

# CLOUD MICROPHYSICS AND AEROSOL EFFECTS ON BROADBAND RADIATIVE FLUXES BASED ON CANADIAN CONVAIR- 580 FLIGHTS

ARM Cloud Properties/AWG Meeting  
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# OBSERVATIONS

- Broad band fluxes (Eppley and Kipp&Zonen) are significantly effected by aircraft position changes (e.g. changes in pitch and roll angles.)
- Shorter flights (<5 minutes) in the clouds complicates calculation of the accurate radiative fluxes.
- Aerosol measurements are obtained from PCASP, TSI7610, and UHSAS.
- Liquid phase related parameters are obtained from Nevzorov probes, FSSPs, and hot wire probes etc.
- Ice phase related parameters are obtained from various optical probes e.g. 2DC, 2DP, CIP, SPEC CPI...

# CONVAIR-580 INSTRUMENTS

## AEROSOL INSTRUMENTS

- PCASP (0.12-3  $\mu\text{m}$ )
- UHSAS (60 nm-1  $\mu\text{m}$ )
- CPC3775(>4 nm)
- CN7610(>11 nm)

## BROADBAND RADIATIVE FLUXES

- Eppley IR (3.5-50  $\mu\text{m}$ )
- Kipp&Zonen SW (0.31-2.8  $\mu\text{m}$ )

## MICROPHYSICAL INSTRUMENTS

- FSSp100 (3-45  $\mu\text{m}$ )
- FSSP100 (5-95  $\mu\text{m}$ )
- PMS 2DC (25-800  $\mu\text{m}$ )
- PM 2DP (200-6400  $\mu\text{m}$ )
- SPEC 2DS (10-1280  $\mu\text{m}$ )
- SPEC CPI (15-2500  $\mu\text{m}$ )
- DMT CIP(15-960; 25-1280  $\mu\text{m}$ )
- King LWC
- Nev LWC
- Nev TWC
- RID

# In-situ measurements with Convair-580

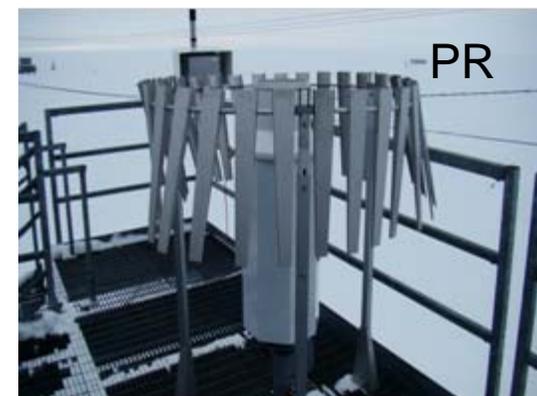


**KIPP&ZONEN SW  
RADIOMETERS**

**EPPLEY IR  
RADIOMETERS**



→ VISIBILITY



↓  
PARTICLE SIZE  
DISTRIBUTION

# ISDAC-FRAM-B ICE FOG PROJECT DAILY SUMMARY

(L GULTEPE- April 30 2008-ismail.gultepe@ec.gc.ca)

Ice fog and blowing snow cases are shown with yellow and light blue colors, respectively. Other cases usually had light snow/small ice crystals. There was only 2 cases for heavy snow conditions. The Convair's summary is prepared using the information available from the NRC flight summary table (Mengistu Wolde). The red colored days indicate the golden days for aircraft. Green checkmarks represent Convair flight days. The last column is for the flights during which Convair took off from Barrow and landed in Barrow before going to Fairbanks. The symbols as LS, IF, HS, BS, CW, and DD represent the light snow, ice fog, heavy snow, blowing snow, clear-weather and diamond dust conditions, respectively.

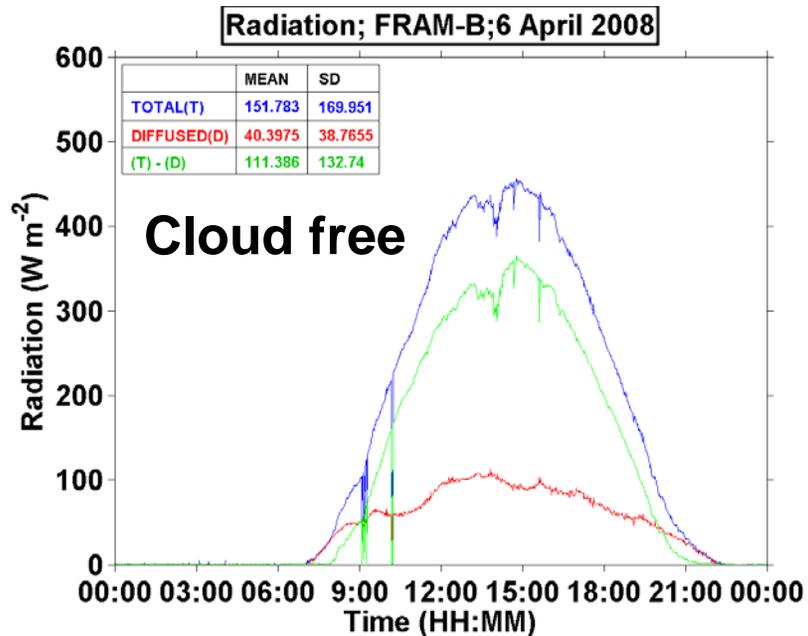
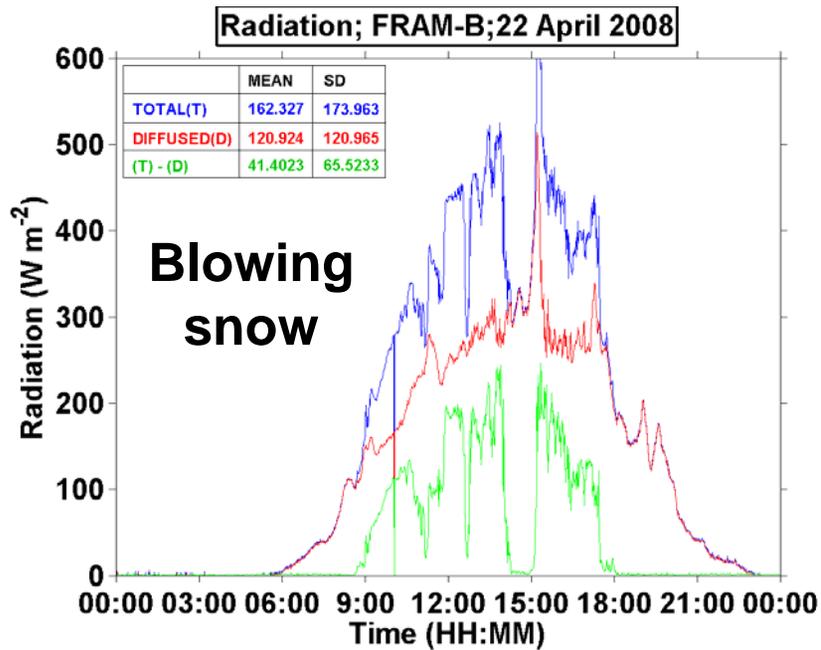
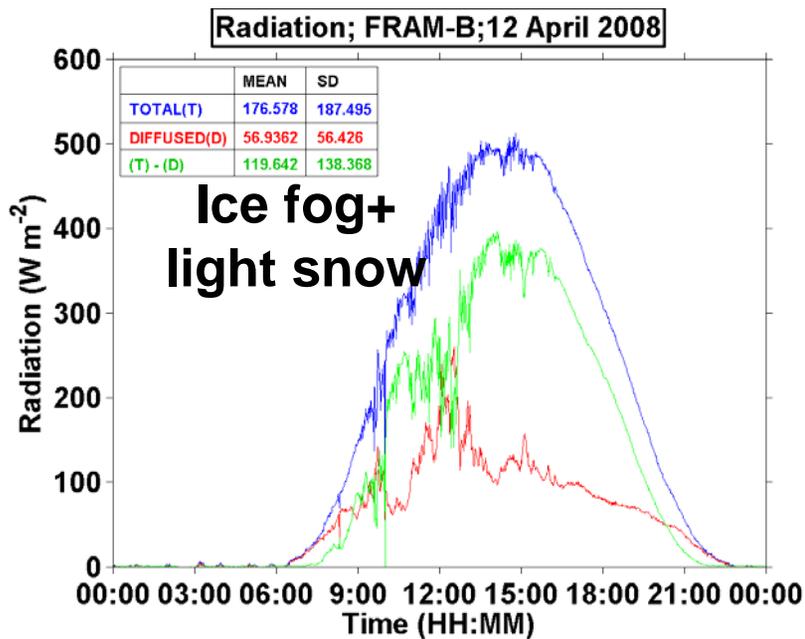
Day	Microphysics at surface	Convair over NSA site	Barrow to Barrow flights
April 1	LS+IF	√(yes)	x(no)
April 2	HS	x	x
April 3	LS	x	x
April 4	IF	√	x
April 5	HS	√	x
April 6	IF	x	x
April 7	LS	x	x
April 8	LS	√(CL)	√
April 9	IF	x	x
April 10	IF	x	x
April 11	IF	x	x
April 12	IF+LS	x	x
April 13	LS+IF	√	x
April 14	LS	√	x
April 15	LS	x	x
April 16	LS	x	x
April 17	CW	x	x
April 18	LS	√	√
April 19	LS	√(PL)	x
April 20	LS	x	x
April 21	LS	x	x
April 22	BS	x	x
April 23	BS	x	x
April 24	BS	√	√
April 25	CW	√	x
April 26	LS	√(CL)	√
April 27	LS+IF	x	x
April 28	LS	√	x
April 29	DD	x	x
April 30	LS	x	x

- ICE FOG
- BLOWING SNOW
- DIAMOND DUST
- HEAVY PRECIP
- LIGHT PRECIP

# DIAMOND-DUST CASE

## APRIL 29 2008



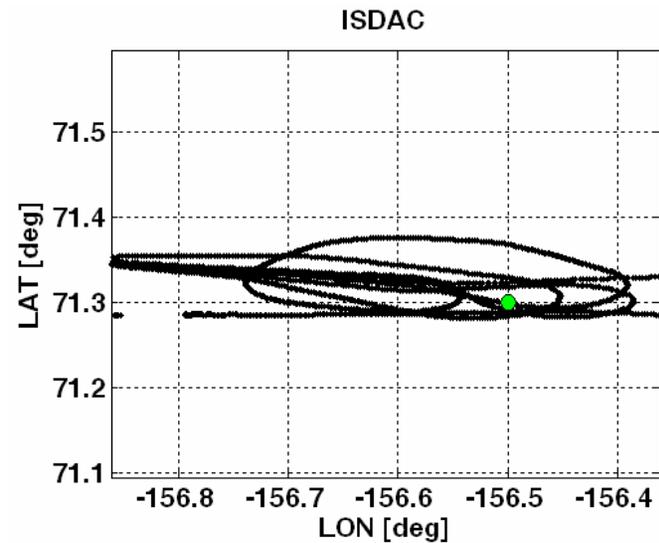
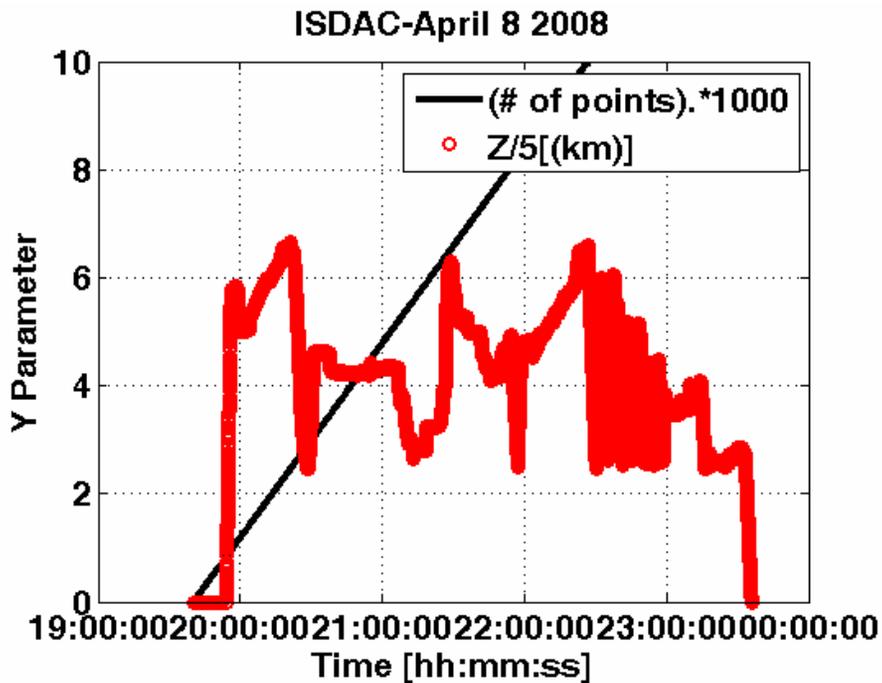


