VOCALS-UK

PIs:	Hugh Coe (Manchester) and Phil Brown (Met Office)
Manchester:	Tom Choularton; Grant Allen, James Dorsey, Gordon McFiggans; Paul Connolly; Keith Bower; Jonathan Crosier; Mike Flynn, Martin Gallagher; Lorenzo Labrador, Hugo Ricketts, Geraint Vaughan, Paul Williams
Leeds:	Mark Bart, Alan Blyth; Alan Gadian; Patricia Krejcl, James McQuaid
Reading:	Julia Slingo; Len Shaffrey; Thomas Toniazzo
Met Office:	Steve Abel, Paul Barrett
Berlin:	Thomas Ruhtz


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MIND YOUR HEAD

Aerosol and Cloud Measurements: Bulk

LWC: Johnson Williams, Nevzerov LWC, Nevzerov TWC

Total Water Content: Liquid + Ice + Vapour (Lynman-α absorption hygrometer)

CCN: Dual channel continuous flow

VACC: Size distribution as a function of thermal volatility

Condensation Particle Counter: TSI-3025A Aerosol concentration > 3 nm

Aerosol Mass Spectrometer: Mass of non-refractory components of aerosol particles as a function of size (50 – 500 nm)

Single Particle Soot Photometer (SP2): Black carbon mass (single particle basis)

Filters: Sub and Supermicron

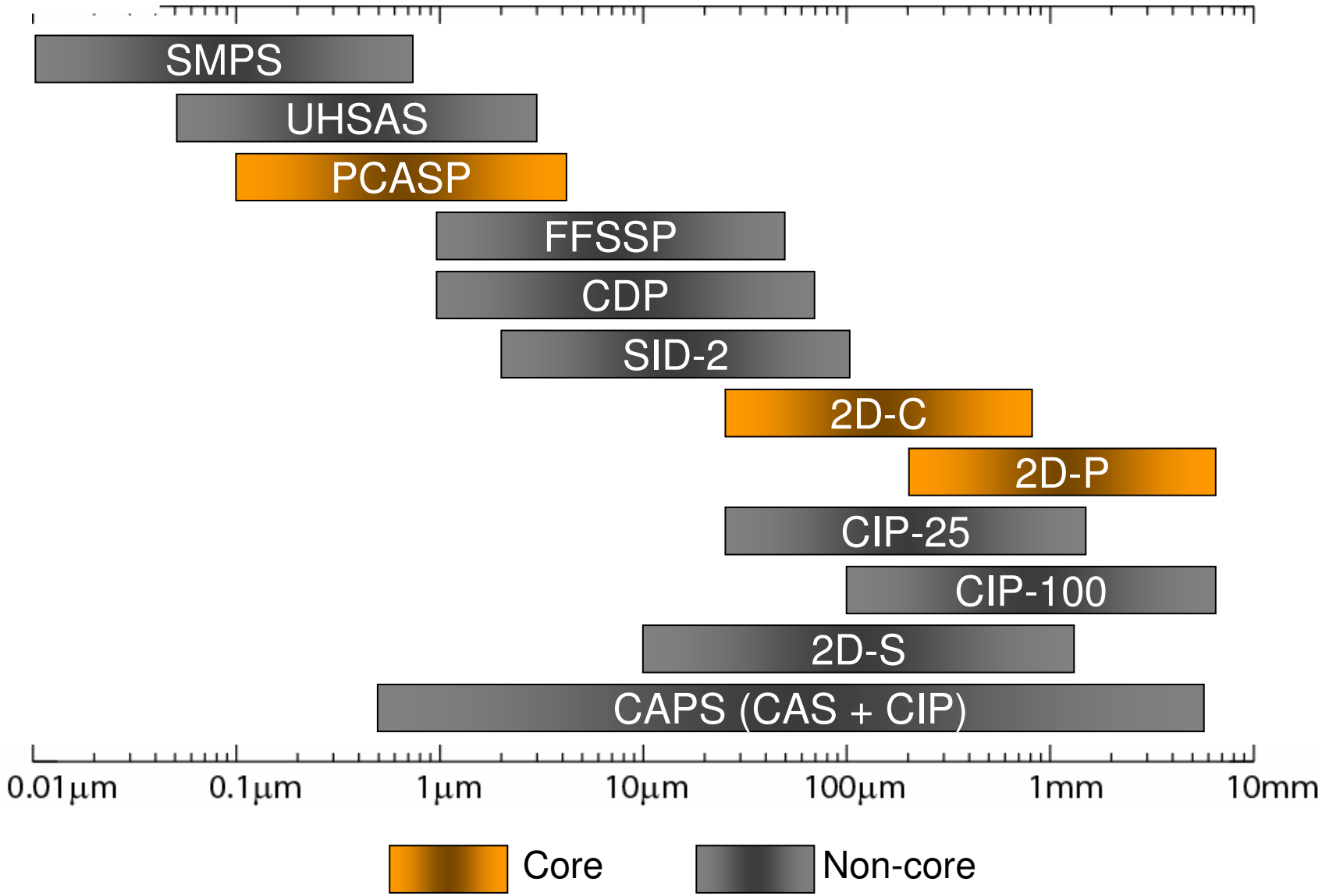
CVI: Counter Flow Virtual Impactor (Residual particle & vapour from cloud drops)

Nephelometer: Aerosol scattering (dry) at λ = 450,550,700 nm

Wet Nephelometer: Aerosol scattering f(RH) at λ = 450,550,700 nm

PSAP: Aerosol absorption at λ = 567 nm

146 – Cloud Physics



Additional Instrumentation

In addition to this instrumentation (see next slides) the aircraft will be fitted with

- Core chemistry: CO, O_3, NO_x, SO_2
- PAN
- Thermodynamics: Temperature, Humidity, Pressure……
- Dynamics: Turbulence probe
- Sondes
- Video Cameras: Upward, Downward, Forward, Rear

Radiation Instrumentation

Microwave Radiometer (MARSS): Upward and downward pointing (+40 to -40 deg)
5 channels 89-183 GHz
Derive LWP, T + q structure

Shortwave Spectrometer (SWS): Pointable high resolution spectrometer measuring radiance across spectral range 0.3 – 1.7 μm
MODIS type retrievals of cloud properties

Spectral Hemispheric Irradiance Measurement (SHIM): As SWS but hemispherically integrating. Mounted on top and bottom of aircraft.
Derive cloud optical depth

Broad Band Radiometers: Derive cloud optical depth

Heiman Radiometer: Sea surface temperature

Airborne Research Interferometer Evaluation System (ARIES): Interferometer producing high resolution spectra 18 – 3.3 μm. Retrieve profiles of gases (CO_2, H_2O, O_3 etc) and sea surface temperature. Cloud info incl cloud top temp……

NERC Do-228 Airborne Research and Survey Facility (ARSF)

LIDAR: A Leosphere (ALS300) aerosol backscatter lidar will be installed on the Do-228

ASP: accumulation mode Optical Aerosol Sizing Probe ($0.1<D_p<10$ µm, 40 channels)

Hyperspectral Imaging:
The Eagle and Hawk hyperspectral sensors are the most They are pushbroom systems Eagle has a 1000 pixel swath width, covering the visible and near infra-red spectrum 400 - 970nm. Spectral resolution of the sensor is 2.9nm

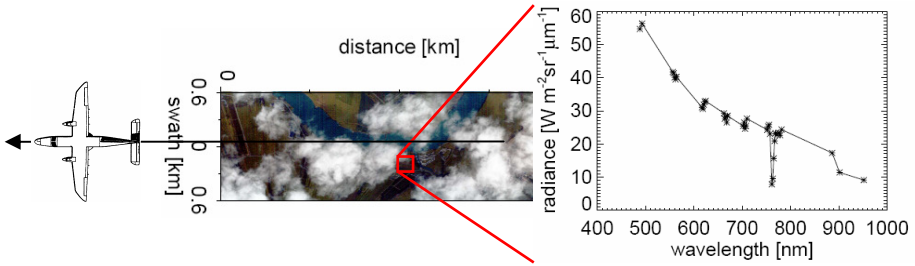
The AISA Hawk has a wavelength range (970 - 2450nm); it has 320 pixels, 244 spectral pixels and a spectral resolution of 8nm

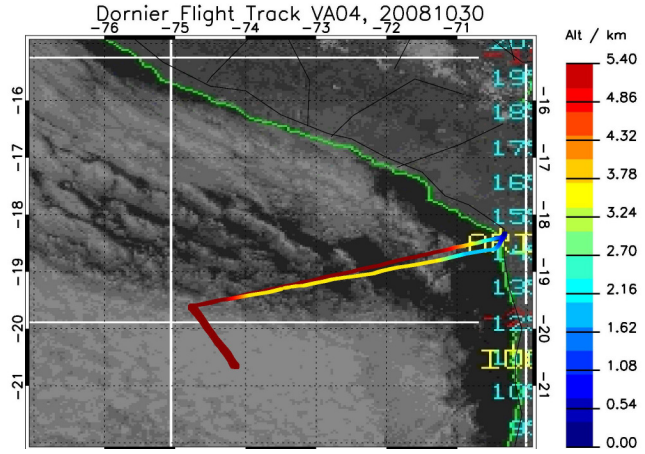
AIMMS: Turbulence sensor

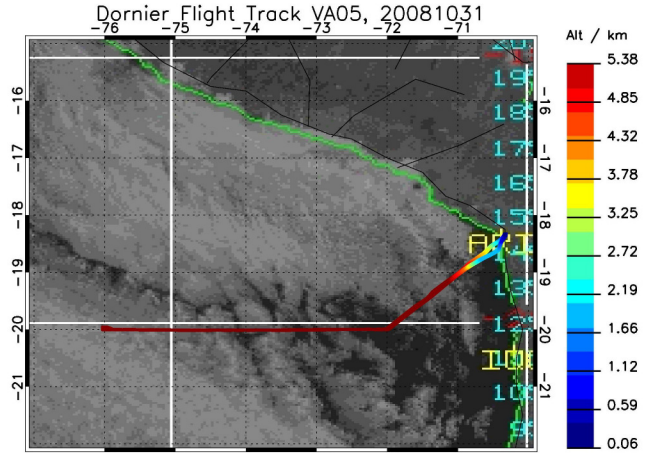
POLARIMETER: Measurement of spectrally resolved full Stokes' vectors

