

# An overview of the Concordiasi project

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**CNRM-GAME**  
Météo-France and CNRS



dépasser les frontières



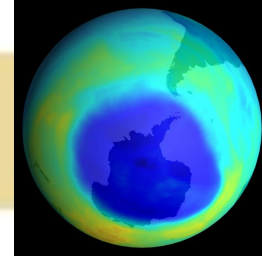
**METEO FRANCE**  
Toujours un temps d'avance

# An international project

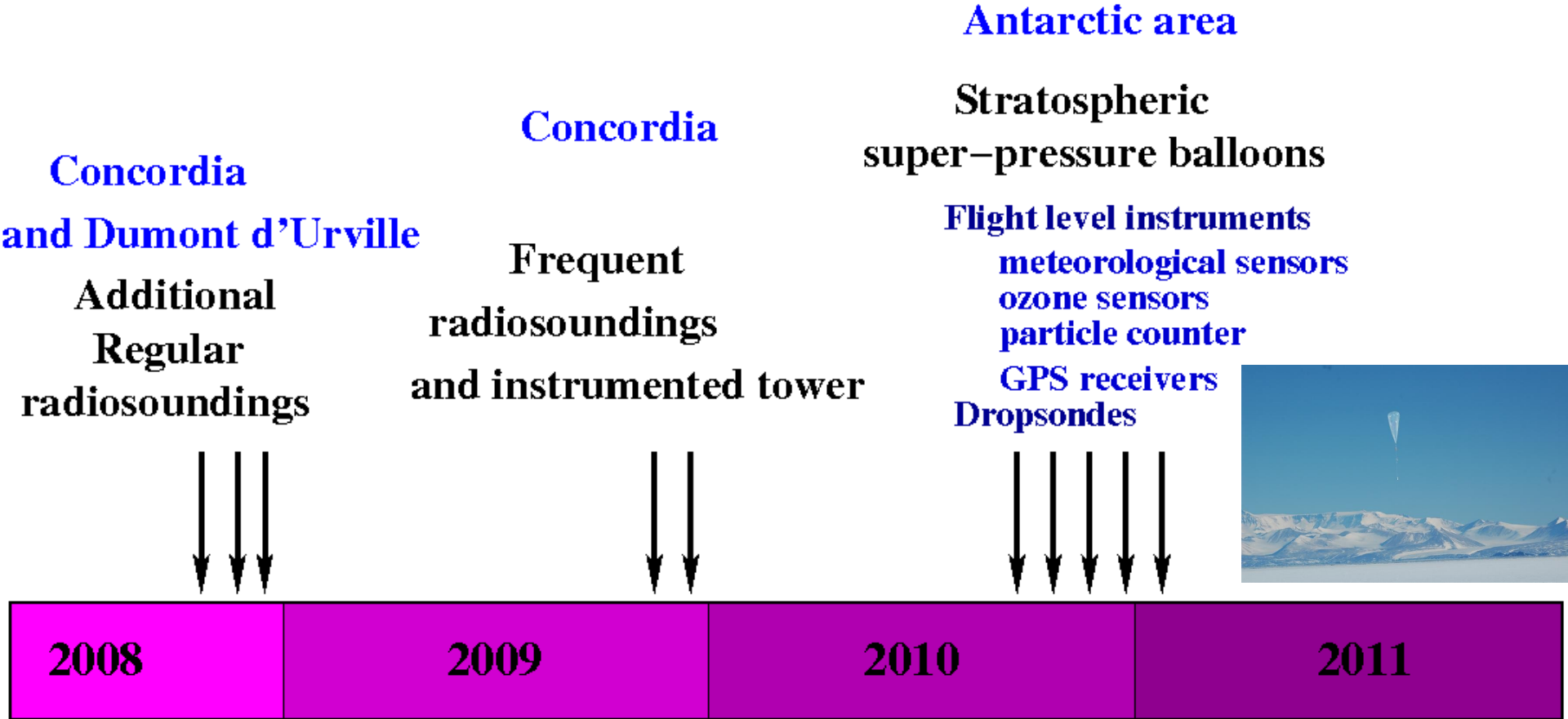
- Participating Institutes:
  - CNES, CNRS/INSU, IPEV, LMD, LGGE, Météo-France, PNRA
  - NSF, Purdue University, UCAR, University of Colorado, University of Wyoming
  - ECMWF
- Collaborating institutes:
  - NWP centres (Met Office, Australia...), NASA/GMAO, UCLA, ....
- Part of the THORPEX-IPY cluster
- Overview of Concordiasi: “The Concordiasi project in Antarctica”  
Rabier et al, Bulletin of the American Meteorological Society, January 2010.
- Website [www.cnrm.meteo.fr/concordiasi/](http://www.cnrm.meteo.fr/concordiasi/)



# Motivation



- Reducing uncertainties in diverse – but complementary - fields in Antarctic science
  - Better use of satellite data, including IASI on board MetOp for analyses, forecasts and reanalyses
  - Progress on the understanding of interactions between ozone depletion, stratospheric clouds and dynamics
- Experimental design
  - Surface-based: radiosoundings at Concordia (and Dumont d'Urville) + 45-m instrumented tower, snowfall and accumulation observations at Concordia
  - Stratospheric superpressure balloons with meteorological sensors, ozone sensors, particle counters, GPS receivers, driftsondes carrying dropsondes
  - Modelling: global and fine-scale models, chemical-transport models



**Preliminary Data Assimilation studies**  
**Instrument preparation**

**IASI retrievals at Concordia**  
**Boundary layer studies**  
**Instrument preparation**

**Targeting dropsondes**



Aerovane

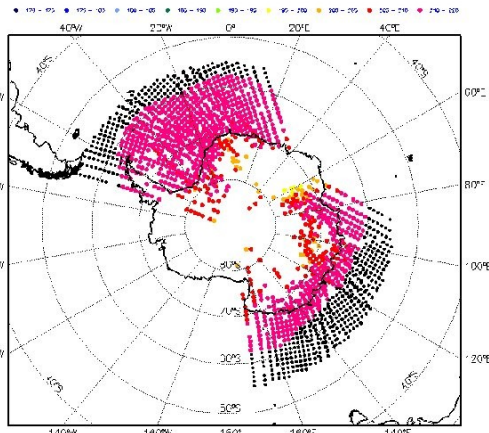
Radiation shielded Thermo-hygrometer

**IASI retrievals at dropsonde locations**  
**Evaluation of chemical transport models**  
**Scientific studies based on stratospheric data**

