

ACLOUD Flight #14 – Polar 6 – 170608

Mission PI P6: Emma Järvinen

Objectives: Co-located flight with P5: satellite overpass and vertical cloud profile over Polarstern.

Crew:

Polar 6	
PI	Emma Järvinen
Basis Data Acq.	Daniel Damaske
PMS	Delphine Leroy
Alabama	Hans Clemen
CVI	Udo Kästner
A + TG	Heiko Bozem
Nevezorov	Dmitry Chechin

Flight times:

Polar 6	
Take off	9:30
Touch down	15:12

Weather situation as observed during the flight (compare to forecast):

The weather forecast predicted slow wind speeds and a layer of broken low clouds in the west and north of the archipelago. The mid- and high-level clouds were predicted to have cleared from the past days. As predicted, low-level clouds were found from Ny Ålesund to Polarstern with only occasional mid- and high-level clouds. The cloud deck was found to be solid until few tens of nautical miles before Polarstern and near Polarstern only a weak and broken cloud layer were observed. Towards the afternoon, the clouds cleared over the open sea.

Overview:

Polar 6 (P6) started before the Polar 5 (P5) and headed towards Ny Ålesund and C1 at an altitude of 4000 ft. The cloud deck began 10 minutes before arriving to Ny Ålesund and to avoid flying in the clouds above terrain, P6 ascended to 4500 ft. Although the first saw tooth pattern was planned to start at C1, it was decided to probe the clouds over the open ocean 10 minutes after passing Ny Ålesund. Before arriving to C1, P6 did one decent through clouds with 200 ft/min. The cloud top was found at 4400 ft and cloud base at 1000 ft. Temperatures were few degree in positive, which resulted in all-liquid cloud phase.

At C1 the P5 was approximately 10 minutes behind, so while waiting to be co-located P6 decided to perform a race track with 2 minute legs at C1. The levels probed were 1800 ft (cloud base at 1700 ft), 2500 ft, 3000 ft and 3400 ft. The cloud was found to consist of multiple layers and the level



Ice edge seen below the cloud layer.

3000 ft was located in between cloud layers. Temperatures were +2°C and the cloud composed of ~10 µm droplets. After the race track P6 and P5 co-located and headed towards C2 at 10:59 – one minute later than planned.

Between waypoints C1 and C2 P6 flew saw tooth pattern. The first descent was with 400 ft/min and the cloud top and base were at 3900 ft and 2600 ft, respectively. Below the cloud base were thin lower clouds approximately at 700 ft. P6 continued to descent to 200 ft. Below the cloud base P6 sampled boundary layer. The ice edge was crossed before the next saw tooth ascent. The next saw tooth pattern was performed over sea ice. The cloud base was at 700 ft and top at 1400 ft. Within this penetration also ice crystals were observed at temperatures around -3°C. The clouds above the sea ice were colder than above open ocean but this day the strong inversion layer was missing.



Patchy clouds near Polarstern.

Temperatures above the cloud top were around 1.5°C. During the next attempt to descent through the cloud the pito-tube started vibrating and the pilots pulled the P6 back up. The reason for the vibration was icing on the pito-tube structures. Altogether 6 minutes were spent above the cloud top to get rid of the ice. During this time, the satellite overpass was missed. After de-icing one more saw tooth descent and ascent were made, which resulted into increasing buildup of ice on aircraft structures and cloud probes. To avoid unnecessary icing the saw tooth pattern was stopped and way to Polarstern was made in clear air at 1200 ft.