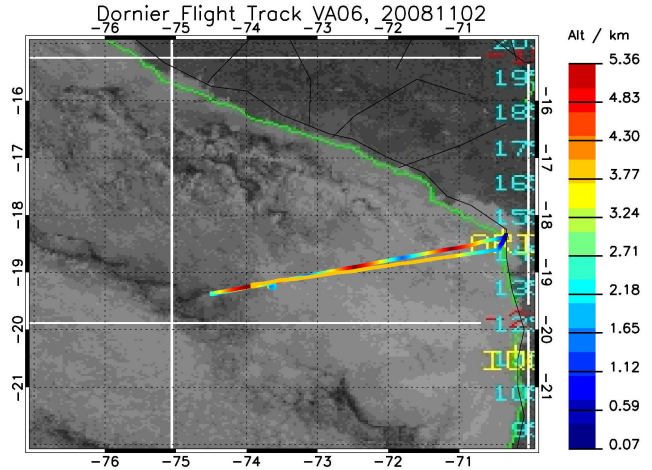
Flights conducted so far:

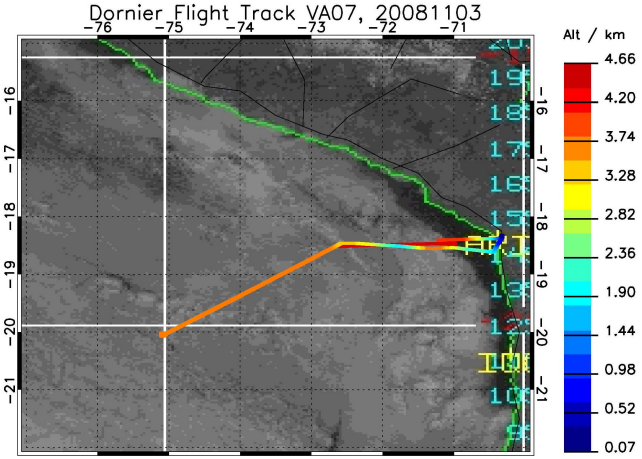
26 Oct	VA01	test flight along 20° S to 74° 38' W
28 Oct	VA02	test flight for polarimeter.
30 Oct	VA03	flight over Ron Brown coord with 146.
31 Oct	VA04	20°S mission with C130 below, 146 above.
2 Nov	VA05	Free tropospheric aerosol with a succession of profiles.
3 Nov	VA06	coordinated with 146: Peruvian border then 75W 20S with 146 below
4 Nov	VA07	20S mission with 5 aircraft, 76W at 15000 back at 11000 and 10000
5 Nov	VA08	pollution profiling along coast.
6 Nov	VA09	test flight out to alpha at 15000' then 20 S

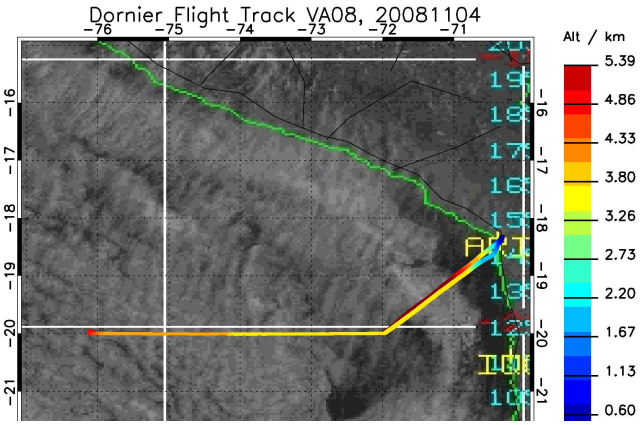


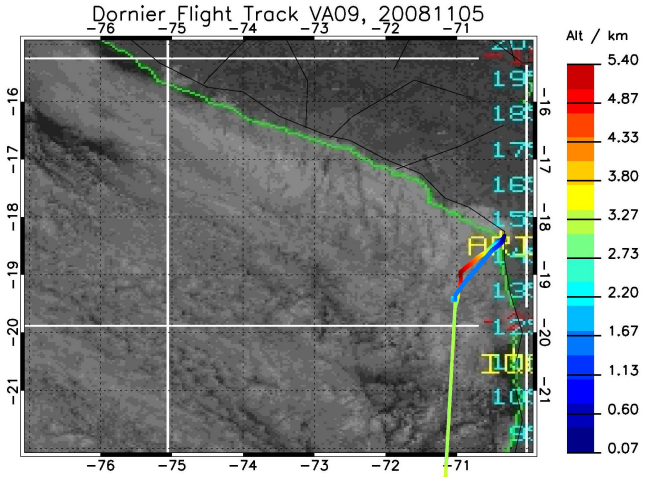

Dornier Flight Track VA04, 20081030
Alt / km
5.40
4.86
4.32
3.78
3.24
2.70
2.16
1.62
1.08
0.54
0.00


Dornier Flight Track VA05, 20081031
Alt / km
5.38
4.85
4.32
3.78
3.25
2.72
2.19
1.66
1.12
0.59
0.06

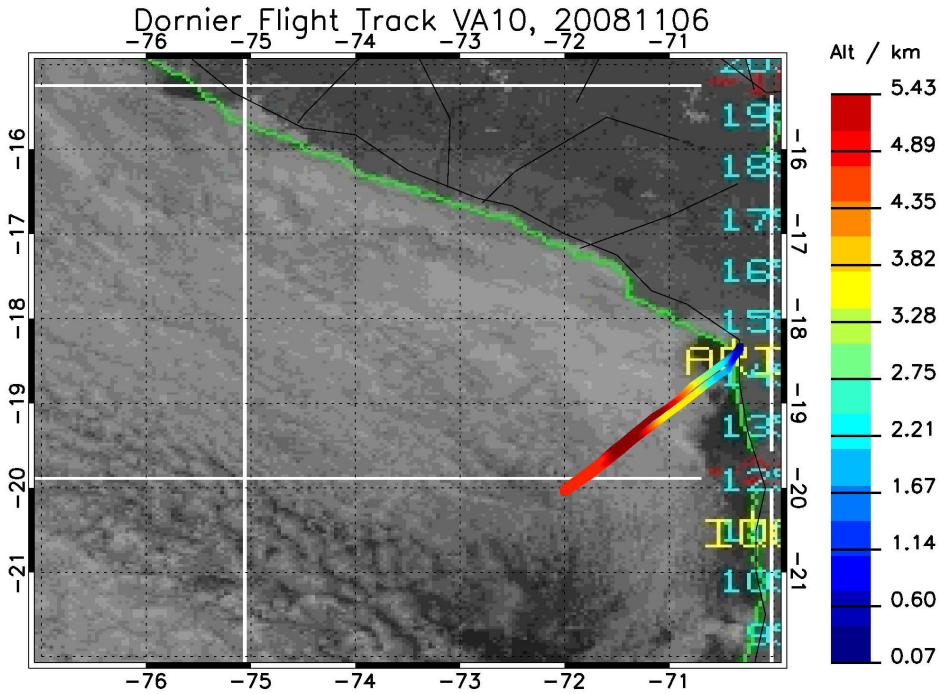

Dornier Flight Track VA06, 20081102
Alt / km
5.36
4.83
4.30
3.77
3.24
2.71
2.18
1.65
1.12
0.59
0.07

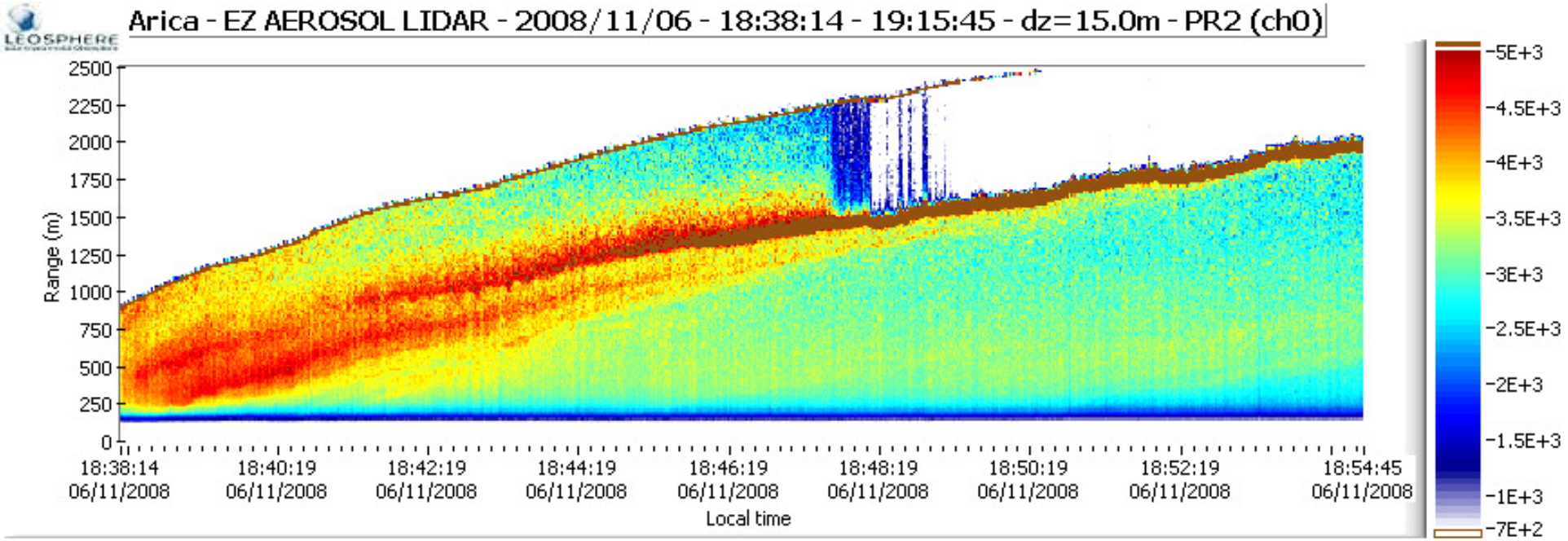

Dornier Flight Track VA07, 20081103
Alt / km
4.66
4.20
3.74
3.28
2.82
2.36
1.90
1.44
0.98
0.52
0.07


Dornier Flight Track VA08, 20081104
Alt / km
5.39
4.86
4.33
3.80
3.26
2.73
2.20
1.67
1.13
0.60


Dornier Flight Track VA09, 20081105
Alt / km
5.40
4.87
4.33
3.80
3.27
2.73
2.20
1.67
1.13
0.60
0.07

Yesterday….