**Data Assimilation studies using balloon data**

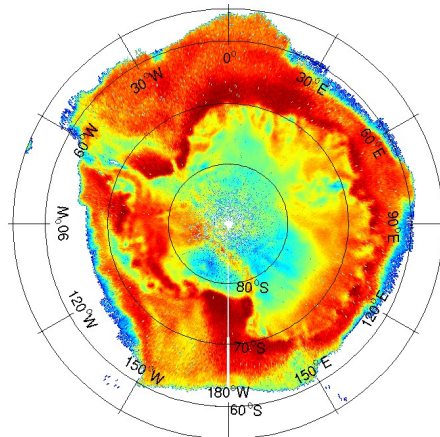
**Validation of satellite data assimilation using dropsonde data**

# Data Assimilation studies over Antarctica

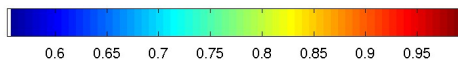


- Additional **IASI** data assimilated over snow and sea-ice

- Additional **microwave observations** assimilated using a dynamical approach for the estimation of the emissivity over land and sea-ice (approach from Karbou, 2006)



AMSU-A channel 3, July 2007



Presentations A. Bouchard, S. Guedj, F. Karbou

# Data at Concordia



An exceptional location to validate satellite data assimilation

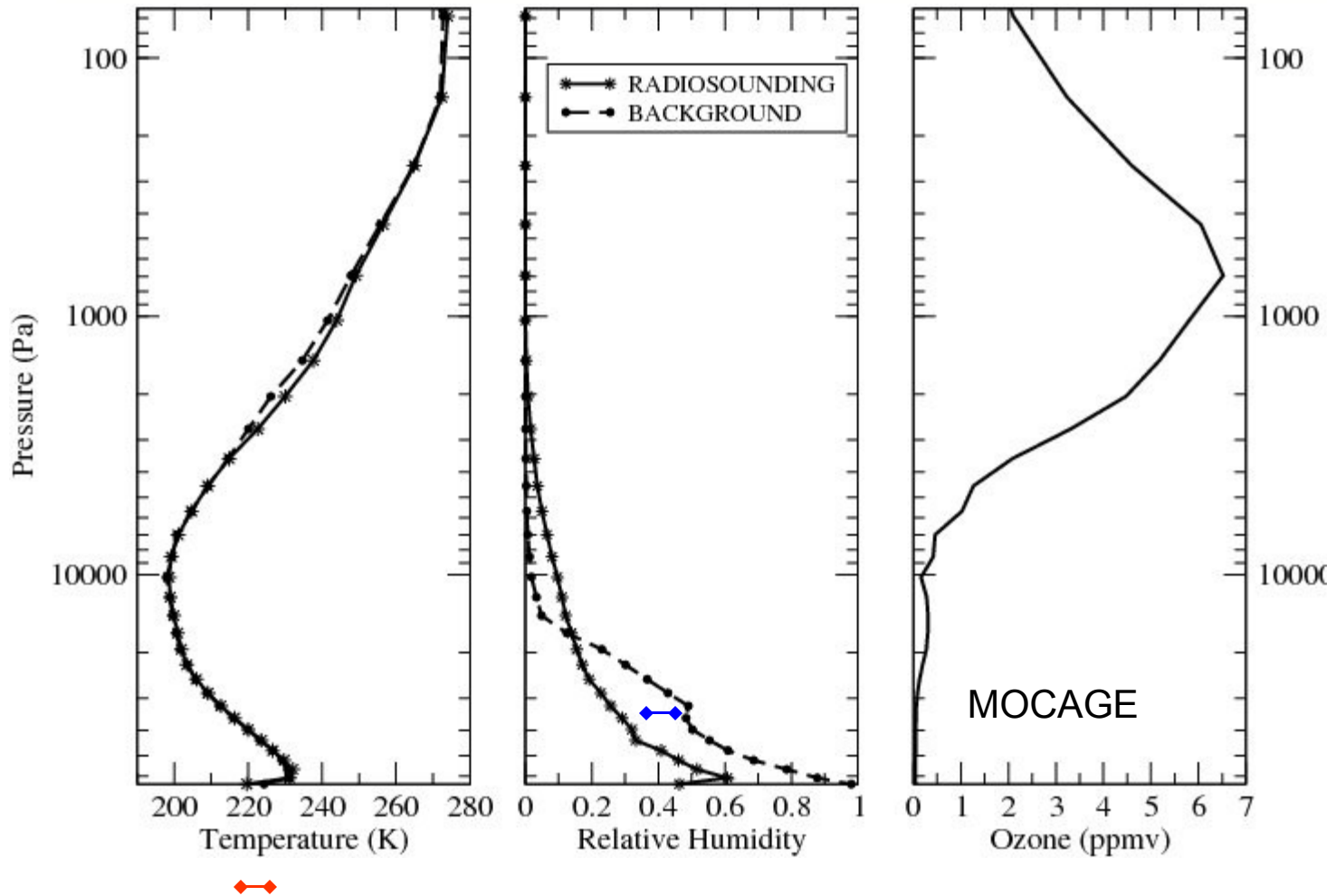


- Time Period : from the 15 September 2008 to 30 November 2008 and 19 November 2009 to 13 December 2009
- Observations:
  - **2008** : Radiosounding at **DomeC** ( $75^{\circ}\text{S}$  ;  $123^{\circ}\text{E}$ ) in order to have 2 observations per day, at **OUTC** and 12UTC. Complementary launch at the same time of IASI overpass.
  - **2009** : As 2008 + Surface measurements (vertical profile of the snow temperature) at the time of the sounding.
- Meteorological conditions :
  - Out of 120 cases in 2008: **62% clear sky**
  - Out of 17 cases in 2009: **59% clear sky**

(talk by D. Six)