# CASES STUDIES

- ***1. April 8 (B-B) mixed phase/clean/light snow at the surface***
- ***2. April 18 (B-B) ice clouds/polluted/some liquid/light snow at the surface***
- ***3. April 24 (B-B) Mixed phase/clean/blowing snow at the surface***
- ***4. April 28 (F-B) clean at low height/mixed phase/snow at the surface***

# April 8

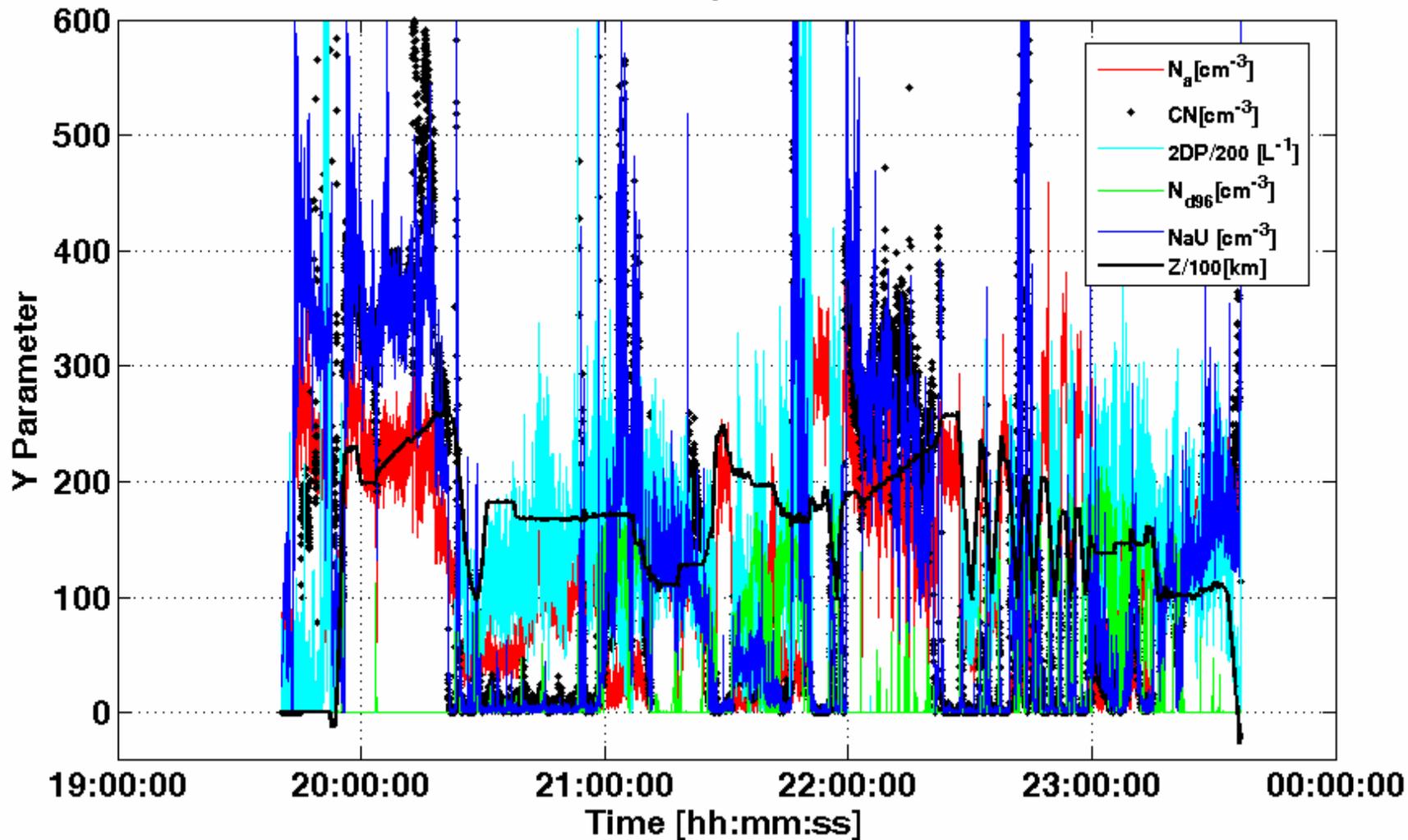
- Barrow to Barrow Flight



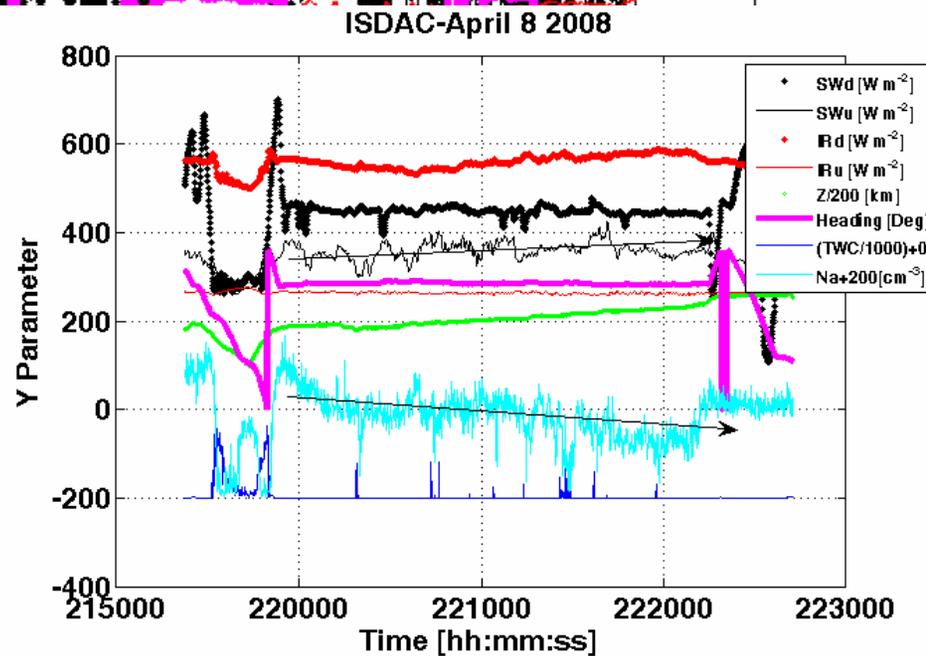
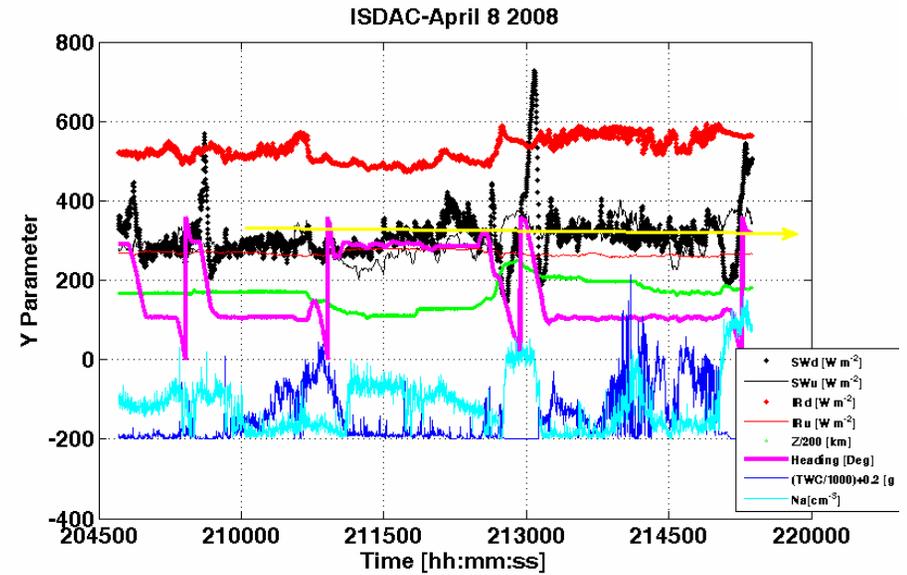
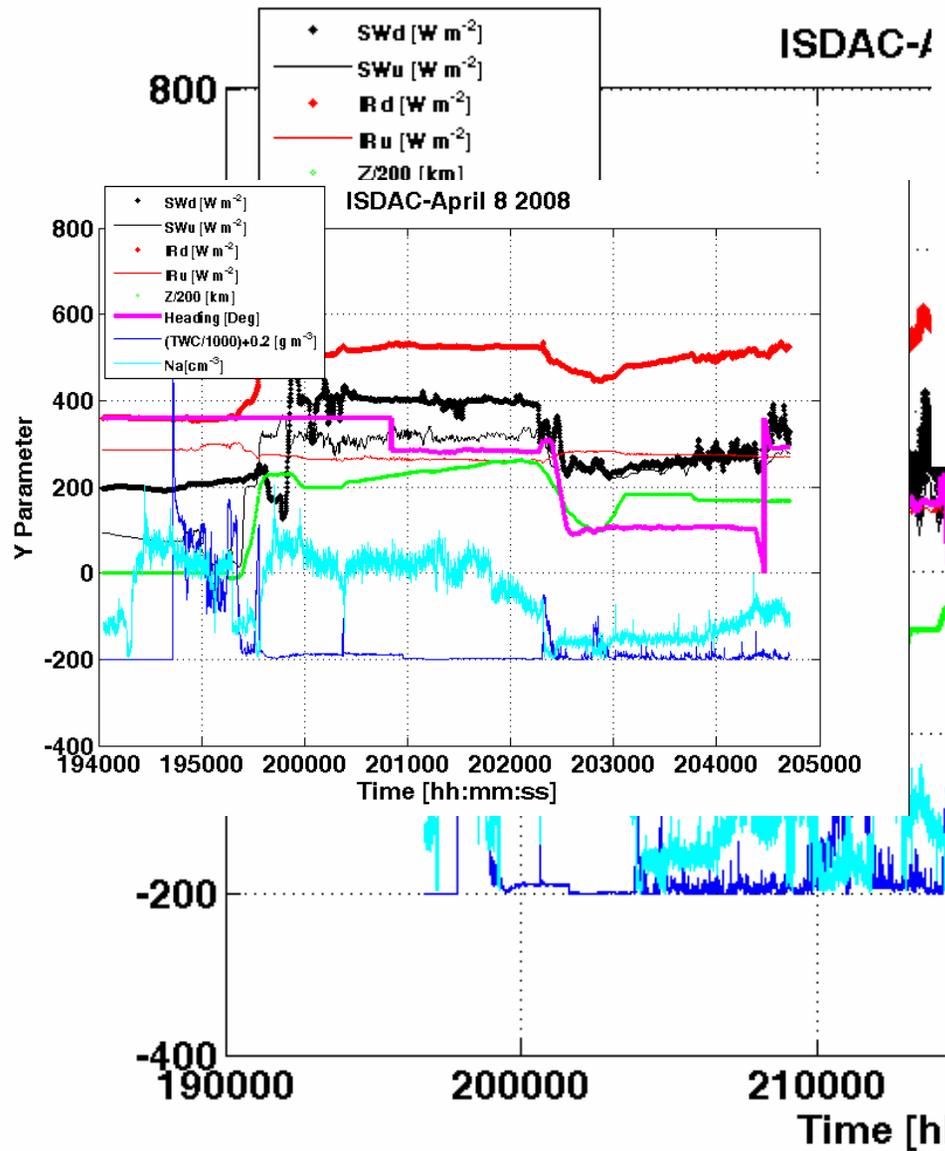
# APRIL 8

