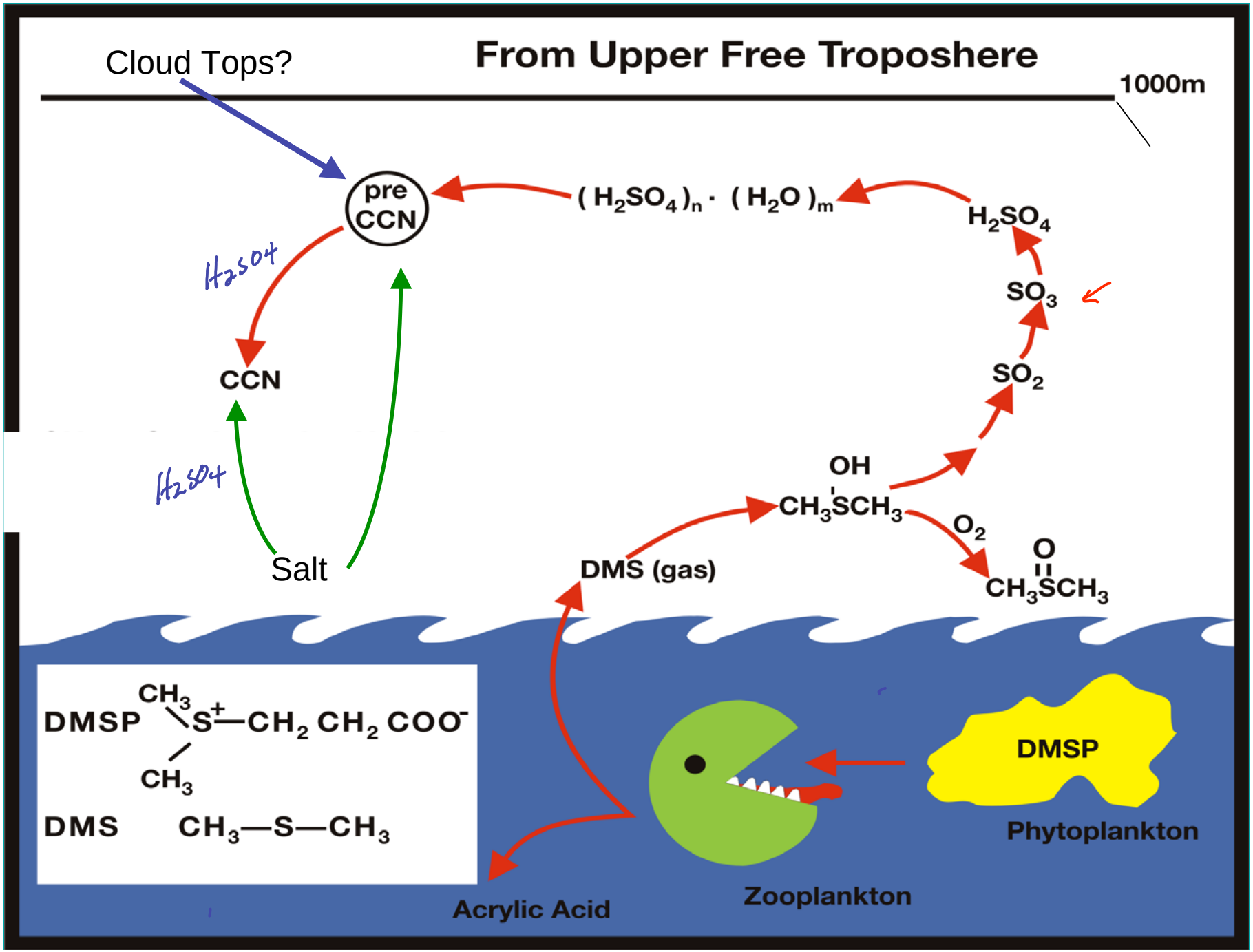
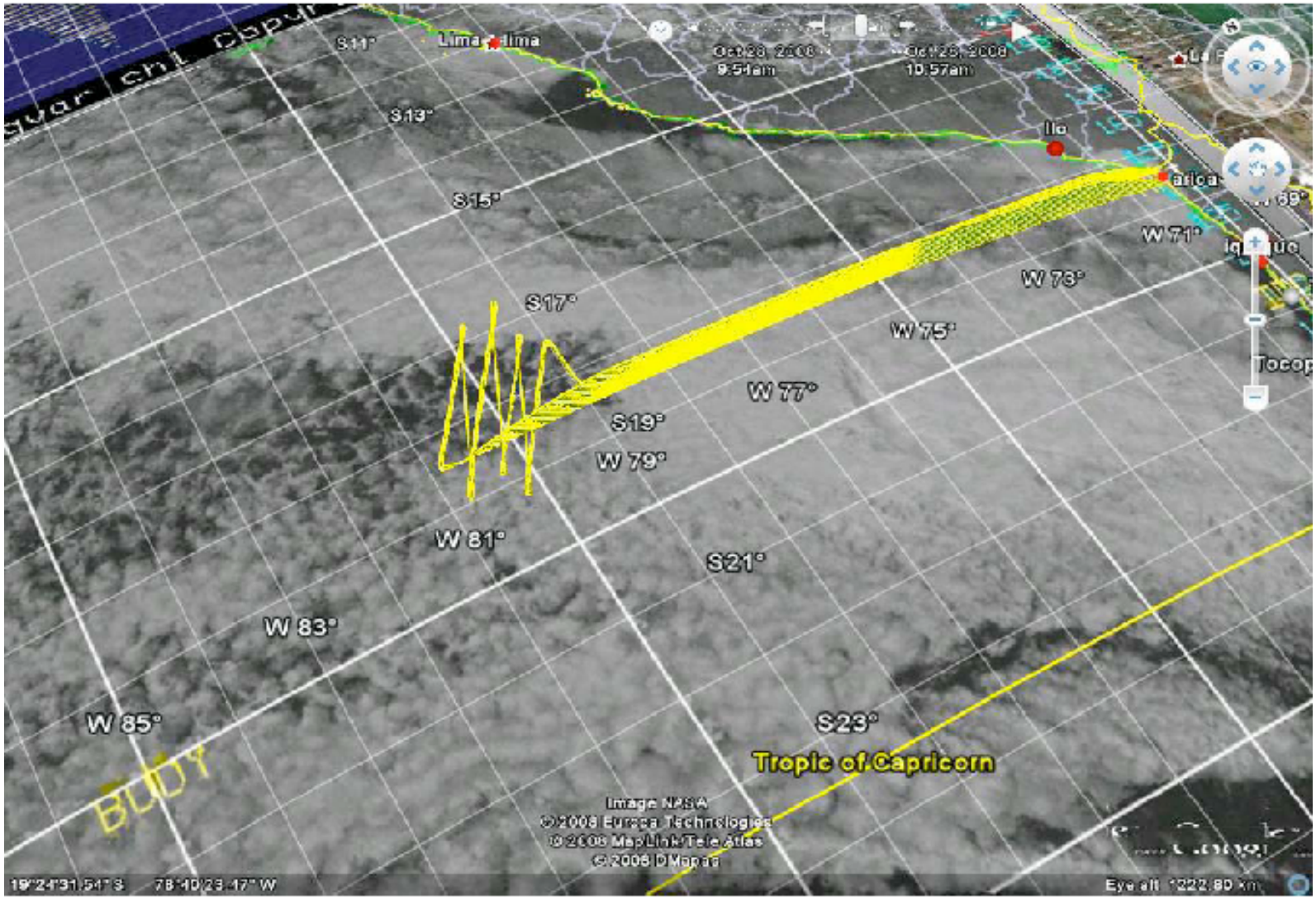
CBL Structure and Chemistry

Alan Bandy, Byron Blomquist
and Nenad Zagorac


Cloud Tops?
From Upper Free Troposhere
1000m
pre CCN
$(H_2SO_4)_n \cdot (H_2O)_m$
H_2SO_4
SO_3
SO_2
CCN
H2SO4
H2SO4
OH
CH_3SCH_3
O_2
O
CH_3SCH_3
Salt
DMS (gas)
DMSP CH_3 S^+—CH_2 CH_2 COO^- CH_3
DMS CH_3—S—CH_3
DMSP
Phytoplankton
Zooplankton
Acrylic Acid

