 – 1420 lousy notes--- make a few penetrations, never string more than 2 together in same growth— (1407 & 1409 – two passes- first over top, second the turret is dying) (1412, 1415, 1420 – 3<?> passes—cloud appears quite mature—graupel...)

1430 – 1445 everything is looking depressed—cloud tops are no longer coming close to our level—clouds difficult to target this high above cloud. Negotiate with -146 to try get lower block

1450 drop to 16 kft

1453 pass over top of cloud at 16 kft, -8 C, about 1000 ft above tops

1455 2nd pass

1500 pass over isolated cell—not much growth

Decide to call it a day—cloud growth is becoming even more suppressed

Post flight:

Upon inspecting data—LWC100 likely lost slave coil while penetrating one of the cells later on (in graupel)

WCR had one crash that took ~10 minutes to recover from.

All in all, a pretty good flight with useful data, I think, from both aircraft. Coordination between aircraft could have been better (but I thought was reasonably good for first flight). We did not use chat between the aircrafts as we should have—it was difficult to tell intentions of the flight scientists on the 2 different aircraft.

At one point -146 went off to work cells around Barstaple and we didn't know they re-positioned themselves...we remained in same grid area pretty much the entire flight.

COPEMED13 (RF04) 2013-07-18

Crew: Tom Drew, Jeff French, Larry Oolman, Alexei Korolov

Summary: First good convection over Cornwall. First flight after reloading RT computer code.

- 1200 Take off, lost Applanix on takeoff.
- 1211 At 12,000 ft, T=0 C, TDP=-14 C, Winds 12 knots @ 60 degrees.
- 1214 First cloud. Updraft 10 m/s, CDP conc > 1500 cm⁻³
- 1222 Climb to 15,000 ft
- 1242 Radar crashed, rebooted.
- 1247 600-800 micron ice particles in remnant of previous cell
- 1249 Precip to ground
- 1251 Climb to 16,000 ft
- 1312 Climb to 18,000 ft, T=-12 C, clouds just reaching our level
- 1413 Baseline shift on LWC100, broken slave coil?
- 1451 Dropping to 16,000 ft. Clouds were all below us. T=-8 C, still above clouds but closer with radar.
- 1507 Heading home
- 1519 Land

Date: 07/10/13

Flight: Flight 3

Crew: Drew, Lasher-Trapp, Oolman, French

Flight time: 3.2

Objective: Work developing clouds in northern Wales.

Planned: 11:30Z takeoff. Climb to FL 85 for transit to Wales. Then pick out a work area and sample clouds. Do a sounding from 1000 ft. to FL240 either before or after cloud work.

Actual: Many military exercises taking place. Most danger areas in vicinity were active. Departed EGTE climbed to FL 85 (and later FL70) enroute to Wales. Exeter handed me to Cardiff, and then to Aberporth Radar who was going to hand me to Valley Radar, but then decided we would be working in his area. Picked an area of developing clouds, I reported we would be working in that area FL 100-140. Fairly quickly decided to go to FL 140 and remained there for the rest of the cloud work. Made repeated runs through what seemed to be two separate sustained areas of buildup. Radar made repeated traffic calls for fast moving aircraft. For sounding, was handed to London Mil who climbed me to FL240 and then handed me back off to Aberporth after we reported below FL 190. Continued the decent to 1000 ft. AGL making a 180 turn at the south end to remain in the work area. Climbed back up to FL 140 and then decided to return to Exeter. Descended to FL 80 for return to Exeter.

Tom Drew

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N2UW Daily Operations- COPE-MED

Date: 10 July 2013 (all times UTC); Flight Number: RF03
Name: Sonia Lasher-Trapp

Crew: (pilot, PI, system scientist, observer)

Drew, Lasher-Trapp, French, Oolman

PLANS

Proposed takeoff 1130 UTC to study deeper clouds in Western Wales near Snowdonia. Model forecasts were for chances of showers there, and visible satellite images showed a line of clouds forming where predicted by the model as early as 1115 UTC.