Nd=200 cm<sup>-3</sup> Na=400 cm<sup>-3</sup>

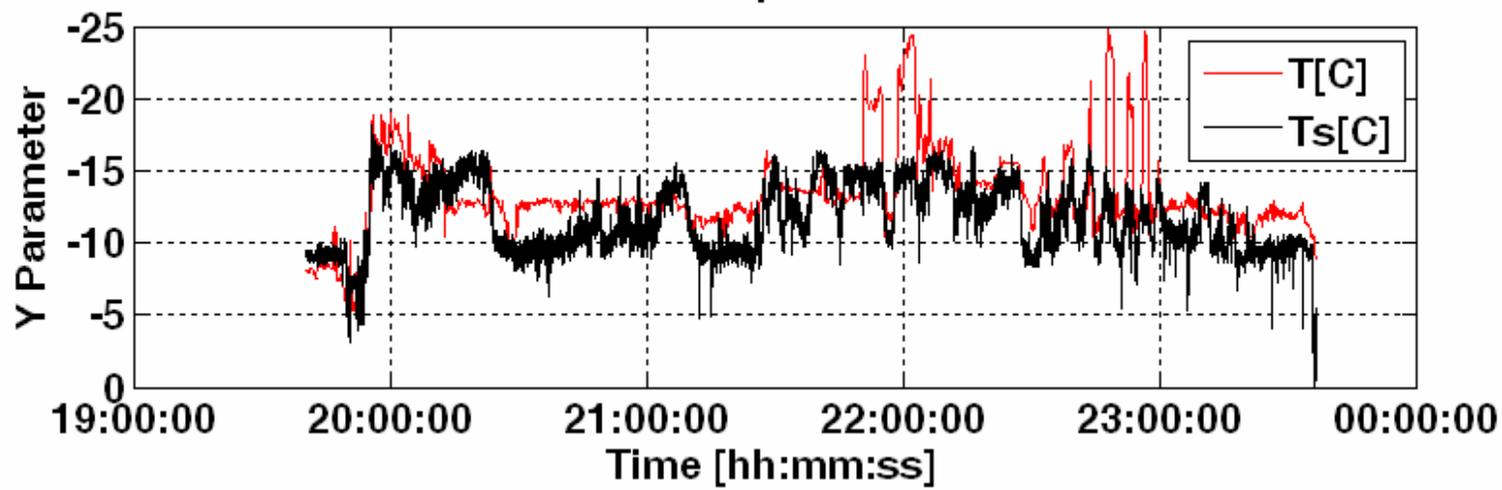
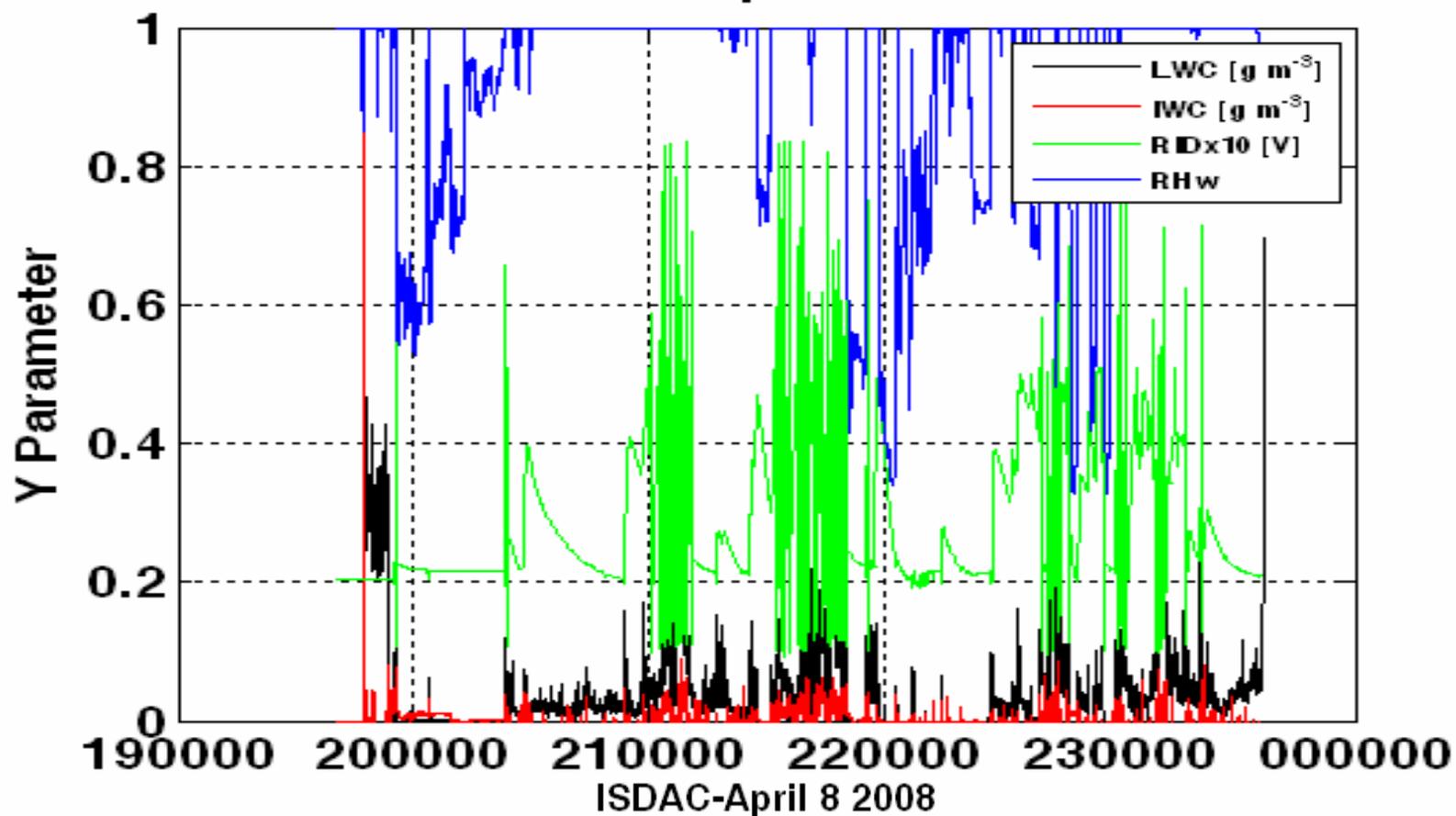
ISDAC-April 8 2008



# Aerosol/cloud effects

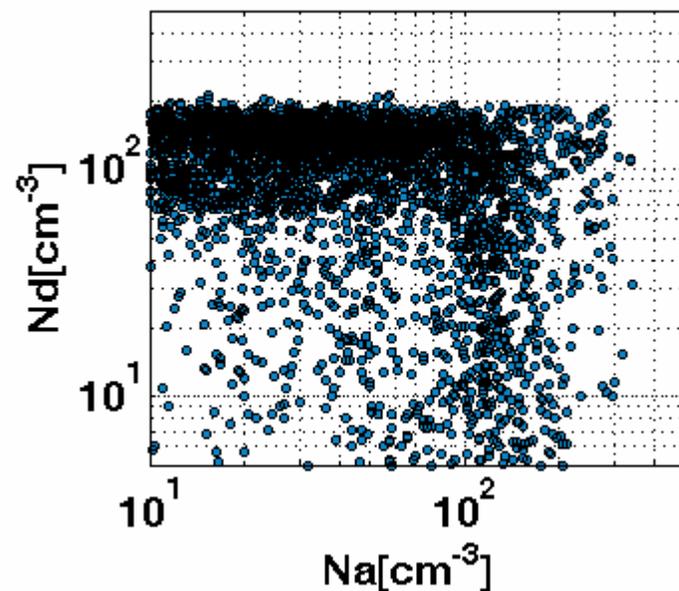


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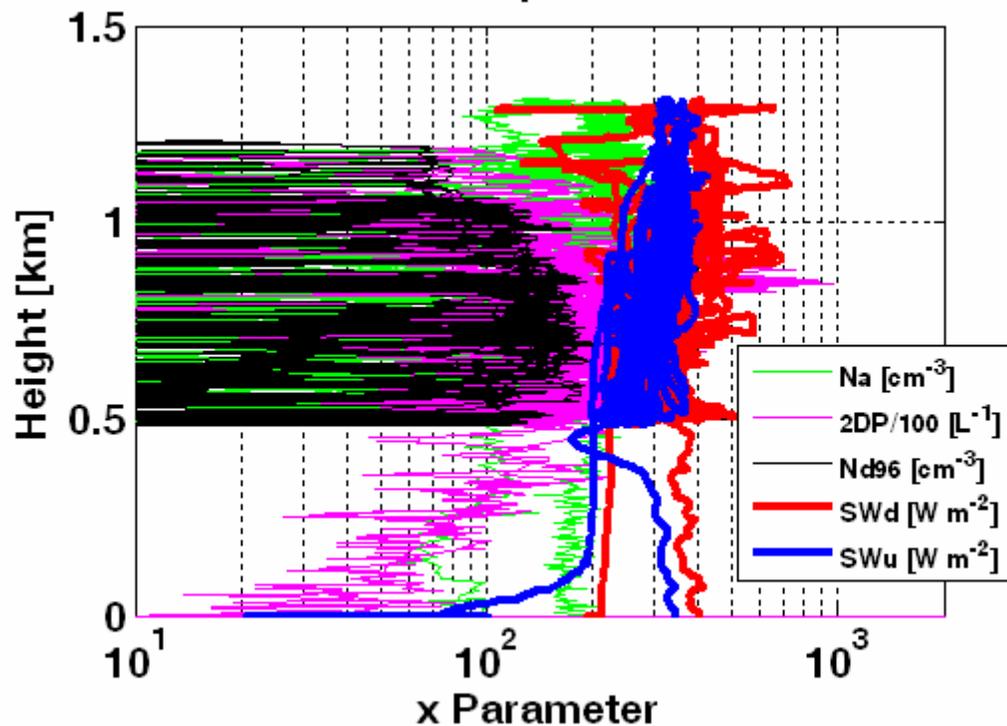