**CONCORDIASI**

# Statistics model/observations at Concordia



70 profiles  
at 00UTC  
From  
15/09/2008  
to  
30/112008

Warm bias in Ts

Wet bias

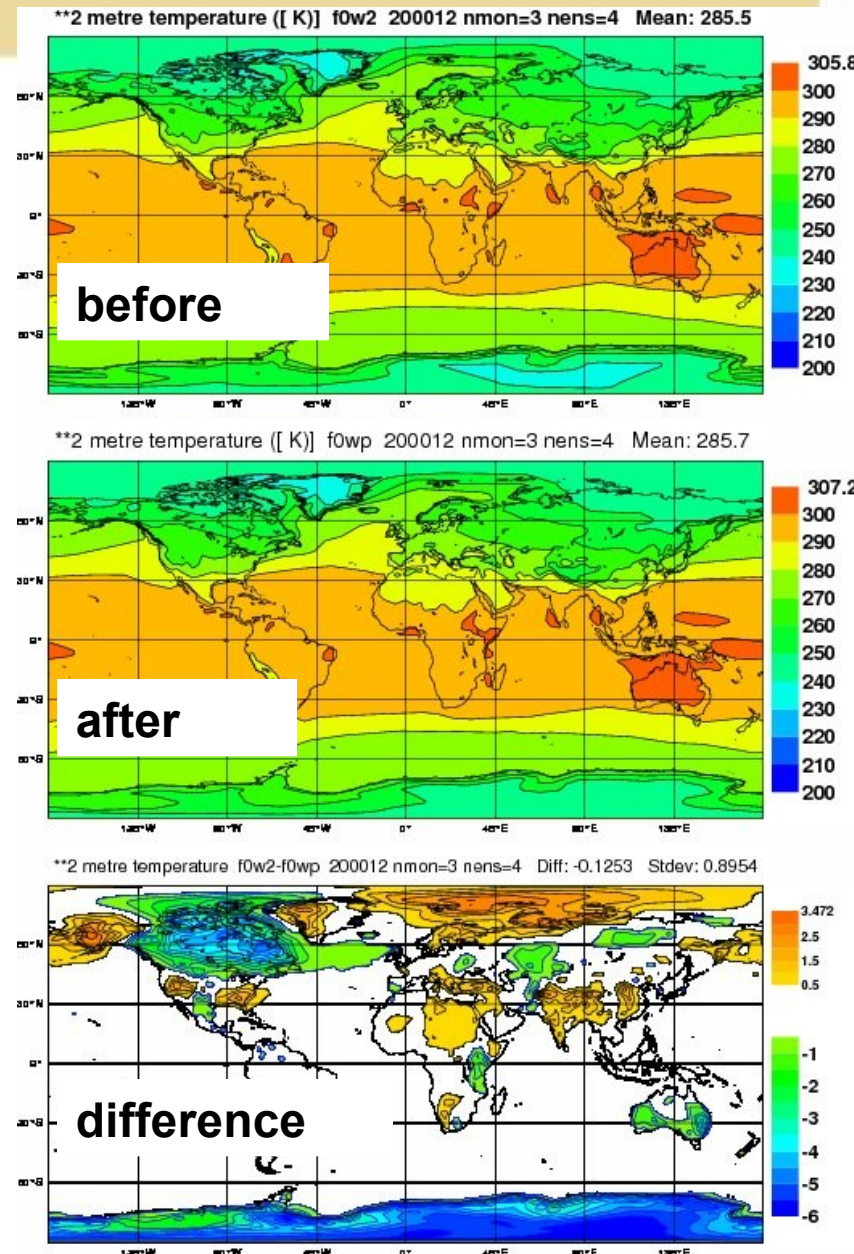
+ field campaign in 2009 with additional measurements

# Model improvement

Statistics at Concordia and diagnostic of model performance  
(talks by C.Genthon)

Improvement in the ECMWF model  
Based on interaction with polar scientists  
Change in albedo over permanent snow effective in 2008. Decreased warm bias  
(talk by G. Balsamo)

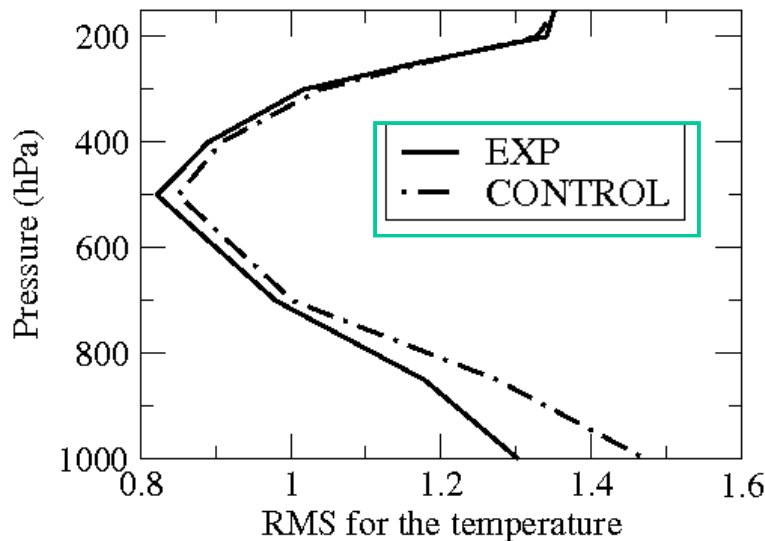
Work performed on snow modelling  
(talk by E. Brun)





# Predictability studies, effects on lower latitudes

Improving assimilation over polar areas can also improve forecasts at lower latitudes



Assimilation experiment with more satellite data over sea-ice and Antarctica:  
**Obs - model** for a period of 20 days during austral winter 2007

Obs : AIREP (airborne data)  
between 20°S and 50°S

**Sensitive areas** will be computed with an experimental version of the ECMWF Ensemble Prediction System (optimised over the polar cap), and dropsonde observations will be deployed in these areas