No ground radar support, no local soundings, single-aircraft study. Not expecting that heavy precip will develop, but may be a good entrainment study and precipitation formation may occur. Only prospect for today and next several days.

FLIGHT NOTES

1120 UTC takeoff; ferry toward Snowdonia (NW Wales) at 8500 ft to stay beneath airways. During ascent noted strong inversion at 3500 ft.

1139 already passed above low level clouds that were very shallow fair weather cumuli; their tops were ~ 8200 ft. Right above aerosol layer (visually very hazy). See higher cloud tops ahead—cumuli building in direction of our target area.

1150 cloud pass near cloud top: CDP has 1100/cc; FSSP has 1150/cc, 1.5 m/s updraft, 0.9 g/m³ lwc. WCR has -35 dBZ echo.

1153 passed through 2 clouds 1800/cc! Very continental air here. WCR echo -25 dBZ.

1156 nearly at our target area—radar crashed twice so had to reboot.

1159 cloud pass with cloud top overhead. Several more passes after this one.

1201 Requested altitude block 10kft – 14 kft and was granted so now will ascend.

1205 10kft.

1206 ascent to 12 kft (+1 °C)

1207 cloud pass at 14 kft, Temp < 0 °C, streamers on 2DP (0°C ~ 13 kft)
Line of cloud passes with one top above us at this altitude.

1211 now setting pointers on tallest clouds, still working at 14 kft. Plan to let cloud tops ascend to this level as we continue to work at this altitude. Temp ~ -3 °C. Several more passes, including a second pass through one of the clouds.

1218 turning back to sample last cloud complex again.

Cloud tops collapsing, will keep passing over their tops to understand the entrainment and mixing leading to their demise.

1227 back through the complex again, as new thermals keep rising up through the remnants of the old. No cloud tops ascending above our altitude at 14kft now.

1227 another pass over cloud complex tops that are collapsing

1238 cloud top right at our altitude at -3 °C.

1242 going back over that same cloud

1244 cloud top straight ahead at -3 °C, Jeff noted 2 g/m³ lwc

1246 cloud top above our present altitude of 13.9 kft as we passed through it. WCR sees 0 dBZ echo below= precip!

1253 rigorous cloud with 3 g/m³ lwc at -3 °C. Ice on rear of wings.

1256 Jeff noted small rain or ice particle on CIP.

1300 +5 dBZ on WCR through this cloud

1303 noting precip as these turrets collapse (not as they ascend to our level)

1305 last pass over cloud complex—nothing growing up to our level at this time anymore.

1308 climbing to 24kft to do a sounding in this area on descent. Doing ramps not a spiral for better winds, 1000 ft per min descent.

1322 starting descent for sounding—pressure = 400 mb, ~ -25 °C.

Very light SE winds aloft. An inversion at 600 mb seems to be what limited the cloud tops to our 14 kft working altitude earlier.

Noting a few levels here:

-15 °C → 20.8 kft, -13 °C → 18.5 kft, -10 °C → 17.1 kft, -7 °C → 15.8 kft, -5 °C → 15 kft, 0 °C → 12.2 kft, middle of haze layer ~ 11 kft

*Due to narrow corridor we went one direction for upper part of sounding, then reversed heading to descend rest of the way to keep the data in the vicinity of the clouds we were

working. As we broke through the lower thin cloud layer (had to pass through clouds a few times due to limited maneuverability in this area), we saw the mountains over which we were working, and presumably their heating fired the convection in this area. (Which was also the same location the UKV model predicted the convection.)

1341 requested 12-14kft block to see if any clouds are developing more than they were earlier.

1347 passed through a cloud at +1 °C with 2 g/m³ and WCR echo indicative of drizzle

1351 decided to call it a day as no clouds even ascending to 14kft anymore.

1427 wheels down at Exeter

Summary:

Despite clouds not developing as deeply or precipitating as much as would be desired for a COPE-MED case, we collected a very interesting data set regarding cumulus development and growth through a strong aerosol layer. Note that during the cloud work we kept bouncing back and forth between sampling 2 different cloud complexes, abandoning one as it collapsed and moving back to the other. The distinction isn't clear from my notes above but should be clear from the a/c track. Lidar showed interesting layered waves through the haze layer, perhaps forced by the cumuli ascending through it. Should be a good data set for entrainment and mixing, perhaps even using the aerosol as a tracer somehow. Winds were light aloft and clouds didn't seem to be shearing over at all.