# CLOUD EFFECT

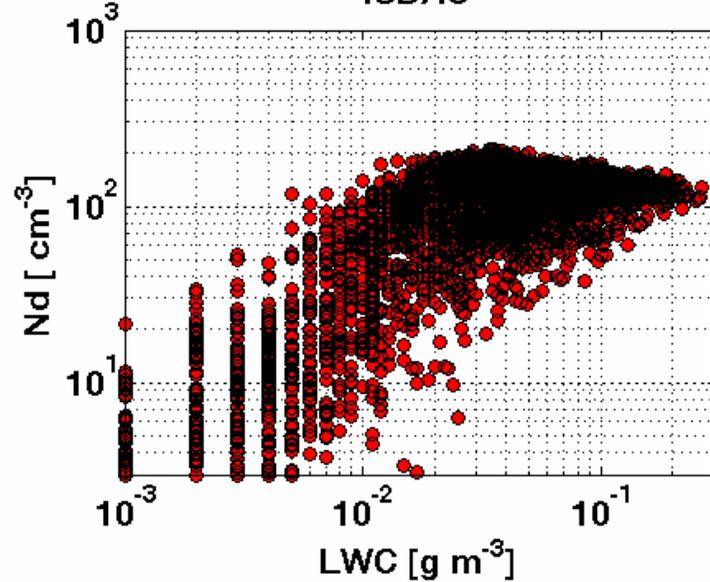
ISDAC-April 8 2008



ISDAC-April 8 2008



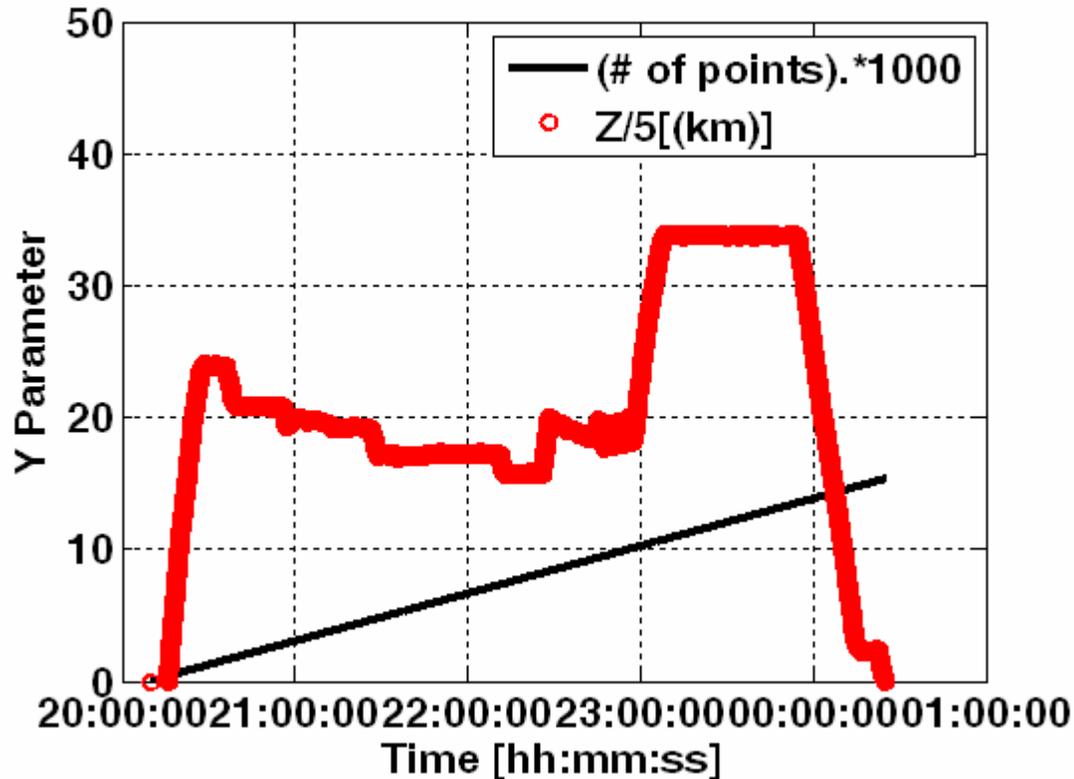
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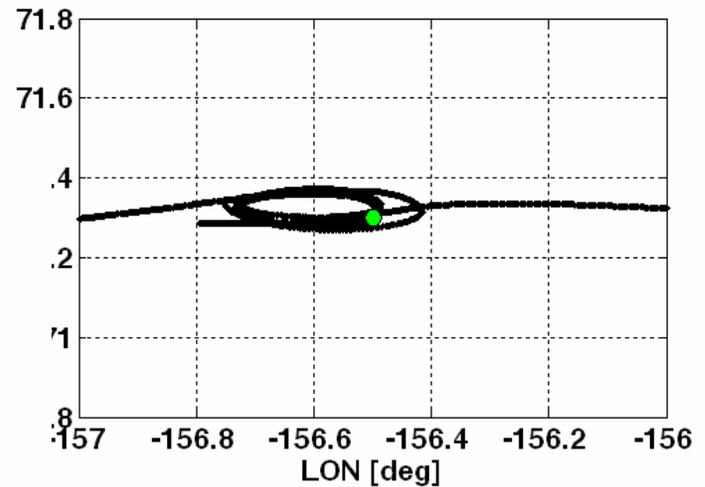
# April 18

- Barrow to Barrow flight (ice clouds)

ISDAC-April 18 FLT#23 2008



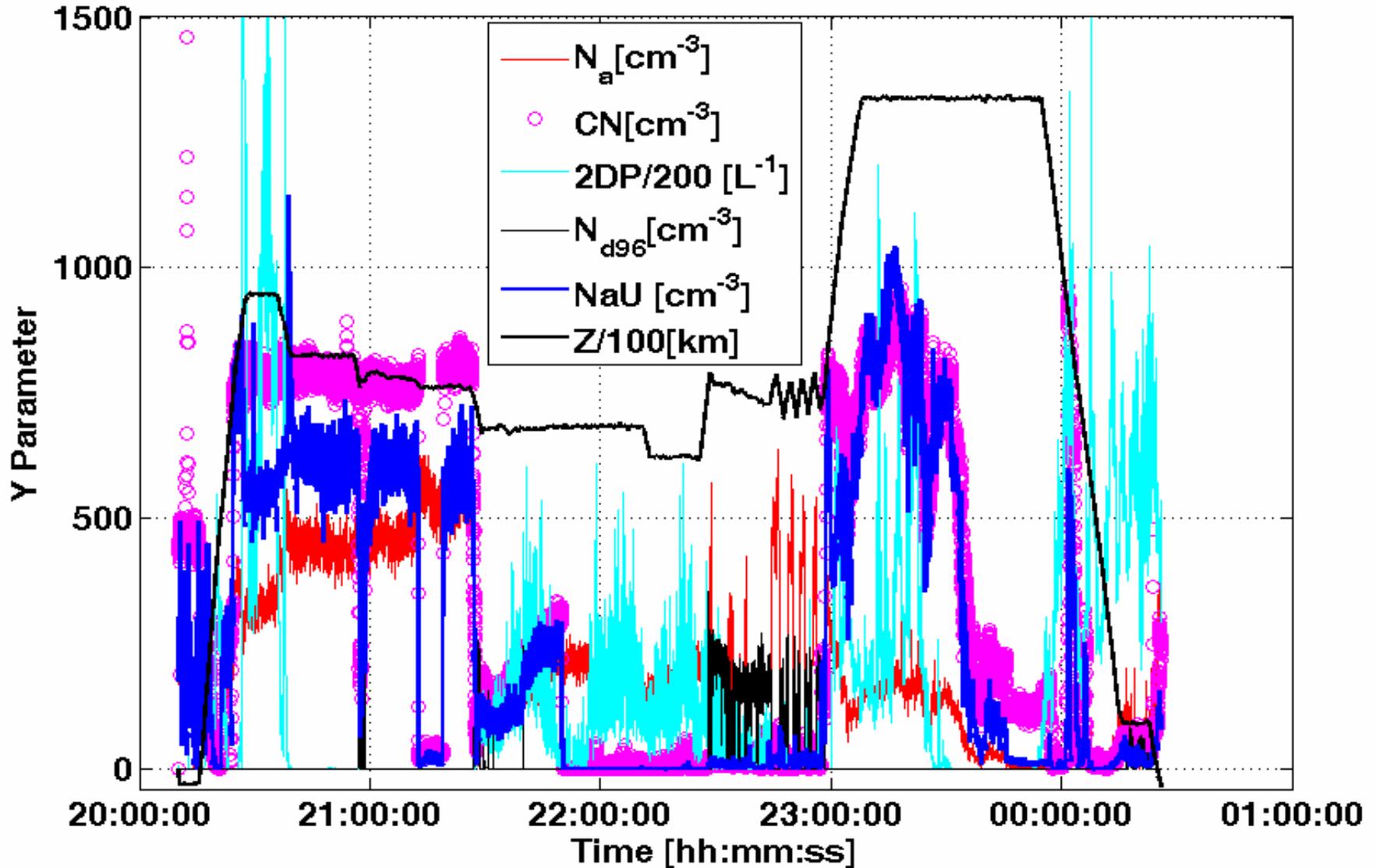
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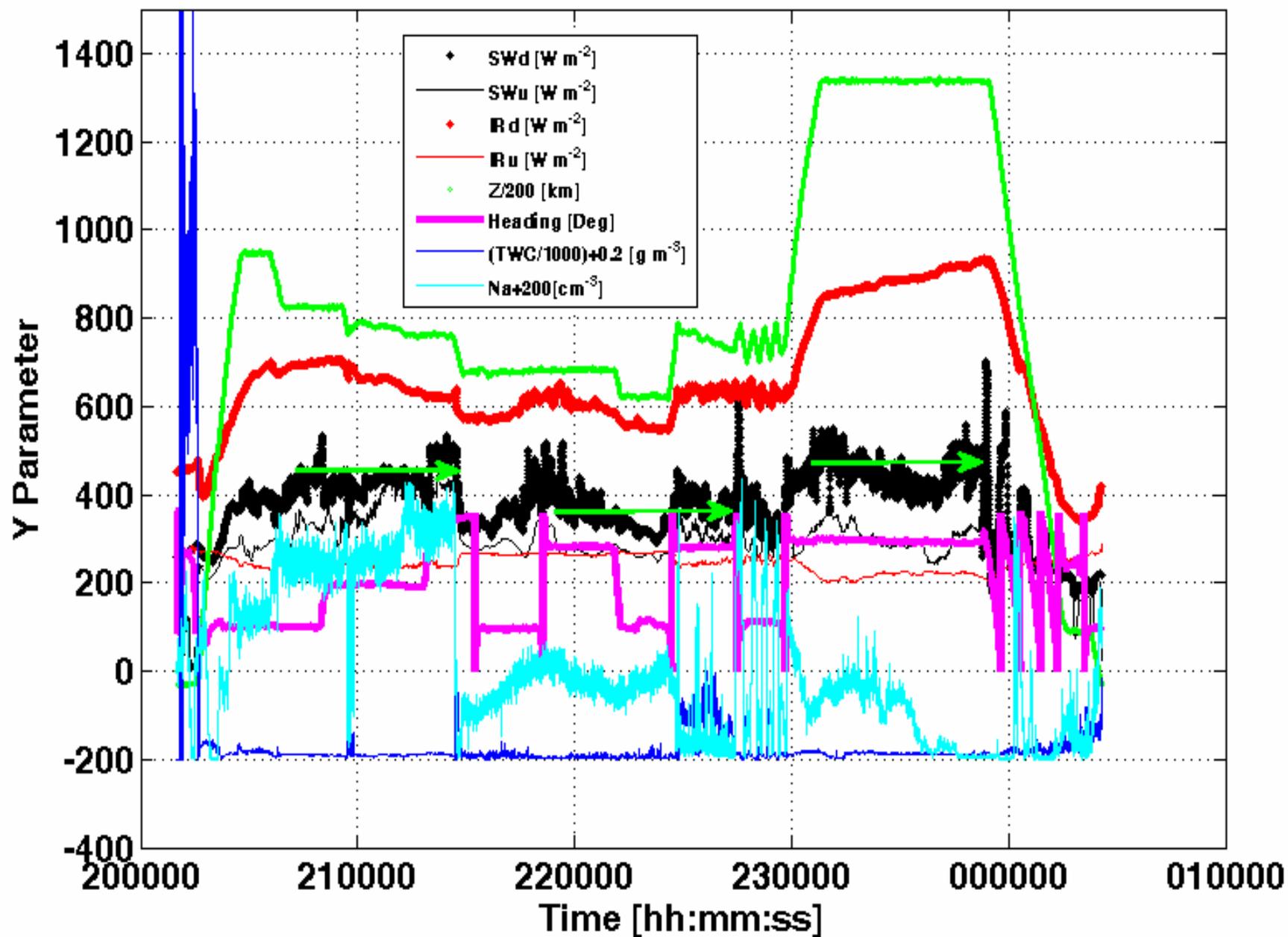
# APRIL 18

