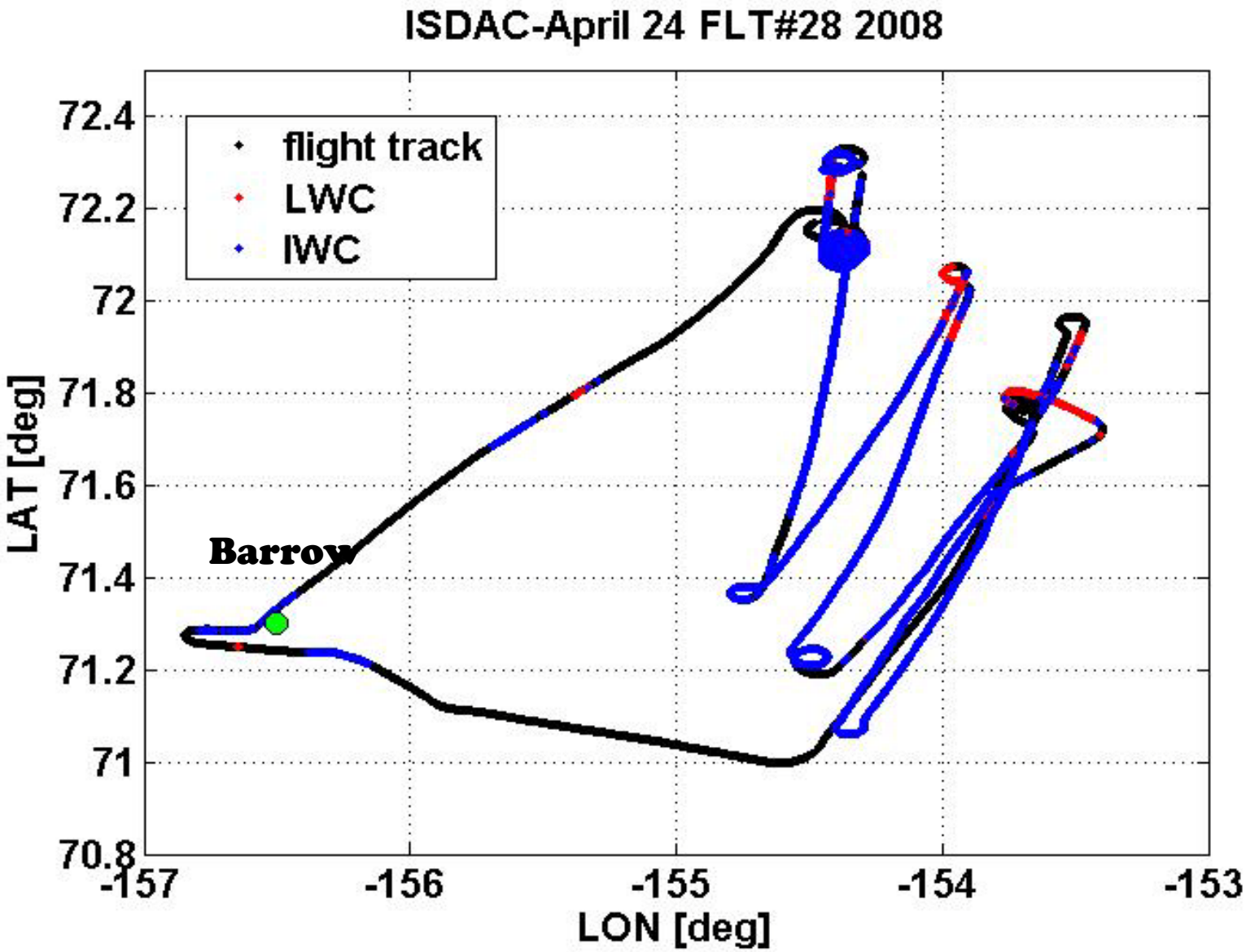
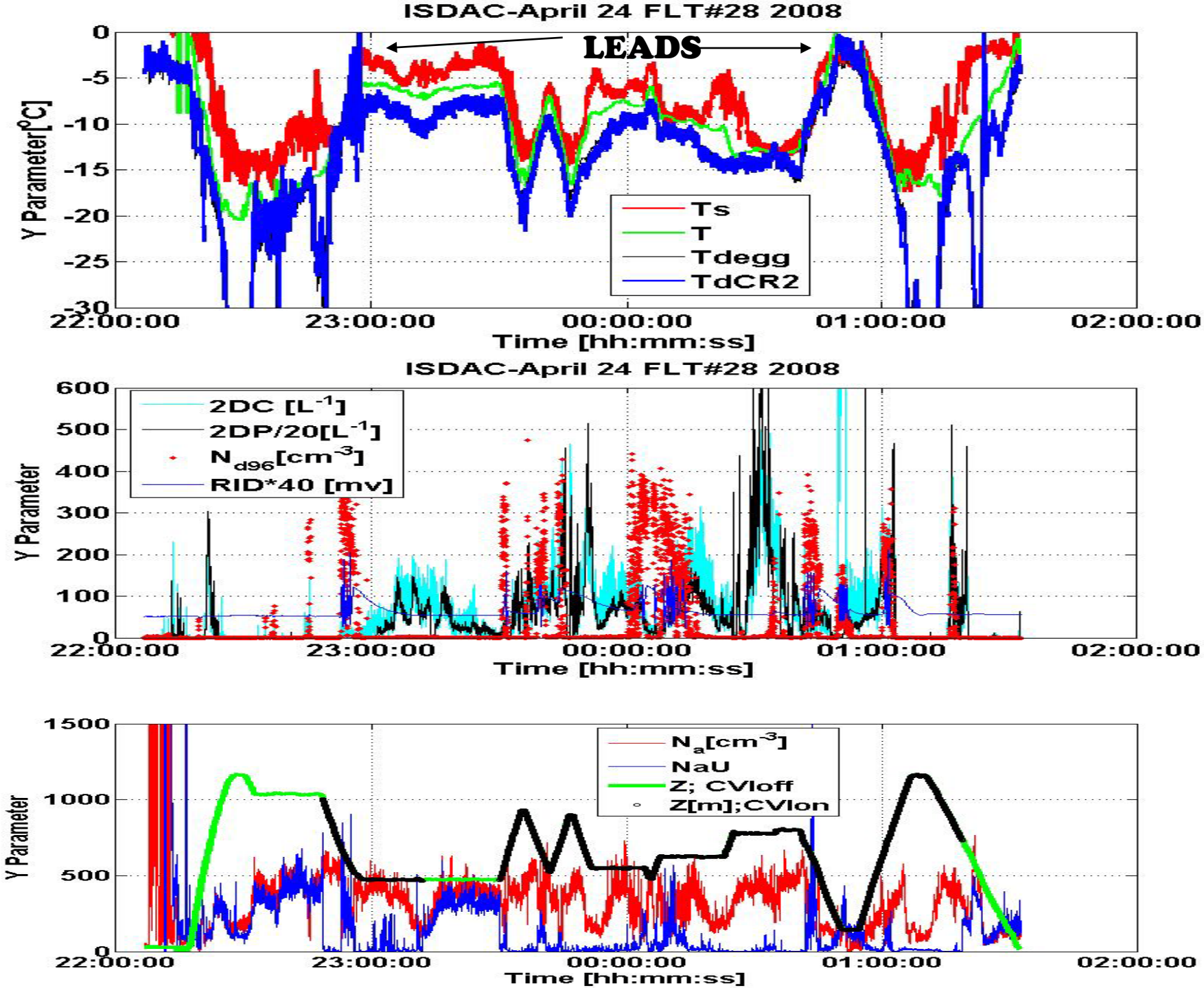
Microphysical Parameterizations Based on ISDAC Aircraft Observations and Aerosol-cloud effects on radiative fluxes

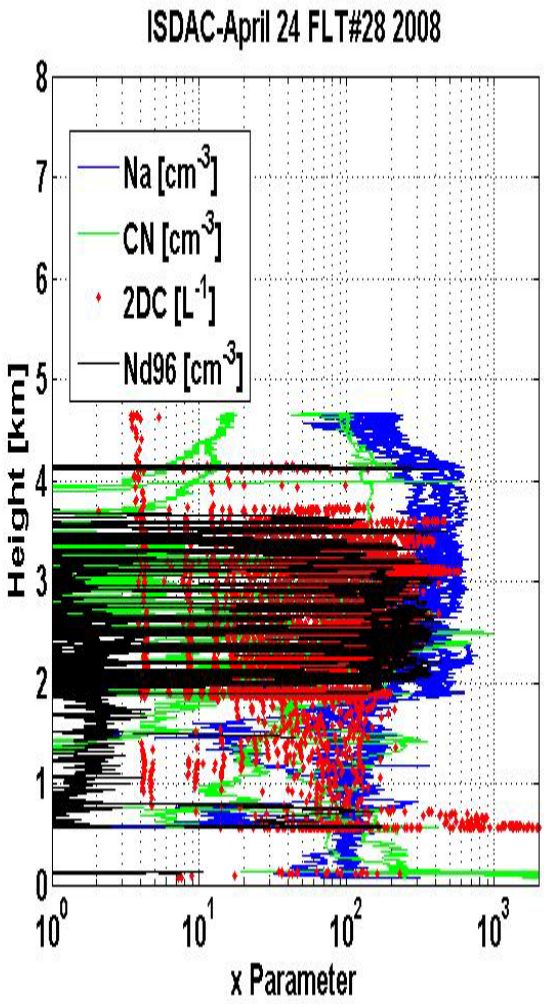
I.Gultepe
Contributions from
N. Shantz
M. Couture