Flight 6


S11°
Lima
Lima
Oct 28, 2008
9:54am
Oct 29, 2008
10:57am
S13°
Ilo
S15°
W 71°
W 73°
S17°
W 75°
W 77°
S19°
W 79°
W 81°
S21°
W 83°
W 85°
S23°
Tropic of Capricorn
BUDY
Image NASA
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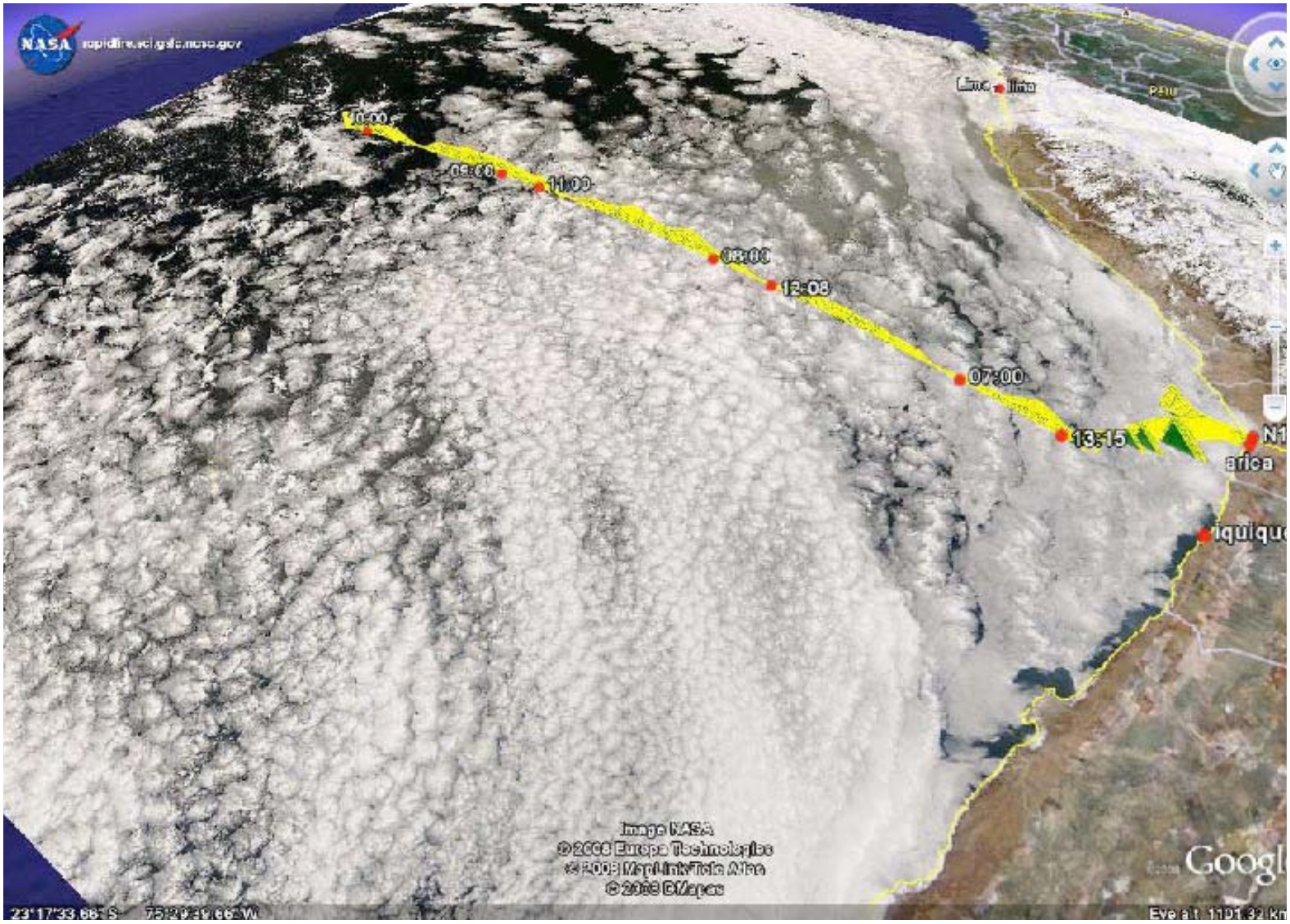
© 2008 DMapas

Flight 4


NASA
10:00
09:08
11:00
08:08
12:08
07:00
13:15
Image NASA
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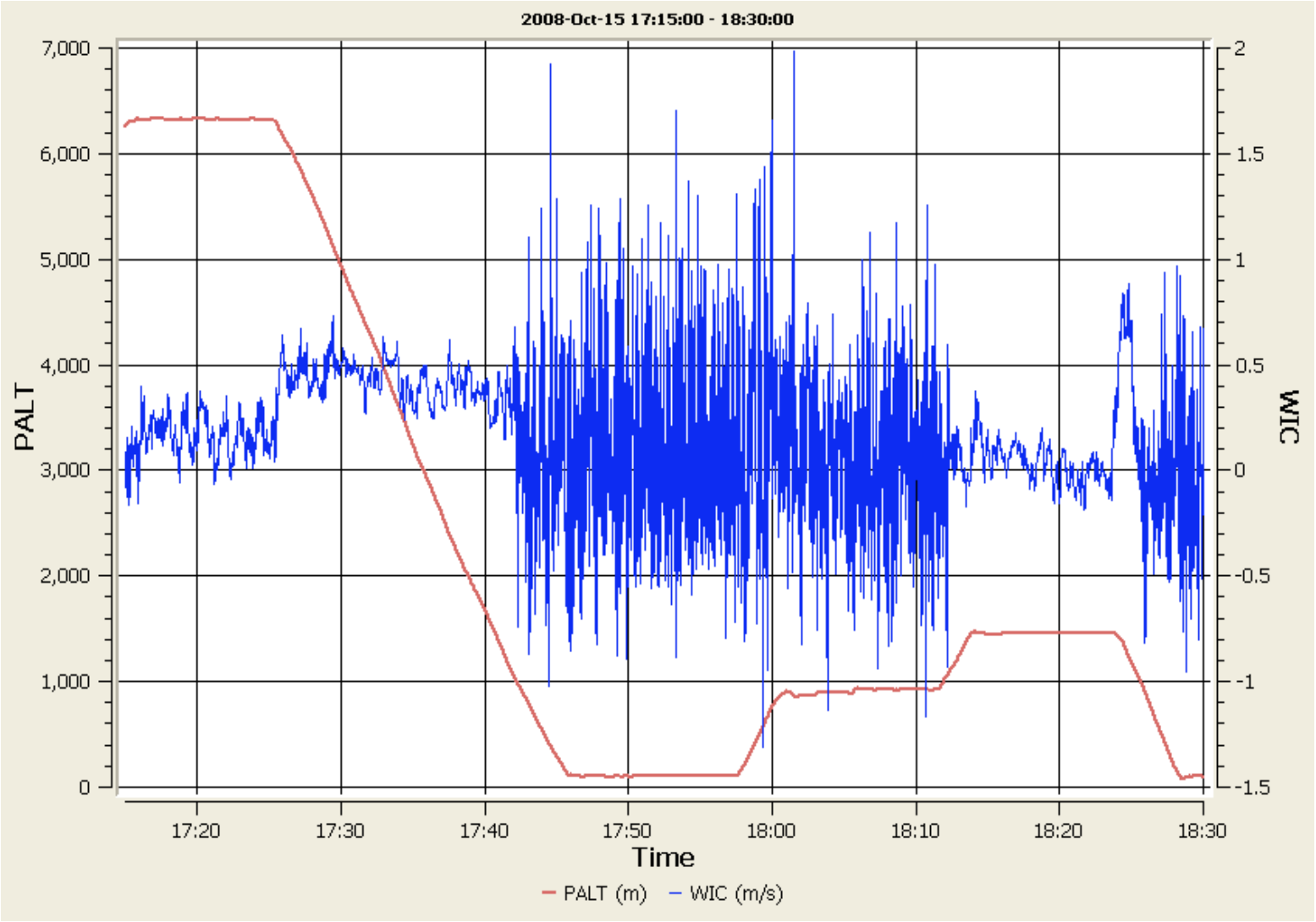
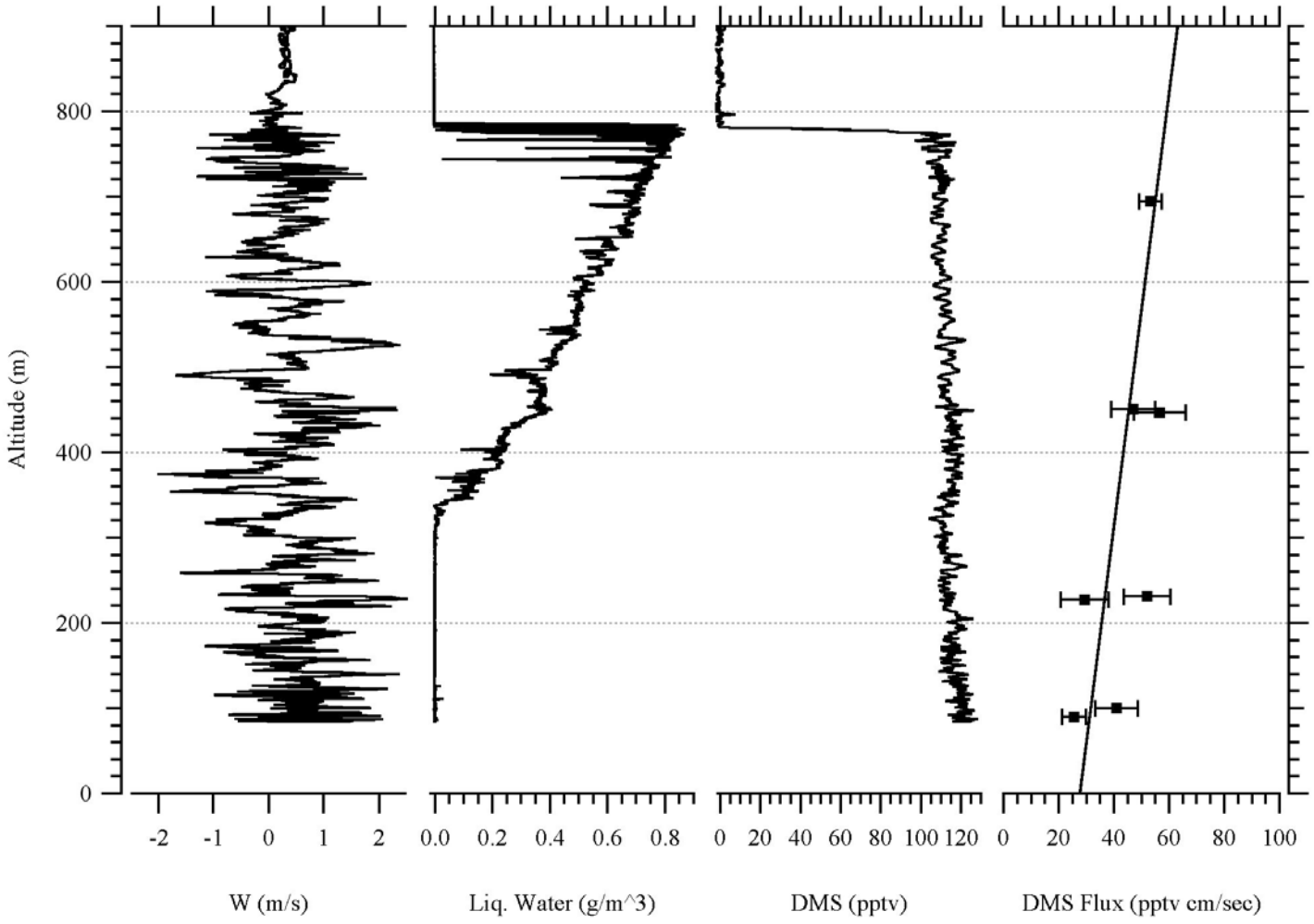
Google

