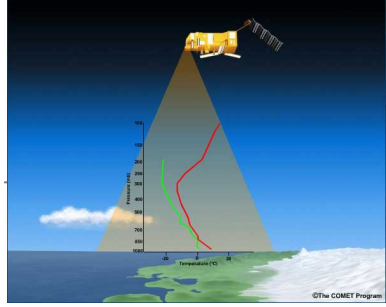
The Concordiasi Project

Additional observations over Antarctica for NWP

F. Rabier, V. Guidard, S. Noton-Haurot,
A. Doerenbecher, D. Puech,
P. Brunel, A. Vincensini, H. Bénichou, Météo-France
Ph Cocquerez, CNES
A. Hertzog, F. Danis, IPSL/LMD
T. Hock, S. Cohn, J. Wang NCAR
C. Sahin, A. Garcia-Mendez, J-N Thépaut ECMWF
A. Cress, U. Pfluger, DWD
R. Langland, NRL
G. Verner, P. Koclas, CMC
R. Gelaro, NASA/GMAO
C. Parrett, R. Saunders Met Office
Y. Sato JMA

CONCORDIASI

Concordiasi = CONCORDIA-IASI



A French-US initiative for climate / meteorology over Antarctica and at global scale

Improve the use of space-borne atmospheric sounders over polar regions, in particular "IASI" on board MetOp

Benefit from the continental French-Italian station "CONCORDIA"

Concordiasi: the international team

Participating Institutes:

- CNES, CNRS (LMD, LGGE, LA), Météo-France
- NSF, Purdue University, NCAR, University of Colorado, University of Wyoming
- Alfred Wegener Institute, UK Met Office
- Polar institutes: IPEV, PNRA, USAP, BAS
- ECMWF, BSRN

Collaborating institutes:

- NWP centres, NRL, NASA/GMAO, UCLA, ….

- **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/**

Part of the THORPEX-IPY cluster

Antarctic area

Concordia

Concordia
and Dumont d'Urville

Additional
Regular
radiosoundings

Frequent
radiosoundings
and instrumented tower

Stratospheric
super-pressure balloons

Flight level instruments
meteorological sensors
ozone sensors
particle counter
GPS receivers
Dropsondes

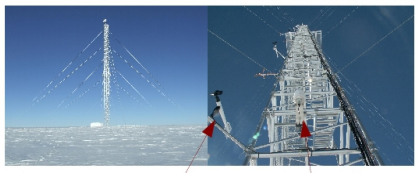
Preliminary Data Assimilation studies
Instrument preparation

IASI retrievals at Concordia
Boundary layer studies
Instrument preparation

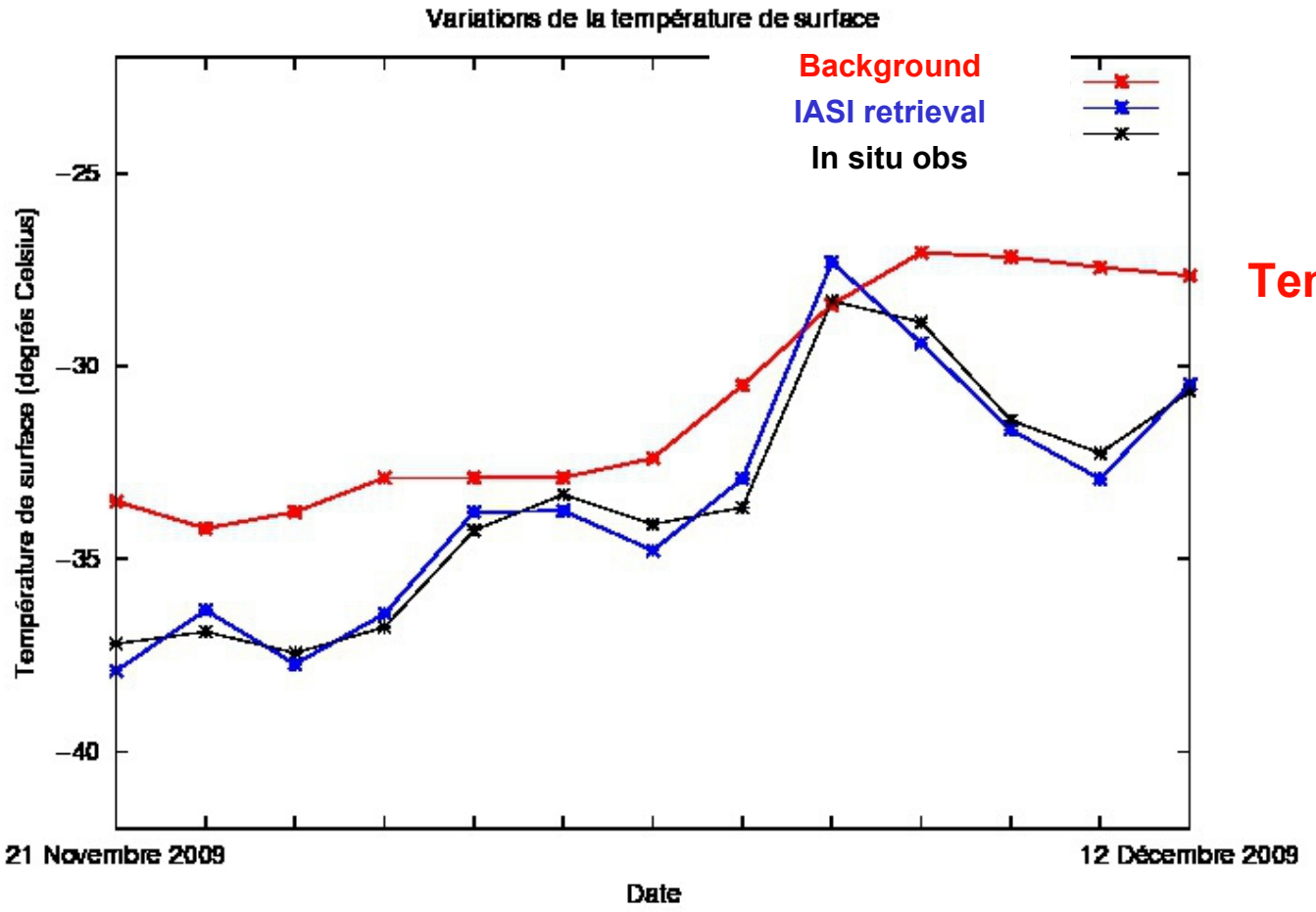
Targeting dropsondes

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



IASI retrievals at Concordia



Good agreement of retrievals for Skin Temperature, compared to in situ data

(BSRN, manual measurements)