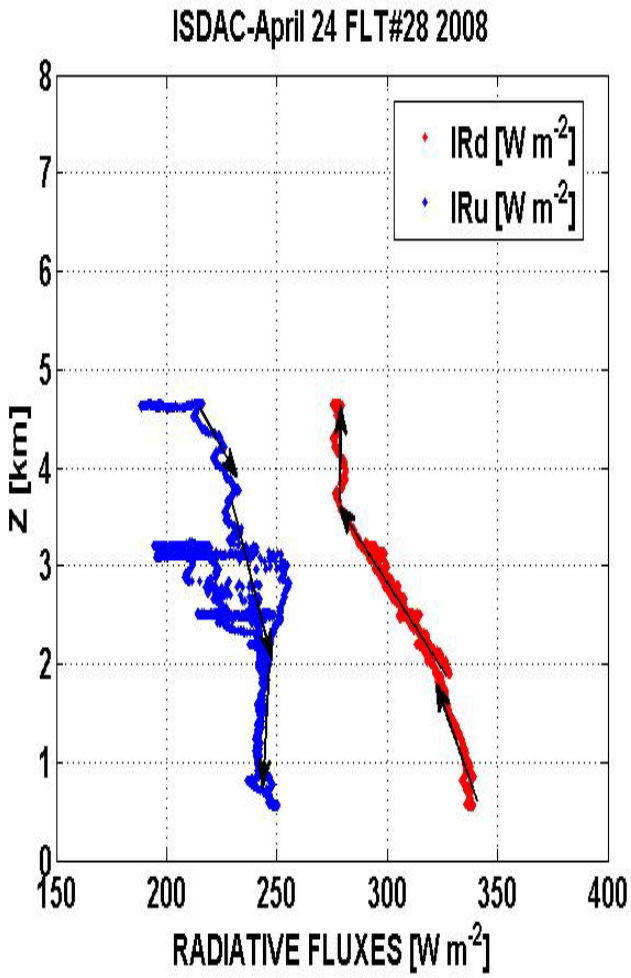
[1]Cloud Physics and Severe Weather Research Section, EC, Toronto, Ontario M3H5T4, **ismail.gultepe@ec.gc.ca**