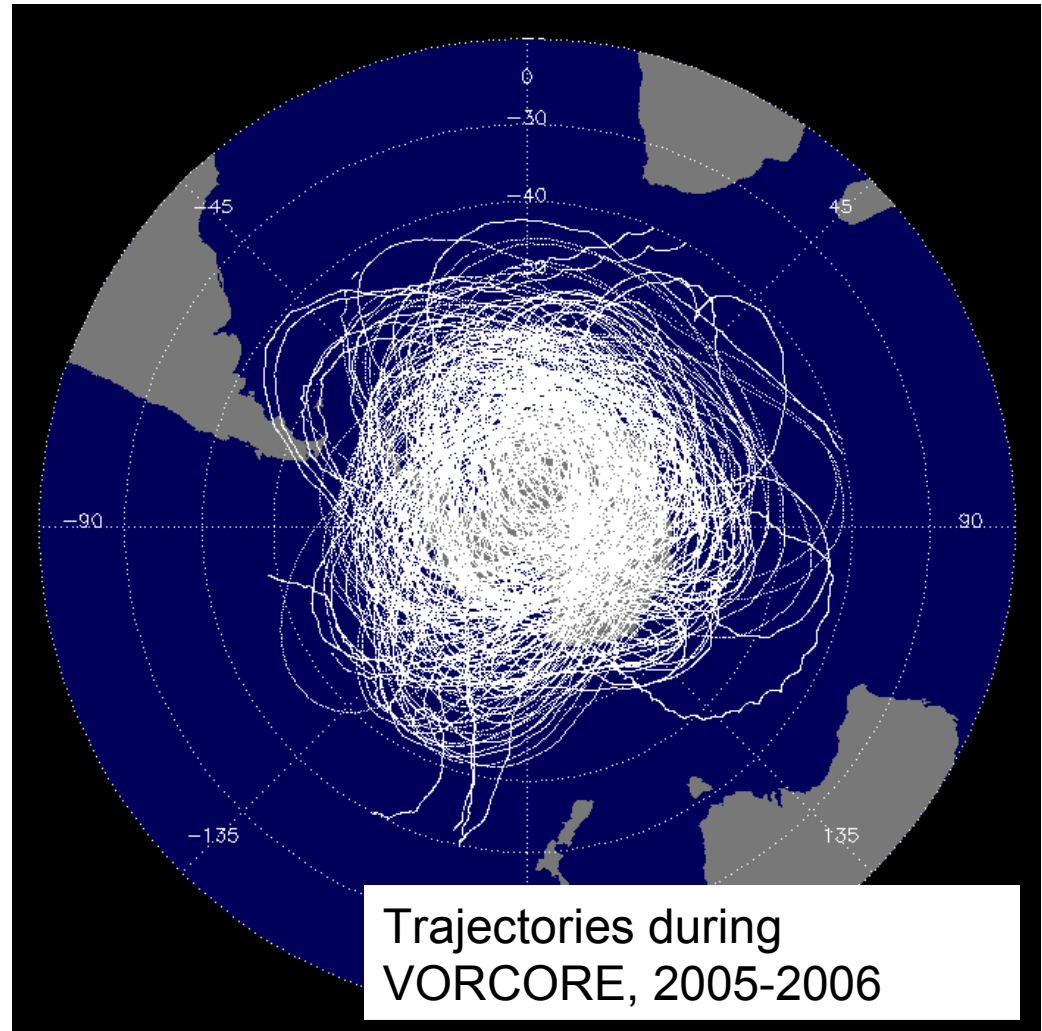
# Lagrangian structures of the flow and data assimilation

Trajectories will be used to better understand the control exerted by the vortex on the motion of air parcels

(talk by R. Mechoso)

Use of the Concordiasi flight-level observations directly in the assimilation

(talk by L-F Meunier)



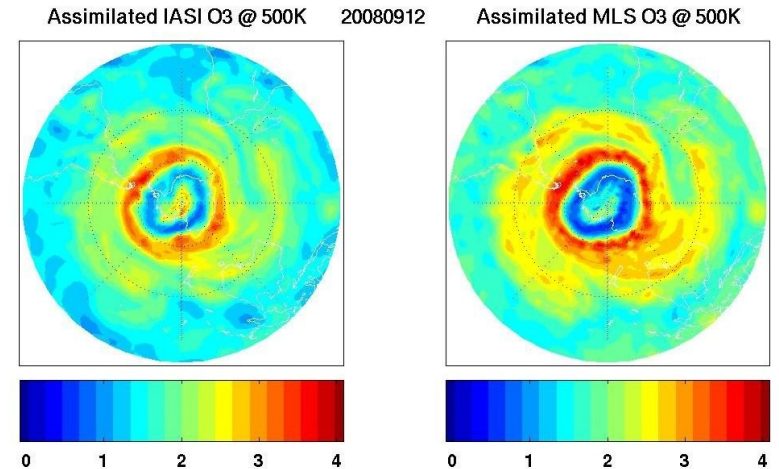
# Ozone depletion, polar stratospheric clouds and stratospheric dynamics

- Interannual variability of ozone depletion depends on the activity of stratospheric waves and the presence of polar stratospheric clouds
- Documentation of ozone loss along trajectories with meteorological, chemical and microphysical observations.

(Talks by A. Hertzog, T. Desher, L. Avallone)

- Validation of Chemical-Transport model and Stratospheric ozone assimilation.

(talk by L. El Amraoui)