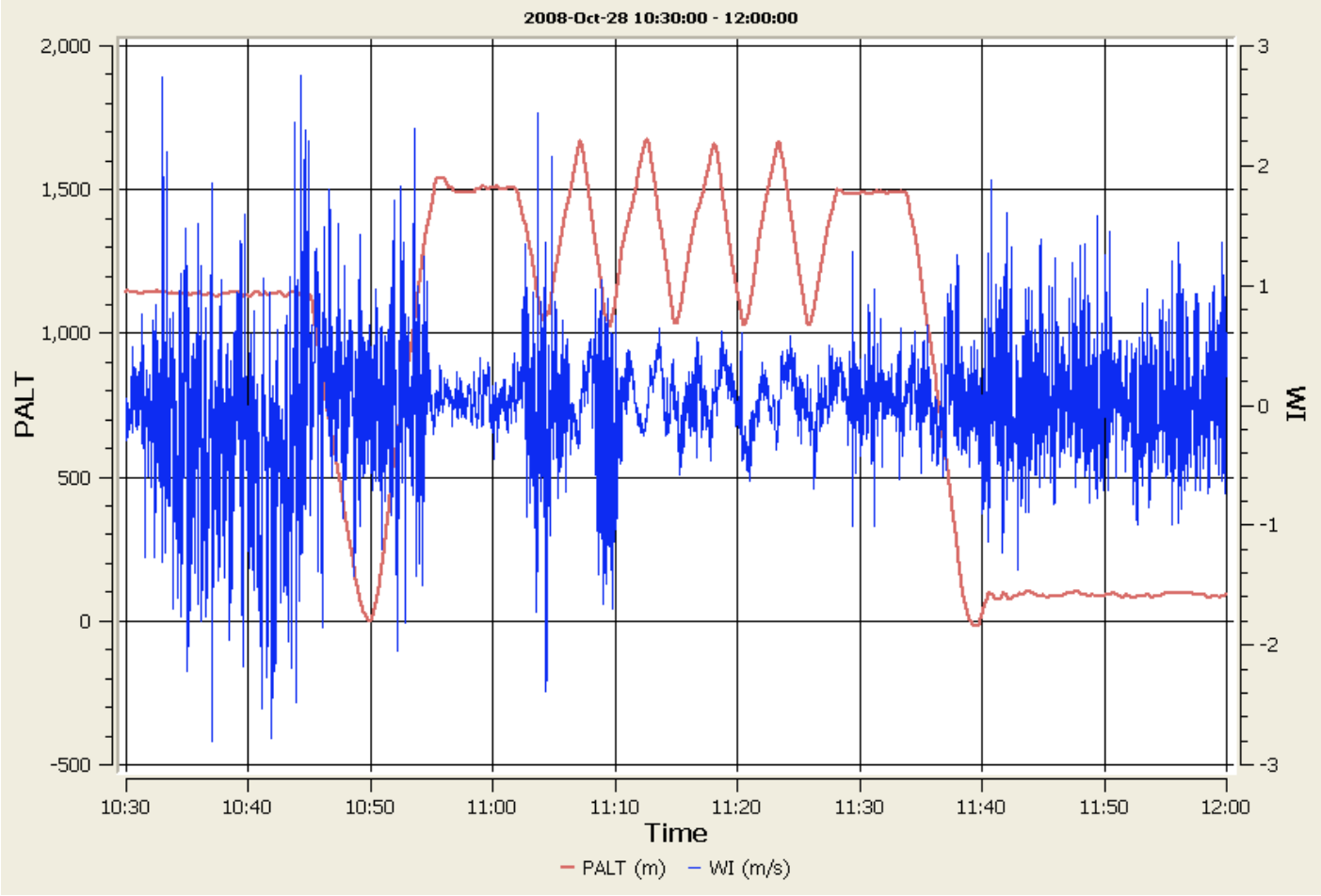
CBL Turbulence – RF4



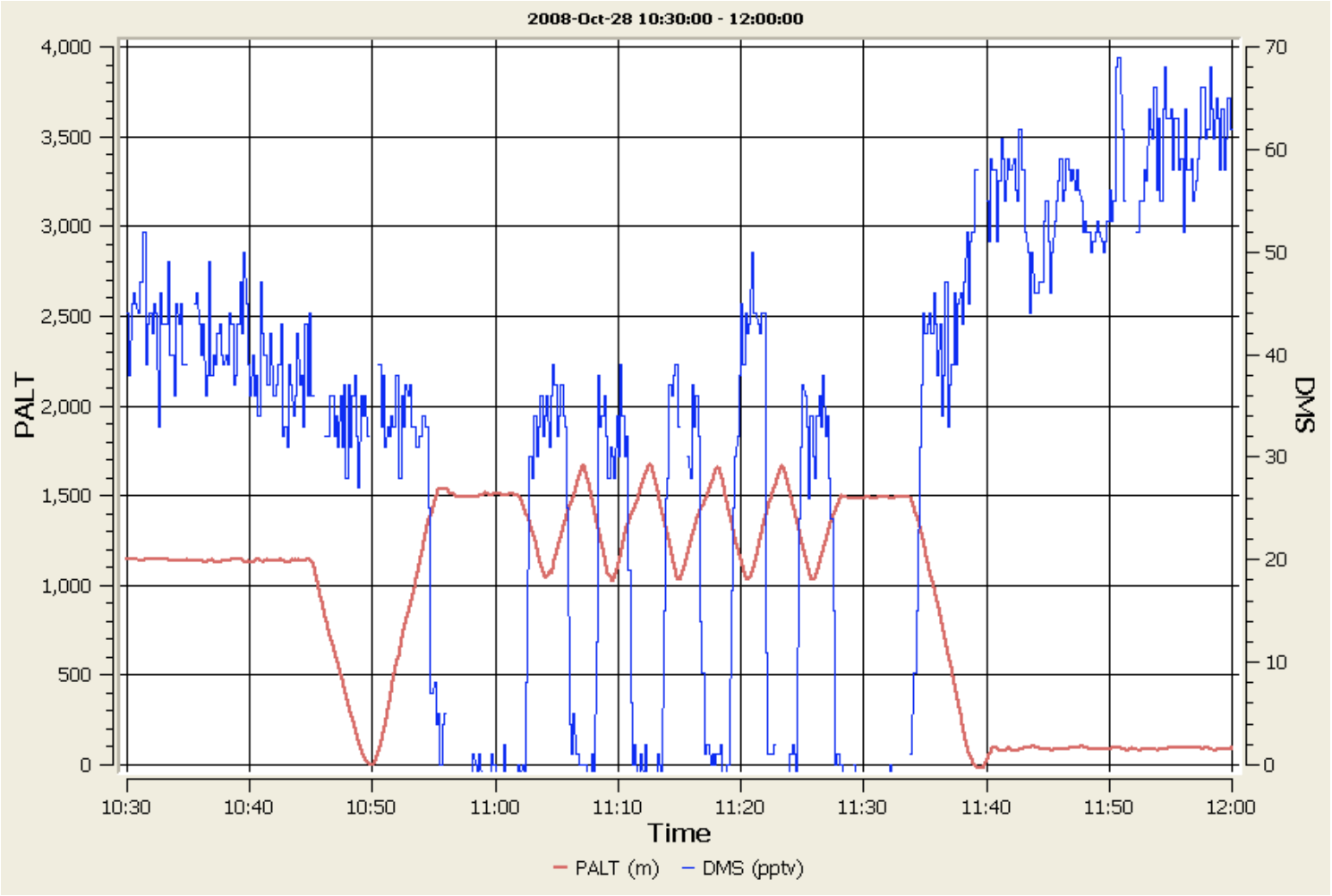
Sun Diego Stratocumulus (1985)