Multiple studies in the literature have modeled this scenario, but no observational study to my knowledge would have the detail that we have here with the WCR, WCL, and cloud passes. Could lead to an interesting case to model. Don't forget about this data set once we get others that meet the COPE –MED objectives more!

COPEMED13 (RF03) 2013-07-10

Crew: Tom Drew, Sonia Lasher-Trapp, Larry Oolman, Jeff French

Summary: Fly line of convection in near the coast of Wales

- 1120 Take off, Applanix good. Climb to 8500 ft.
- 1140 Descend to 7000 under airway.
- 1156 Radar crashed on file change with H1V1 mode. Killed and restarted wcrserv. Crashed again. Rebooted.
- 1159 The radar is restarted.
- 1201 Climbing to 10,000 ft.
- 1208 12,000 ft. T= +1 C
- 1210 14,000 ft. T= -2 C. Above cloud top.
- 1214 Hit the cloud top this time. Lots of fine layering in the lidar.
- 1312 Climbing to set up descent sounding. Switched to 8.3 km mode
- 1322 At 24,000 ft, heading down @ 1000 ft/min
- 1334 19,500 ft, at bottom of thick haze.
- 1341 Done with the sounding. Radar back to H1V1. Climbing to 14,000 ft.
- 1347 Drizzle reaching ground
- 1351 At 14,000. Nothing new to work. Going home.
- 1352 Dropping to 8000 ft to get under flyway.
- 1400 Scrambled GPS signals from military exercise?
- 1427 Land

COPE-MED

RF03 (July 10) Flight Notes-Jeff French

Crew- T Drew, S Lasher-Trapp, L Oolman, J French

Prior to flight:

Forecast showers over Wales. Do not anticipate clouds getting much higher than -10 to -20 C. Single aircraft operations. Not expecting this to be a great flight, but want to work 'kinks' out of the system; try flight patterns, clearances and test the instrumentation.

Plan for 1230 local (1130 Z) takeoff—cumulus clouds show up on satellite about 45 minutes prior to takeoff

No known instrument issues going into the flight.

Flight:

Takeoff ~1130 Z (1230 local) {throughout—all times referred to UTC}

On climb out, note a reasonably strong inversion at 3500 ft. No clouds over SW peninsula, but after traversing the channel, note some small convective clouds over southern Wales with some larger clouds further to the north. Decide to try to work clouds over the northern portion—around Snowdonia(?)

~1145 begin passes at ~FL070—first pass at 1149Z—FL070, 9C, droplets ~1200 /cm³!!, lwc over 1 g/m³. Passed through a few more tops as we continue flight to north—towards main area we want to work.

~1155 WCR server crashed twice—Larry is rebooting Ferret—after reboot, WCR appeared to work fine

1210 in 'area of interest', climbed to FL140 to get to colder portions of cloud—at this level we are just above the tops of many of the clouds—hope to work these as they come up to and pass through our level. -2C

1215 to 1310 – Many passes over tops of individual clouds within cluster. Generally working two clusters, one further north, another further south. Clouds are 'pulsating' with tops ~10 to 14 kft—seldom reaching (or exceeding) our level.

1230 – 1245 – see in WCR some echoes as high as about ~+5 dBZ, generally lower down in cloud, off to the side of the main cores (but main cores are attenuated...). Also, the few clouds that actually penetrate at this level note very high CLWCs—up to 3-4 g/m³ (depending on which probe you believe). High concentrations (>1000 /cm³, as high 1500—again depending on which probe you believe). The CIP

doesn't appear to see any droplets of 100 micron or larger—but need to look at the images very closely once on the ground.

Note—we are seeing very stratiform regions of aerosol from aircraft down to ~12 kft from lidar—clouds are penetrating into these layers and once can easily visualize folding and distortion of the layers. This may be useful to visualize impact of detrainment on surrounding air (dynamics) using aerosol as tracer???