# Test campaign in the Tropics

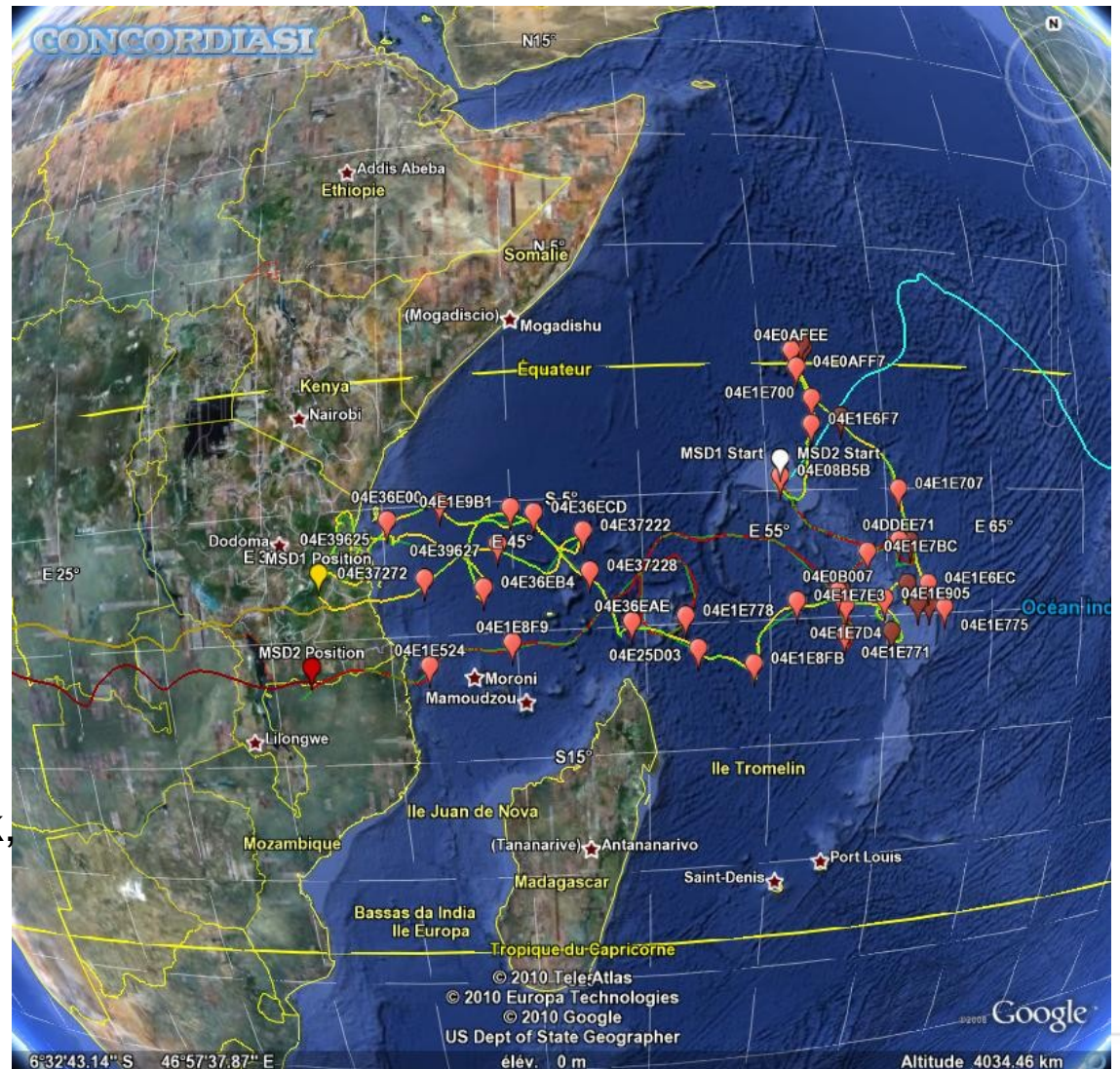
## Pre-Concordiasi

February-March 2010

2 Driftsondes

1 additional  
stratospheric balloon

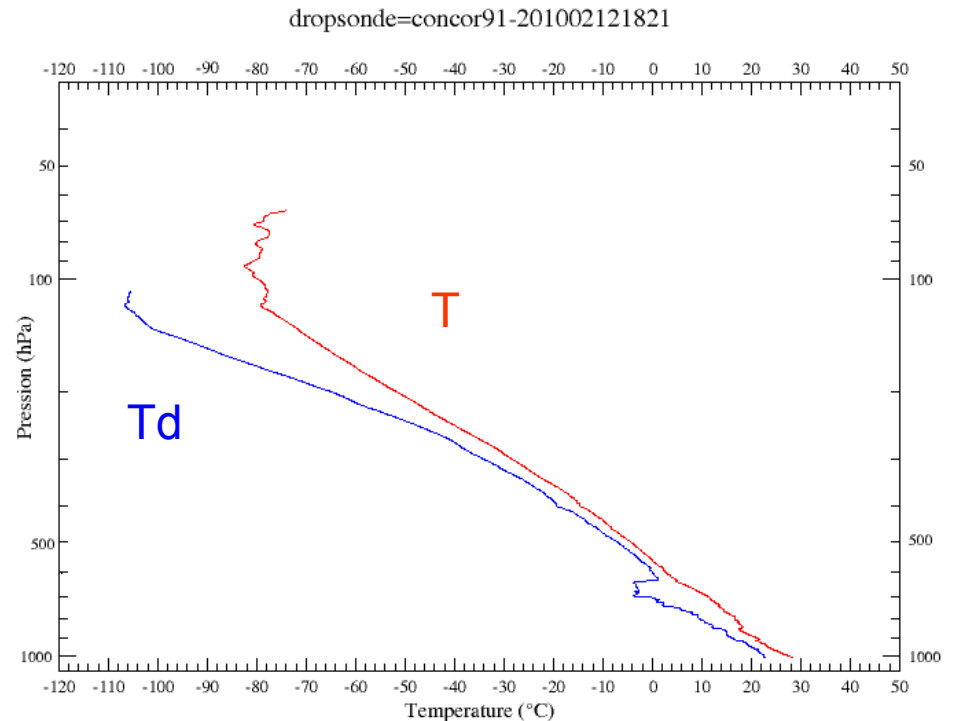
Talks by P. Cocquerez, T. Hock,  
A. Doerenbecher, V. Guidard



**CONCORDIASI**

# Data on the website

- Non-protected access: data from GTS (needs simple registration to access data)
- Protected access: high-resolution soundings. both from driftsondes and Concordia.

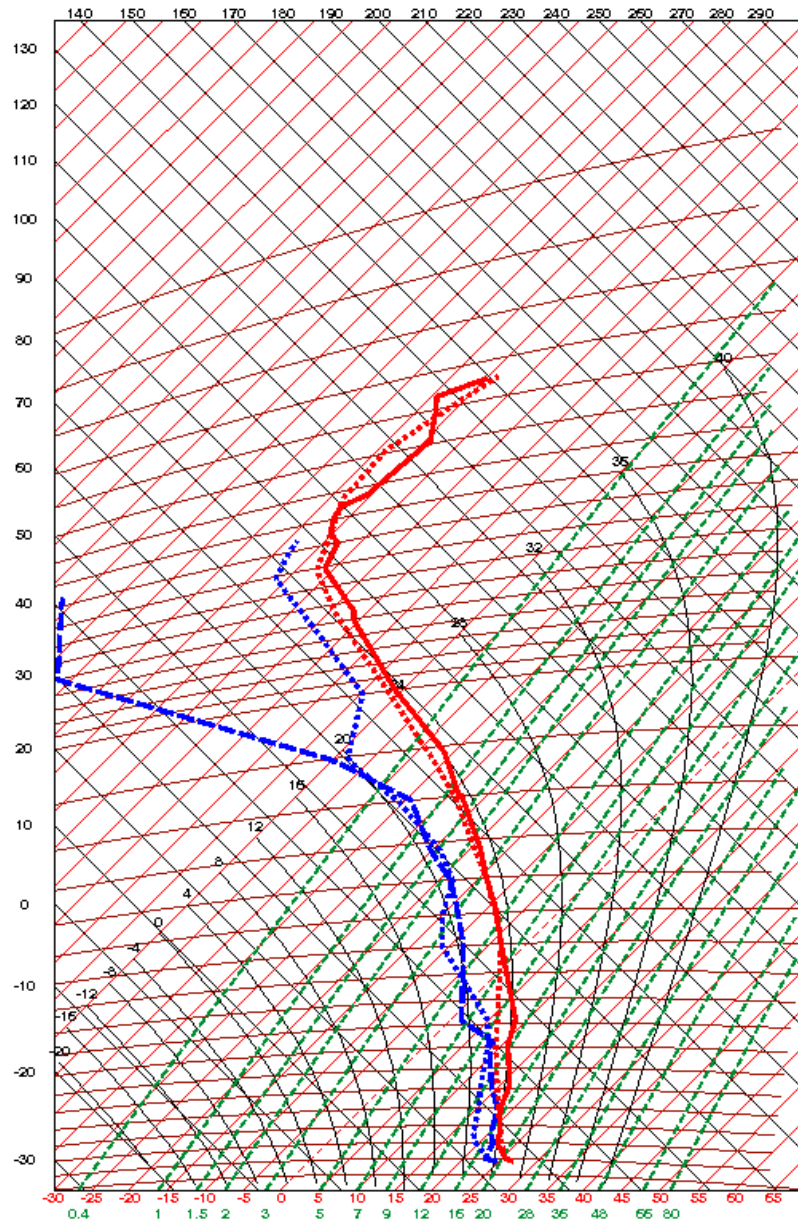


(Dominique Puech)