Dropsondes to calibrate the assimilation and for predictability studies

Localized singular vectors are computed at ECMWF
Computed October the 3rd for dropsondes the 4 th

Most of the sondes are dropped when coinciding MetOp overpasses + A-train

Part of the dropsondes are deployed in sensitive areas

Some in the Weddell Sea

Calibration/validation of IASI assimilation,

including cloudy cases

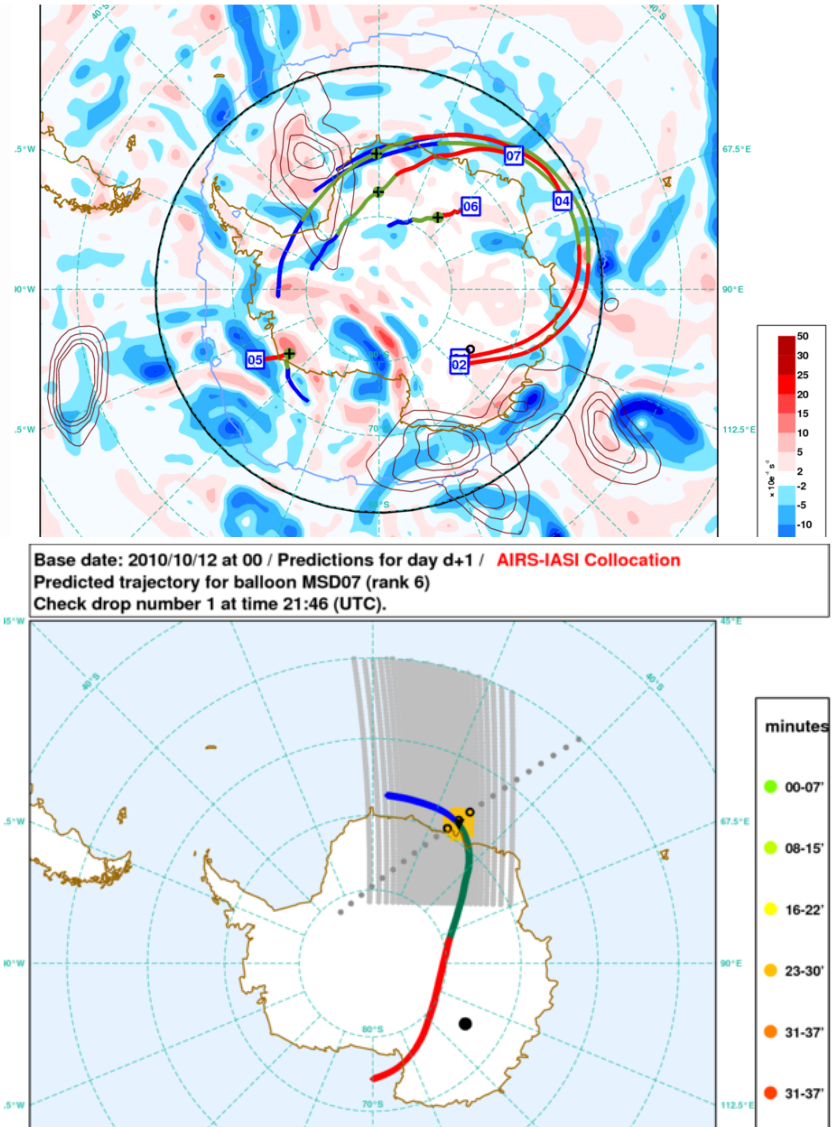
validation of AVHRR winds and error specification…