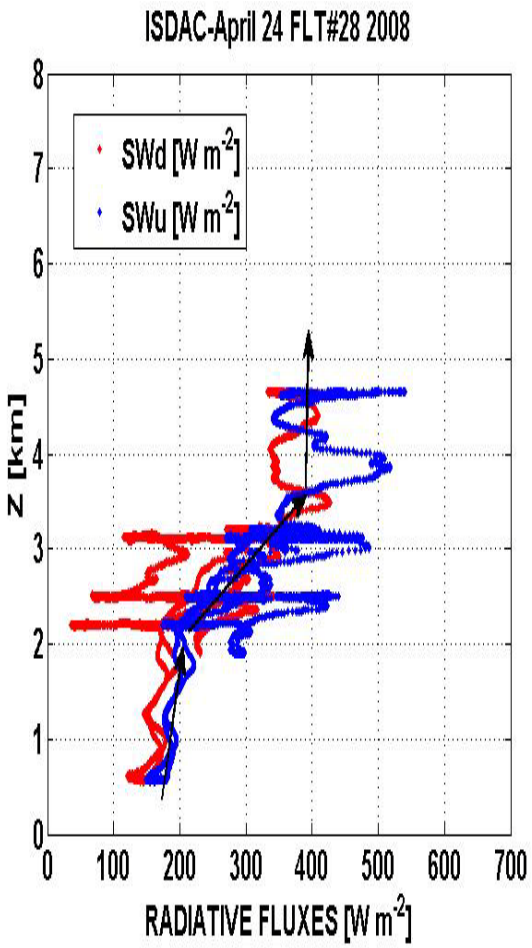
Polluted case

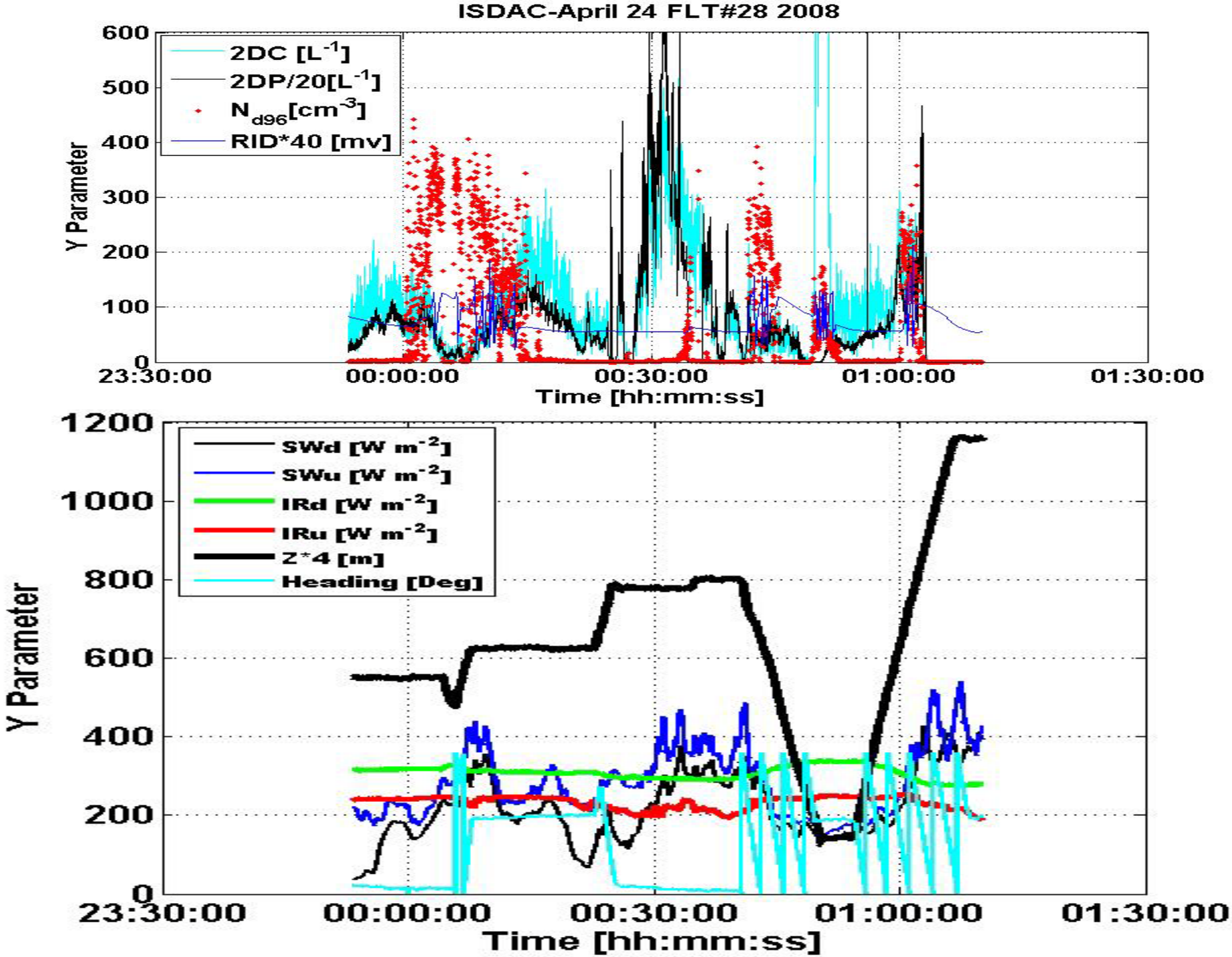


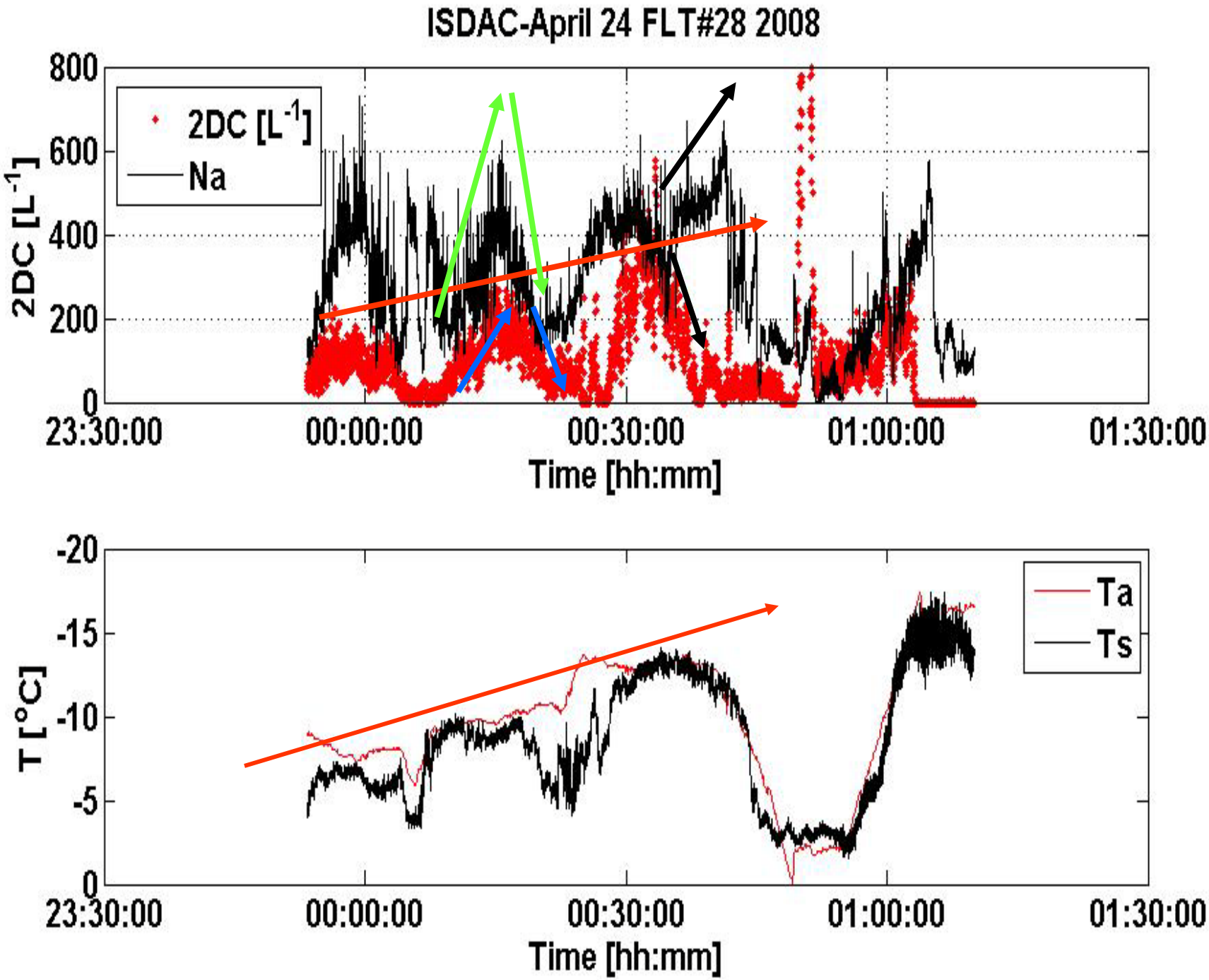

ISDAC-April 24 FLT#28 2008
LEADS
Y Parameter[°C]
Ts
T
Tdegg
TdCR2
Time [hh:mm:ss]
ISDAC-April 24 FLT#28 2008
Y Parameter
2DC [L-1]
2DP/20[L-1]
Nd96[cm-3]
RID*40 [mv]
Time [hh:mm:ss]
Y Parameter
Na[cm-3]
NaU
Z; CVloff
Z[m];CVlon
Time [hh:mm:ss]

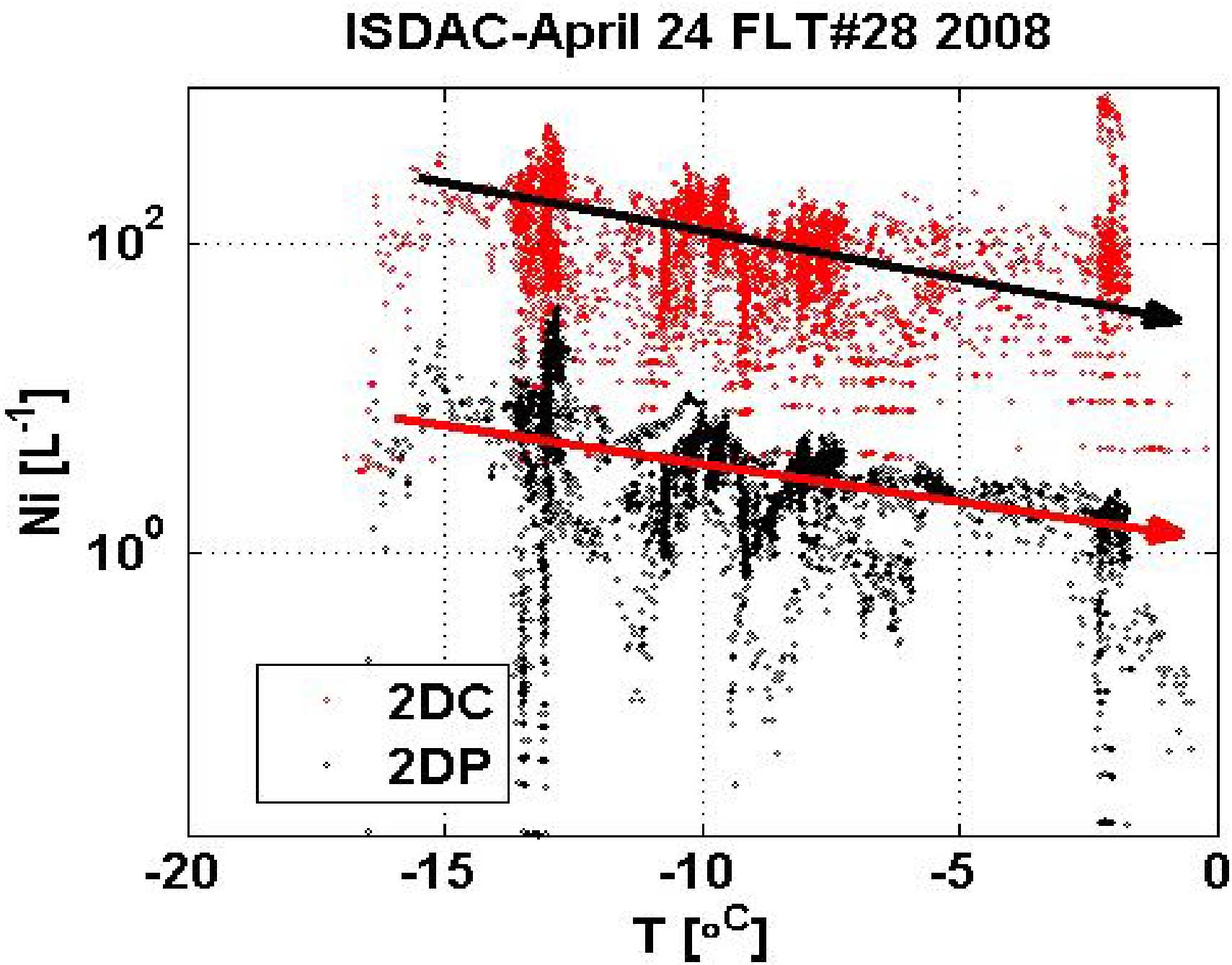

ISDAC-April 24 FLT#28 2008
Na [cm-3]
CN [cm-3]
2DC [L-1]
Nd96 [cm-3]
Height [km]
x Parameter

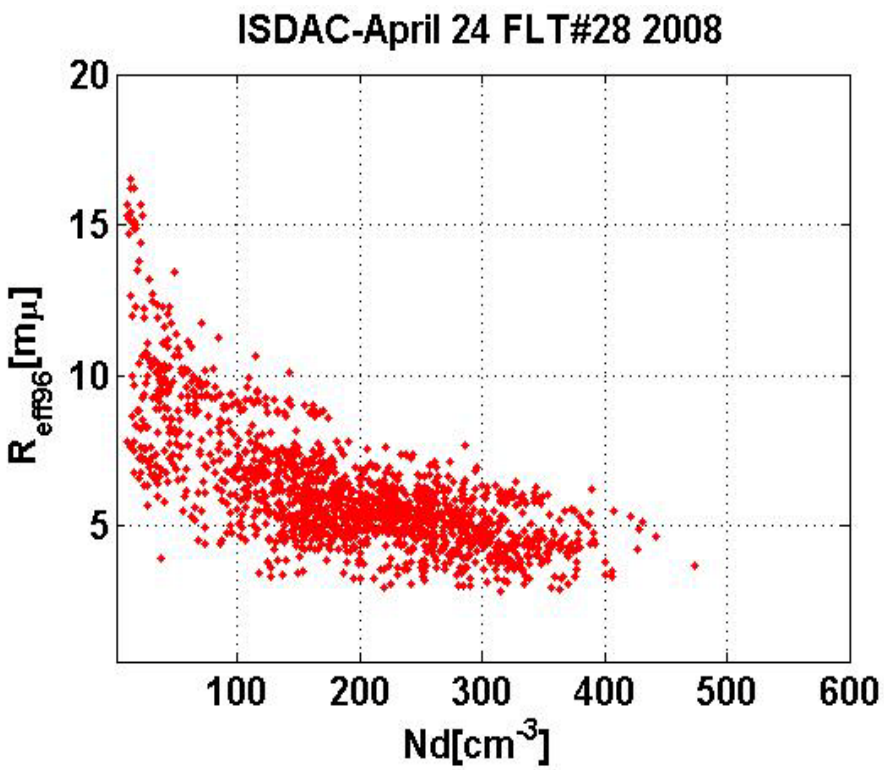

ISDAC-April 24 FLT#28 2008
IRd [W m-2]
IRu [W m-2]
Z [km]
RADIATIVE FLUXES [W m-2]