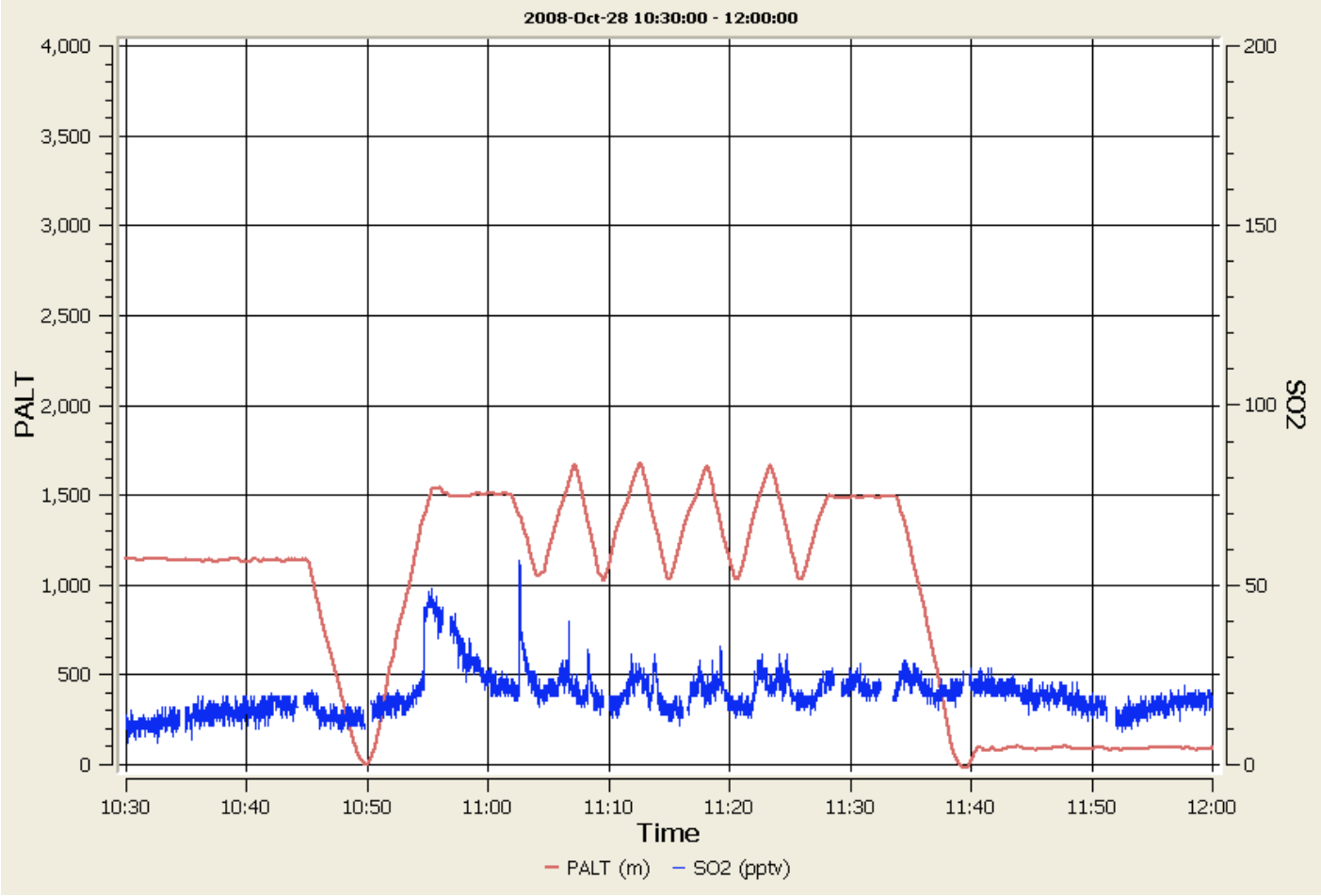
Low Turbulence in POC – RF6



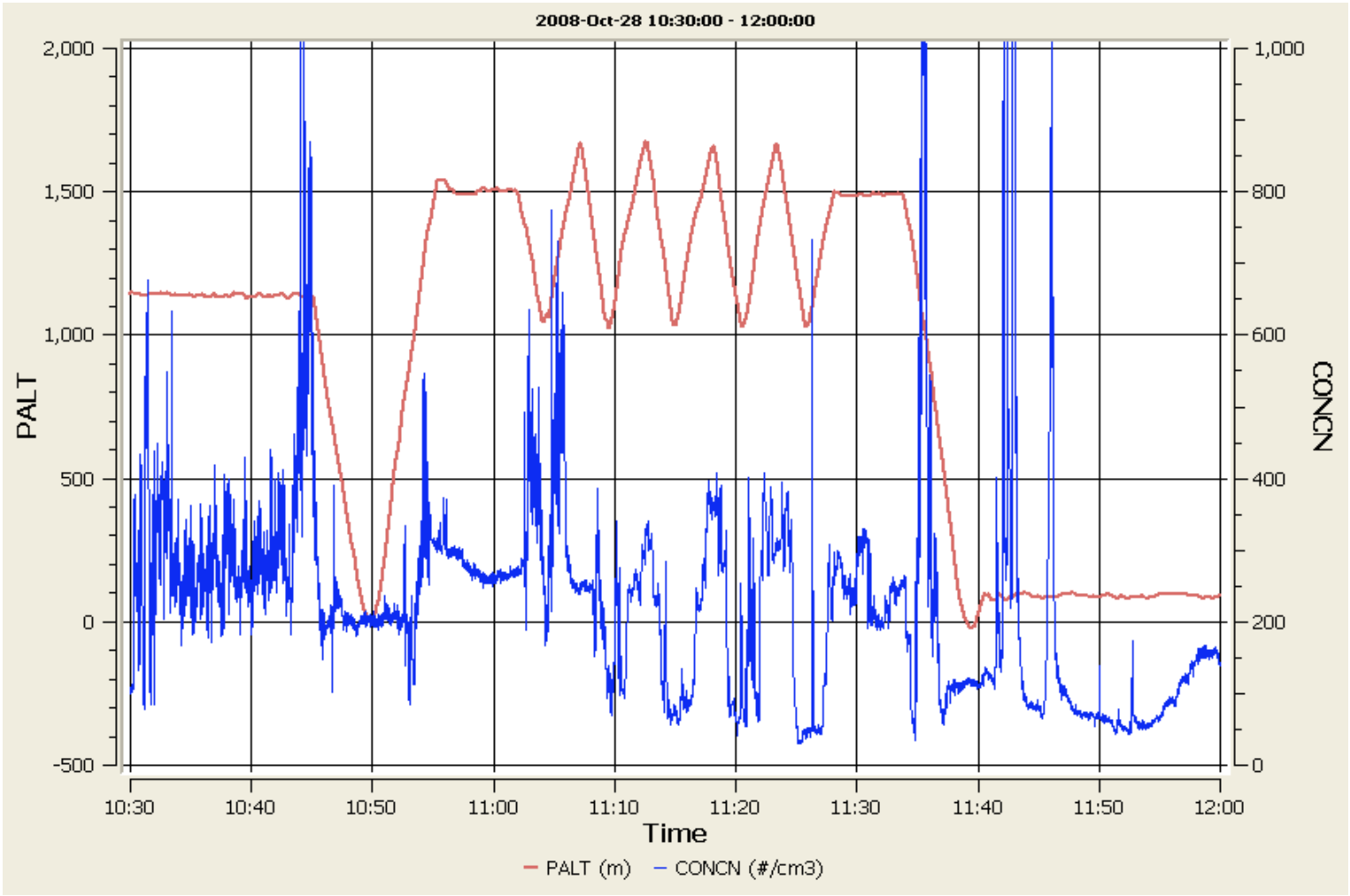
DMS Flight 6 POC



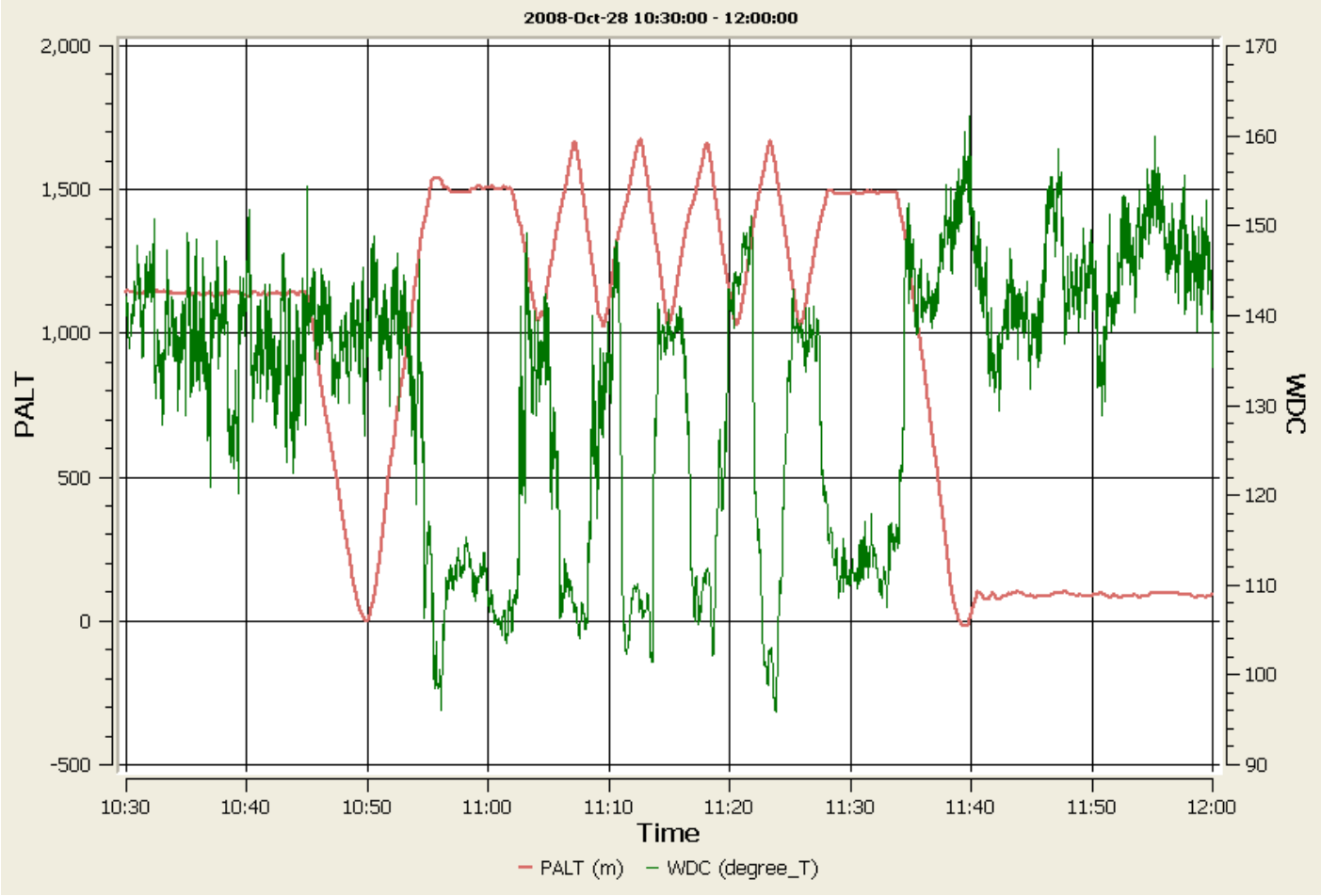
SO_2 in POC – RF6



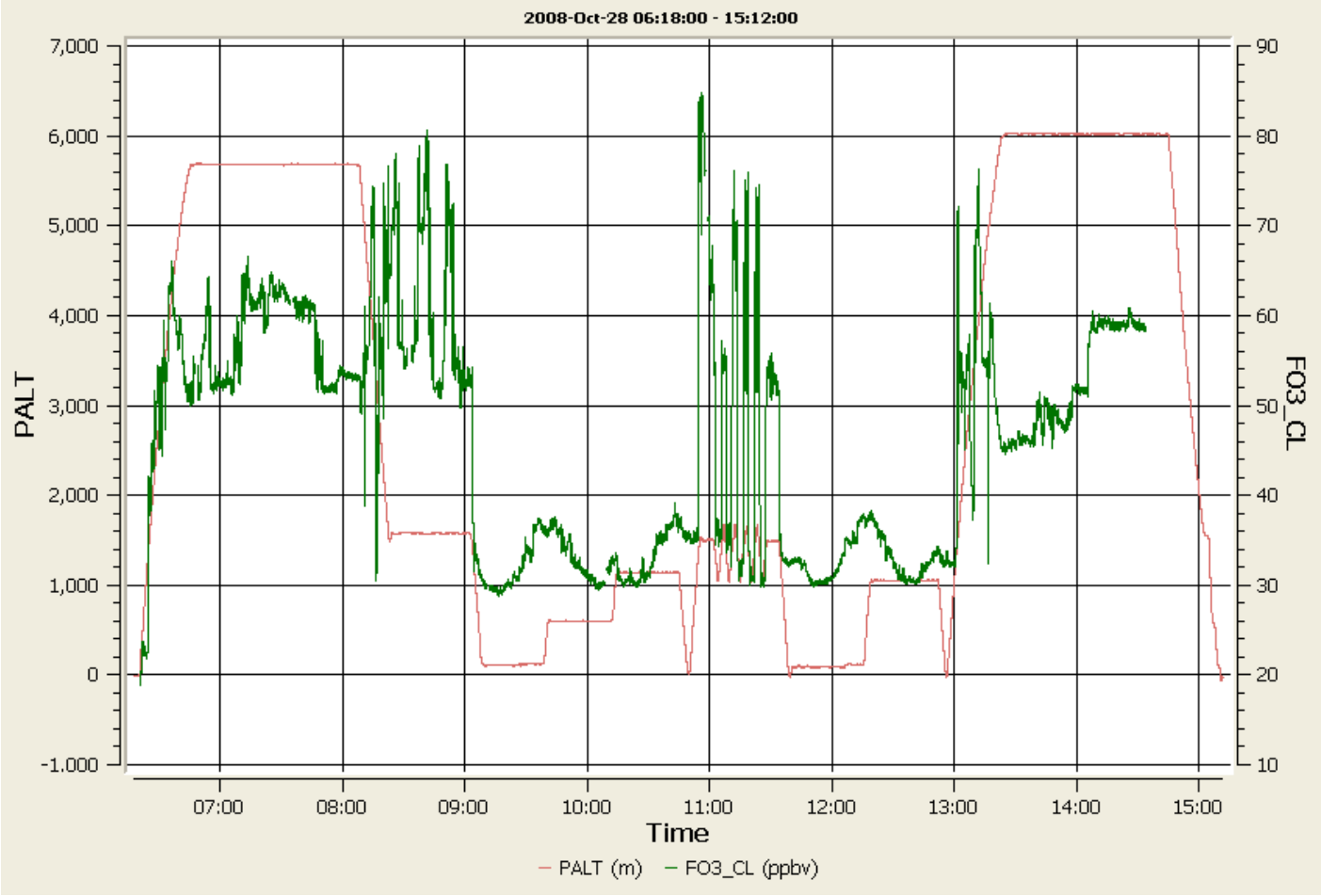
CONCN – RF6


2008-Oct-28 10:30:00 - 12:00:00
2,000
1,500
1,000
500
0
-500
PALT
1,000
800
600
400
200
0
CONCN
10:30
10:40
10:50
11:00
11:10
11:20
11:30
11:40
11:50
12:00
Time
PALT (m)
CONCN (#/cm3)