Dornier Flight Track VA10, 20081106
−76
−75
−74
−73
−72
−71
−16
−17
−18
−19
−20
−21
Alt / km
5.43
4.89
4.35
3.82
3.28
2.75
2.21
1.67
1.14
0.60
0.07


LEOSPHERE
Arica - EZ AEROSOL LIDAR - 2008/11/06 - 18:38:14 - 19:15:45 - dz=15.0m - PR2 (ch0)
Range (m)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
18:38:14 06/11/2008
18:40:19 06/11/2008
18:42:19 06/11/2008
18:44:19 06/11/2008
18:46:19 06/11/2008
18:48:19 06/11/2008
18:50:19 06/11/2008
18:52:19 06/11/2008
18:54:45 06/11/2008
Local time
-5E+3
-4.5E+3
-4E+3
-3.5E+3
-3E+3
-2.5E+3
-2E+3
-1.5E+3
-1E+3
-7E+2

BAe 146 Flights completed to date:

- 20-South cross sections
  on **B408**(26/10); **B410**(29/10); **B412**(31/10); **B414**(4/11)
  - 4, all with different characteristics in terms of:
    - Well-mixed and decoupled boundary layers
    - Homogeneity of stratocumulus
    - Drizzle occurrence
  - 2 intercomparisons with C-130 **B412** and **B414**
  - 2 low-level returns **B408** and **B410**
  - 2 high-level sonde-dropping (78W to 72W) **B412** and **B414**

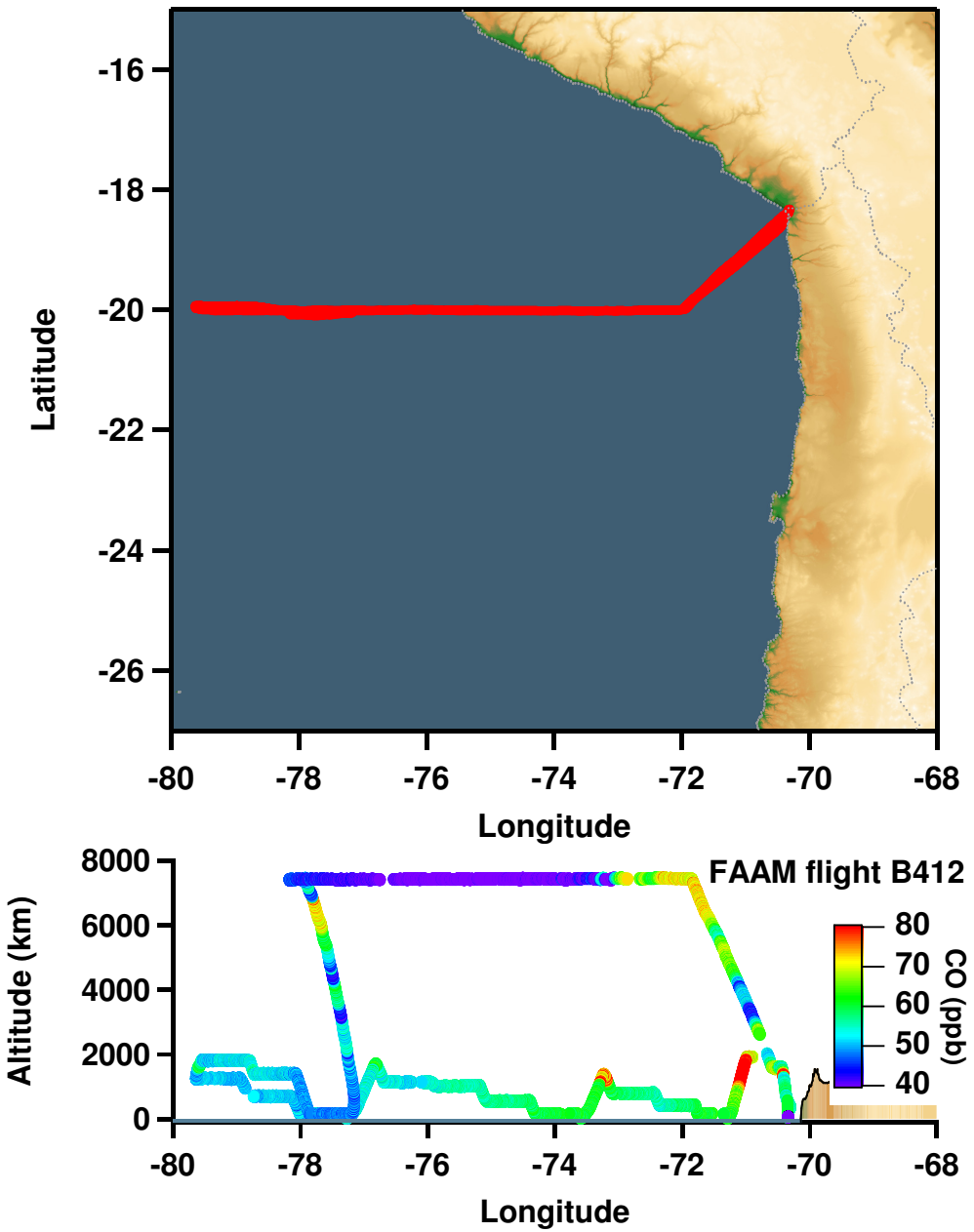
- POC studies
  - 2 completed (**B409** and **B415**)
  - one sampled subsequently by C-130 (quasi-Lagrangian) (**B409**)
  - One at sunset (**B409**) and one at sunrise (**B415**)

- Pollution (non)-plumes (**B413**)
  - Coastal survey in vicinity of Ilo smelter. Speculation that it had been turned off were later found to be true!

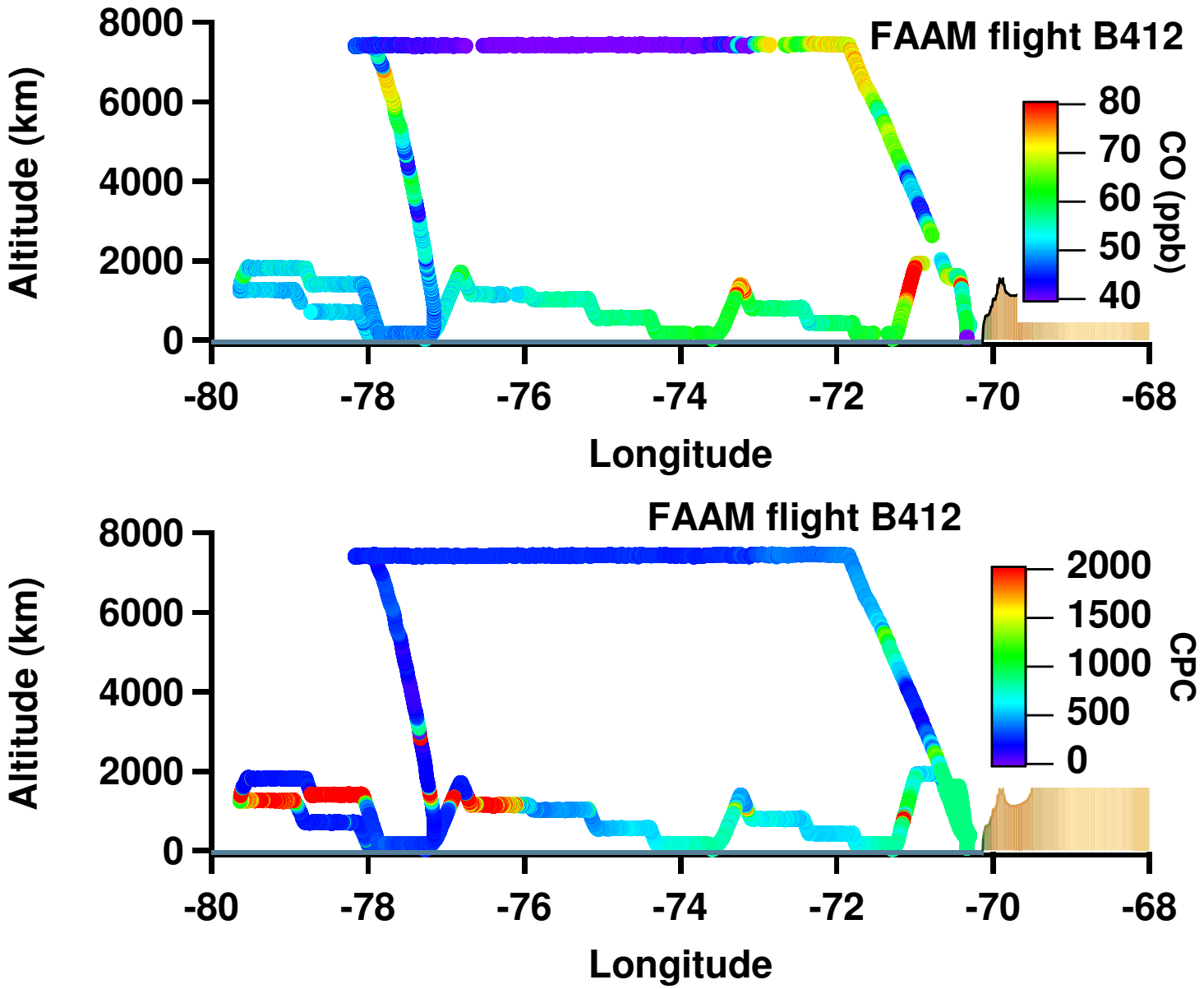
Possible flight missions for the remaining period