Model validation

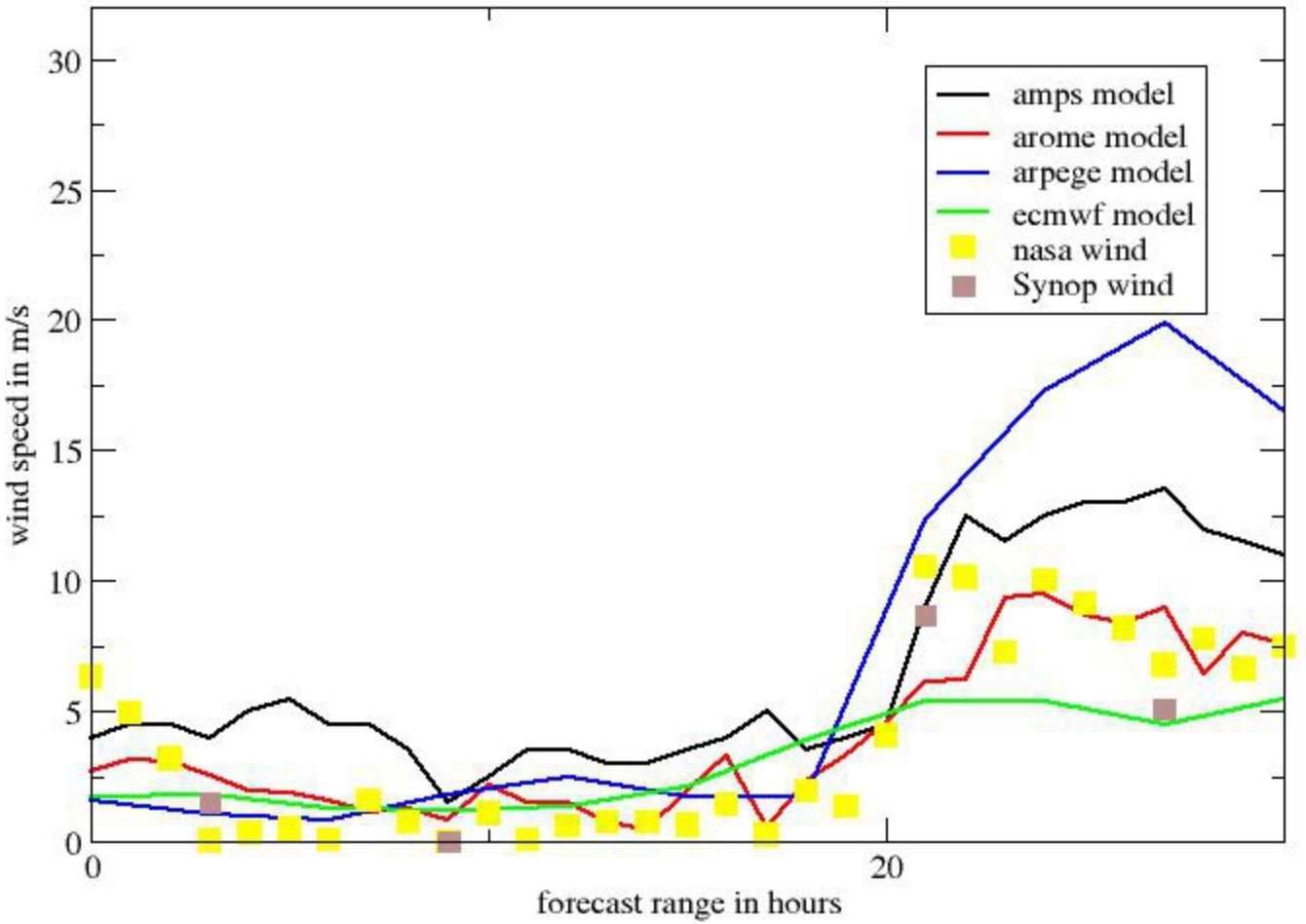
Comparison of monitoring statistics

Data impact studies

intercomparison of sensitivity to observations



Date 20101001



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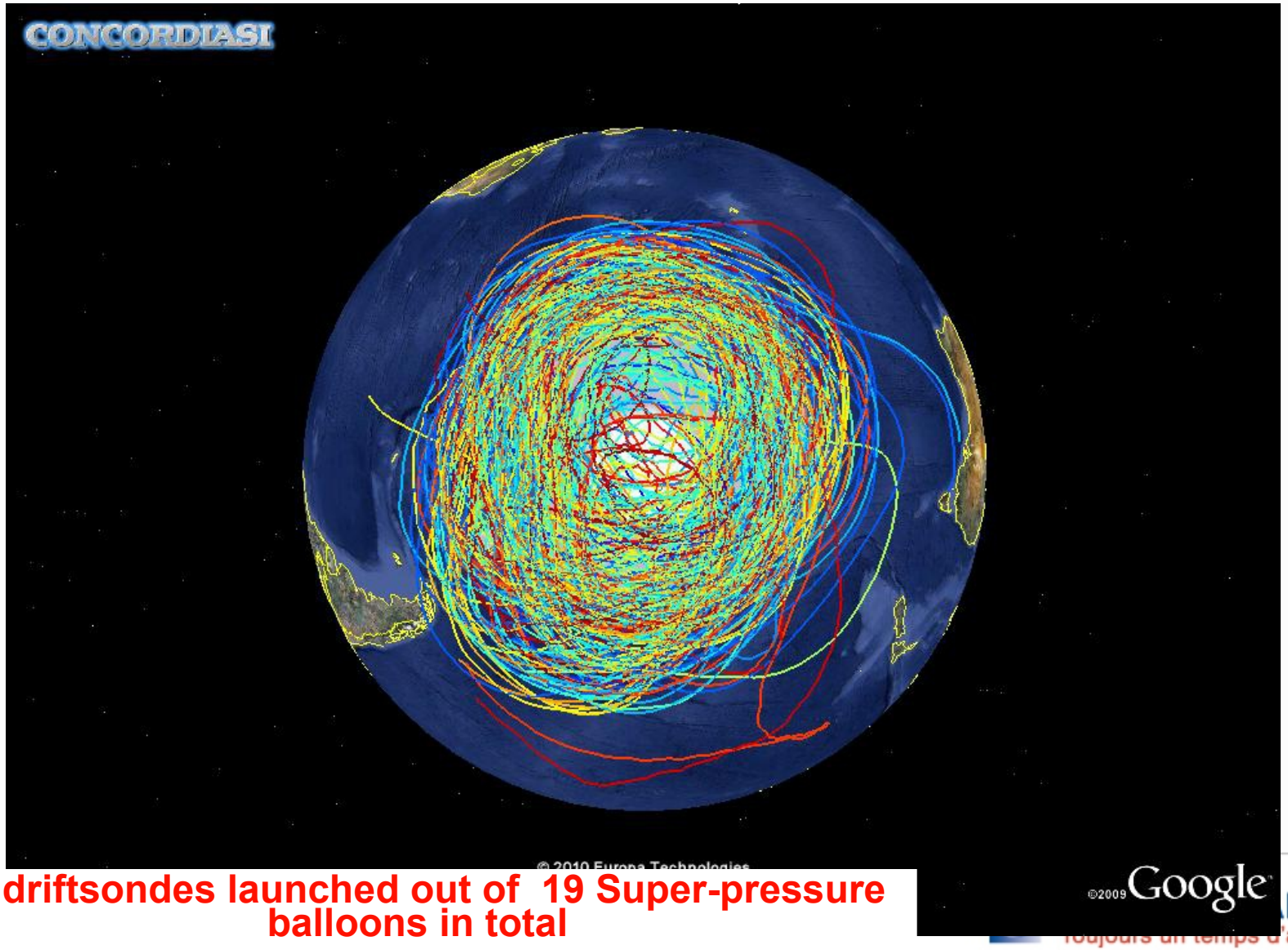
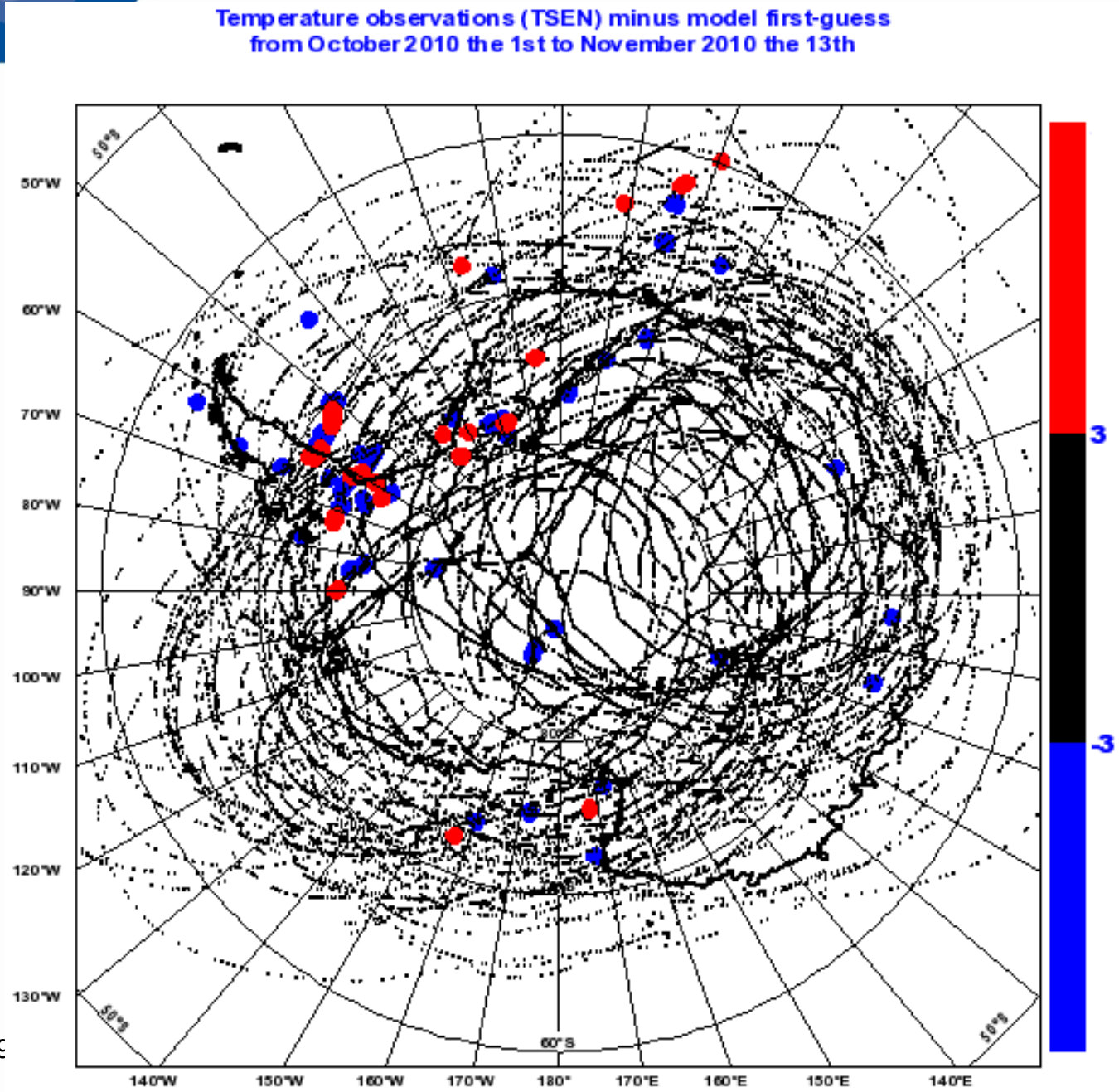
CONCORDIASI
Flights overview



13 driftsondes launched out of 19 Super-pressure balloons in total

Monitoring of gondola temperature at 60-70 hPa



Large departures where gravity-wave activity

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Assimilation of gondola information at DWD