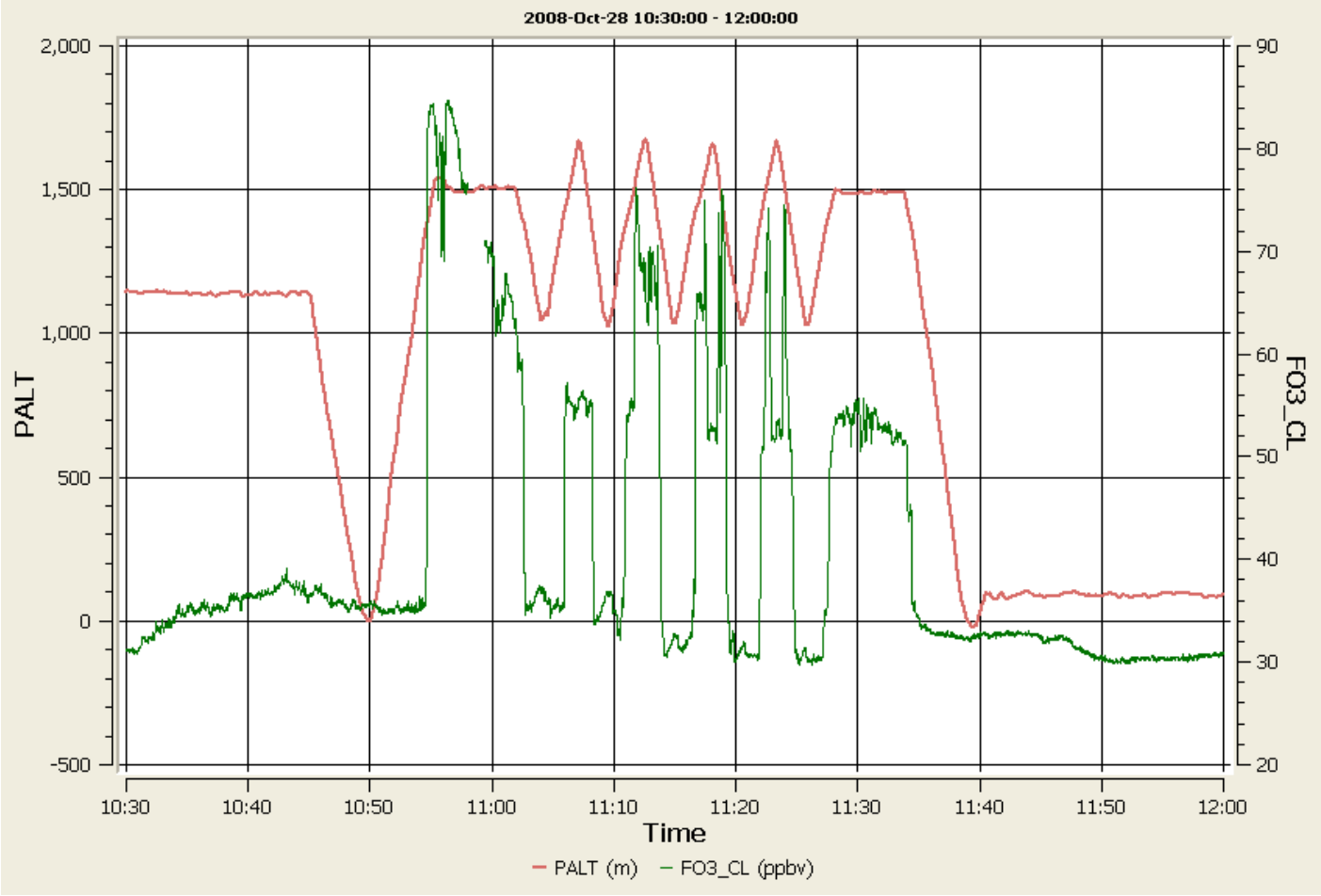
Wind Shear at CBL Top



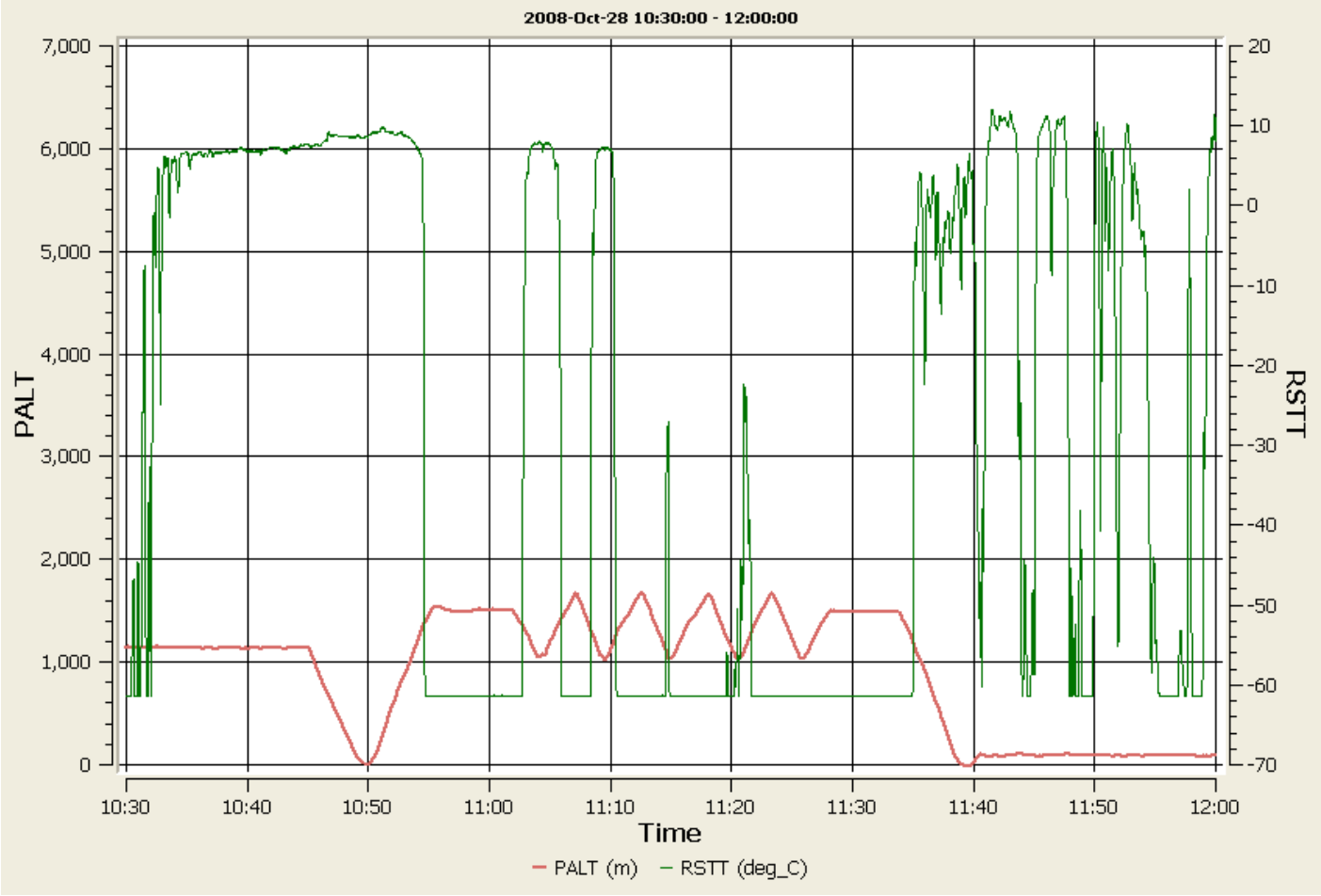
O_3 – RF6


2008-Oct-28 06:18:00 - 15:12:00
PALT
FO3_CL
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
-1,000
90
80
70
60
50
40
30
20
10
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
Time
PALT (m)
FO3_CL (ppbv)

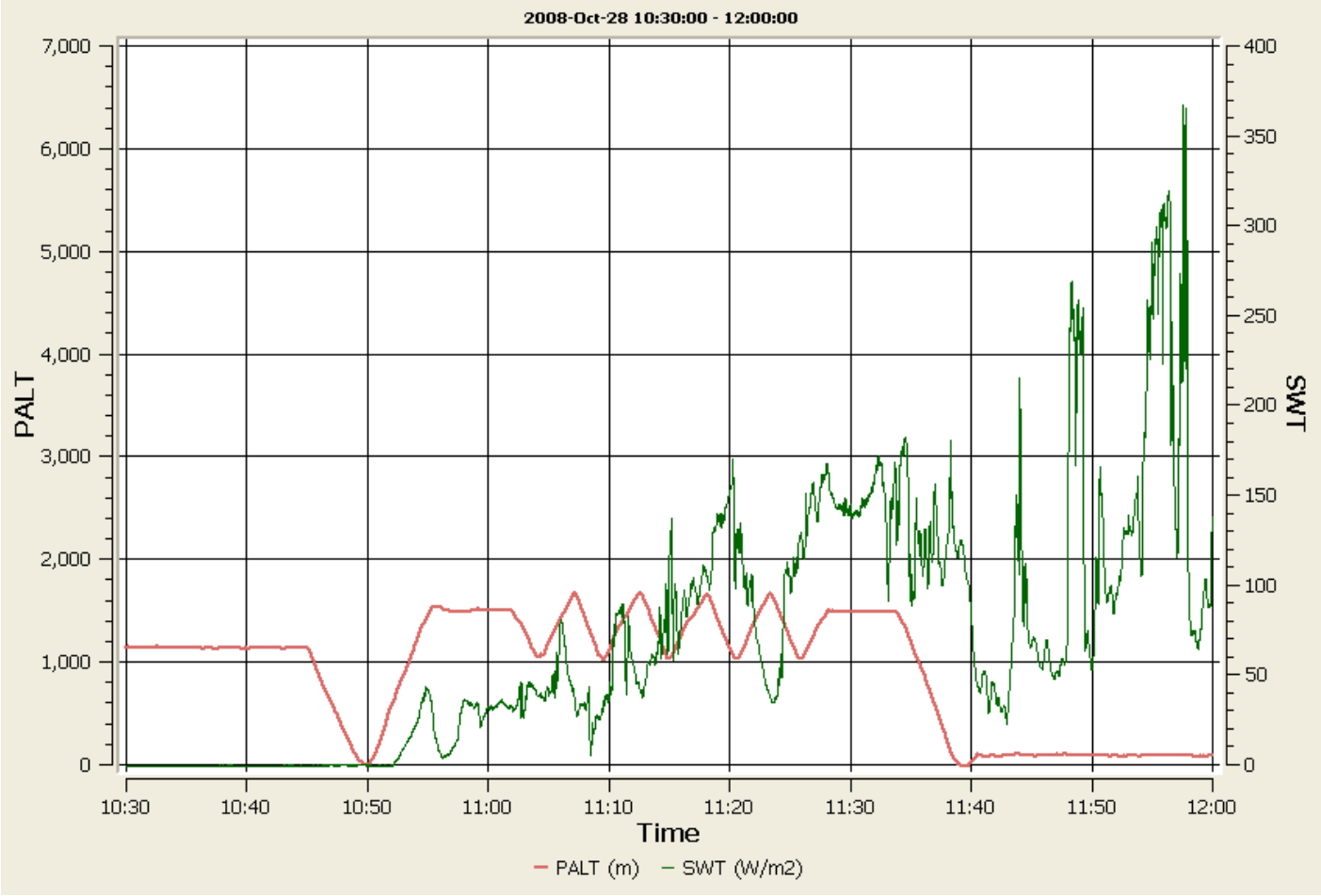
O_3 – RF6


2008-Oct-28 10:30:00 - 12:00:00
2,000
1,500
1,000
500
0
-500
PALT
90
80
70
60
50
40
30
20
FO3_CL
10:30
10:40
10:50
11:00
11:10
11:20
11:30
11:40
11:50
12:00
Time
PALT (m)
FO3_CL (ppbv)