- 20-S cross section
  - At least 2 and possibly 3 more
  - Coordination with G-1 on one of these (Sat 8th?)
- POC studies
  - At least one more (maybe Friday 7th)
- Lagrangian studies
  - Opportunities for combined missions with C-130, day-flights during the last week
- Last flight day, Fri 14th Nov

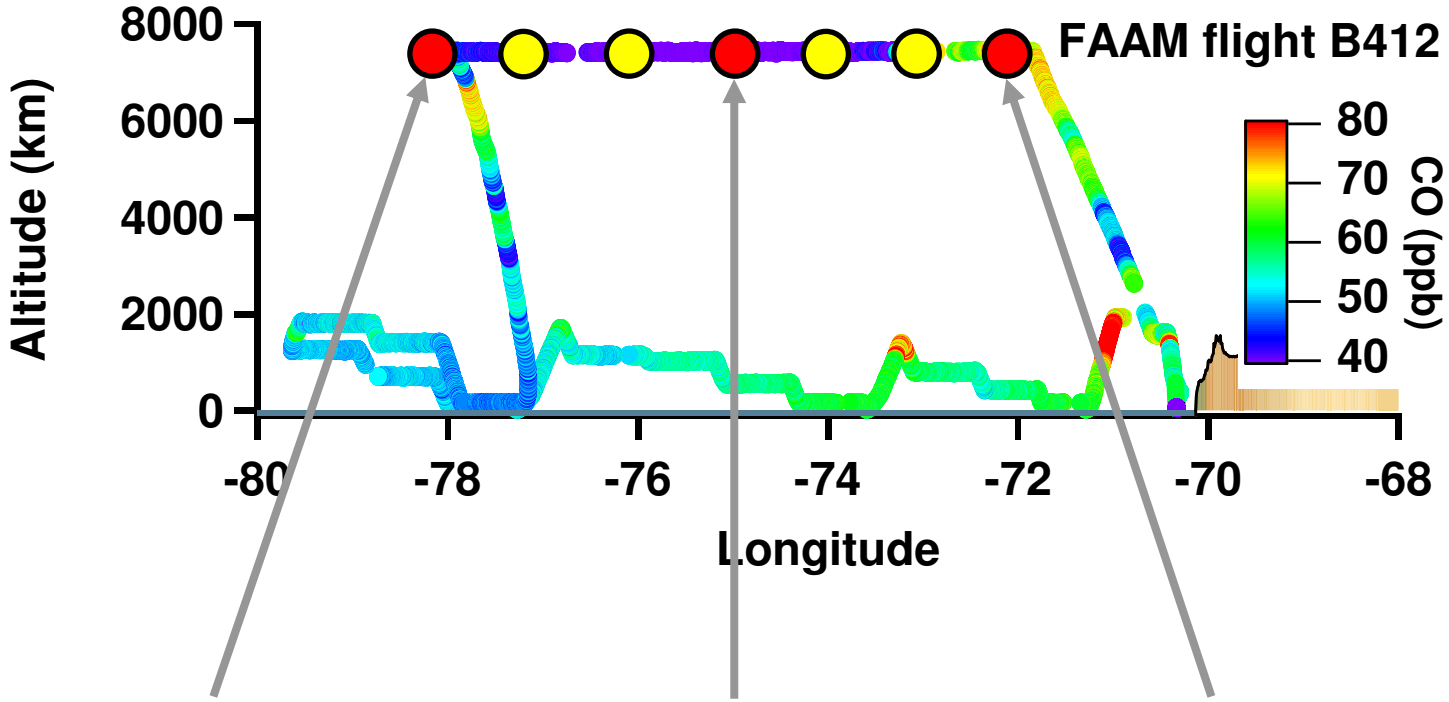
Data Highlights: An example of a 20S Lagrangian (B412)

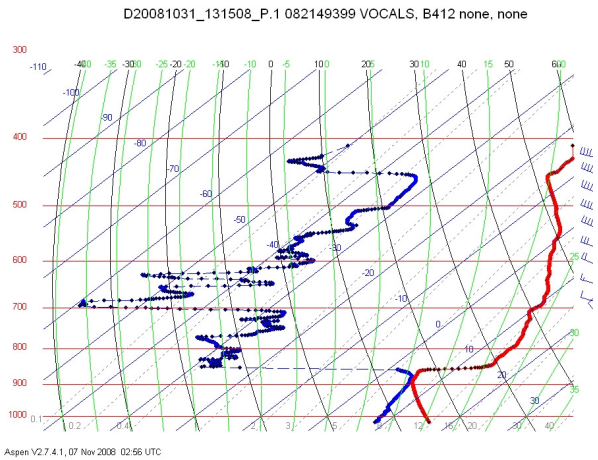


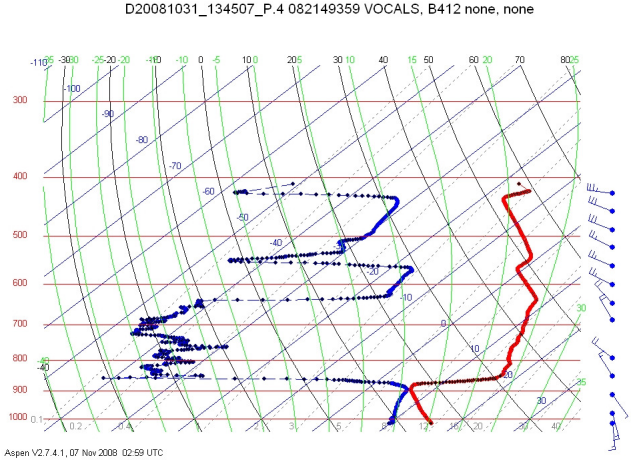
Data Highlights: An example of a 20S Lagrangian (B412)

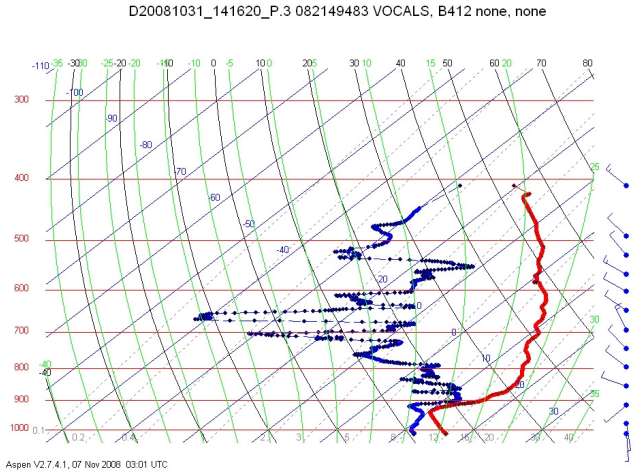


Data Highlights: An example of a 20S Lagrangian (B412)