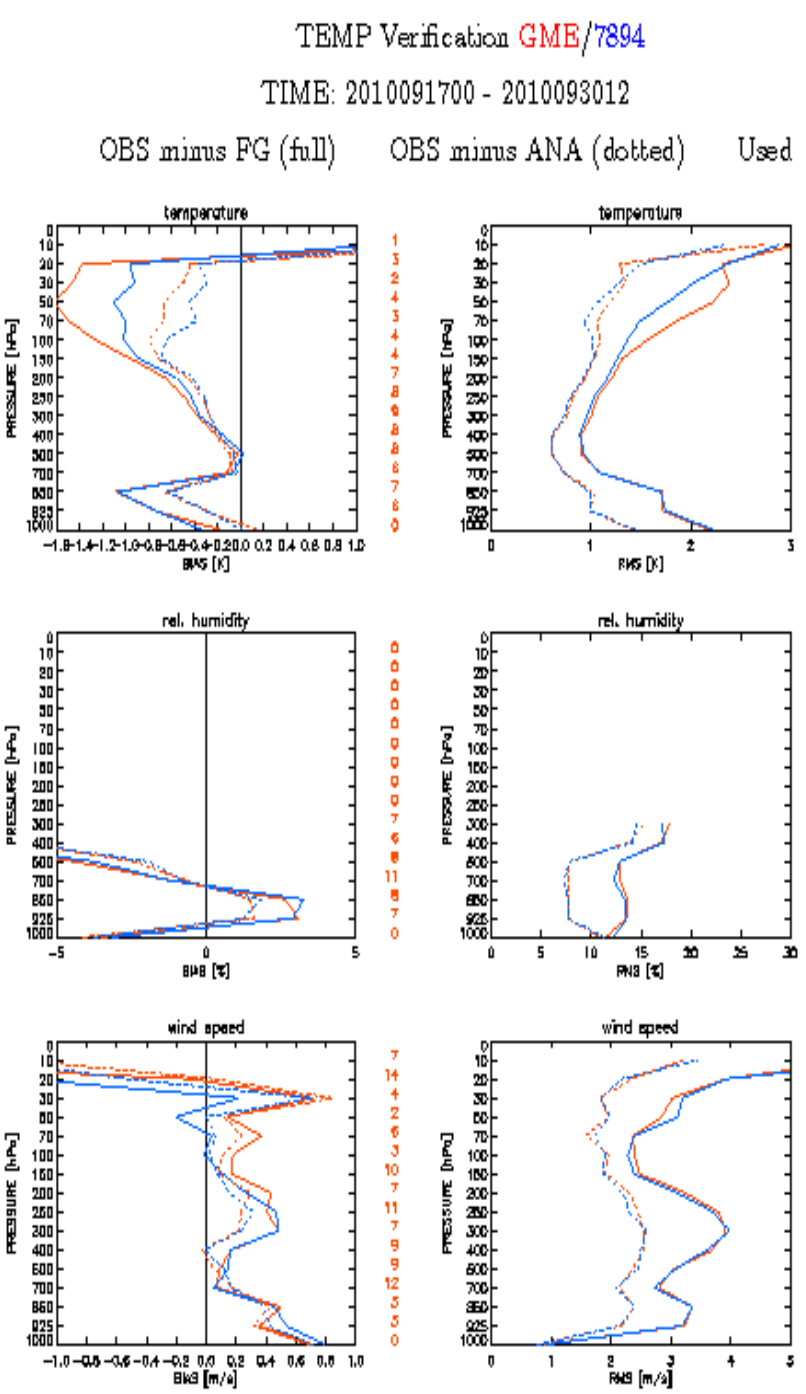
Radiosonde Verification

- Bias (left); RMS (right)
- Antarctic region
- Comparison of Routine (red) against Experiment using stratospheric balloon measurements (blue)

Results:

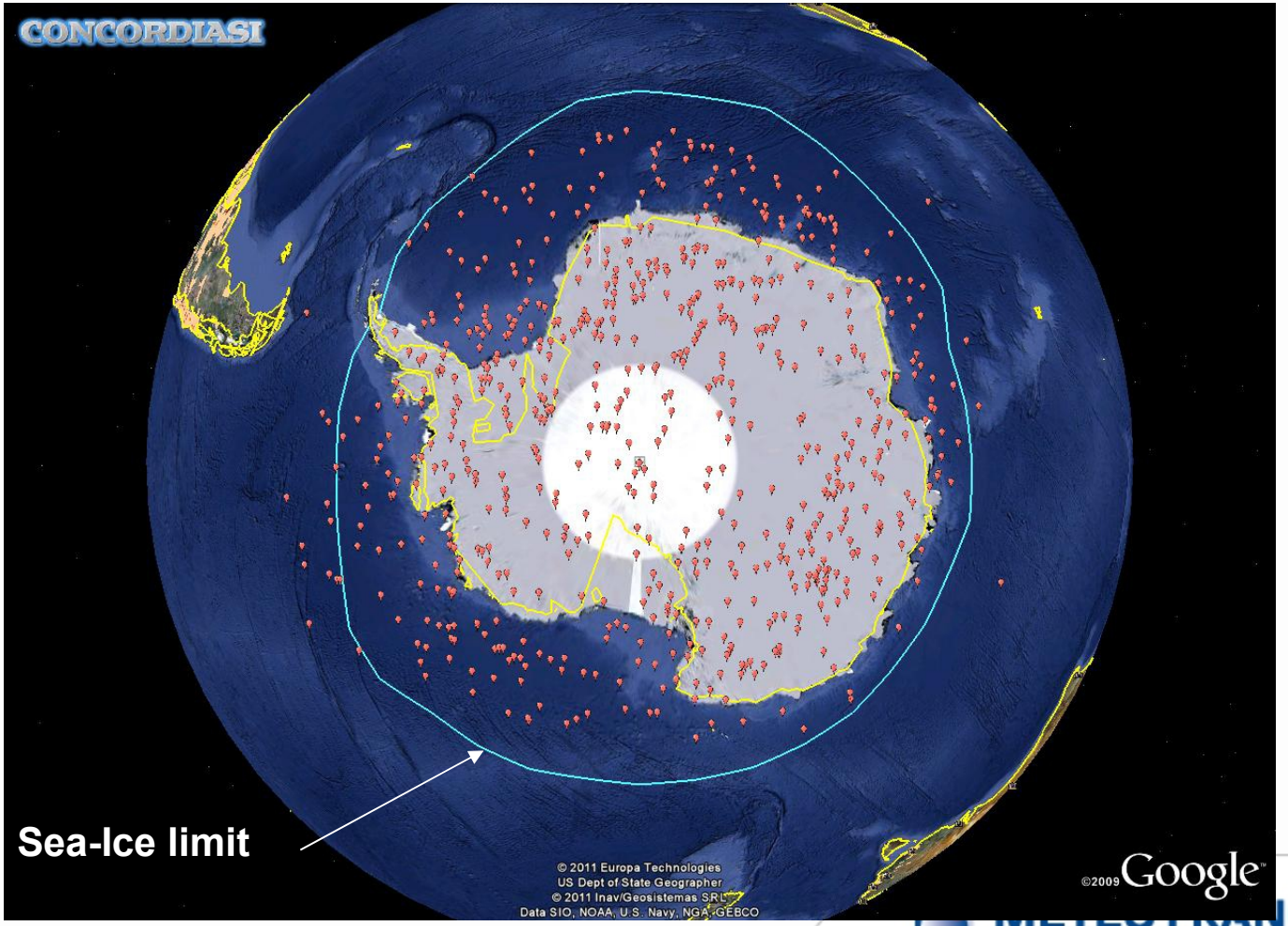
Temperature- and Windspeedbias is reduced over Antarctica in the lower stratosphere