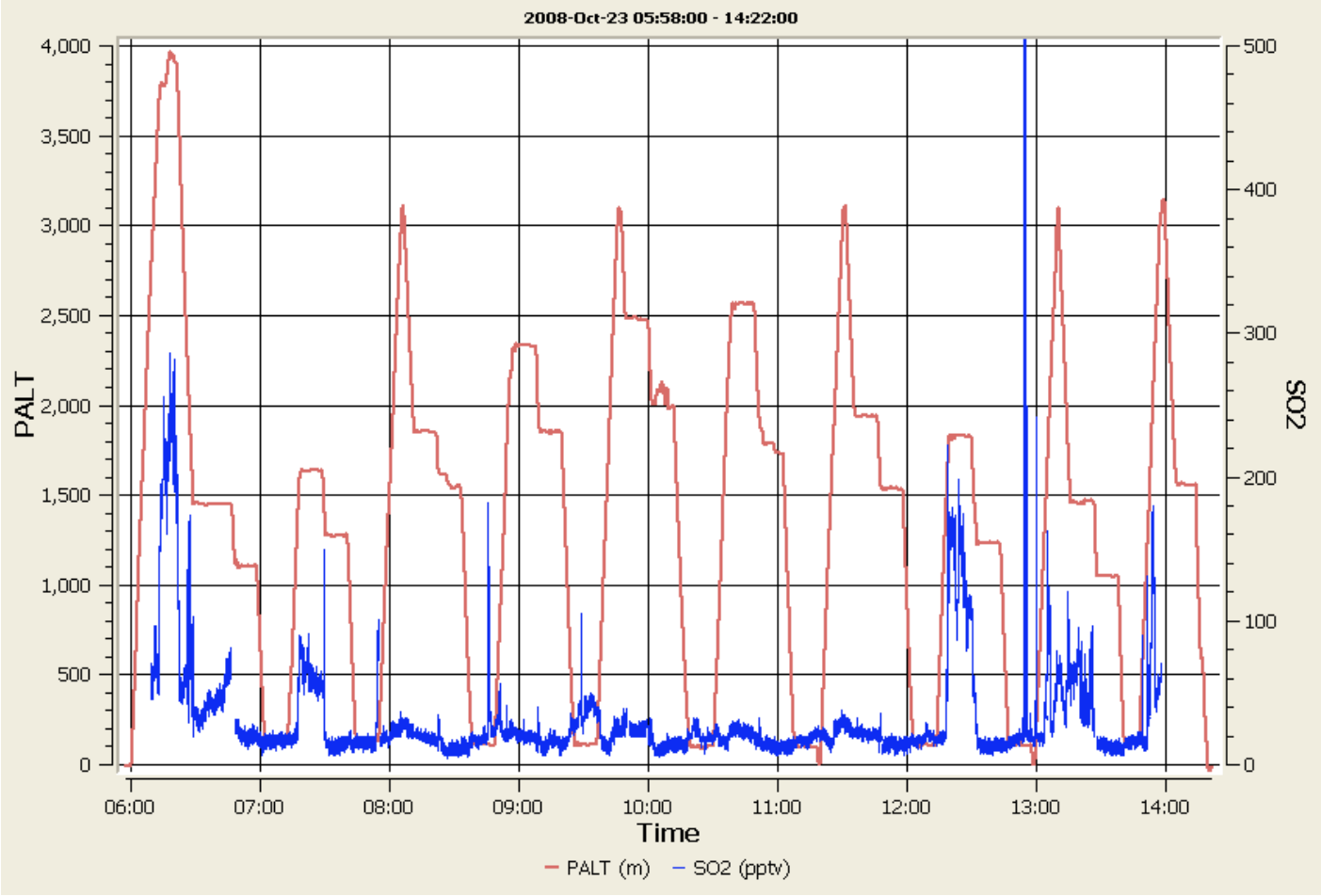
Sky / Cloud Temperature –RF6



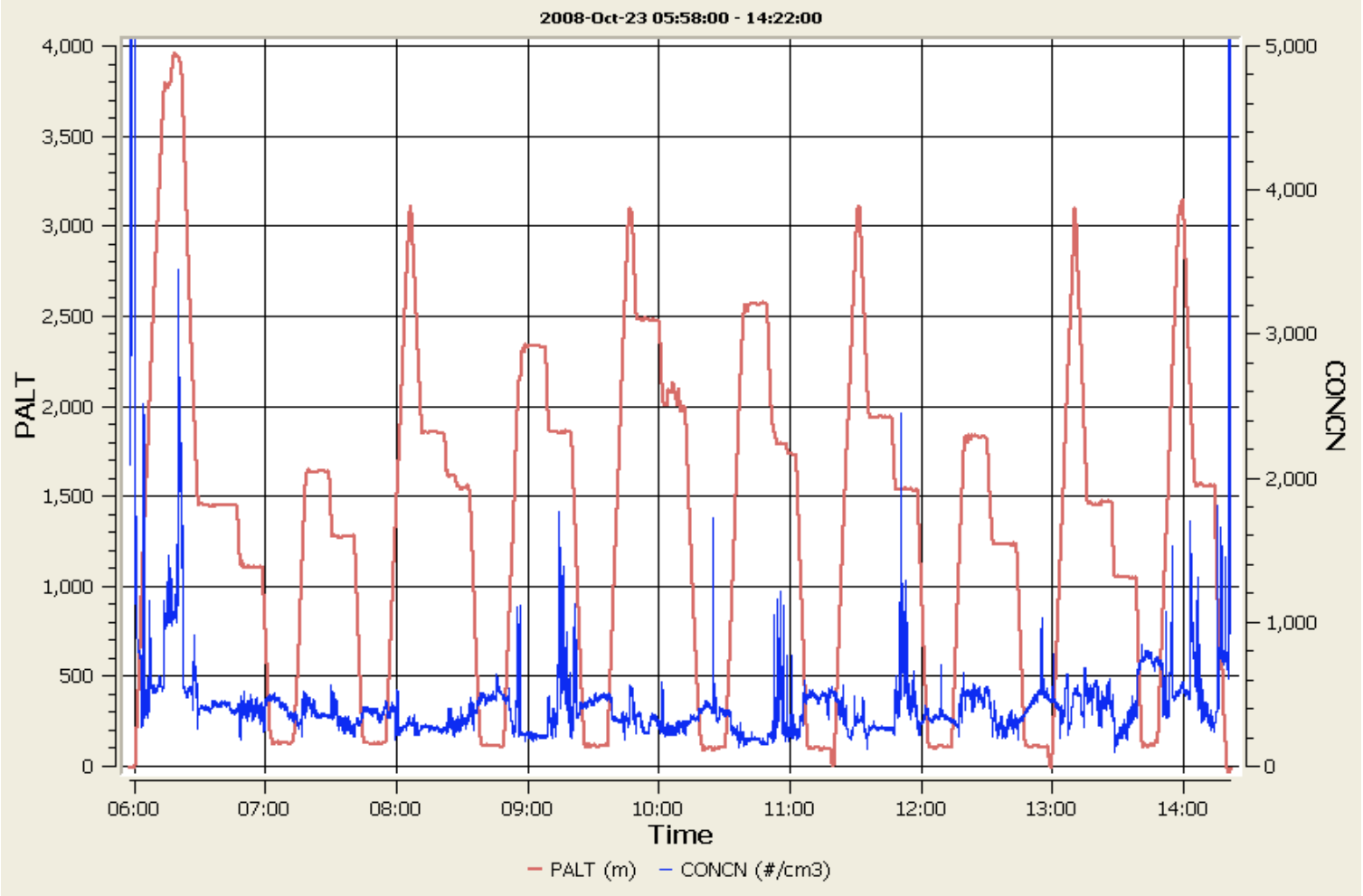
Shortwave Irradiance – RF6



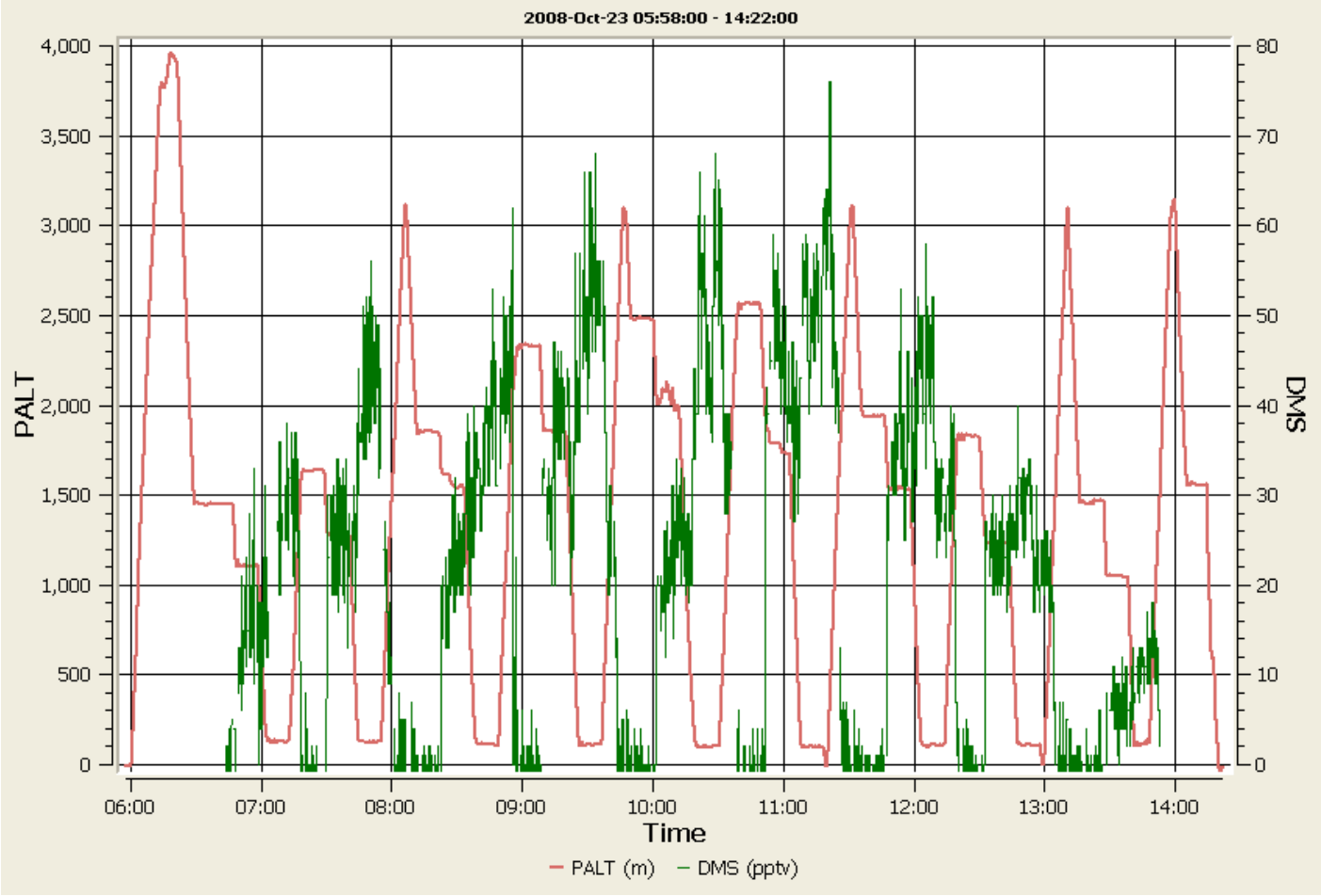
SO_2 in RF4


2008-Oct-23 05:58:00 - 14:22:00
PALT
SO2
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
500
400
300
200
100
0
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
Time
PALT (m)
SO2 (pptv)