Na=600 cm<sup>-3</sup> Nd=200 cm<sup>-3</sup>

ISDAC-April 18 FLT#23 2008

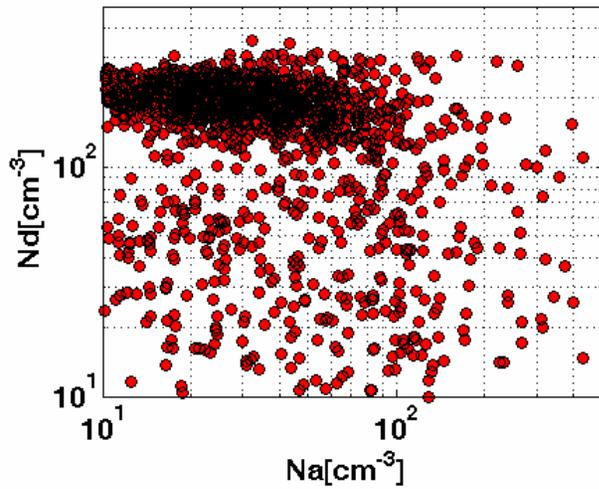


# ISDAC-April 18 FLT#23 2008

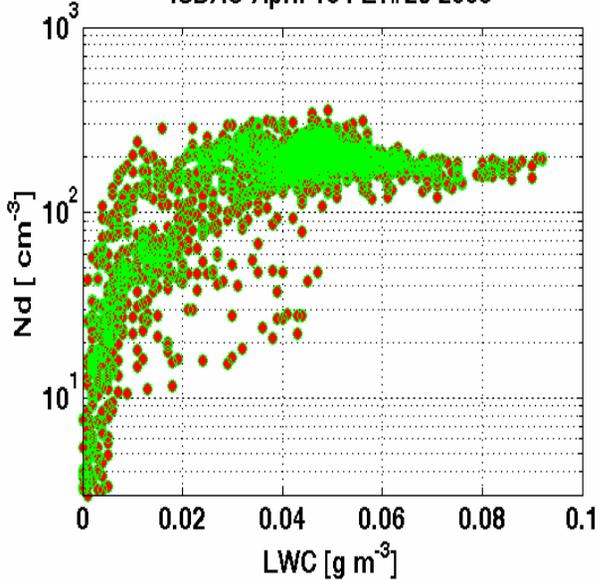


# SWd and SWu BRF

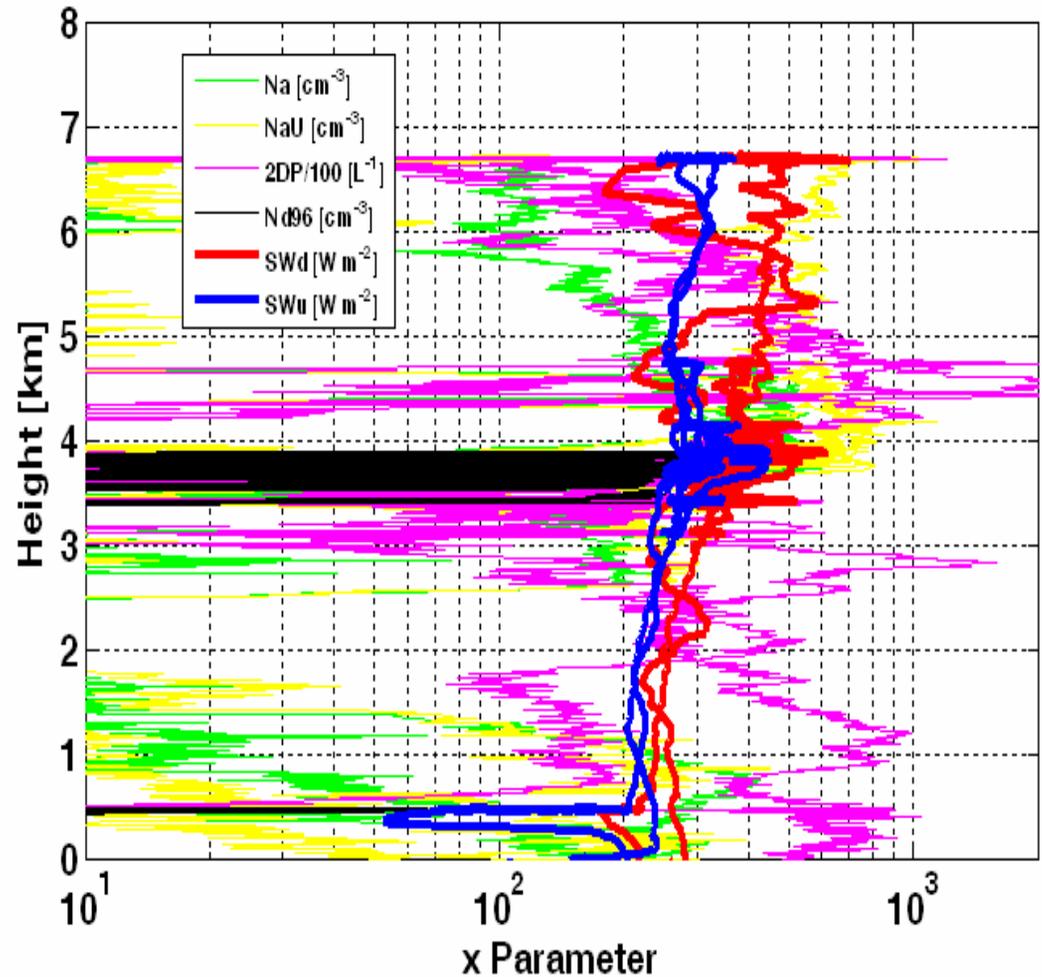
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ISDAC-April 18 FLT#23 2008



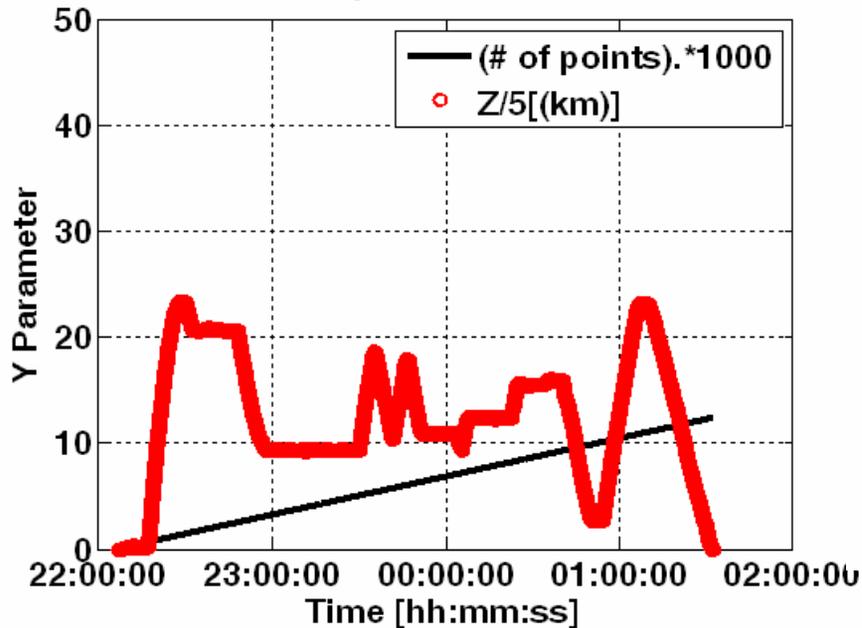
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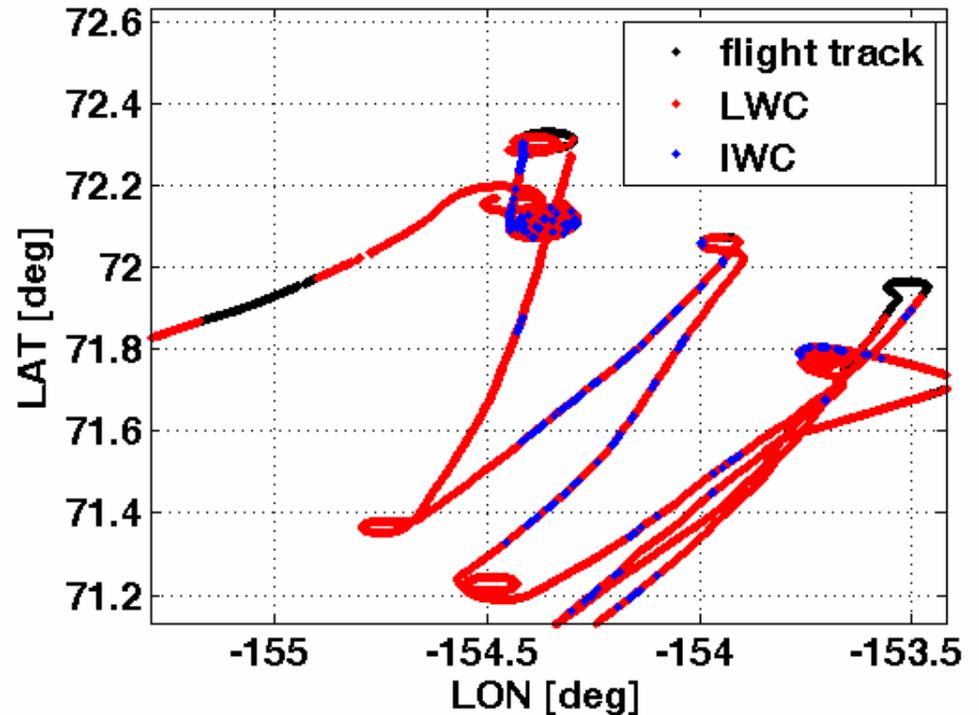
# April 24