RMS of temperature is reduced considerably for both, OBS minus FG and OBS minus Ana

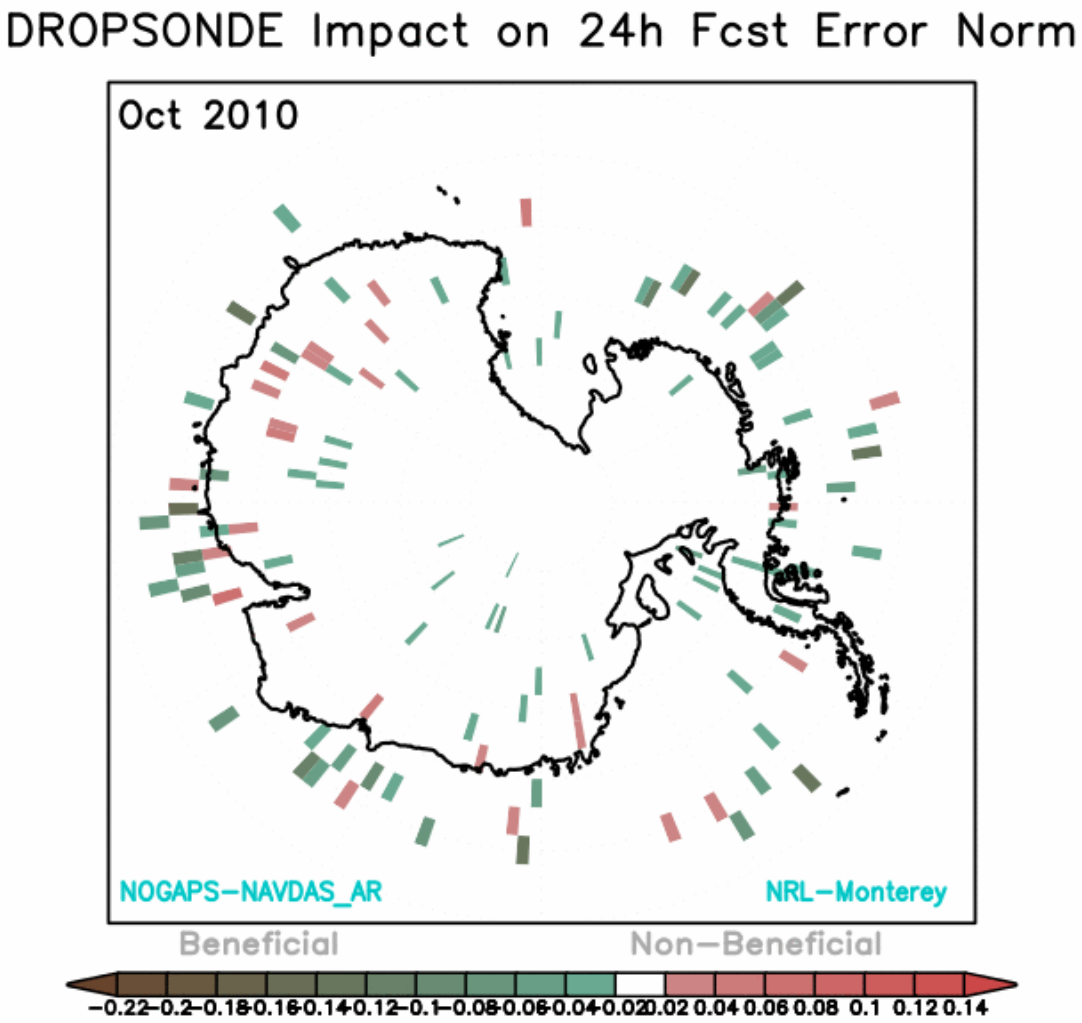


A. Cress DWD

640 Dropsondes (20100923-20101201)



Sensitivity to obs performed by NRL



Rolf Langland, NRL

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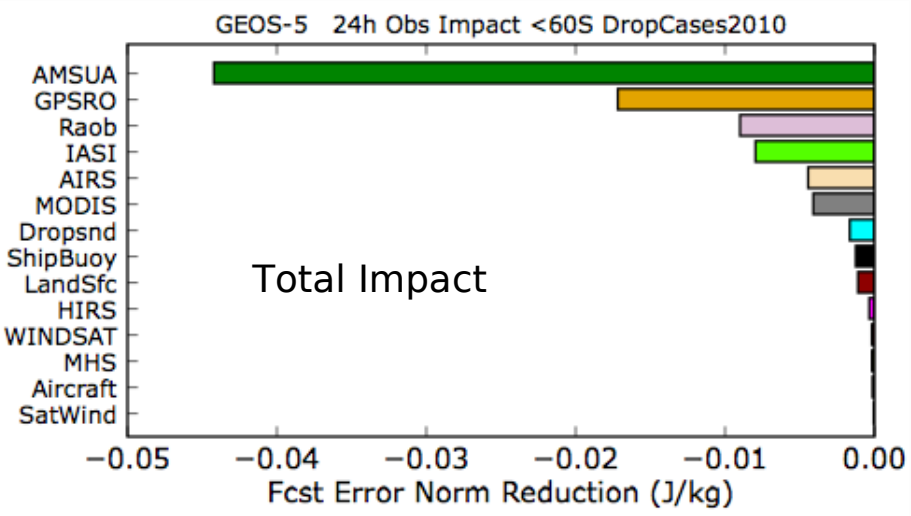