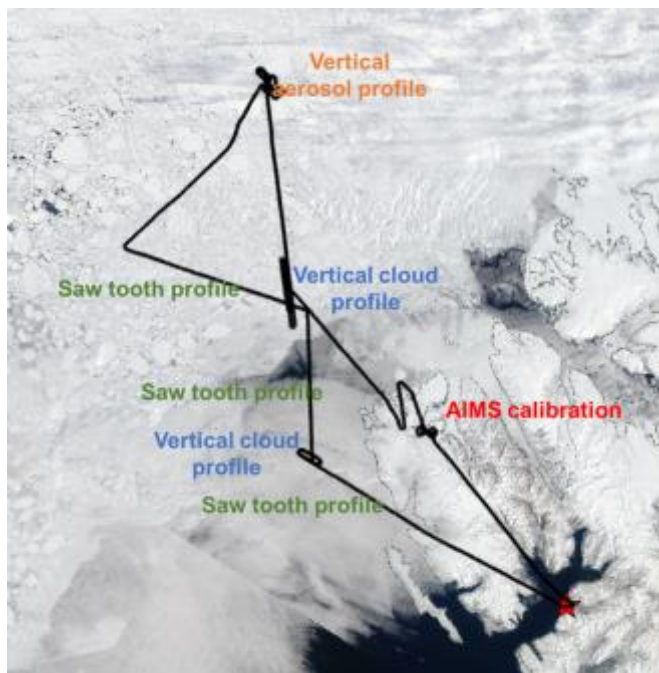
At Polarstern the clouds were broken and thin, so instead of performing a cloud race track near Polarstern we performed an aerosol race track with 1-minute legs and constant ascent with 800 ft/min. The race track started at 200 ft and ended at 12000 ft. After sampling the ceiling altitude 3 minutes, P6 headed towards C1 with a constant ascent.

The cloud deck turned more solid in between Polarstern and C1 and the solid cloud layer offered the change to perform the cloud race track near C2. The cloud top was observed to be at 1400 ft and the cloud base was located at 400 ft. The race track was performed as 8-minute legs with first leg below the cloud base (200 ft), the second at 600 ft and the third at 800 ft. During the third leg, the vibrations in the pito-tube occurred again and weren't avoided even after de-icing above the cloud deck. To avoid damaging the pito-tube the cloud profile was stopped and the coordinates were set to LYR. On the way back P6 sampled the vertical distribution of aerosol by ascending to 12000 ft and maintaining that level for 2 minutes before descending to 8000 ft. At 8000 ft a calibration pattern for the AIMS was performed with jaws at different speeds and circles with different banks.



Solid cloud deck started before C2.

Flight track and pattern:



Detailed Flight Logs:

All times are in local time.

9:30	Take off <ul style="list-style-type: none"> • 4000 ft and 140 kn towards Ny Ålesund
9:48	Cloud deck begins
9:51	Ascent to 4500 ft to avoid clouds <ul style="list-style-type: none"> • some mid-level clouds in sight
9:57	Ny Ålesund <ul style="list-style-type: none"> • cloud top almost at 4500 ft
9:59	To 4600 ft
10:01	Patchy mid-level clouds above
	Saw Tooth Profile in Clouds
10:05	Saw tooth ↓ 300 ft/min <ul style="list-style-type: none"> • Cloud top at 4400 ft (+2°C) • mid-level clouds were above
10:10	Change to 500 ft/min
10:14	Cloud base at 1000 ft
10:14	At 500 ft <ul style="list-style-type: none"> • no precipitation
	C1 Cloud Race Track (2 min legs)
10:18	Climbing to cloud level with 500 ft/min
10:21	Cloud base at 1700 ft
10:21	Level 1800 ft
10:25	Right turn, climb to 2500 ft
11:26	Level 2500 ft <ul style="list-style-type: none"> • small droplets around 10 μm
10:29	Right turn, climbing to 3000 ft