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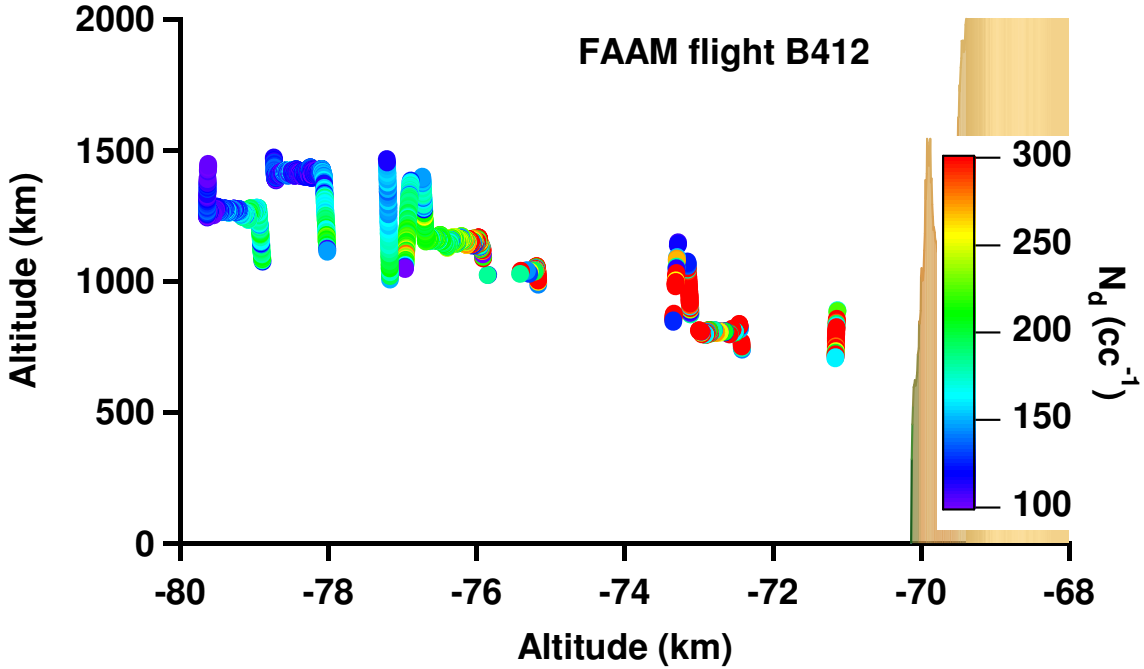
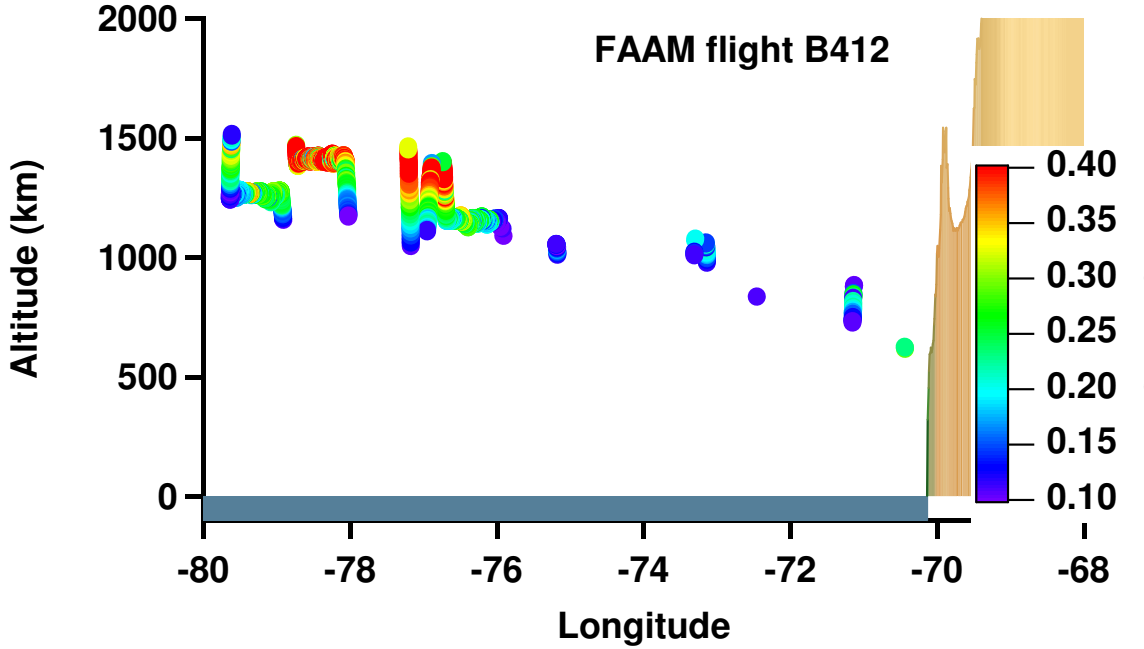
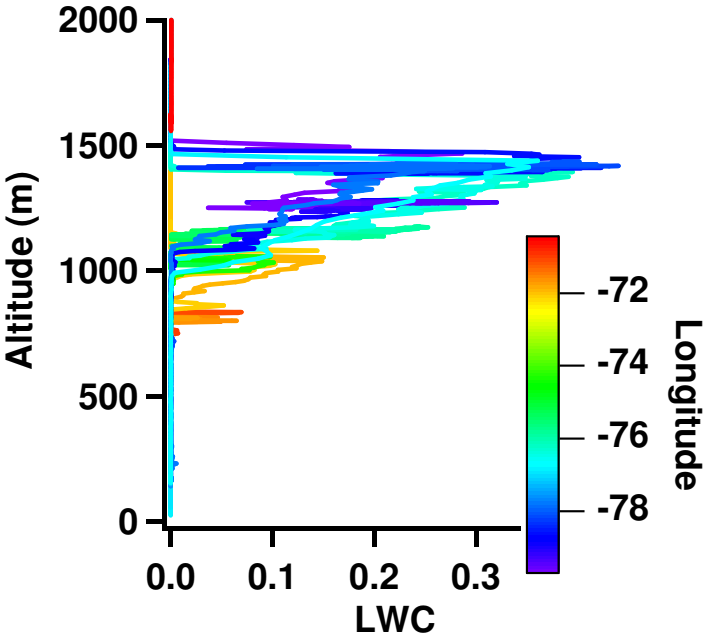
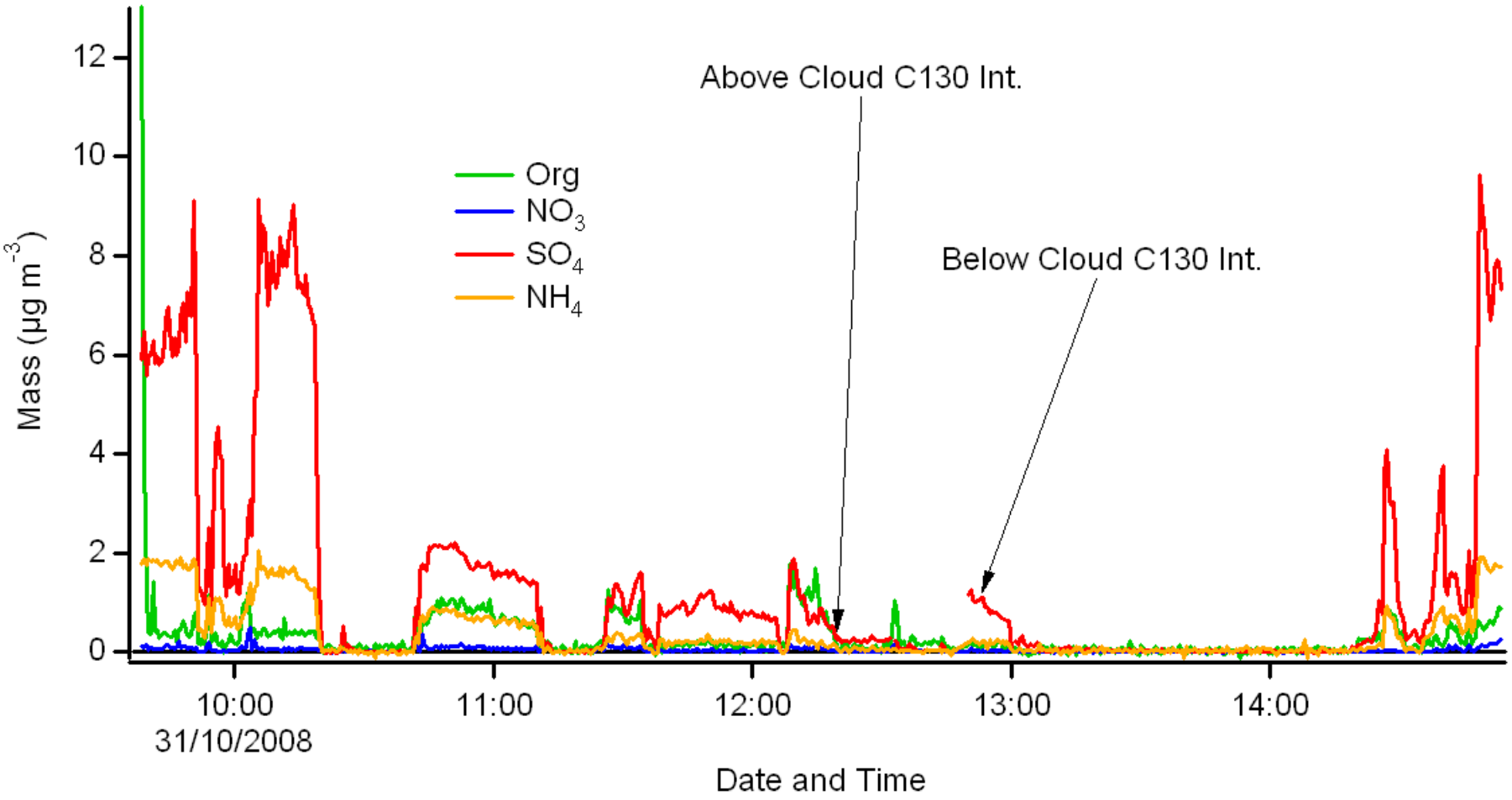