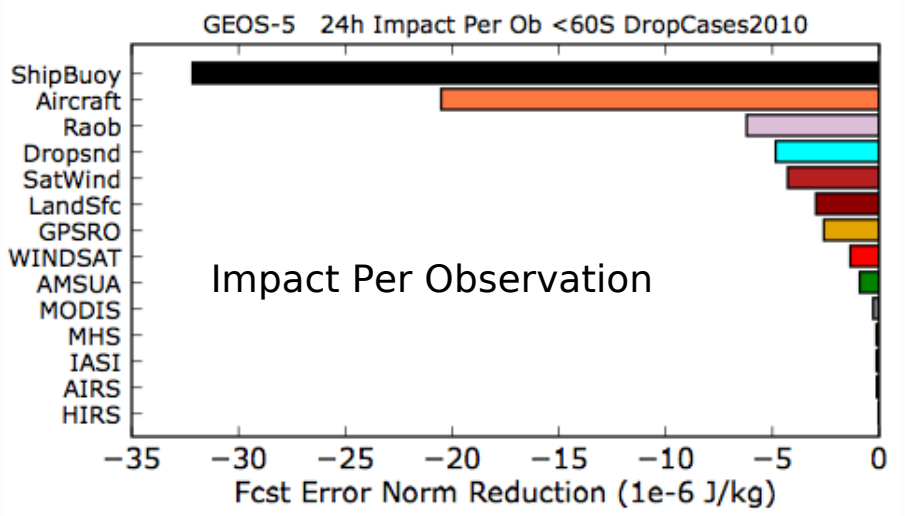
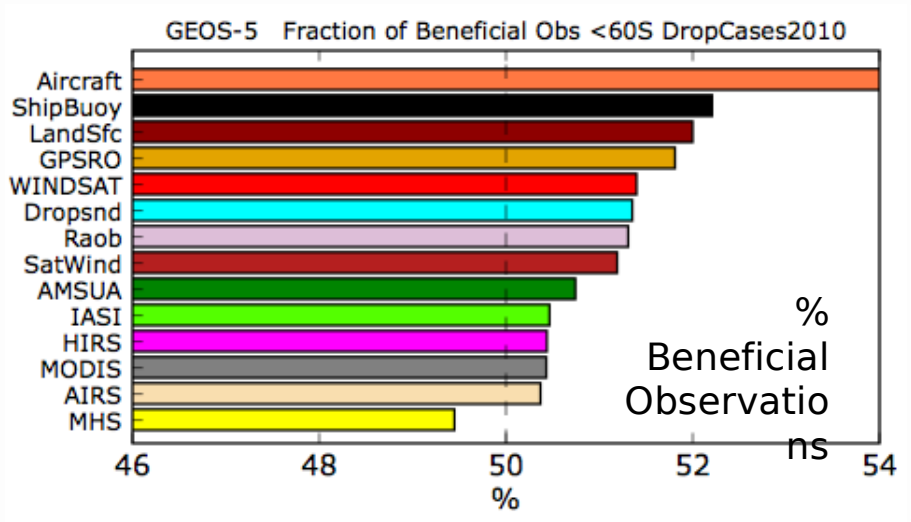
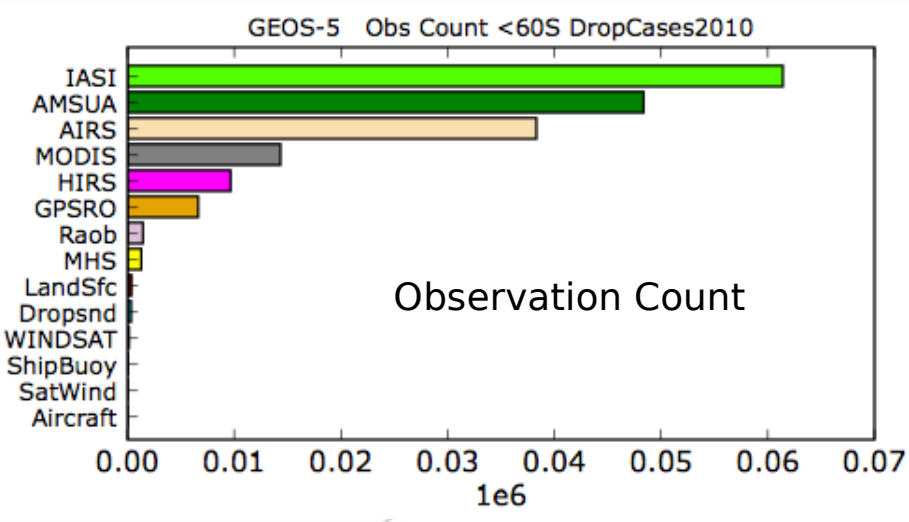
GEOS-5 Observation Impacts for Concordiasi

Average for All Drop Cases – 60°S-90°S Observations









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OSE at Météo-France: impact of both dropsonde and gondola information over 7 weeks