10:30	Level 3000 ft <ul style="list-style-type: none"> • Between cloud layers
10:32	Level 3400 ft (without turn)
10:33	Back in cloud <ul style="list-style-type: none"> • Cloud droplets small, around 10 μm
10:35	C1: Climb out of the cloud
	Saw Tooth Profile
10:36	Above the clouds at 4000 ft <ul style="list-style-type: none"> • Some mid-level cloud right above
10:41	Saw tooth \downarrow 400 ft/min <ul style="list-style-type: none"> • Cloud top at 3900 ft
10:44	Cloud base at 2600 ft <ul style="list-style-type: none"> • Some lower thin clouds ahead (+4°C)
10:47	Top of the boundary layer at 1500 ft
10:49	Thin cloud layer at 700 ft
10:51	At 200 ft <ul style="list-style-type: none"> • Ice edge ahead
10:55	Saw tooth \uparrow 200 ft/min
10:57	Cloud base at 700 ft <ul style="list-style-type: none"> • Ice crystals, needles at -3°C • Droplet sizes around 18 μm
11:01	Cloud top at 1400 ft <ul style="list-style-type: none"> • No ice at the top • Temperature in the inversion layer 1.5°C
11:05	Saw tooth \downarrow 200 ft/min <ul style="list-style-type: none"> • Cloud top at 1500 ft (-4°C) • Big droplets around 25 μm
11:09	Back up due to vibrations <ul style="list-style-type: none"> • De-icing at 2200 ft (1°C)
11:15	Saw tooth \downarrow 200 ft/min <ul style="list-style-type: none"> • Cloud top at 1300 ft (-4.8°C)
11:21	Some ice crystals
11:22	Cloud base at 700 ft <ul style="list-style-type: none"> • Some precipitation ice but also droplets -> cloud base not clear
11:30	C3
11:31	Saw tooth \uparrow 200 ft/min <ul style="list-style-type: none"> • Cloud base at 250 ft
11:36	Cloud top at 1300 ft <ul style="list-style-type: none"> • No ice in the cloud top • Clouds start to form patchy
11:43	End of saw tooth, heading to Polarstern at 1200 ft
11:57	Descent to Polarstern -> only thin and patchy clouds
	PS Aerosol Race Track
12:14	Start race track at 100 ft
12:19	PS plume
12:32	12000 ft
12:35	Head to C1
12:40	Start descent
	Solid cloud deck ahead that ends to sea ice border

	Cloud Race Track, 8 min legs
13:01	Cloud top at 1400 ft
13:03	Cloud base at 400 ft
13:04-13:10	Level 200 ft <ul style="list-style-type: none"> No precipitation
13:10	Turn near ice edge -> clouds getting thinner
13:15-13:23	Level 600 ft <ul style="list-style-type: none"> Small droplets around 10 μm Cloud base lowered towards end of the leg
13:23	Turn and climb to 800 ft
13:24	Level 800 ft <ul style="list-style-type: none"> Only liquid at -4°C
13:25	Out of cloud due to vibrations
13:35-13:40	Level 800 ft
13:40	Stop race track due to vibrations
14:06	Level 12000 ft
14:08	Level 8000 ft
	AIMS Calibration
14:14	Jaws 100 kn
14:15	Jaws 120 kn
14:17	Jaws 140 kn
14:18	Jaws 160 kn
14:19	Bank 160 kn
14:22	Jaws 160 kn
14:23	Jaws 140 kn
14:24	Jaws 120 kn
14:26	Jaws 100 kn
14:28	360° turn, 15° bank, right turn
14:31	360° turn, 30° bank, right turn
14:33	360° turn, 45° bank, right turn
14:35	360° turn, 15° bank, left turn
14:38	360° turn, 30° bank, left turn
14:40	360° turn, 45° bank, left turn
14:43	Head to LYR
15:12	TOUCH DOWN

Instrument Status:

Polar 6	
Basis data acquisition	
Nose Boom	
PHIPS	
SID-3	
CIP	
PIP	
CDP	
ALABAMA	
CVI	
CVI UHSAS	
CVI ???	