- Barrow to Barrow Flight

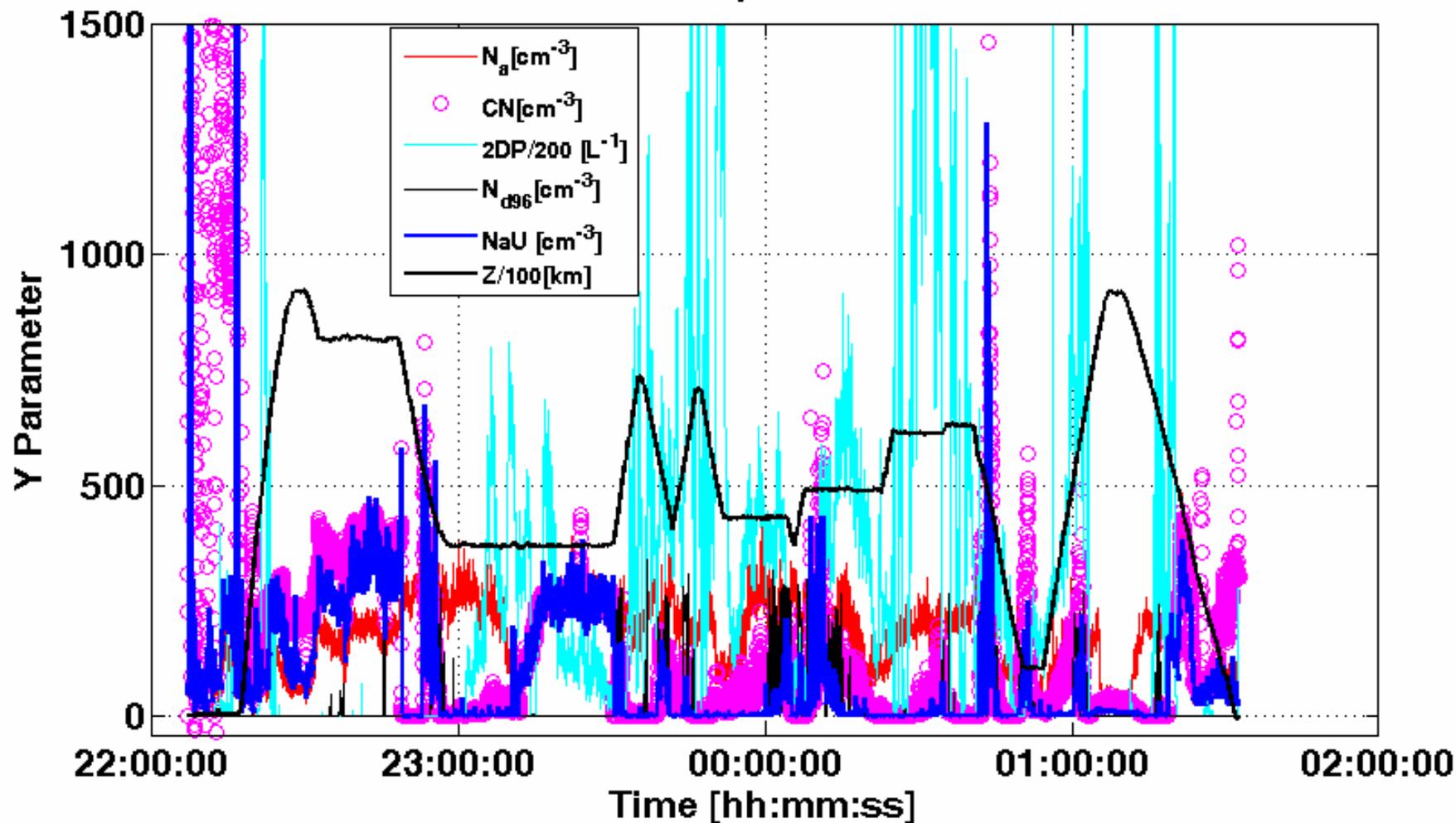
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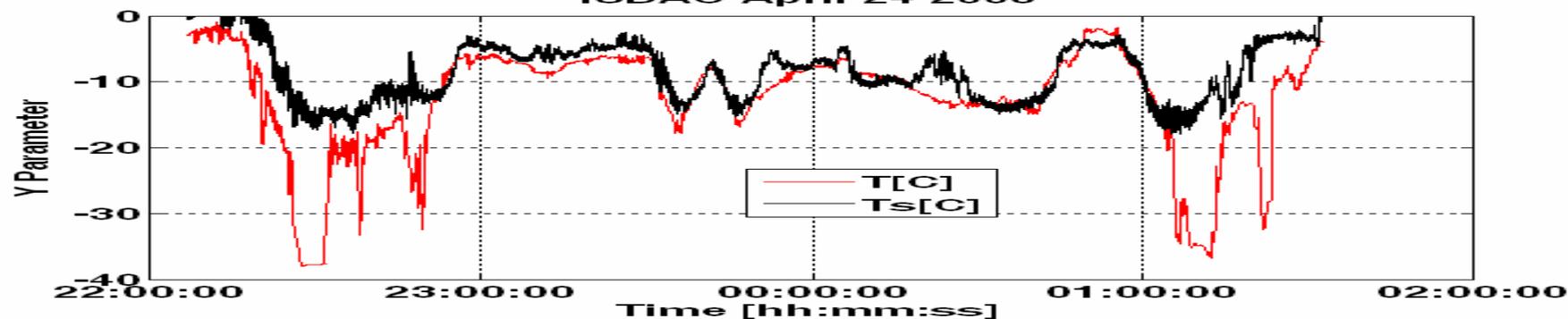
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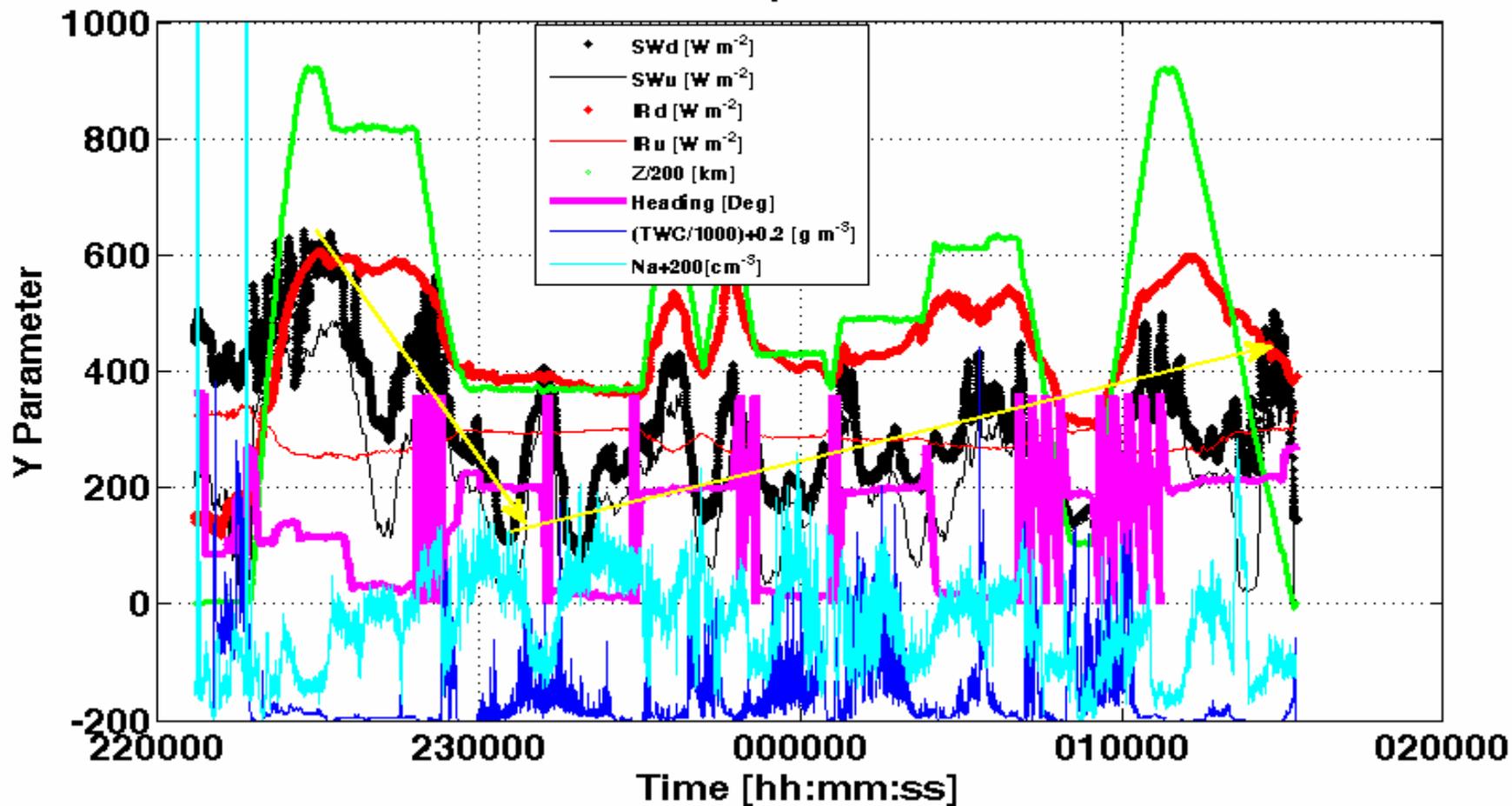
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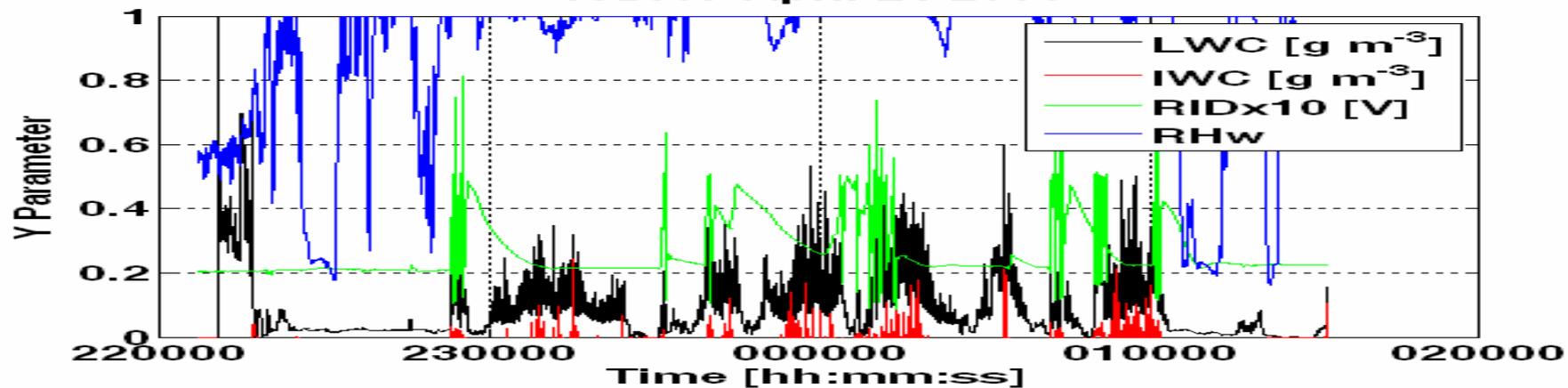
## ISDAC-April 24 2008



# ISDAC-April 24 2008

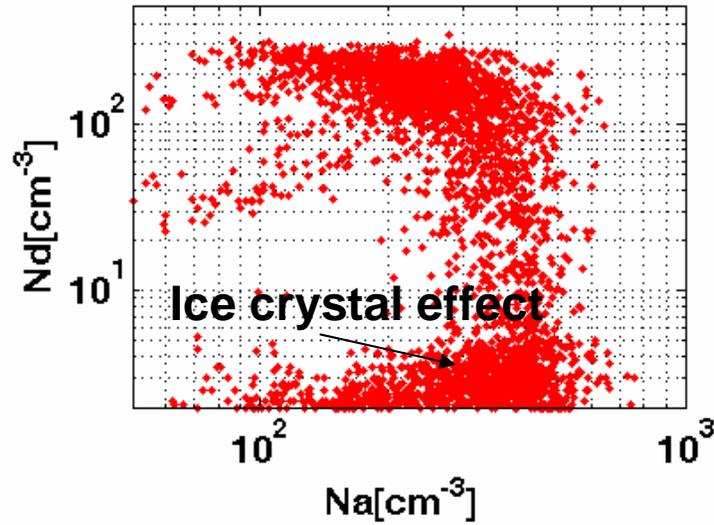


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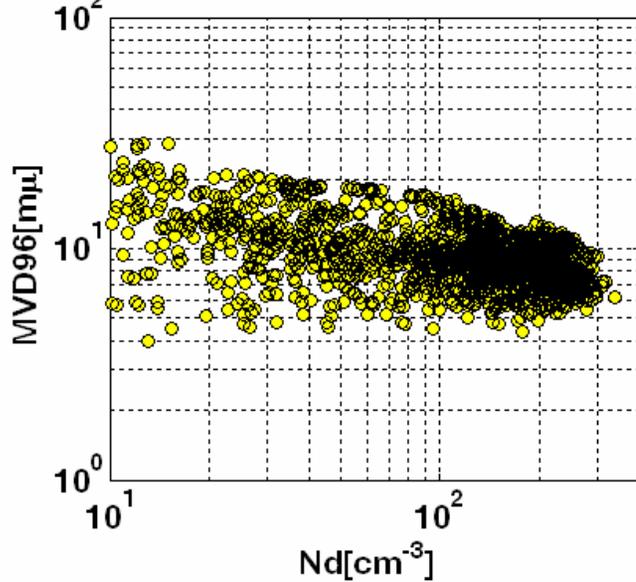