<http://www.cnrm.meteo.fr/concordiasi-dataset/>

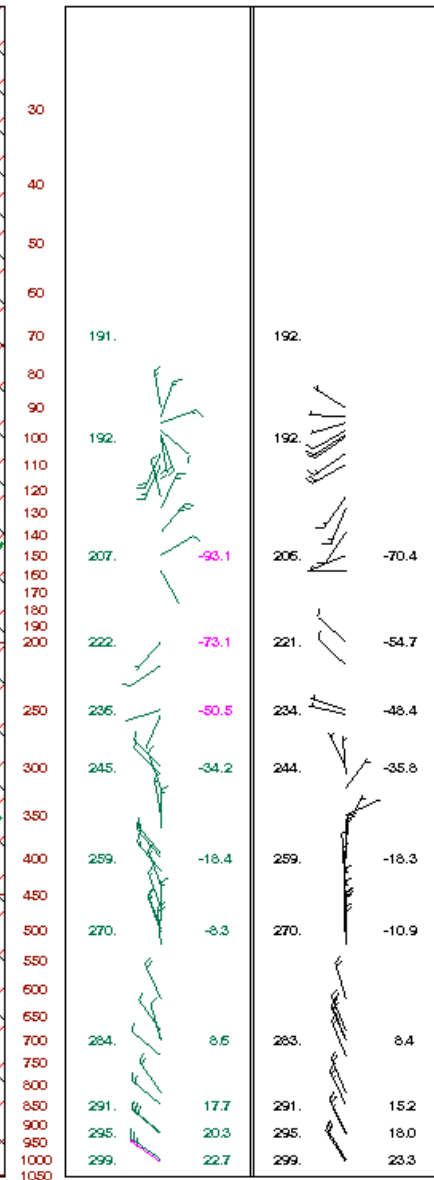
# Example of Comparison with the ECMWF model

Dopsonde (103) 9.8S, 61.2E 14 FEB 2010 5 UTC



OBSERVED

FG 4DVAR

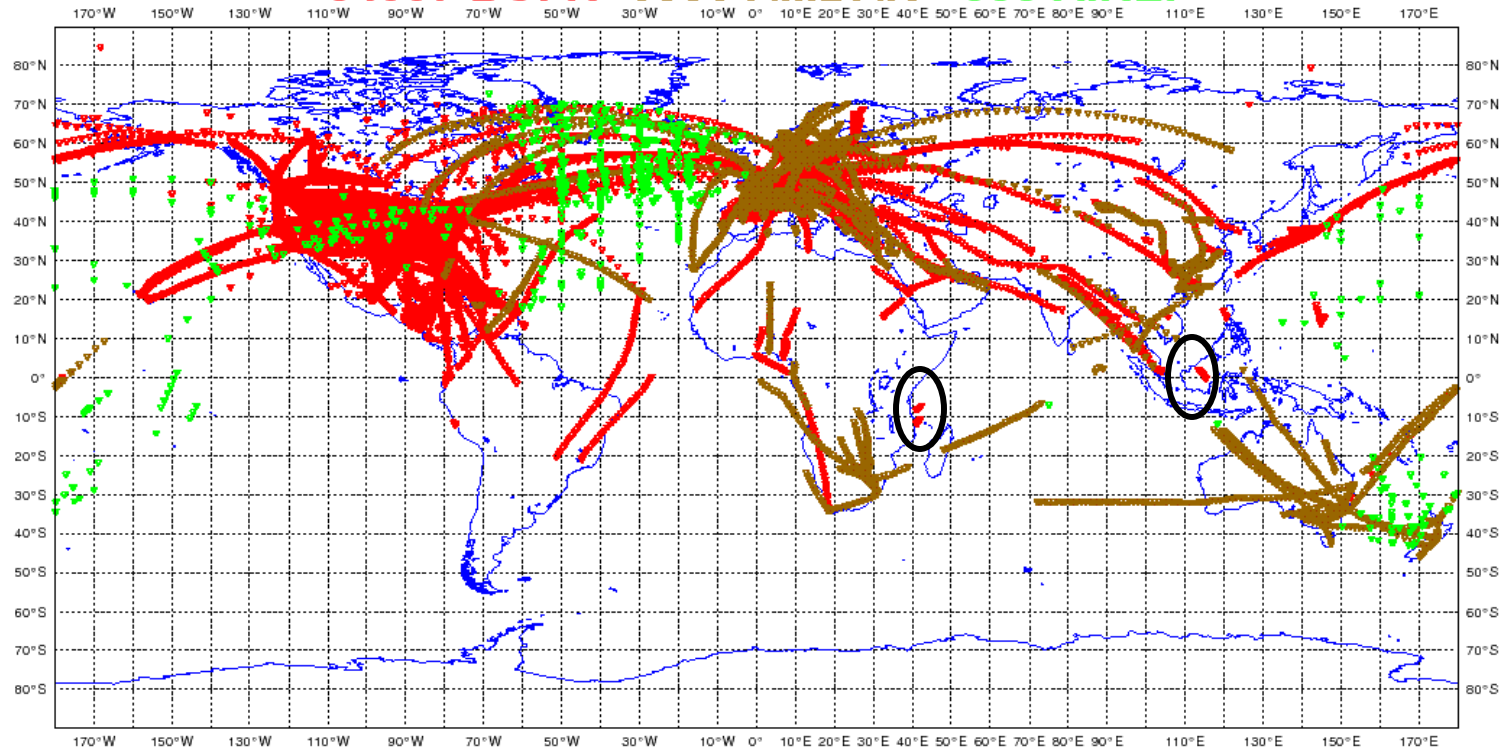


Only major problem is Humidity above 300 hPa

# Gondola information assimilated

**METEO-FRANCE** couverture de donnees - AVIONS  
2010/03/02 18H UTC cut-off long  
Nombre total d'observations apres screening : 42435

34997 BUFR 6550 AMDAR 888 AIREP



# Météo-France Statistics for gondola temperature and wind

Global statistics for the three gondolas, averaged from 12/02/2010 to 21/03/2010

RMS per parameter (averaged over 2000 to 3000 observations)	RMS (Obs – Background)	RMS (Obs – analysis)
Wind speed	3.49 m/s	2.03 m/s
Wind direction	29°	14°
Temperature	1.85 K	1.00 K

Also assimilated at Met Office since 9 March.