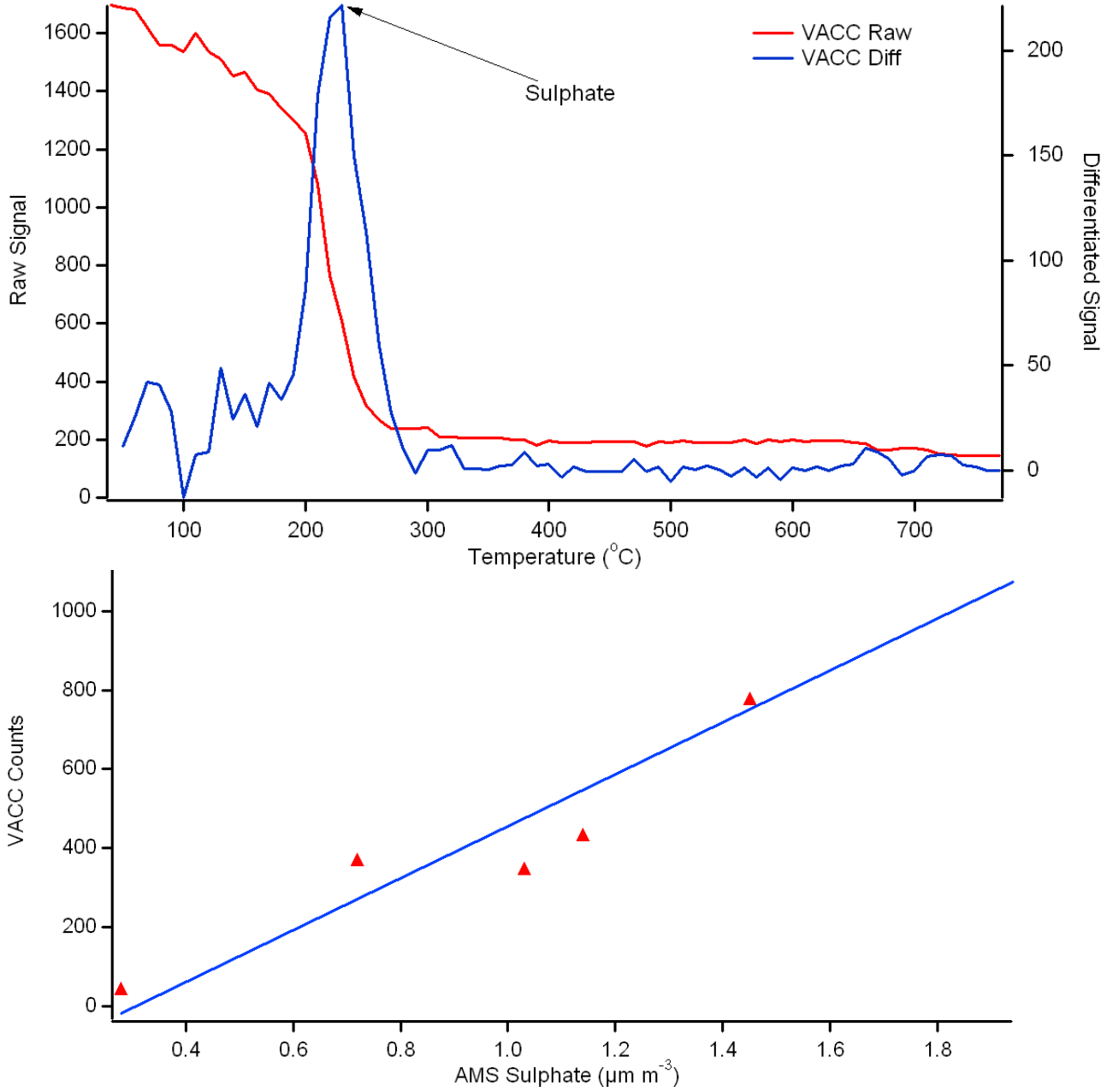




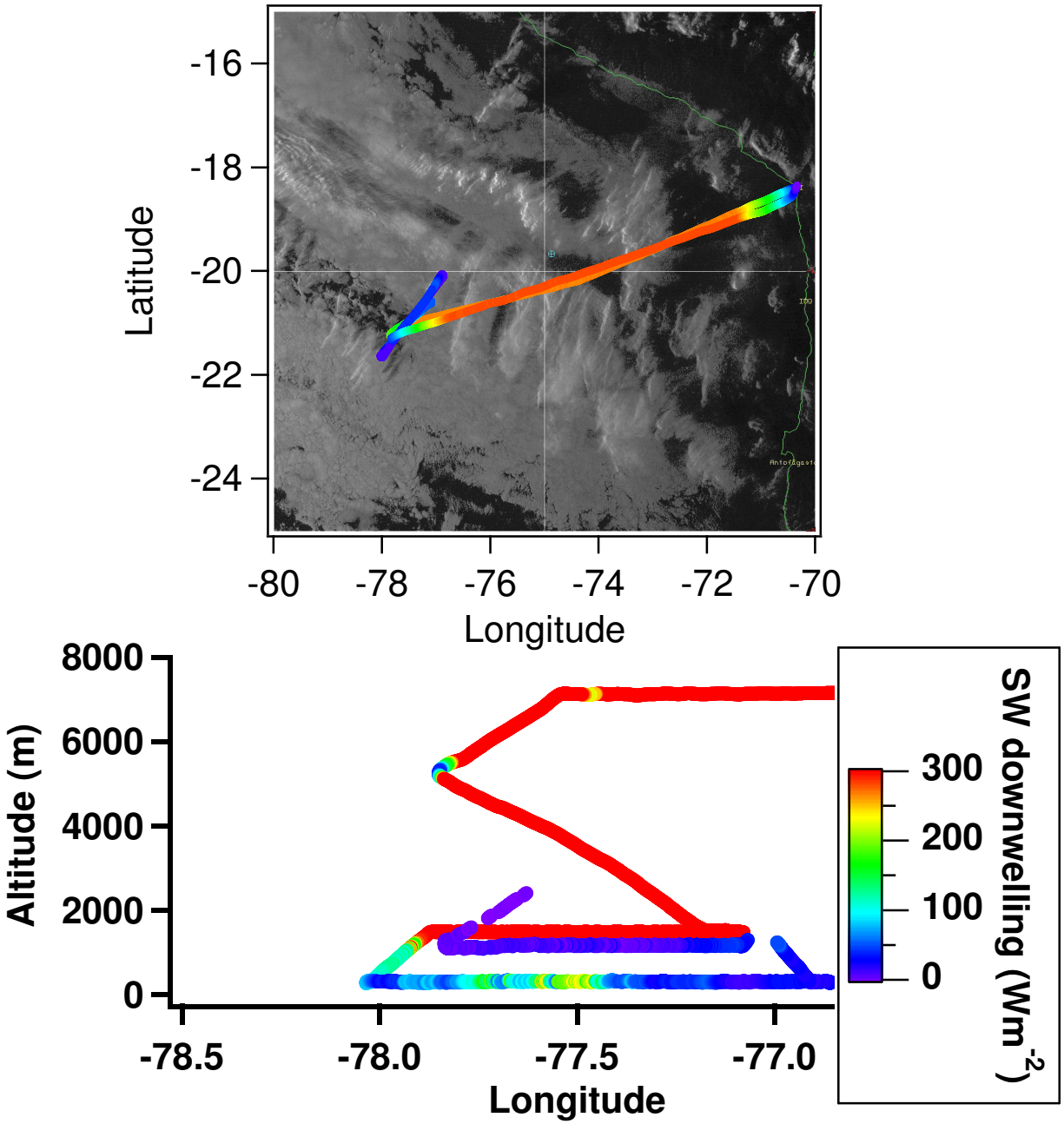
Data Highlights: An example of a 20S Lagrangian (B412)

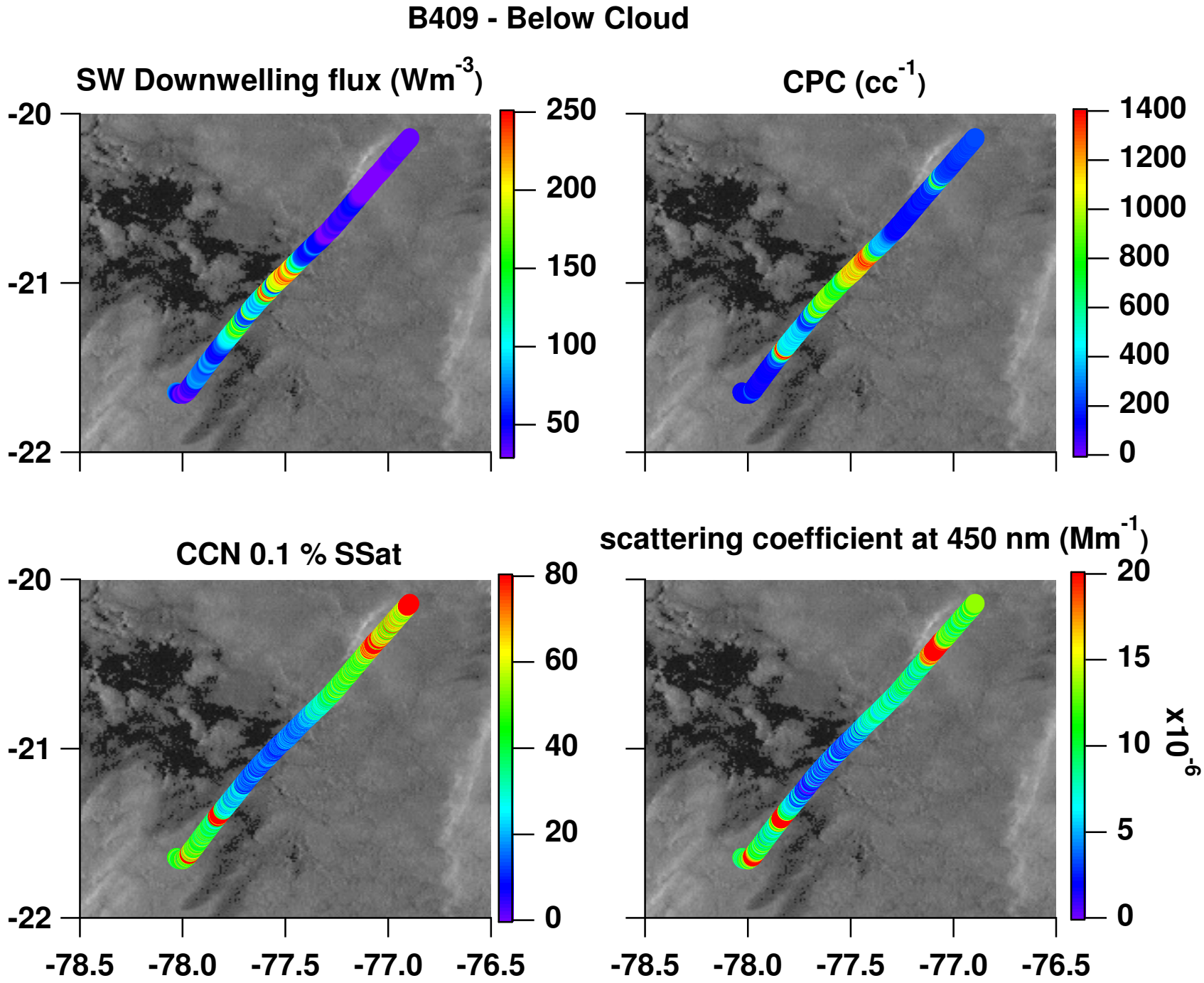


Data Highlights: An example of a 20S Lagrangian (B412)