Also—at level of penetrations—it is very hazy—perhaps some elevated humidity (is this regional or due to cloud transport?? I think the former...); this may add to what we are seeing on the lidar?

1310 – decide to break off from clouds and do a sounding—maybe give the clouds a bit more time to grow to colder heights.

Sounding—climb to 24 kft, then down to ~1 kft over surface, then back to 14 kft.

Back at 14 kft, clouds look no more impressive (maybe even less so) than prior to sounding—decide nothing else to do on these clouds thus return home.

1430 Z Wheels down

Post flight:

No known instrument issues.

Case may be interesting from an entrainment/detrainment study with layered aerosol outside of cloud near tops, reflectivities ~-5 -- -10 dBZ at top (use dual Doppler to look at circulations in cloud??); plenty of entrainment in cores; but little evidence for any precipitation formation. VERY high cloud droplet concentrations and copious amounts of liquid water (especially for no precip!). Interesting case—but not a typical “COPE” case.

BTW—aerosol content was expected high because flow was from east—so we were basically downwind of London, Manchester, etc.

Date: 07/09/13

Flight: Flight 2

Crew: Drew, Korolev, Oolman, French

Flight time: 2.3

Objective: Nevzorov TWC Calibration runs, clear air maneuvers, radar circles .

Planned: Originally shooting for 11:00Z takeoff, changed to a 10:30Z takeoff. Western Radar closed at 12:30Z and London Mil said (regrettably) that they may be unable to work us do to intensive military exercises taking place that day. The supervisor seemed quite relieved when I said we could adjust to work with Western Radar. Plan to climb to FL 230 towards Eaglescott. Work between Eaglescott and Davidstow at FL 230, FL130, and 3000 ft. Making five speed changes for 1 minute each. Do Clear air maneuvers. Then complete the rest of the Nevzorov speed runs, finish with radar circles over flatter terrain.

Actual: Departed EGTE step climbed to FL 230 working with Western Radar towards Eaglescott then turned towards Davidstow. Did five (ias) speed changes ~180 (almost) 165, 150, 135, 120 between those two points. Did clear air maneuvers then descended to FL 130. Did five (ias) speed changes 180, 165, 150, 135, 120. Descended to about 3400 MSL (3000 AGL) Did five (ias) speed changes 200, 180, 160, 140, 120. Found a relatively flat area near Davidstow did right circles but had traffic and windmills in area. Decided to do left circles over brown raised area (moore?) Returned to Exeter via Eaglescott (straight in RW08).

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COPEMED13 (RF02) 2013-07-09

Crew: Tom Drew, Alexei Korolev, Larry Oolman, Jeff French

Summary: Calibration flight for radar, winds, and Nevzorov. No 2D-P images, probe connected to the wrong port.

- 1023 Take off, Applanix good.
- 1047 At 23,000 ft. T = -24 C, winds 10 knots @ 80 degees.
- 1049 Start 2 minute legs at indicated airspeeds between 115 and 170 knots
- 1052 Beams scrambled
- 1104 Start wind calibration maneuvers.
- 1125 At 13,000 ft. Vary the indicated airspeed from 190 down to 120 knots.
- 1145 At 3000 ft. Vary the indicated airspeed from 200 down to 120 knots.
- 1206 Radar circles
- 1217 Head home
- 1228 Shut down radar and lidar
- 1235 Land

COPE-MED

RF02 (July 9) Flight Notes-Jeff French

Crew- T Drew, J French, L Oolman, A Korolev

Prior to flight:

Clear air calibration flight—3 primary missions:

1. Nevzorov calibration to determine clear air corrections---3 levels, at each level conduct 5 S/L runs for ~1 minute, each at different flight speeds. Pick levels: 23 kft, 13 kft, 3000 ft AGL
2. Rodi maneuvers, conduct at 23 kft
3. Radar circles at 3000 ft AGL

No known instrument issues going into the flight.

Flight:

Takeoff ~1020 Z{throughout—all times referred to UTC}

On climb out, note a convective BL from surface to about 2500—3000 ft.