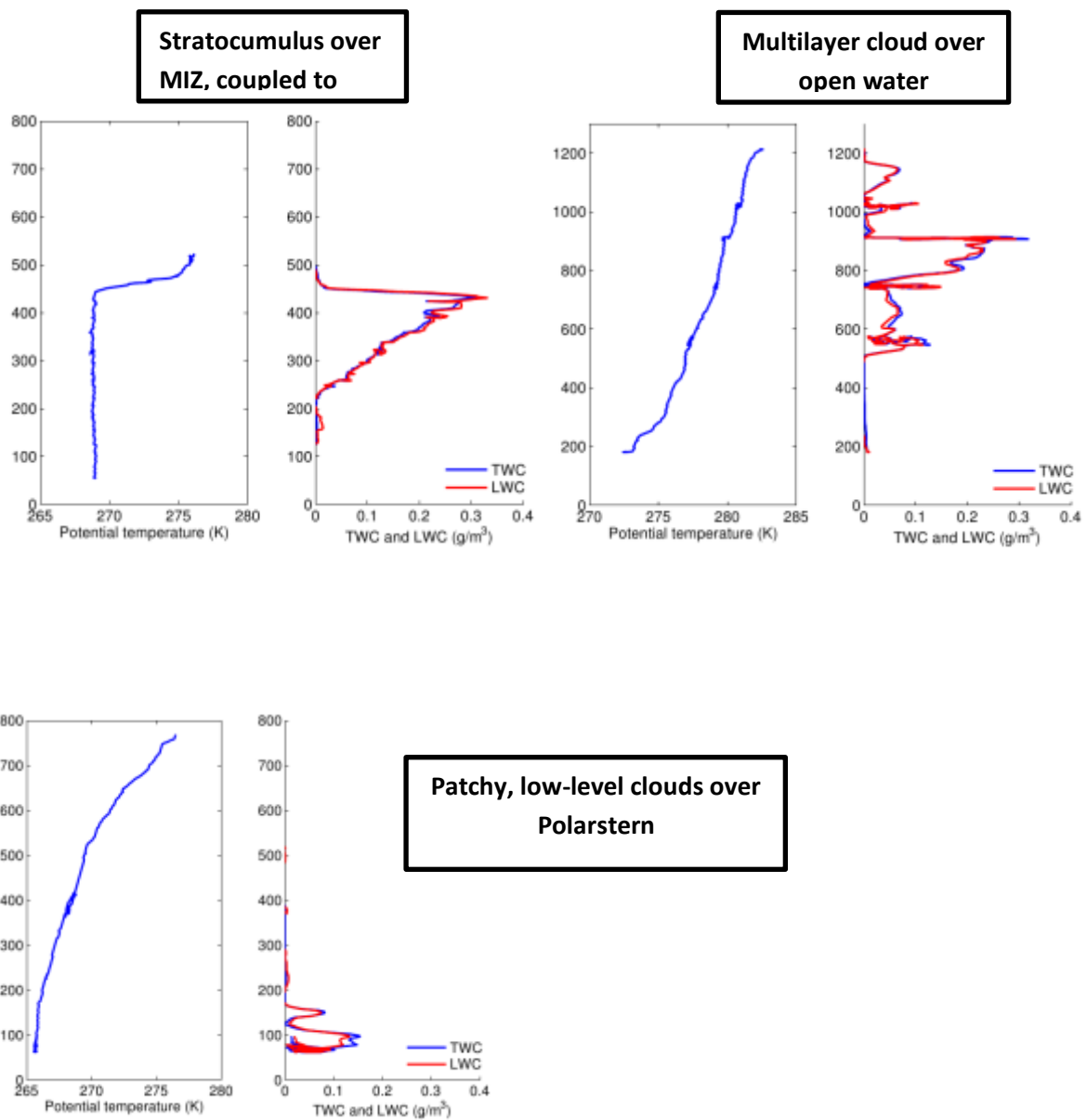
AWI SP2	
AWI UHSAS	
CO/CO2/O3	

Comments:

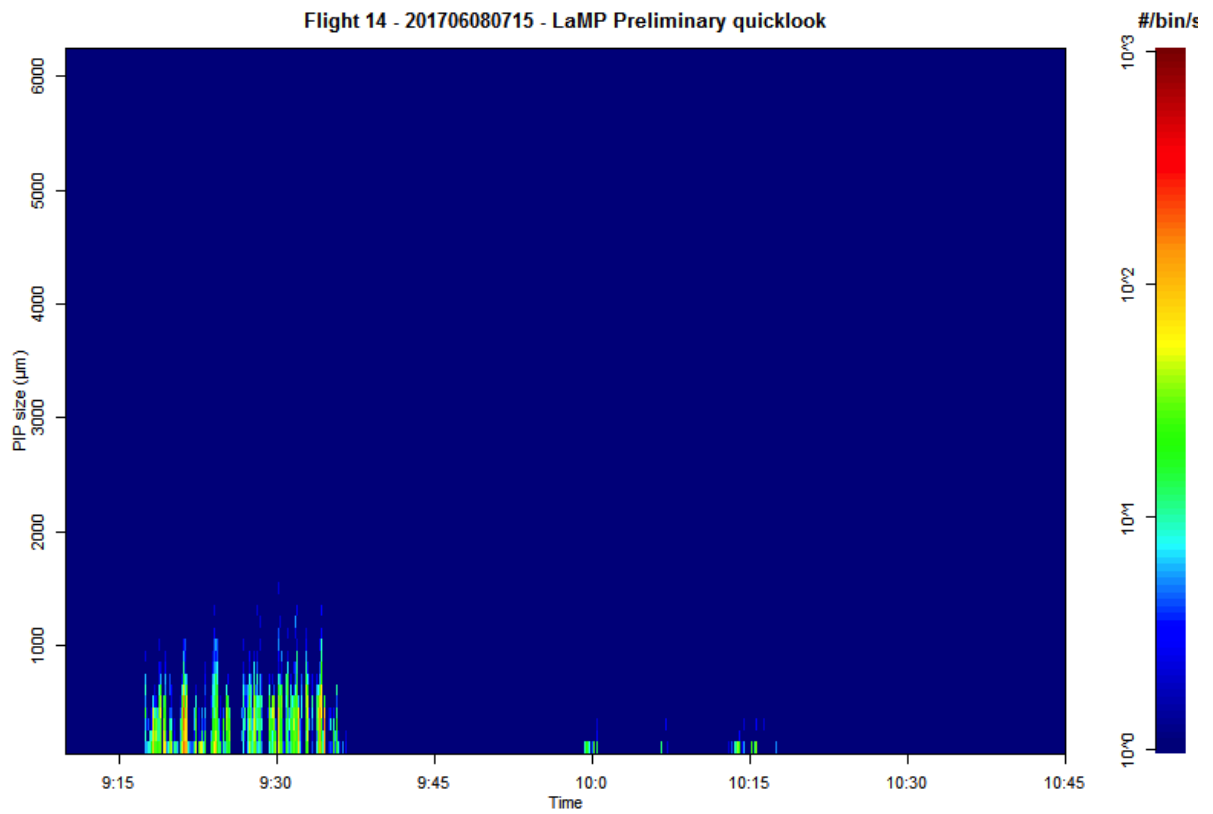
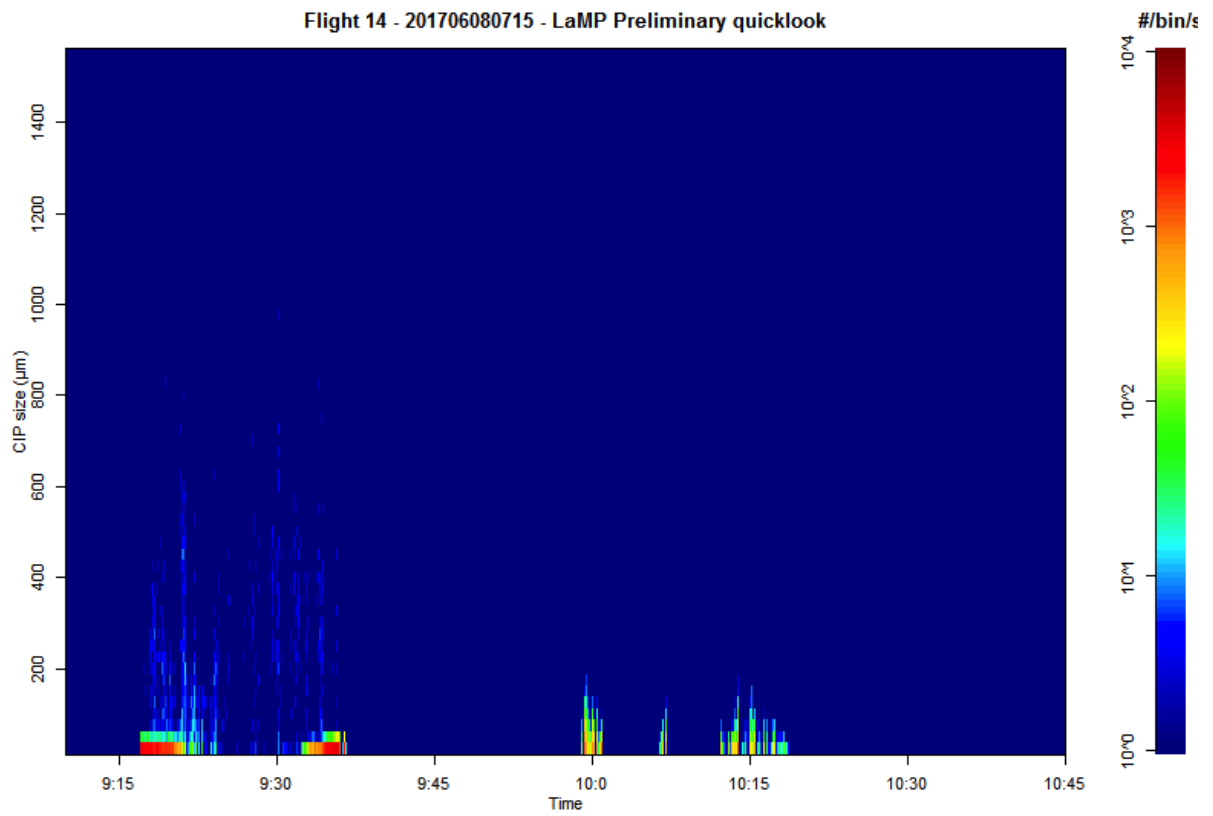
No instrumental problems.