# SWu and SWd BRF

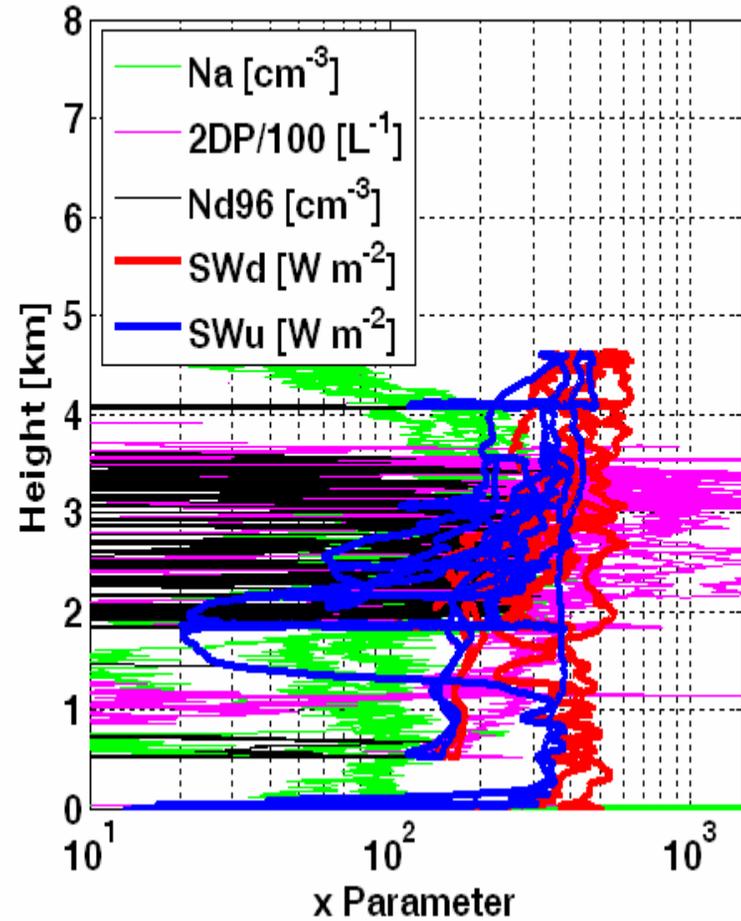
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ISDAC-April 24 FLT#28 2008

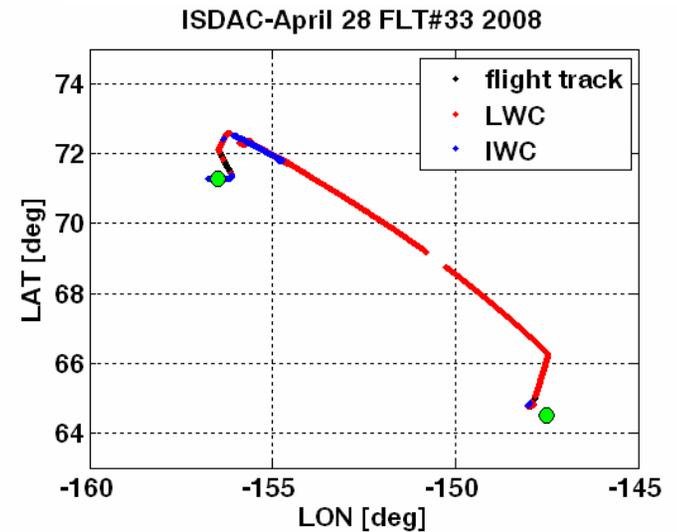
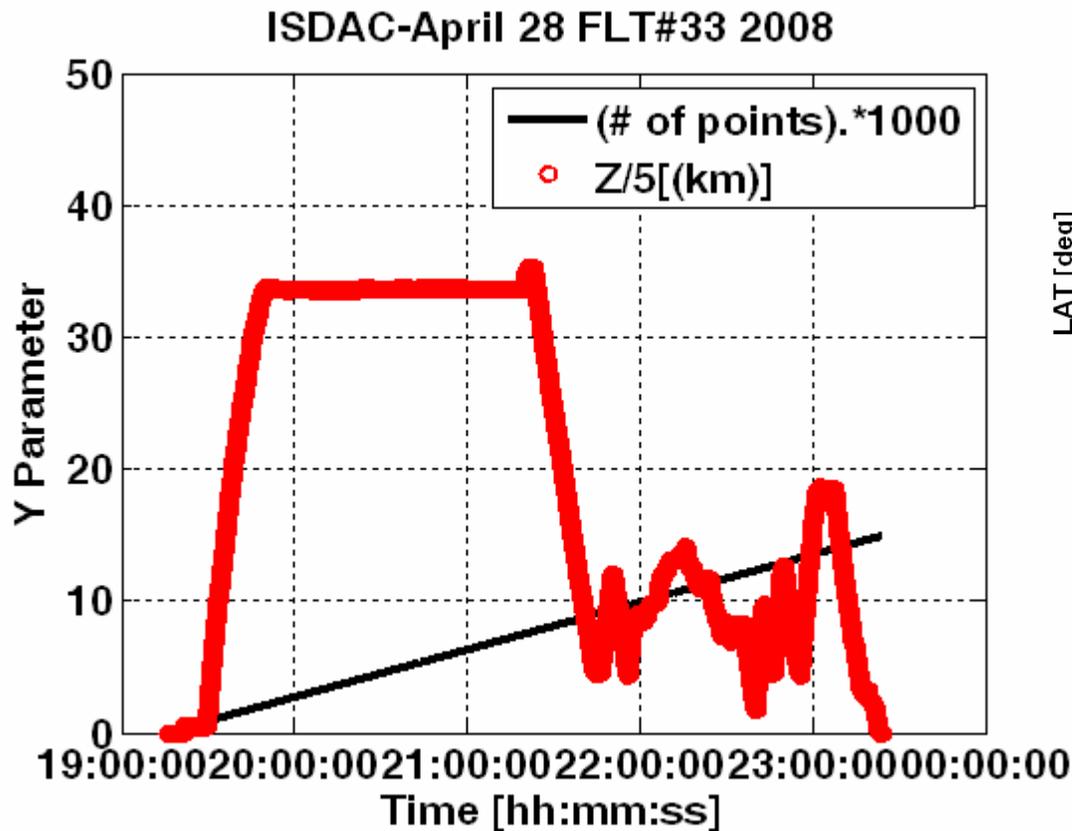


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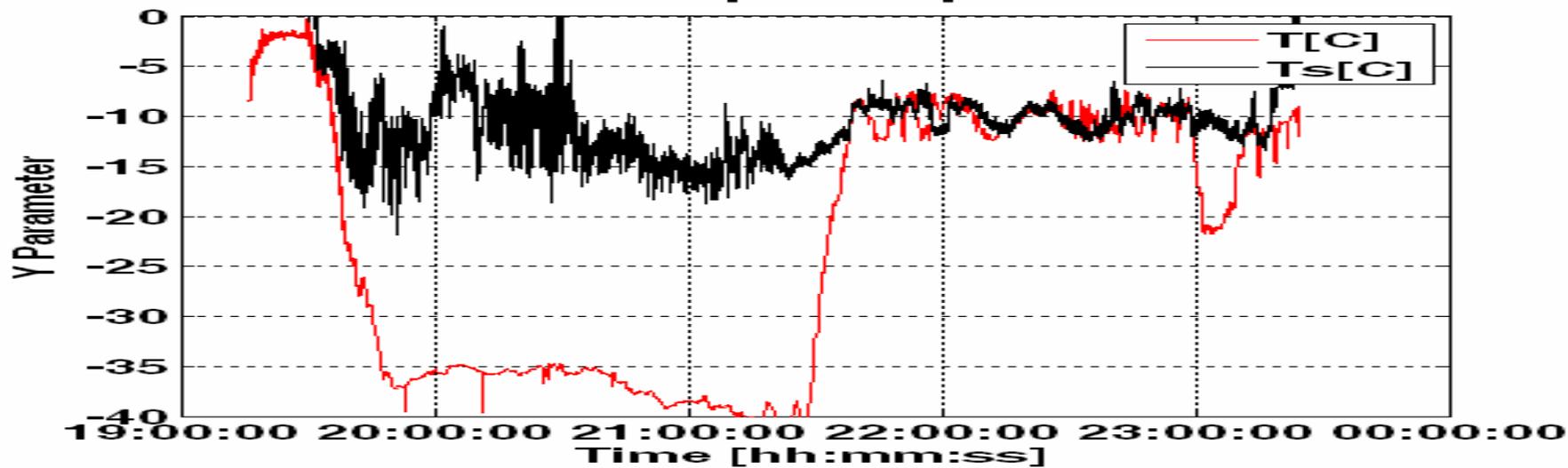
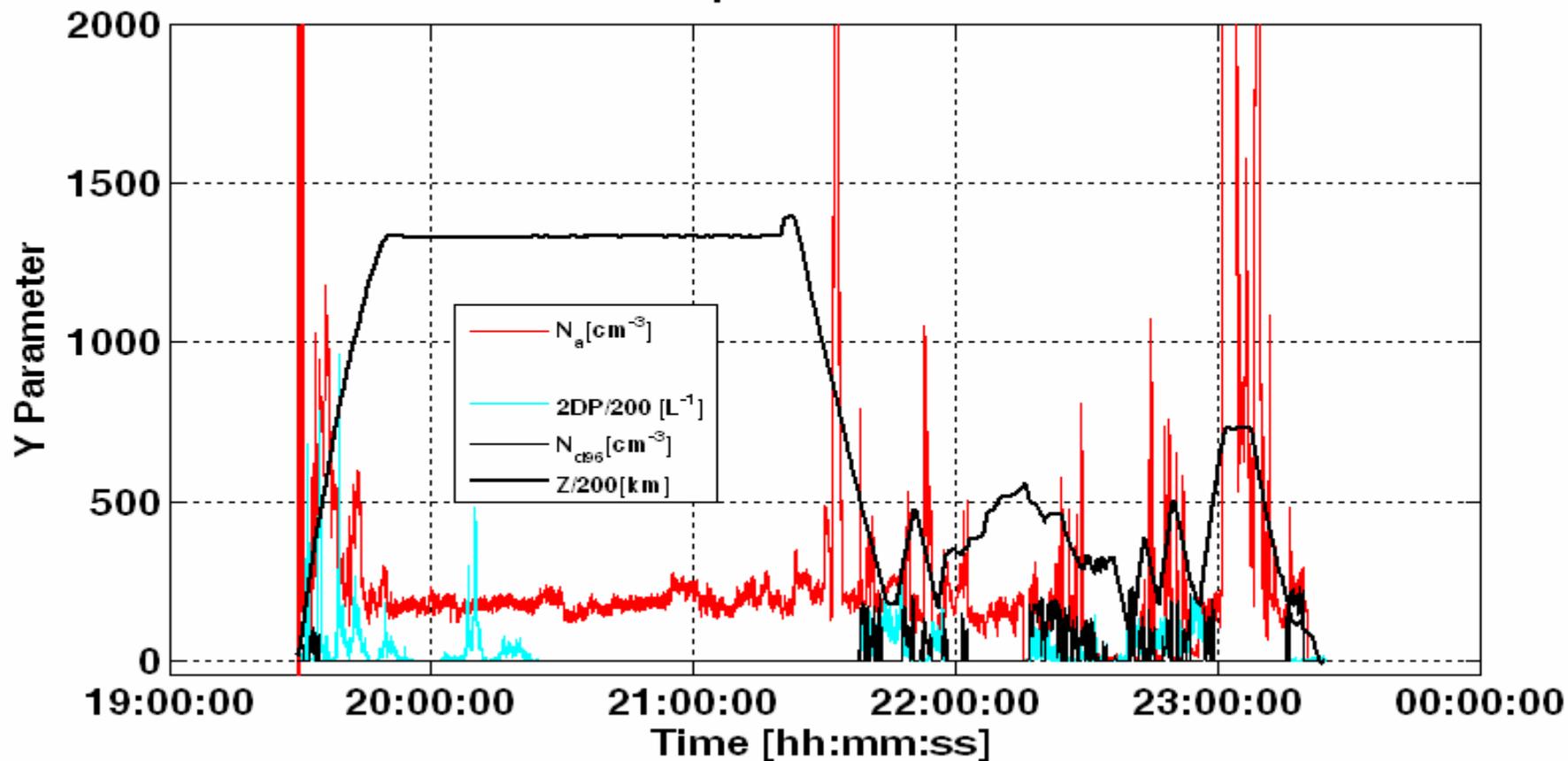