Note some bugs on radar—weak (needless to say, but I say it anyways).

1050 to 1103 – 5 legs at FL230 from speeds ~120 IAS to 168 IAS

1105 – 1108 Rodi circle left (yaw)

1109 – 111130 Rodi circle right (yaw)

111245 – 1115 Rodi circle right (speed)

1116 – 1119 Rodi circle left (speed)

1125 to 1138 – 5 legs at FL 130 from speeds 120 to 193 IAS

1148 to 1205 – 5 legs at 3000 ft AGL from speeds 120 to 200 IAS

1208 to 121020 Radar circle right

1215 to 1217 Radar circle left.

Return home

1236 Wheels down

Post flight:

No known instrument issues.

Calibration flight went as planned.

Date: 07/03/13

Flight: Flight 1

Crew: Drew, Lasher-Trapp, Oolman, French

Flight time: 1.5

Objective: Explore cloud working conditions over Davidstow.

Planned: 9:00 AM Takeoff. Climb to FL 180 to Davidstow then spiral down to FL 80 over Davidstow. Set pointer and work back up using pointer.

Actual: Departed EGTE climbed to FL 180 enroute to Davidstow. Spiraled down to FL 80. Set pointer and made repeated passes though it in 2000 ft. increments. Returned to EGTE.

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Daily Operations

Date:

Project:

Name:

Flight Number: (RF = Research Flight, TF = Test Flight, GF = Ground File)

Crew: (pilot, PI, system scientist, observer)

Preflight/Startup Notes: (proposed & actual takeoff time, problems, delays)

Post-flight Notes: (flight notes, in-flight concerns, landing time)

Instrument/Equipment Issues:

COPE-MED (RF01) 03-July-2013

Crew: Tom Drew, Sonia Lasher-Trapp, Larry Oolman, Jeff French

Mission: Fly a line that passed through Davidstow earlier. If the opportunity is available, fly radar calibration circles.

Instrumentation: CDP is removed. 2D-P connected to the wrong port.

0804 Take off, lost the Applanix. Dry layer between 800 and 580 hPa.

0825 Spiral down from 18000 ft over Davidstow. There are no deep clouds, only a low stratus deck and some thin high clouds.

0833 At 8000 ft.

0835 Torque works.

0836 Work upward in block altitudes.

0841 LWC100 reading 0.15 in left turn, check beta on ground.

0857 Radar beams scrambled.

0929 No data on 2DP, check on ground.

0930 Land

COPE-MED

RF01 Flight Notes-Jeff French

Crew- T Drew, S Lasher-Trapp, L Oolman, J French

Prior to flight:

Weak system moved through area previous evening, showers were on radar over night and early morning hours. Radar indicated showers have passed area of interest by takeoff time. Appeared only shallow stratus in the wake of the system. Main purpose of flight is to test pattern and clearances, etc. Also allow us to get our 'feet wet' for using pointer, etc

CDP is not on aircraft for flight

Flight:

Takeoff ~0800 Z (0900 local)

Transit towards Davidstowe at 18 kft, stratus cloud about 1500 ft top (or so...), 0 C level quite high, around 14 kft. Strong inversion above stratus deck ~8 C, and very dry throughout and above inversion

0815 (or so) descend to 8 kft in spiral directly over Davidstowe

0835 set pointer for first "mock" pass at 8 kft

0838 2nd pass at 8 kft

Climb to 10 kft, note LWC100 noise (~0.18) in right bank turns

0843 3rd pass at 10 kft

08?? 4th pass at 12 kft

Climb to 14 kft, during climb get above dry layer—note that the lidar sees elevated return from aerosol/haze above this dry layer.

0854 5th pass at 14 kft

???? 6th pass at 16 kft

Decide to head home—

0916 – for several minutes descend into and fly through stratus with lwc up to ~1 g/m³, some drops on CIP, 2DP not seeing anything

0930 wheels down

Post flight:

Worthwhile test flight..lidar appeared to work well, radar worked well, unable to find a clear area to perform radar circles.

Some question as to whether the 2DP was working, need to test on ground prior to next flight.