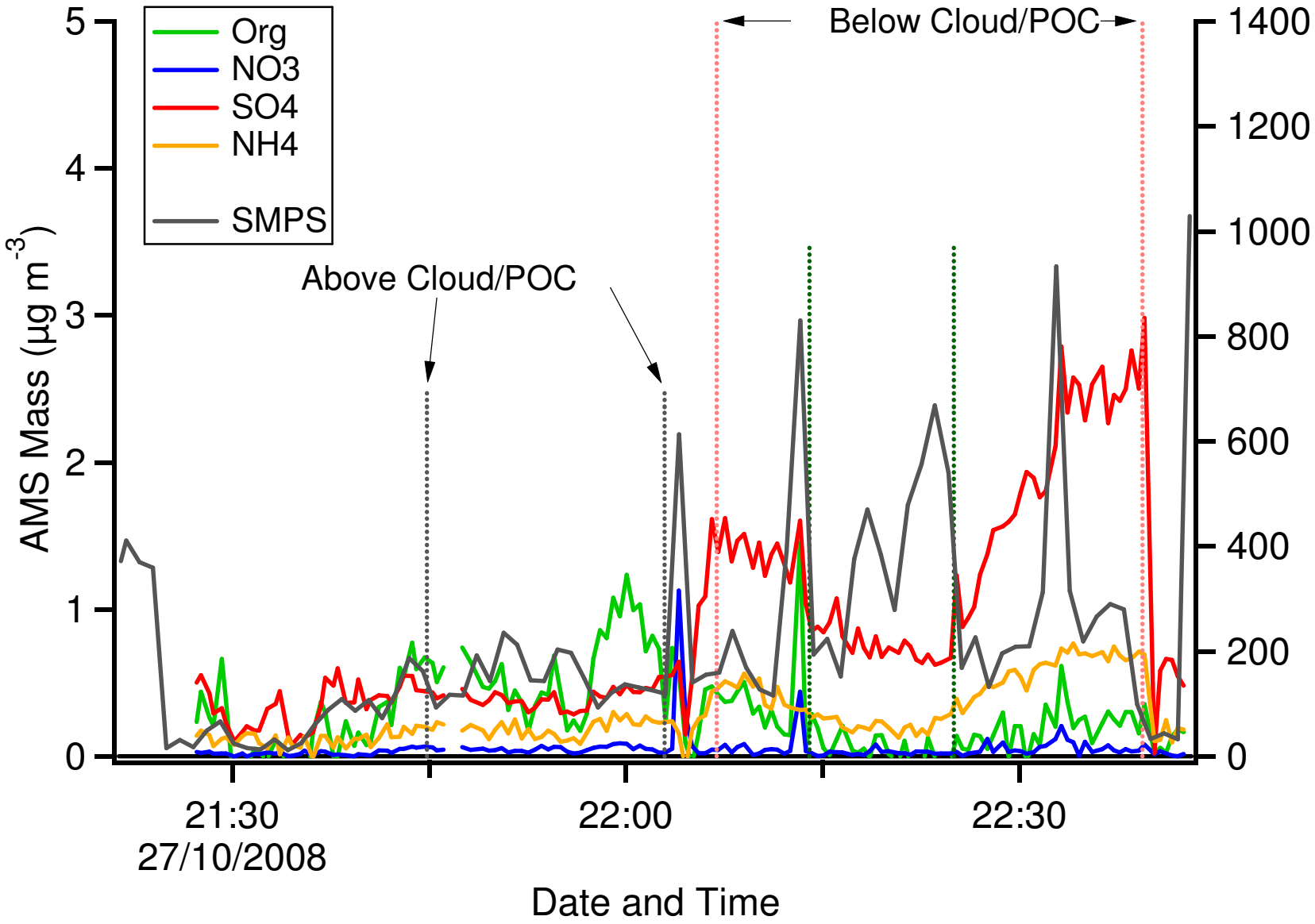


Data Highlights: An example of POC mission (B409)

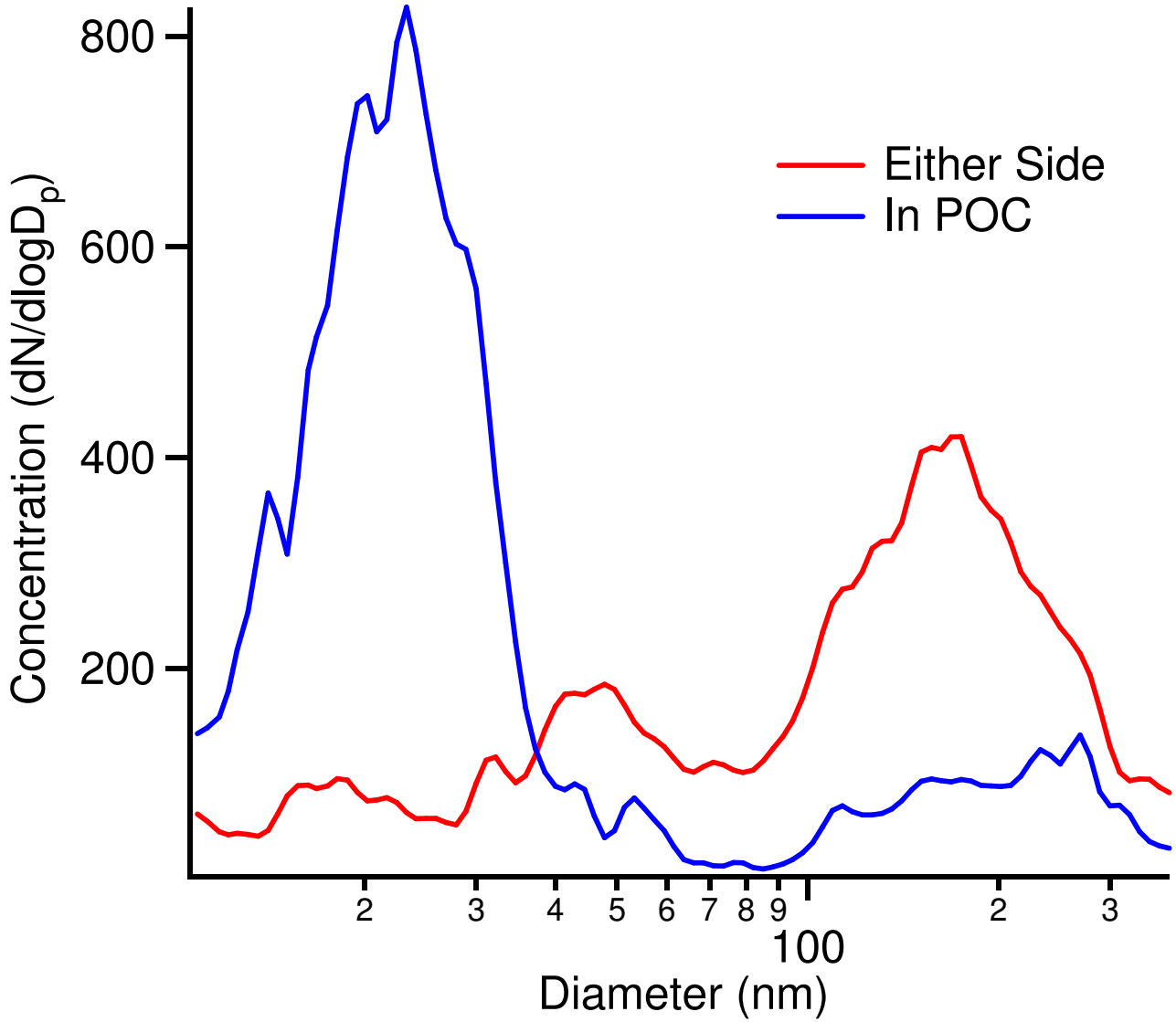


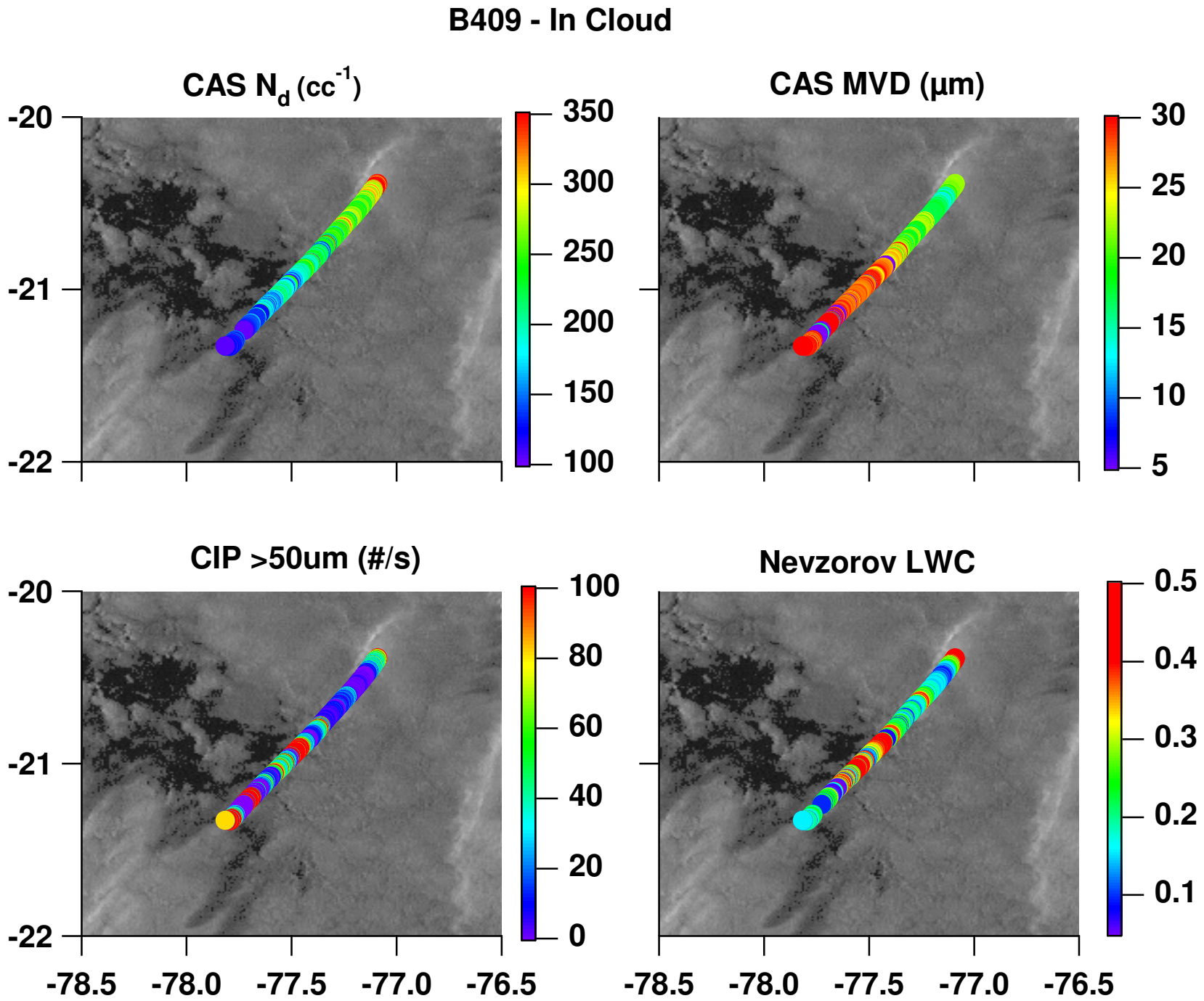

B409 - Below Cloud
SW Downwelling flux (Wm-3)
CPC (cc-1)
CCN 0.1 % SSat
scattering coefficient at 450 nm (Mm-1)
-20
-21
-22
-78.5
-78.0
-77.5
-77.0
-76.5
250
200
150
100
50
1400
1200
1000
800
600
400
200
0
80
60
40
20
0
20
15
10
5
0
x10-6