Quicklooks:

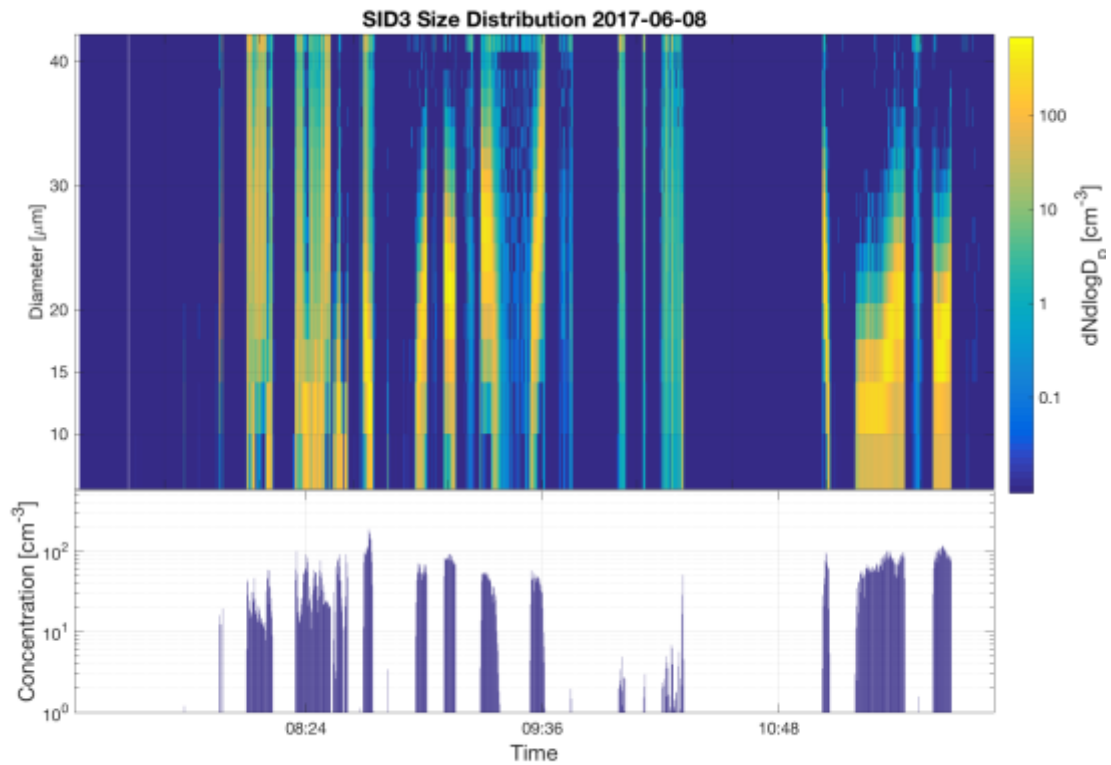
The Nevzorov liquid water content (LWC) and total water content (TWC) probe:



PIP and CIP: size distribution



SID-3: size distribution



Trace Gases