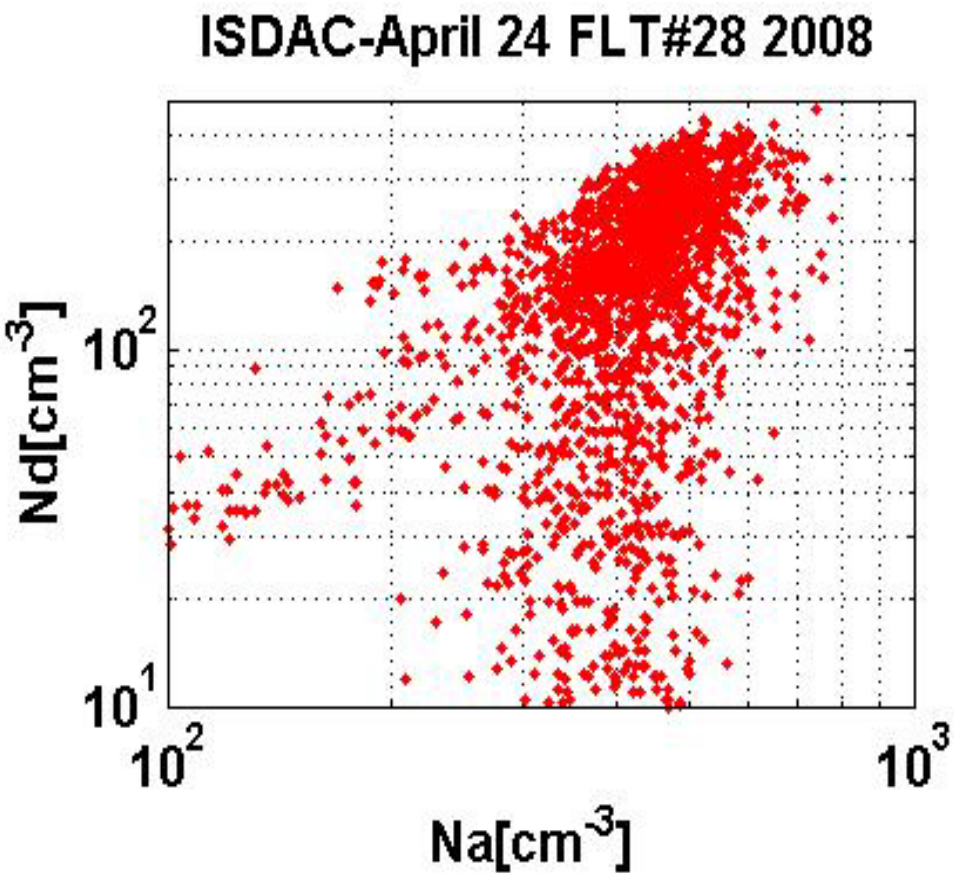

ISDAC-April 24 FLT#28 2008
SWd [W m-2]
SWu [W m-2]
Z [km]
RADIATIVE FLUXES [W m-2]


ISDAC-April 24 FLT#28 2008
2DC [L-1]
2DP/20[L-1]
Nd96[cm-3]
RID*40 [mv]
Y Parameter
Time [hh:mm:ss]
23:30:00
00:00:00
00:30:00
01:00:00
01:30:00
SWd [W m-2]
SWu [W m-2]
IRd [W m-2]
IRu [W m-2]
Z*4 [m]
Heading [Deg]

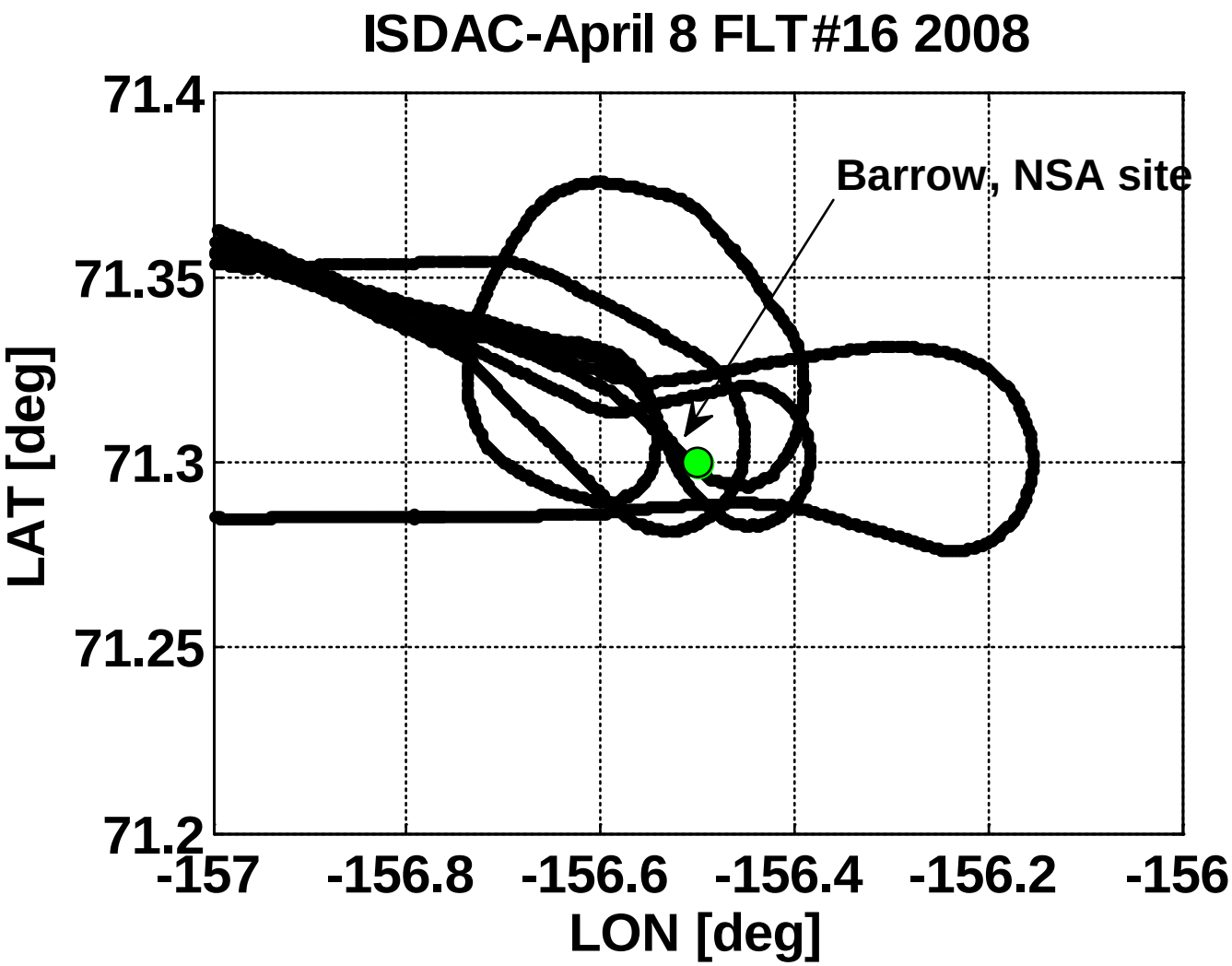

ISDAC-April 24 FLT#28 2008
2DC [L-1]
Na
2DC [L-1]
800
600
400
200
0
23:30:00
00:00:00
00:30:00
01:00:00
01:30:00
Time [hh:mm]
Ta
Ts
T [°C]
-20
-15
-10
-5
0
23:30:00
00:00:00
00:30:00
01:00:00
01:30:00
Time [hh:mm]