Aerosol composition below cloud during POC mission B409

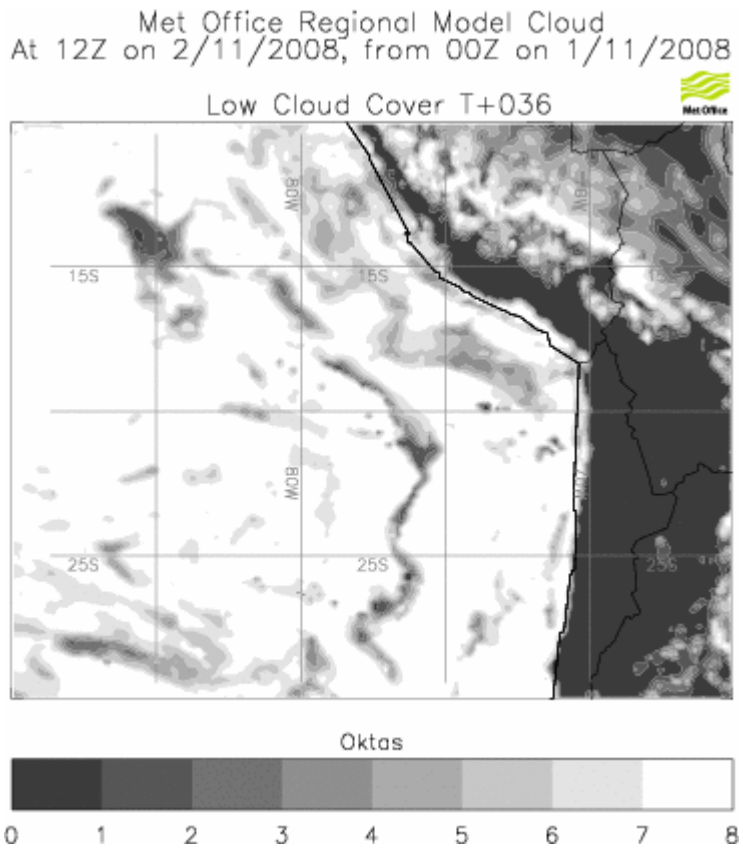


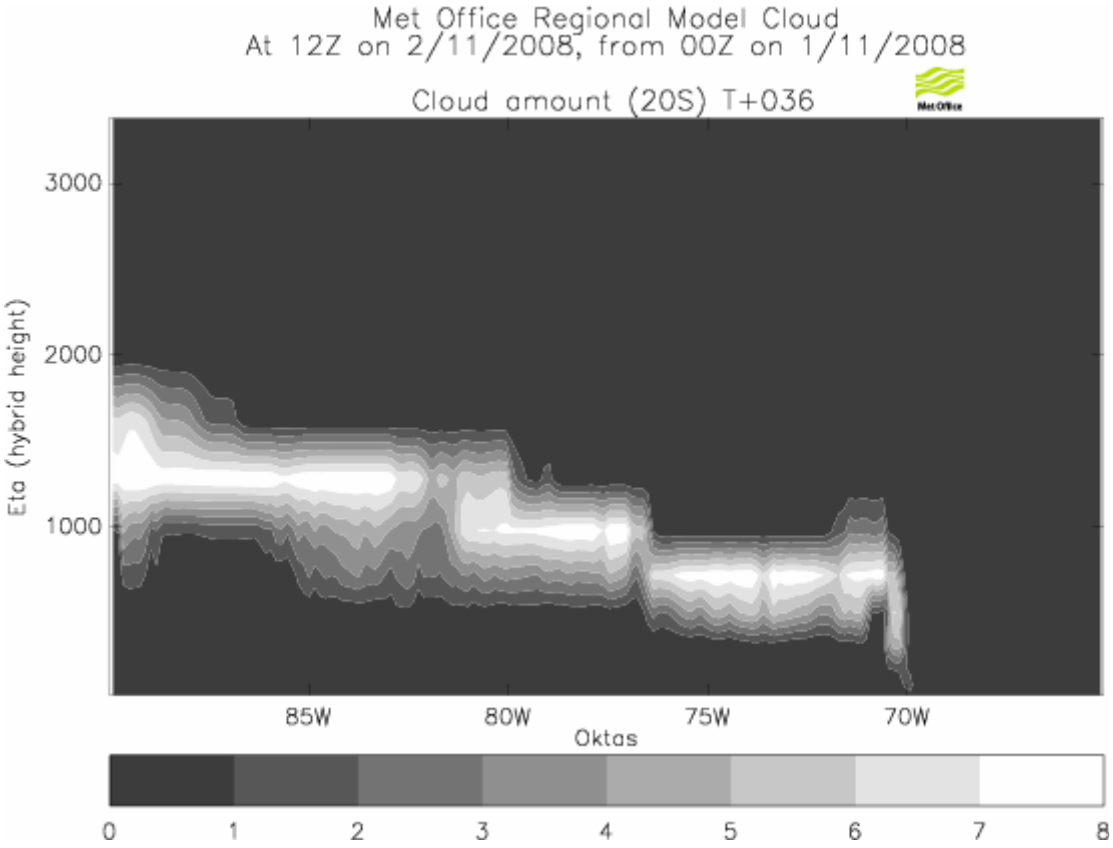
Aerosol size distribution below cloud during POC mission B409




B409 - In Cloud
CAS N_d (cc^{-1})
350
300
250
200
150
100
CAS MVD (µm)
30
25
20
15
10
5
CIP >50um (#/s)
100
80
60
40
20
0
Nevzorov LWC
0.5
0.4
0.3
0.2
0.1
-20
-21
-22
-78.5
-78.0
-77.5
-77.0
-76.5

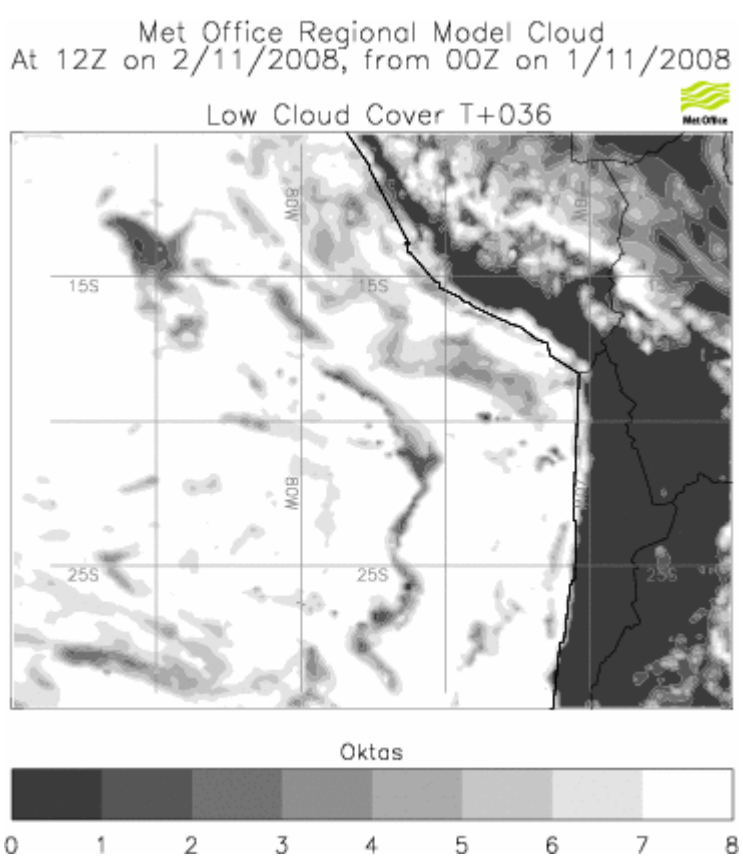
Unified Model performance example

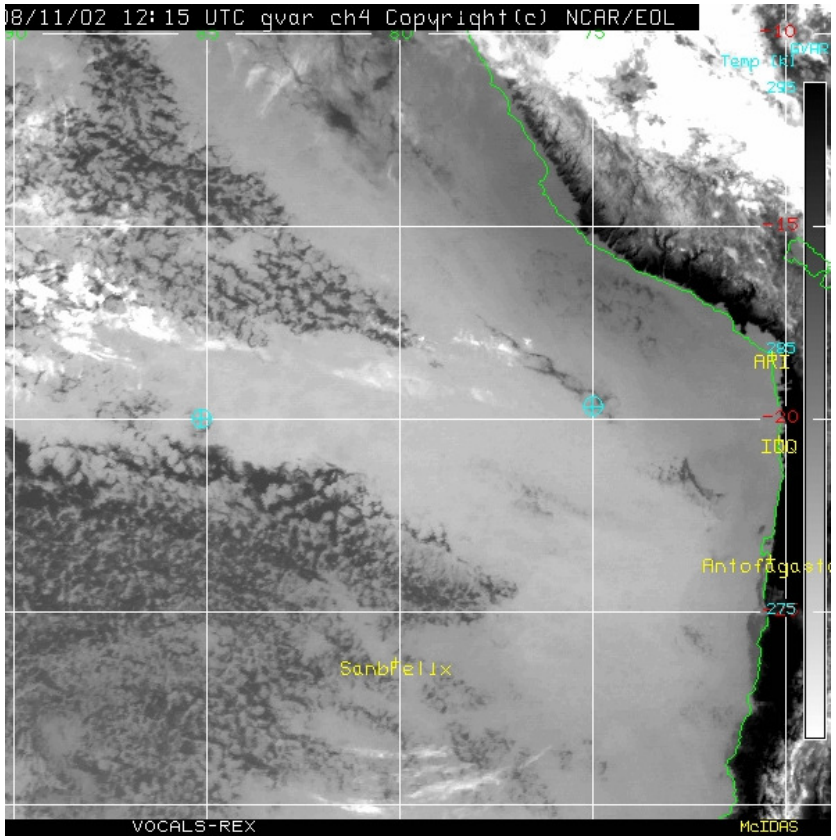




Model has cloud inhomogeneities but often artefacts – change of BL height between grid levels (increase from 38 to 70 model levels in 2009).

Unified Model performance example





Model has cloud inhomogeneities but often artefacts – change of BL height between grid levels (increase from 38 to 70 model levels in 2009).

Seems to miss larger POC/rift regions but may get some realistic structure parallel to Peru coast