Also monitored at Environnement Canada, preparations under way at other centres for the September campaign



# Outlook

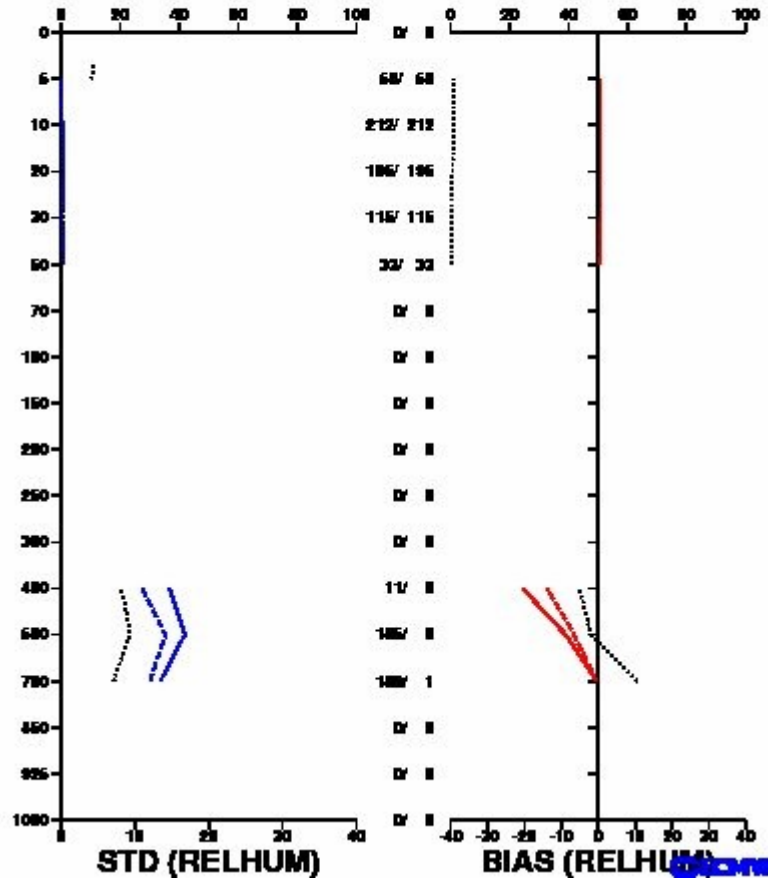
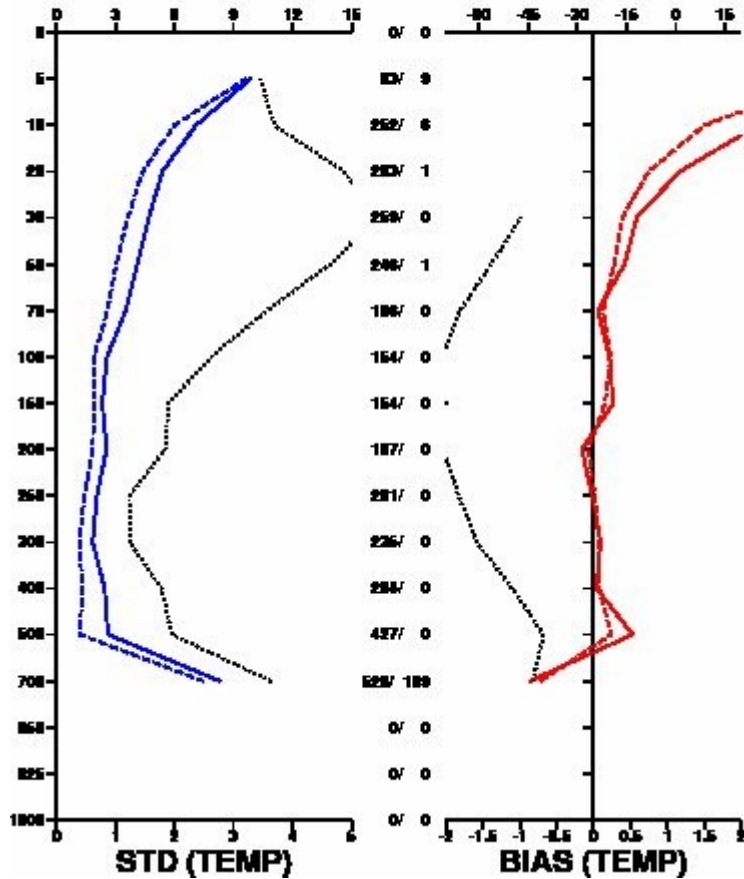
Concordiasi 2008 and 2009 field campaigns: data have started to be used in studies. More to be done

Balloon test campaign successful: promising for the 2010 field campaign from McMurdo