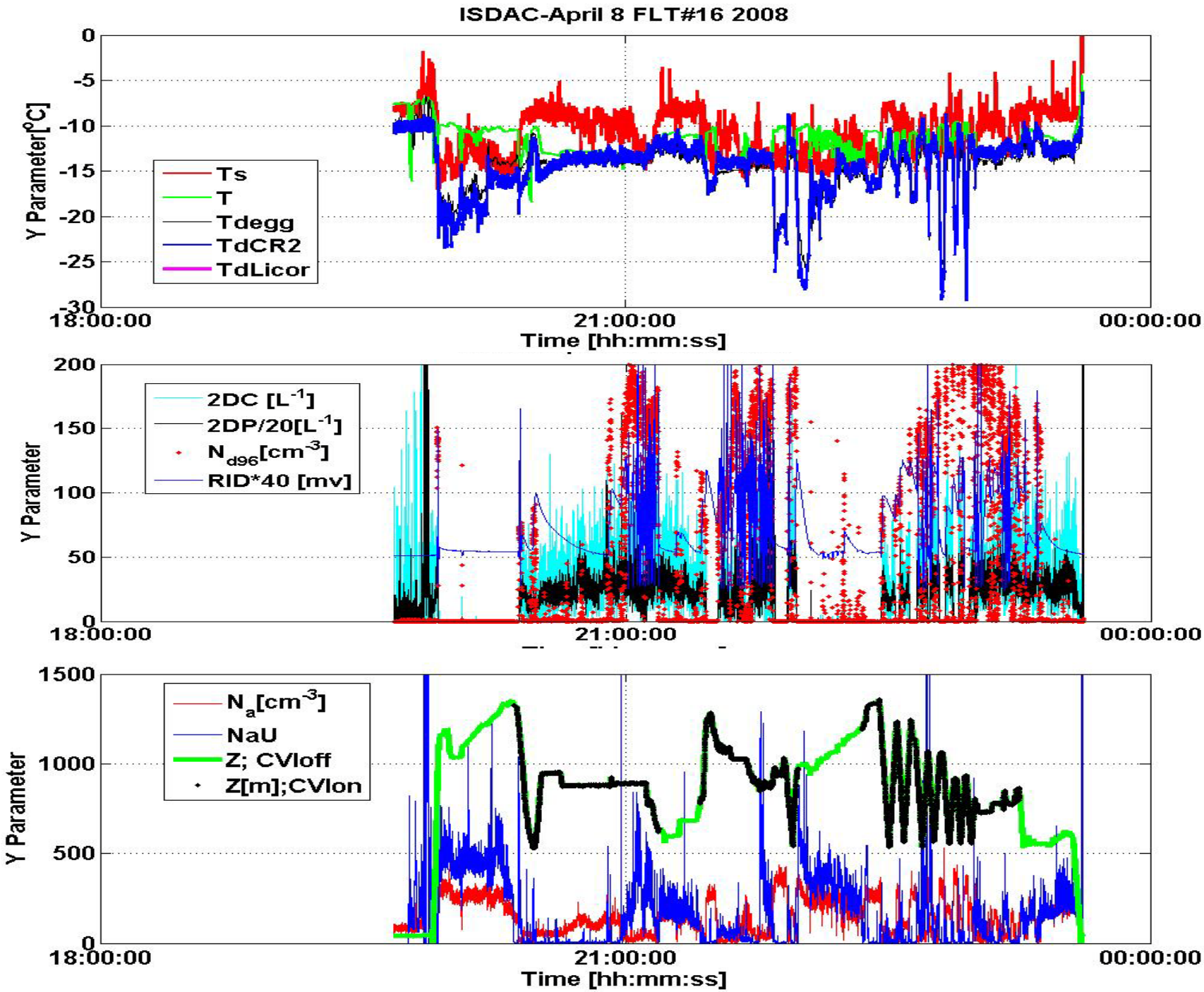

ISDAC-April 24 FLT#28 2008
Ni [L-1]
10^2
10^0
-20
-15
-10
-5
0
T [°C]
2DC
2DP


ISDAC-April 24 FLT#28 2008
20
15
10
5
100
200
300
400
500
600
Nd[cm-3]
Reff96[mμ]

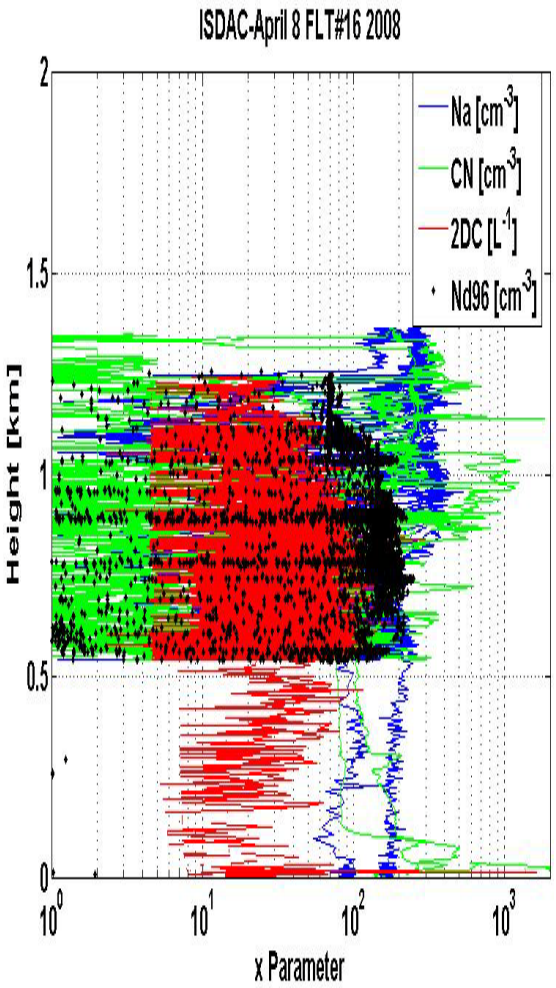

ISDAC-April 24 FLT#28 2008
10^2
10^1
10^2
10^3
Nd[cm-3]
Na[cm-3]