# April 28 flt33 f1

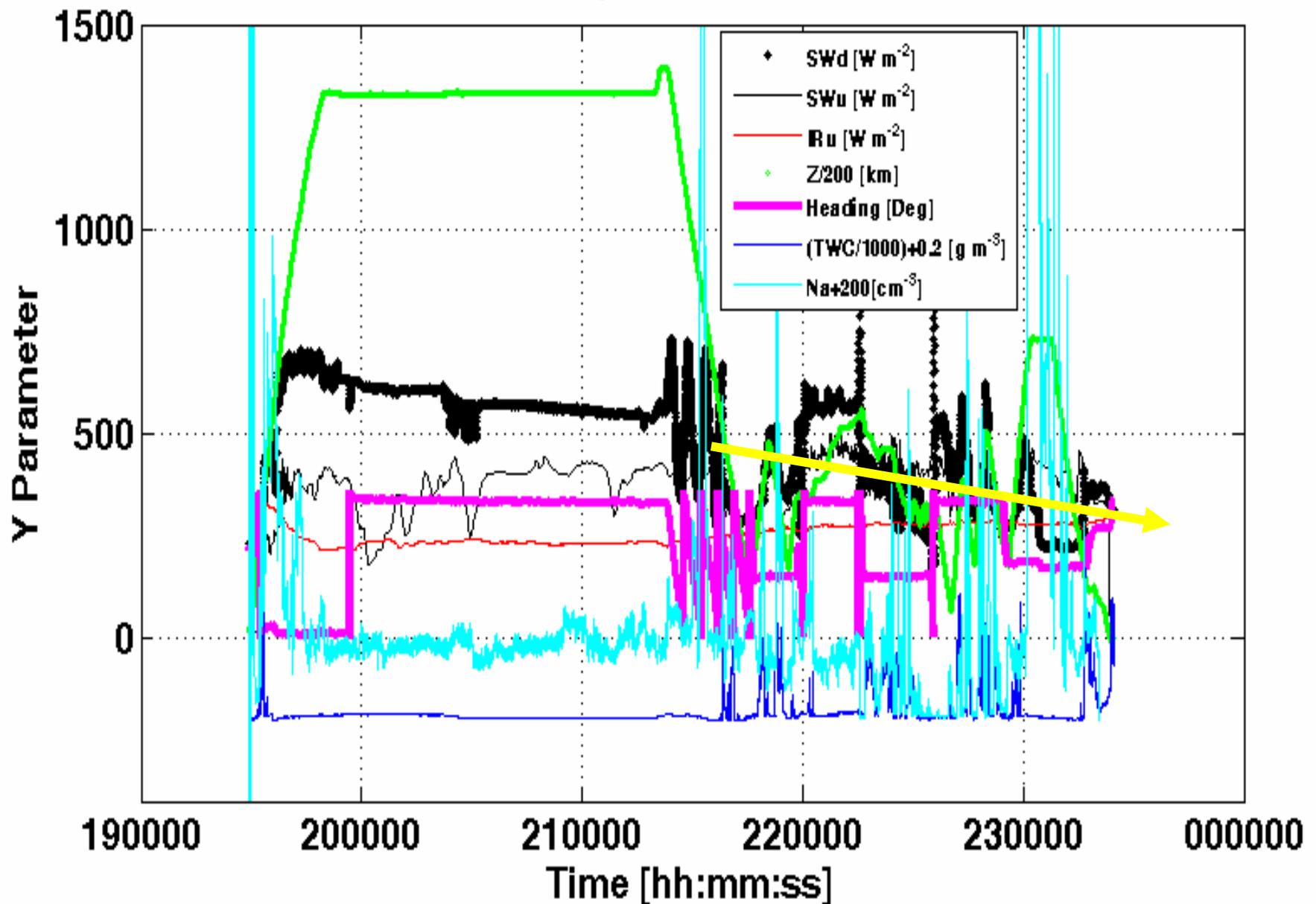
- Fairbanks to Barrow flight



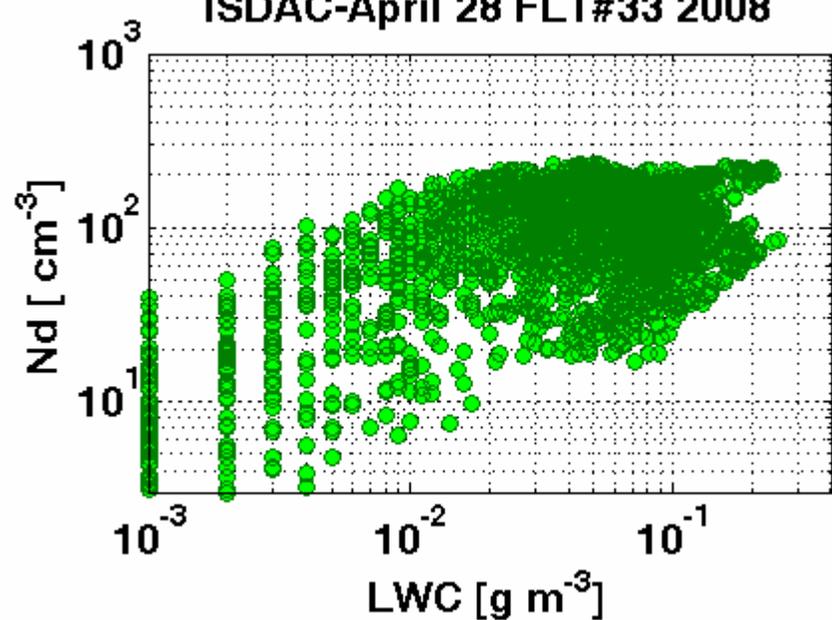
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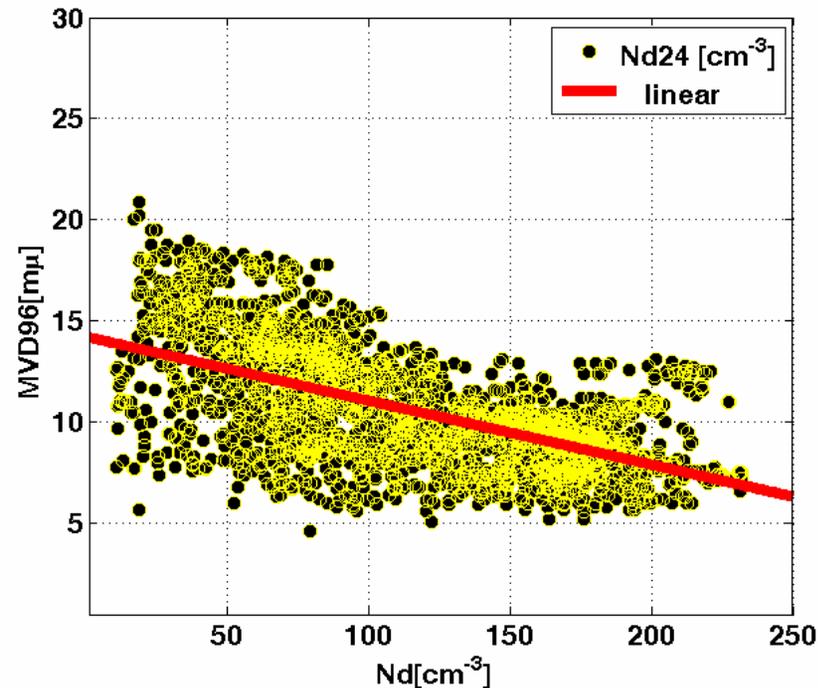
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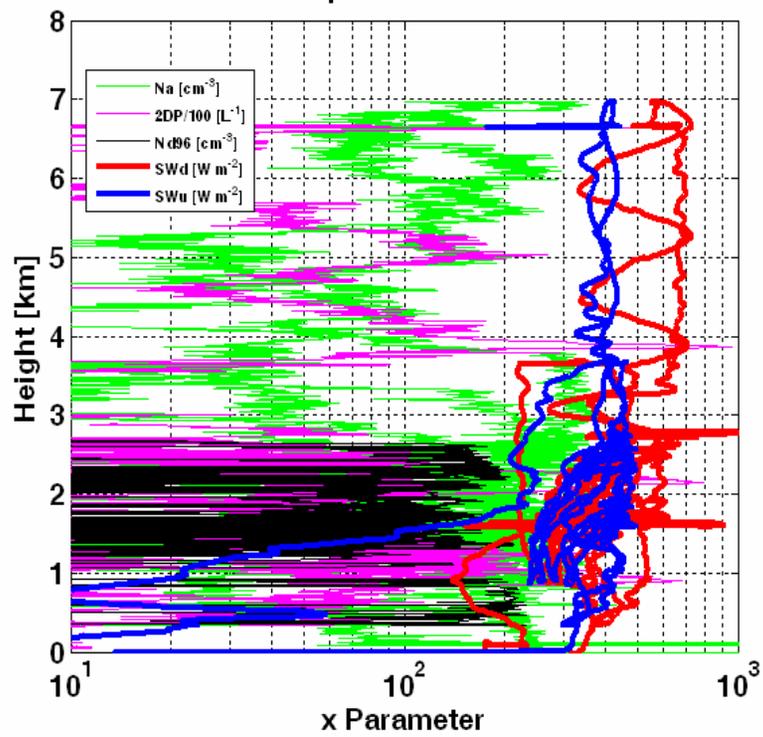
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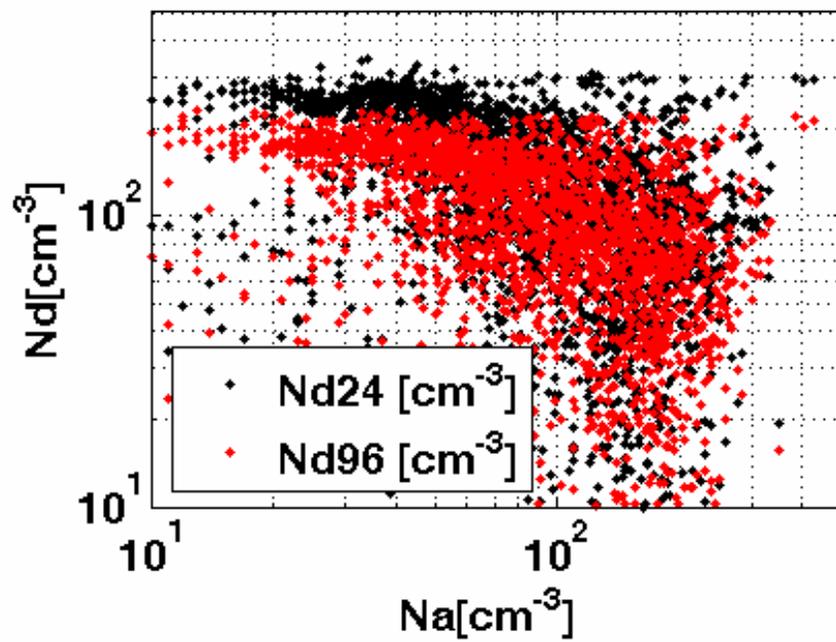
ISDAC



ISDAC-April 28 FLT#33 2008



ISDAC-April 28 FLT#33 2008



# CONCLUSIONS and QUESTIONS?

- **Ground based observations are documented for model and remote sensing applications.**
- **In-situ cases are being specified for cloud and aerosol effects on BRF**
- **Uncertainties on BRF, aerosols, and microphysics are being estimated.**