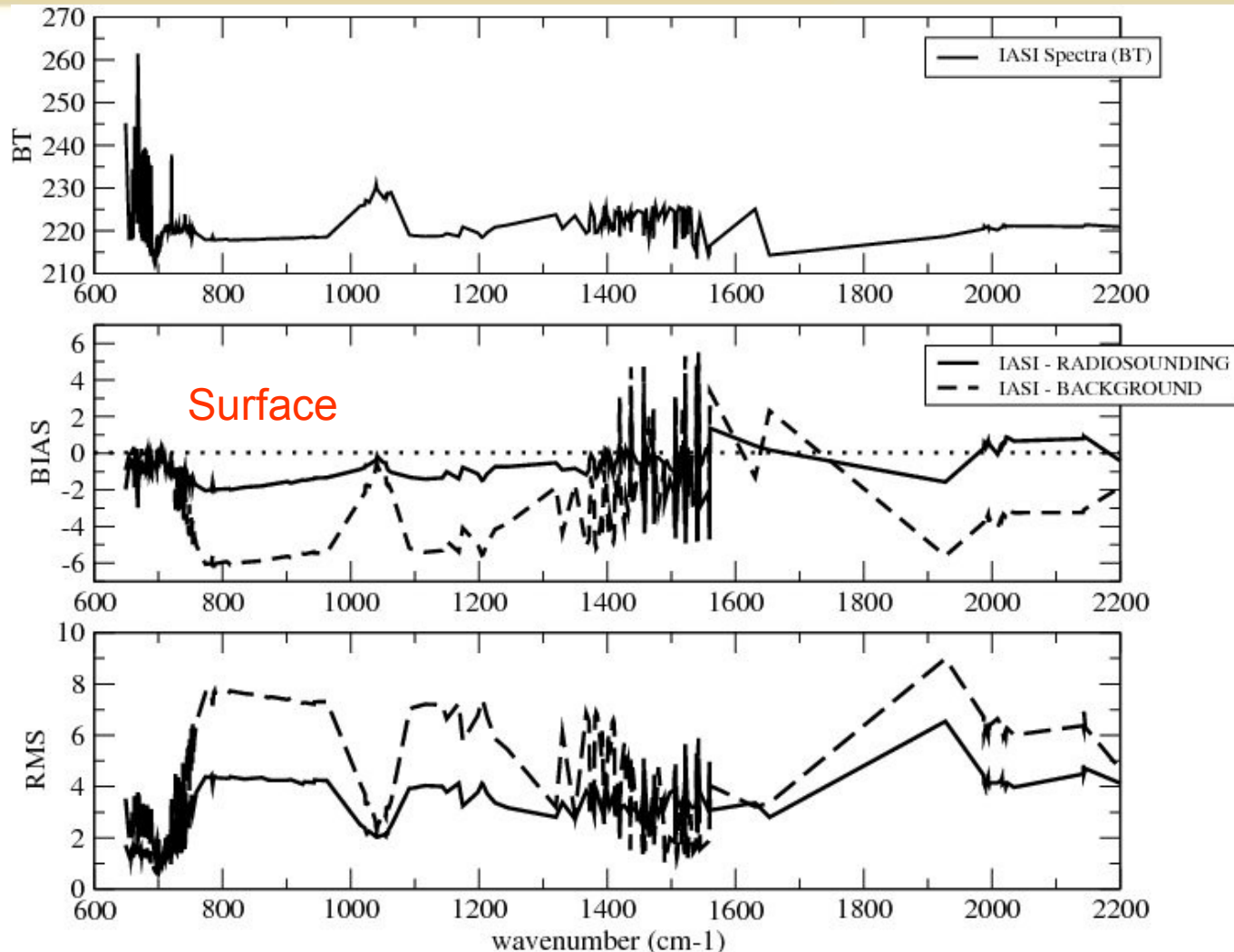
Need to engage the community to use the data, and to interact on scientific studies

Extend scientific results to broader applications than Concordiasi

Concordia  
 15 SEP-30 NOV 2008  
 90S-180W/90N-180E  
 00/06/12/18 UTC uncorrected data combined

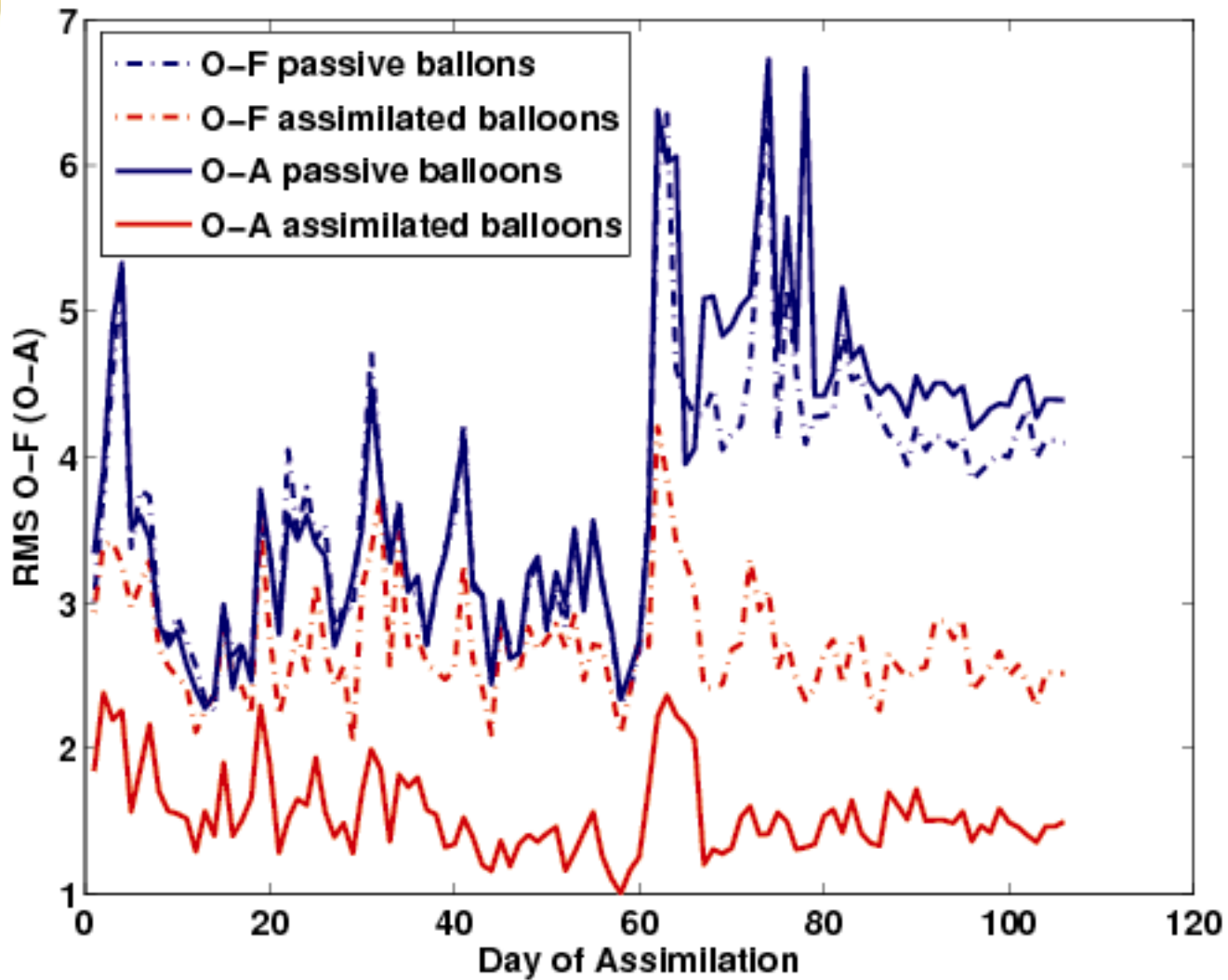


# Statistics wrt IASI (70 cases in 2008)



Large impact of  $T_s$  (more detailed studies in 2009, talk by A. Bouchard)

Link with snow modelling (talk by E. Brun)



A. Tangborn, L-F. Meunier