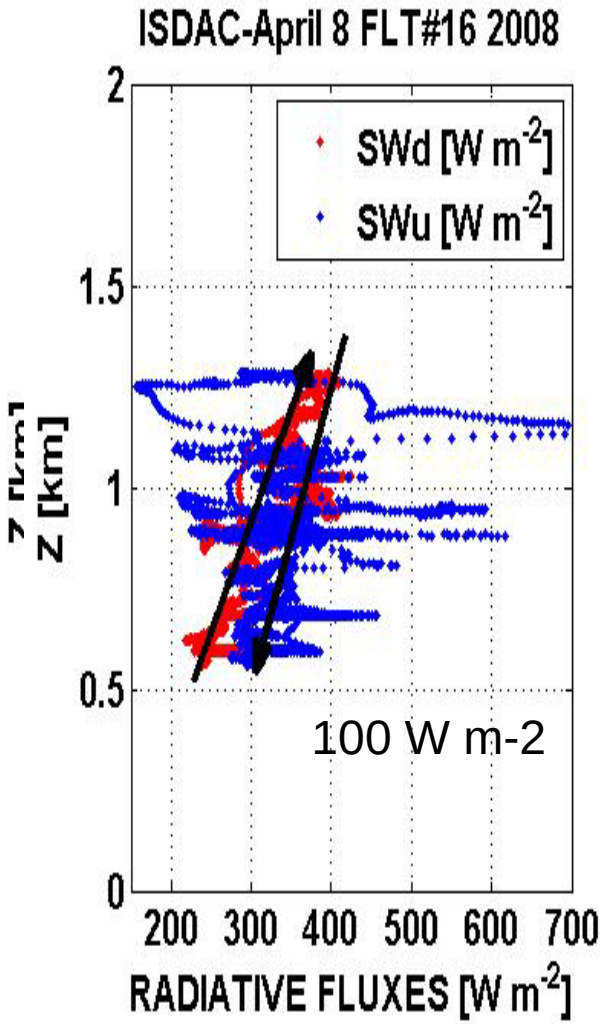
April 8; Clean case

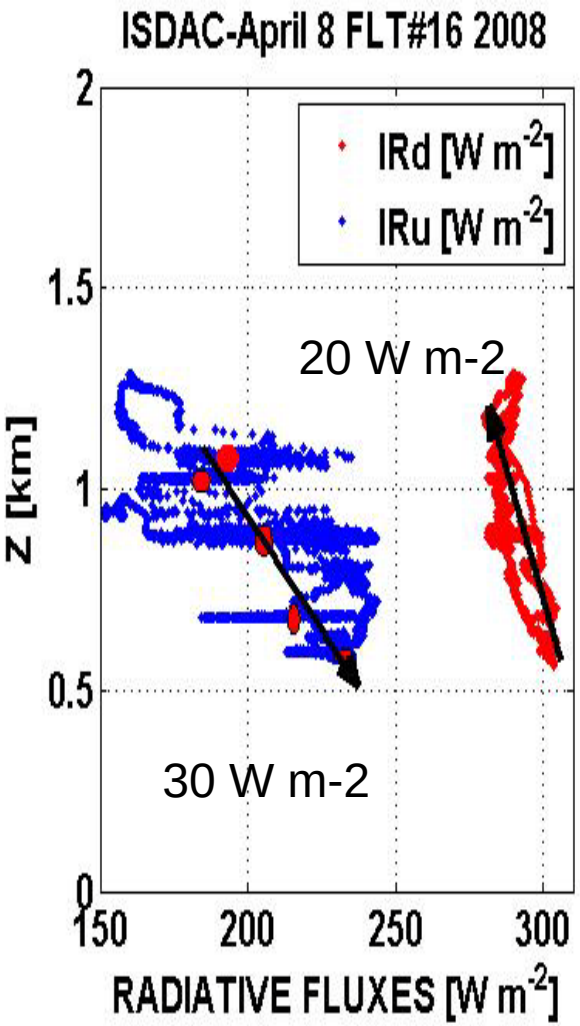


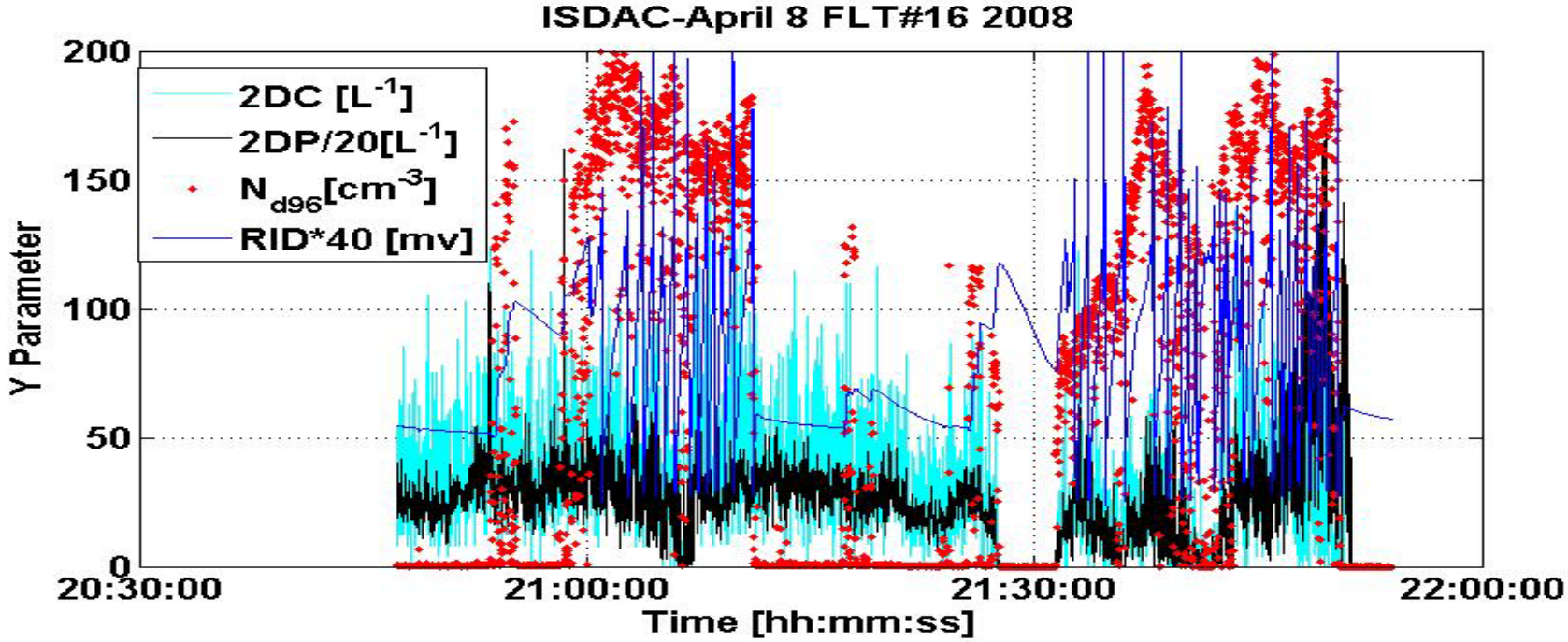

ISDAC-April 8 FLT#16 2008
Y Parameter[°C]
Ts
T
Tdegg
TdCR2
TdLicor
0
-5
-10
-15
-20
-25
-30
18:00:00
21:00:00
00:00:00
Time [hh:mm:ss]
Y Parameter
2DC [L-1]
2DP/20[L-1]
Nd96[cm-3]
RID*40 [mv]
200
150
100
50
0
18:00:00
21:00:00
00:00:00
Y Parameter
Na[cm-3]
NaU
Z; CVloff
Z[m];CVlon
1500
1000
500
0
18:00:00
21:00:00
00:00:00
Time [hh:mm:ss]