CONCN – RF4


2008-Oct-23 05:58:00 - 14:22:00
PALT
CONCN
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
5,000
4,000
3,000
2,000
1,000
0
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
Time
PALT (m)
CONCN (#/cm3)

DMS –RF4


2008-Oct-23 05:58:00 - 14:22:00
PALT
DMS
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
80
70
60
50
40
30
20
10
0
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
Time
PALT (m)
DMS (pptv)

Flight 4

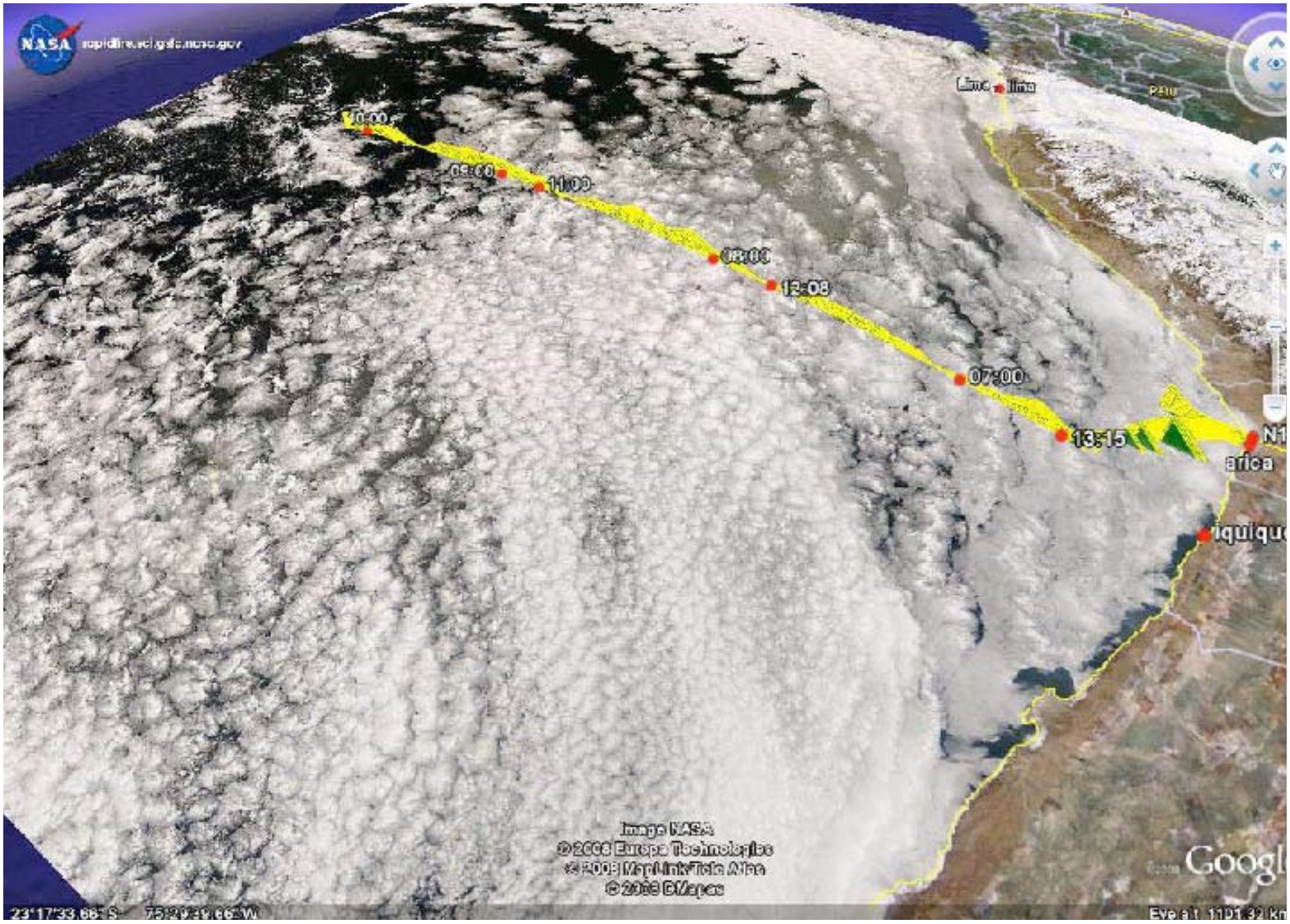

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Image NASA
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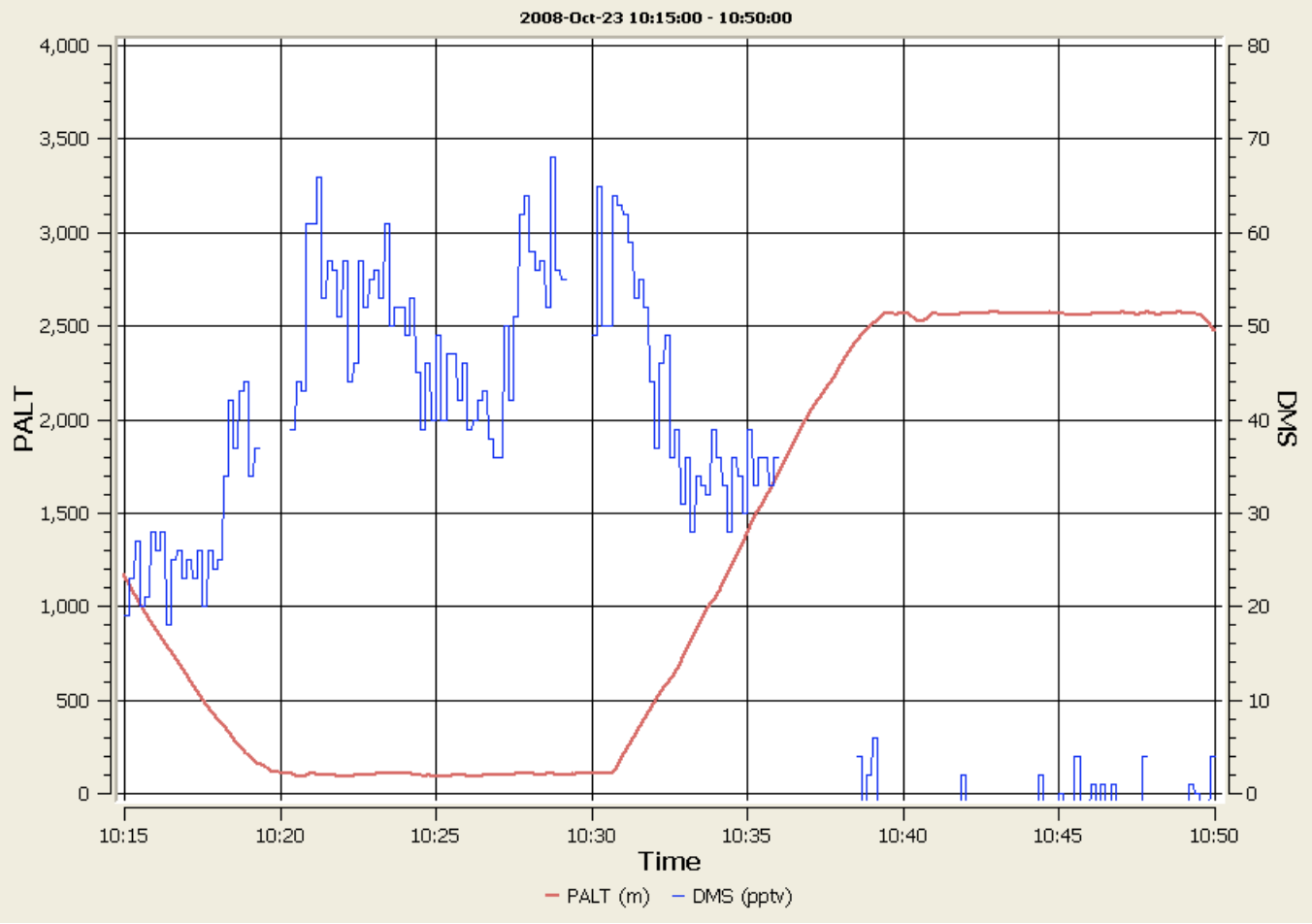
Trade Wind Regime – RF4



Results and Conclusions

- VOCALS Stratocumulus CBL very stable and turbulent and very similar to DYCOMS II CBL
- Entrainment velocity probably about 0.5 ± 0.3 cm s^{-1}
- Scalars and vertical velocity well mixed vertically
- Turbulence much less in POC's
- Very large change in wind direction at CBL top
- SO_2 less than 30 pptv in CBL
- DMS less than 50 pptv in CBL and negligible in FT
- CBL photochemistry minimal? –Cloud chemistry dominates. Impossible to estimate due to no NO
- Photochemistry becomes important in POC's
- NOX accelerates photochemistry in POCS