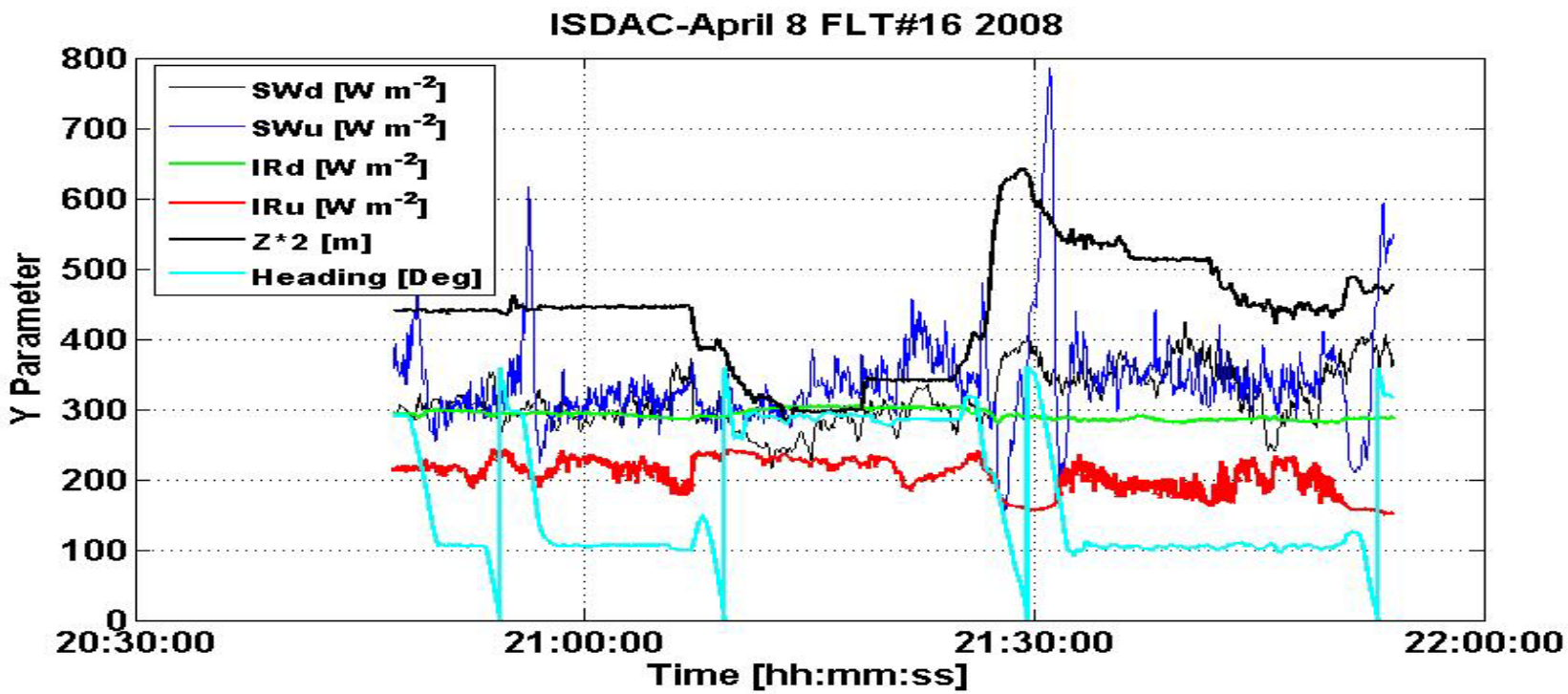
ISDAC-APRIL 8 CASE (FLT#16) 2008 CLEAN CASE

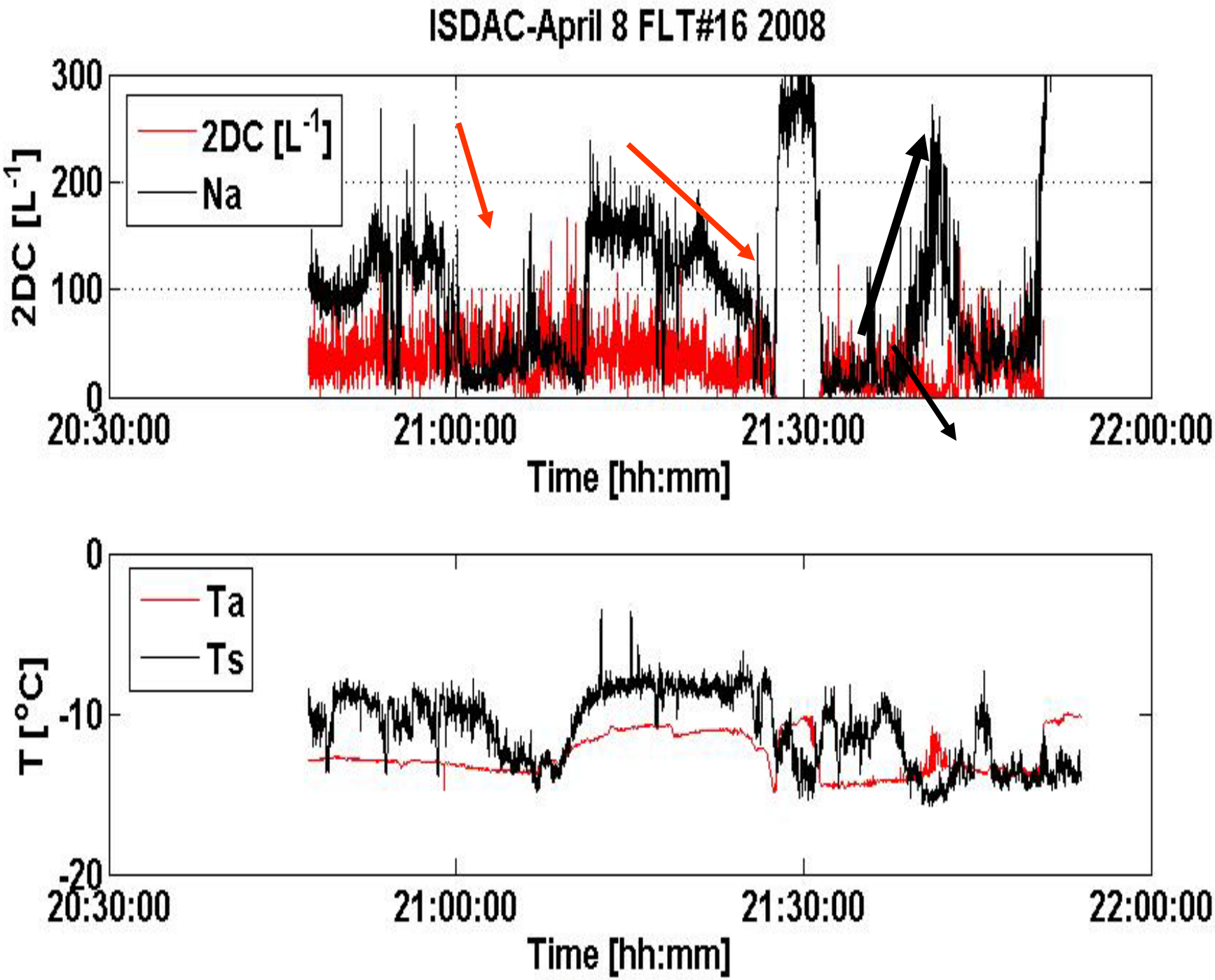


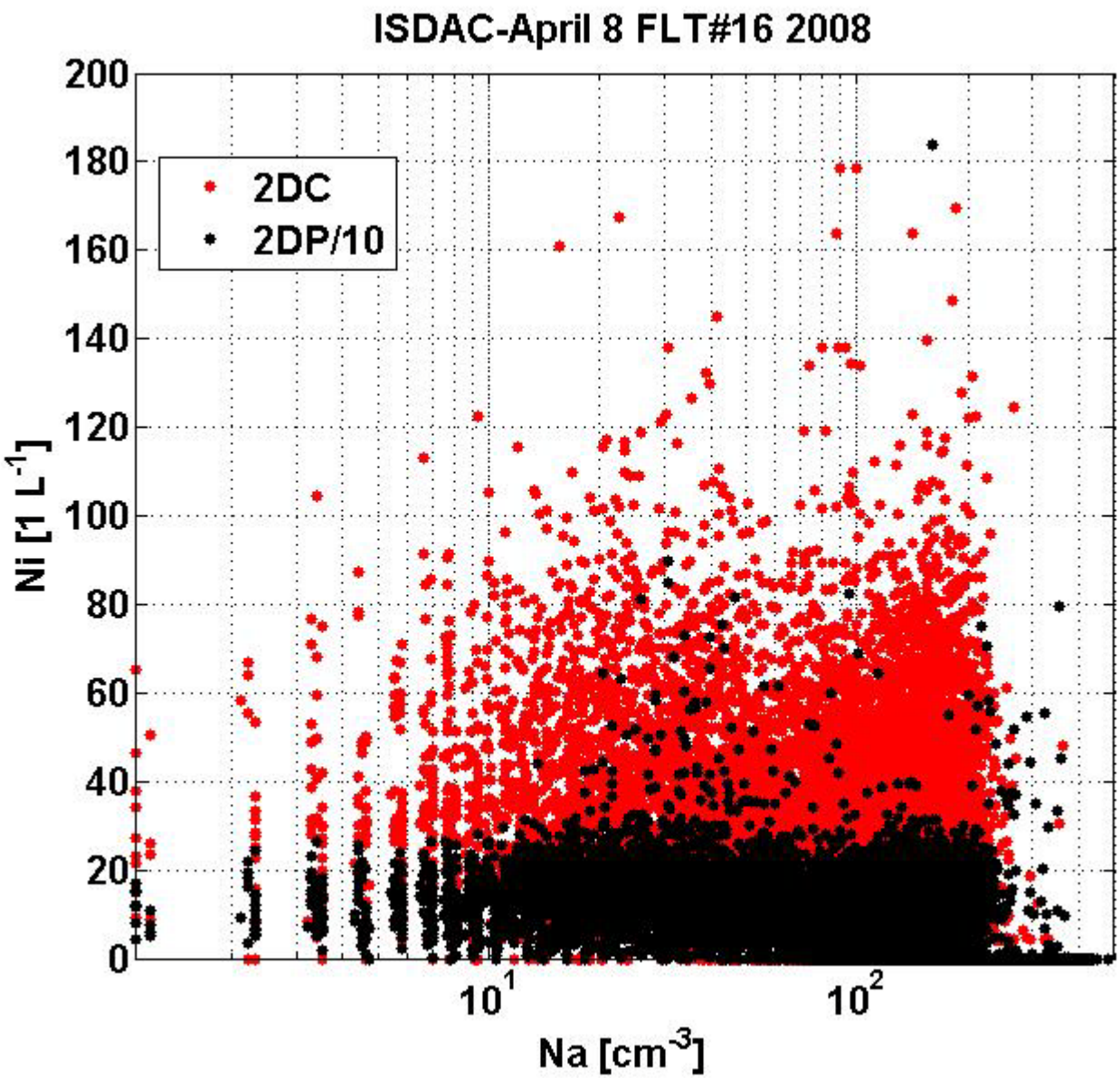




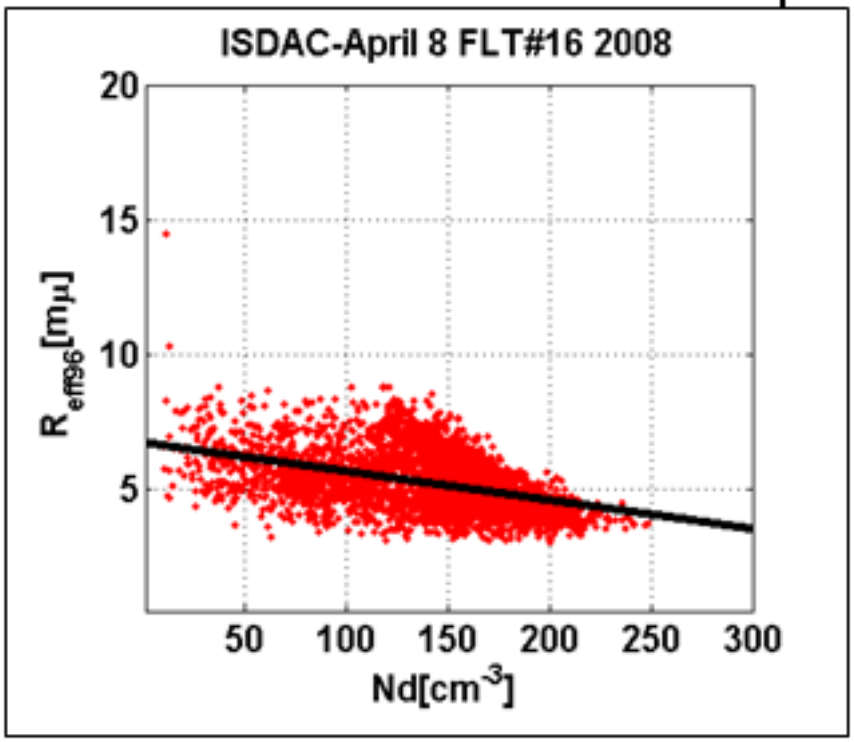

ISDAC-April 8 FLT#16 2008
2DC [L-1]
2DP/20[L-1]
Nd96[cm-3]
RID*40 [mv]
Y Parameter
200
150
100
50
0
20:30:00
21:00:00
21:30:00
22:00:00
Time [hh:mm:ss]


ISDAC-April 8 FLT#16 2008
SWd [W m-2]
SWu [W m-2]
IRd [W m-2]
IRu [W m-2]
Z*2 [m]
Heading [Deg]
Y Parameter
800
700
600
500
400
300
200
100
0
20:30:00
21:00:00
21:30:00
22:00:00
Time [hh:mm:ss]


ISDAC-April 8 FLT#16 2008
2DC [L-1]
Na
2DC [L-1]
300
200
100
0
20:30:00
21:00:00
21:30:00
22:00:00
Time [hh:mm]
Ta
Ts
T [°C]
0
-10
-20
20:30:00
21:00:00
21:30:00
22:00:00
Time [hh:mm]


ISDAC-April 8 FLT#16 2008
2DC
2DP/10
Ni [1 L-1]
Na [cm-3]
200
180
160
140
120
100
80
60
40
20
0
10^1
10^2

April 8 case



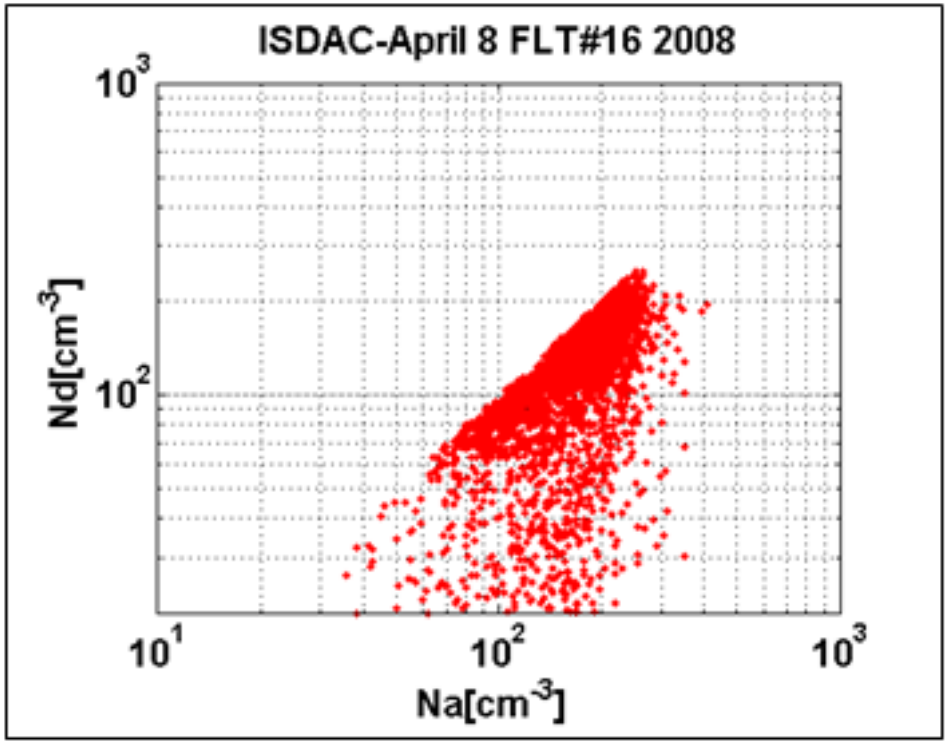


Fig. 4: Scatter plot of R_{eff} versus N_d (box a) and N_d versus N_a (box b) for the April 8 case. These figures suggest that increasing N_a results in changes of both R_{eff} and N_d.

GEOPHYSICAL RESEARCH LETTERS, VOL. 34, LXXXXX, doi:10.1029/2006GL028223, 2007

Click Here for Full Article

Cloud fraction parameterization as a function of mean cloud water content and its variance using in-situ observations

I. Gultepe[1] and G. A. Isaac[1]

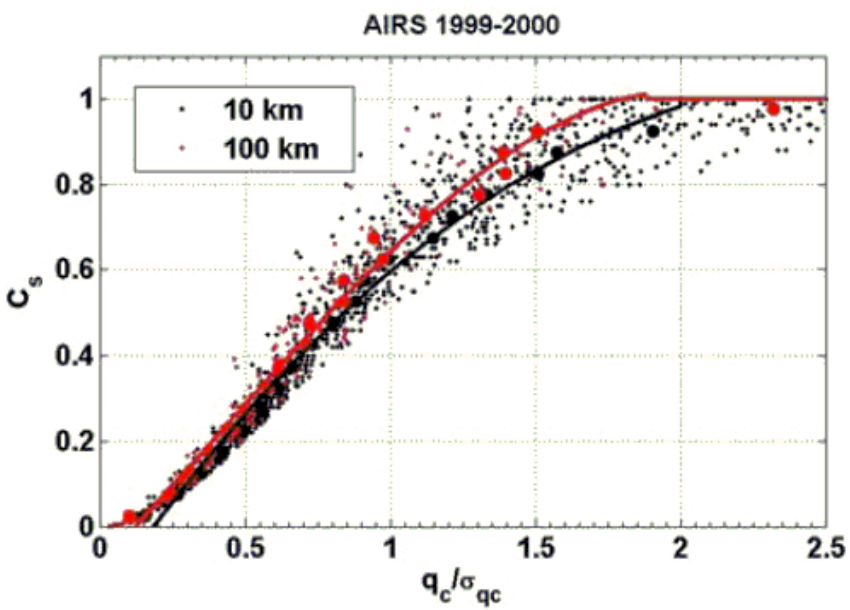


Figure 2. Shows C_s versus mean q_c divided by its standar deviation. Solid line is the fit to the data. Filled circles a obtained at 0.05 intervals of C_s. Cloud cover values estimated using observations from AIRS data.

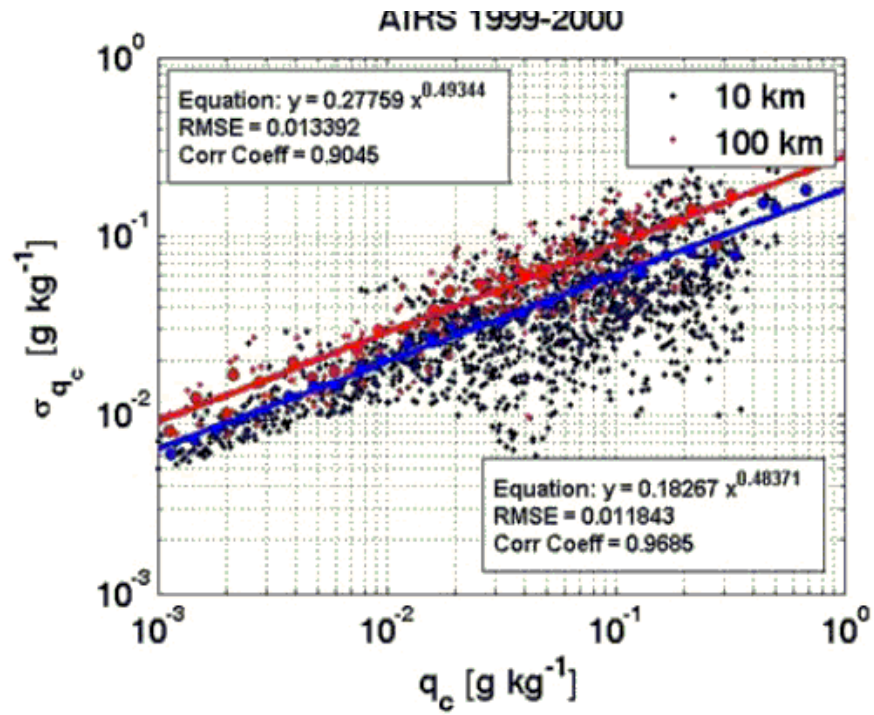
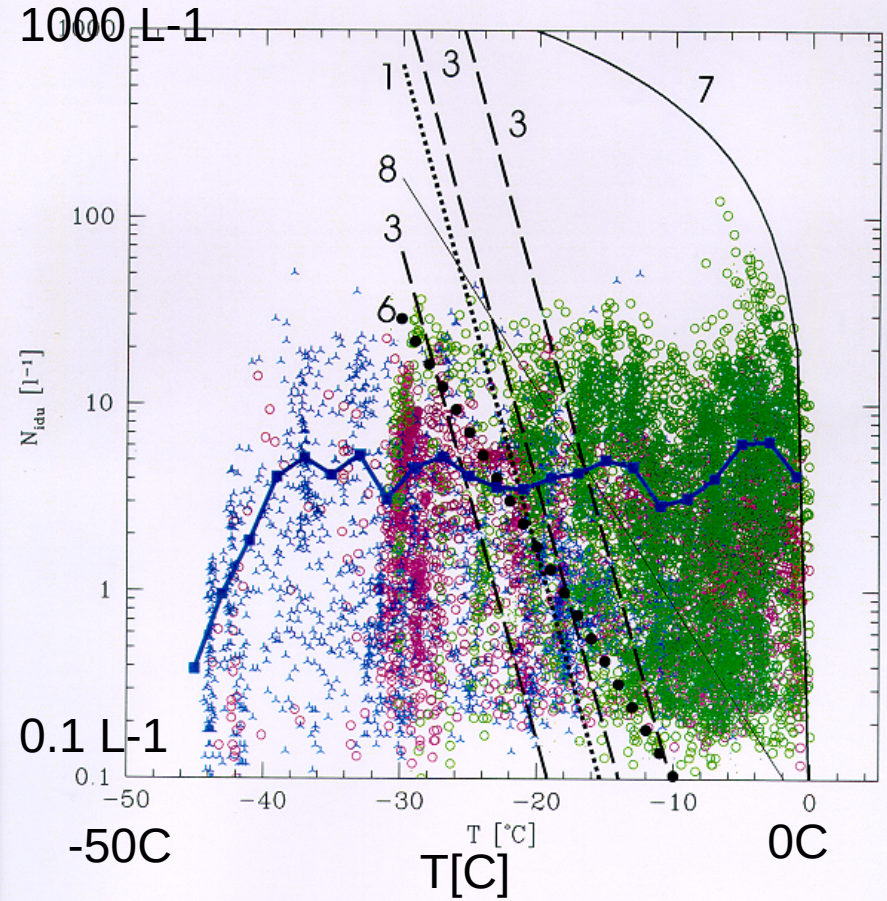


Figure 3. Standard deviation of q_c versus q_c averaged over 10 and 100 km scales. Solid line represents a best fit applied to 10 km (red line) and 100 km (blue line) data sets.

Ni-T relationships

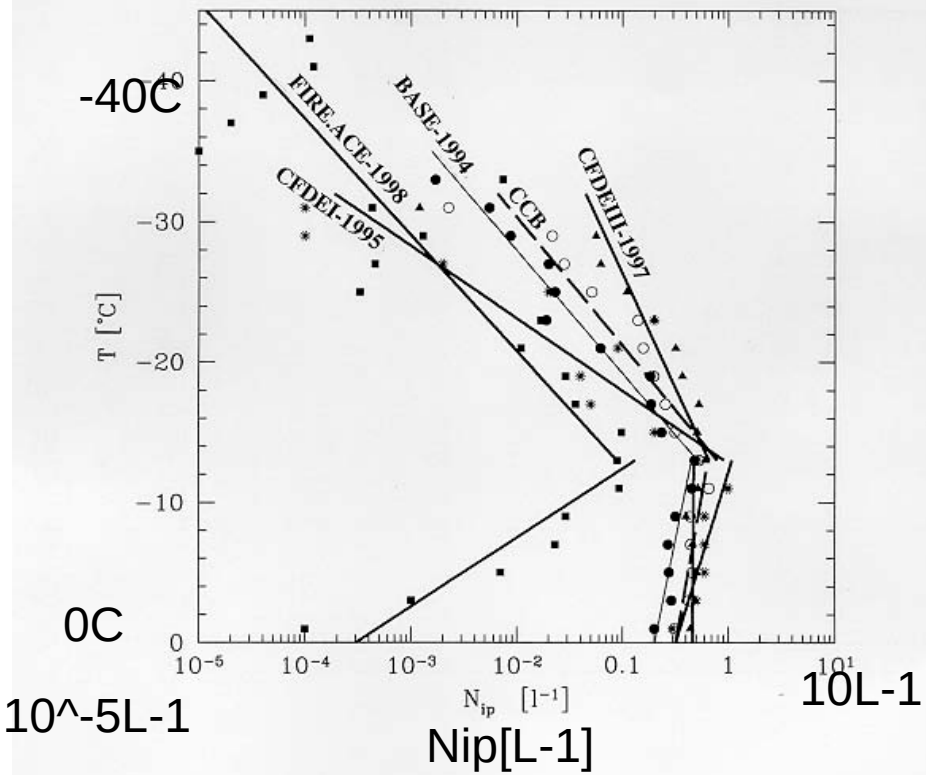
Inter. J. of Climate, Gultepe et al 2001

2DC probe;
<100 micron



2DP probe

<1000 micron



CONCLUSIONS

- Ni is strongly related to Na, T, RHi, w, and radiative processes.
- Uncertainty in Ni-T is very large that parameterizations should consider its variability.
- Cloud cover parameterizations should include not only TWC but also particle number concentration.
- Scales issues need to be clarified when aircraft observations are averaged.
- Results will be applied to WRF (Boybeyi) , GEM-REG (Girard), and GCMs.