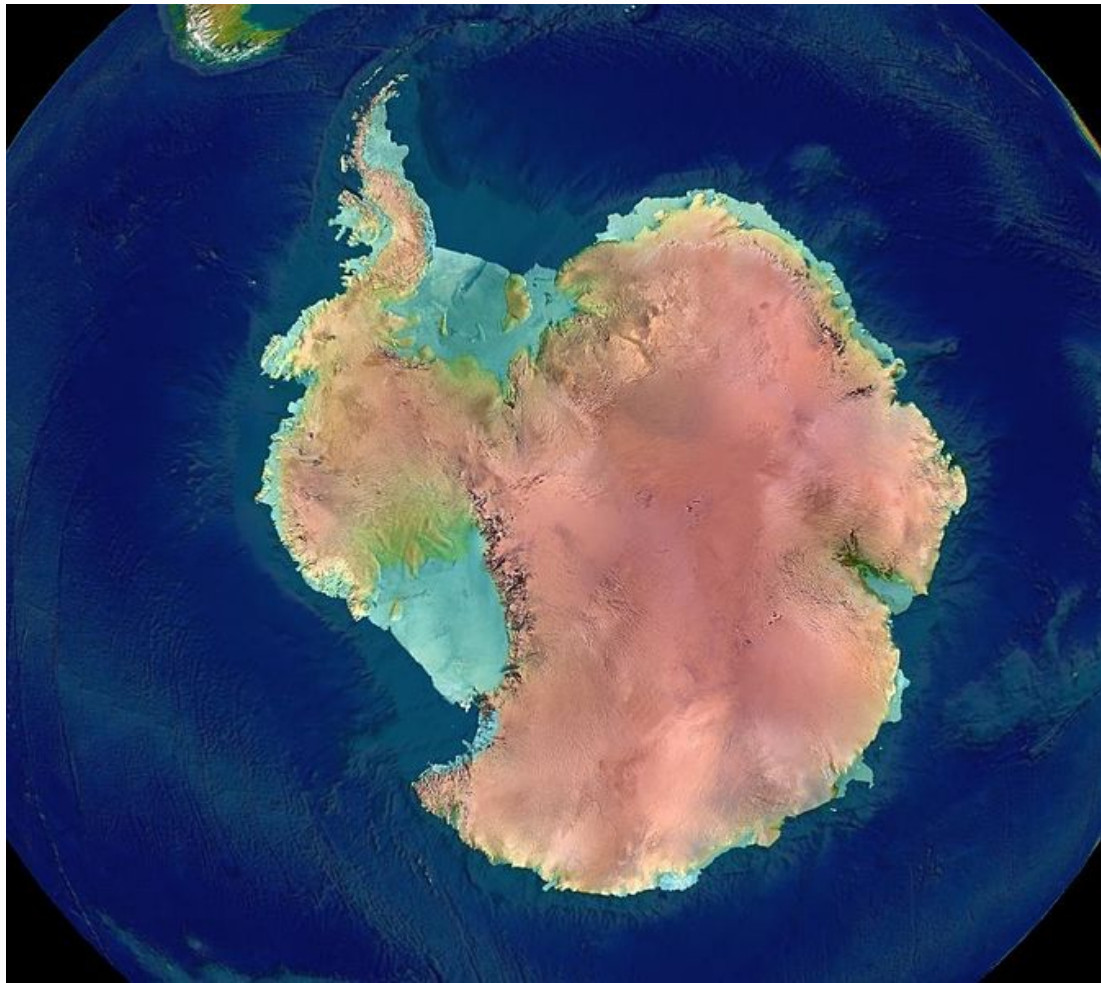
Significant impact in reduction of RMS(O-G) wrt radiosondes over Antarctica

	Without	With
U 200hPa (m/s)	2.53	2.47
V 200 hPa	2.60	2.53
U 250 hPa	2.87	2.75
V 250 hPa	2.73	2.67
T 500 hPa (K)	1.03	1.01

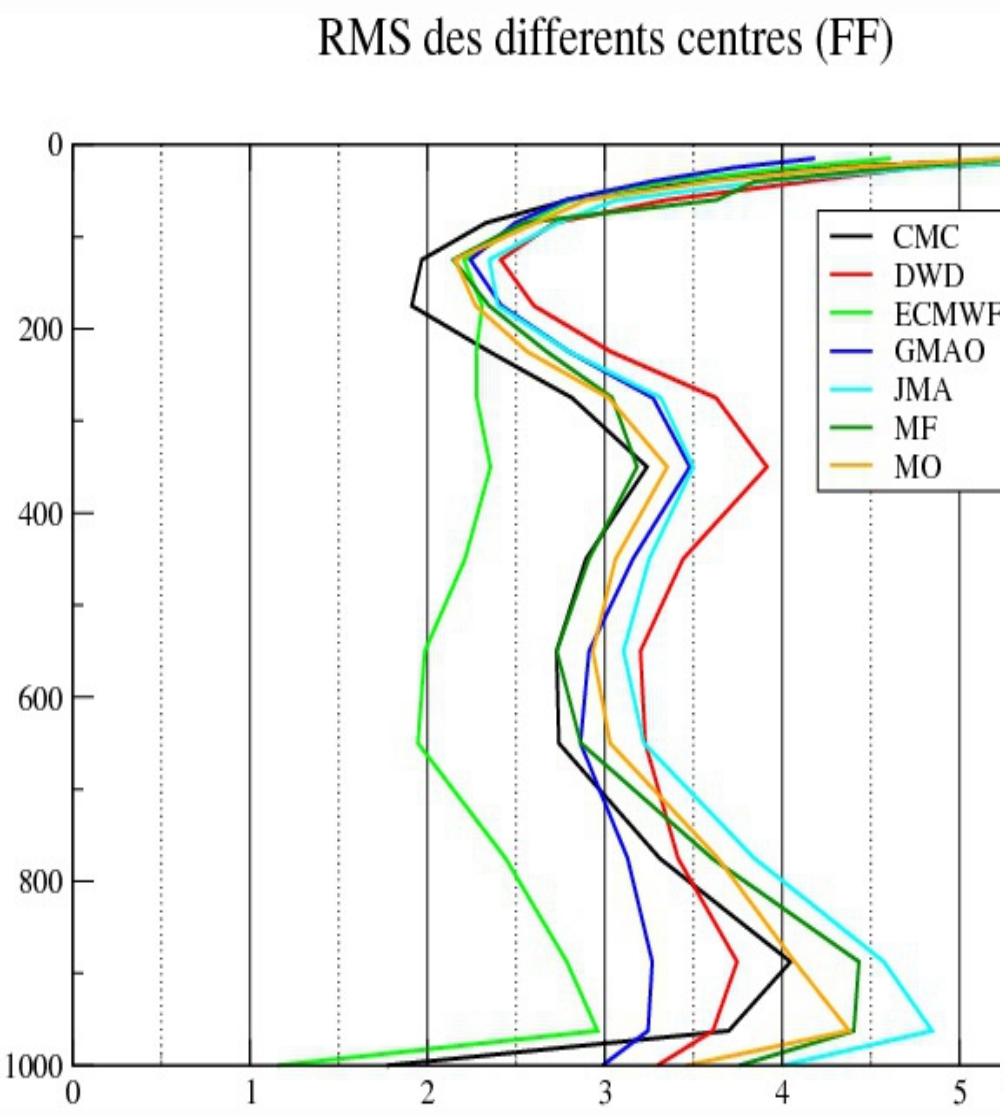
Model performance monitoring with dropsondes

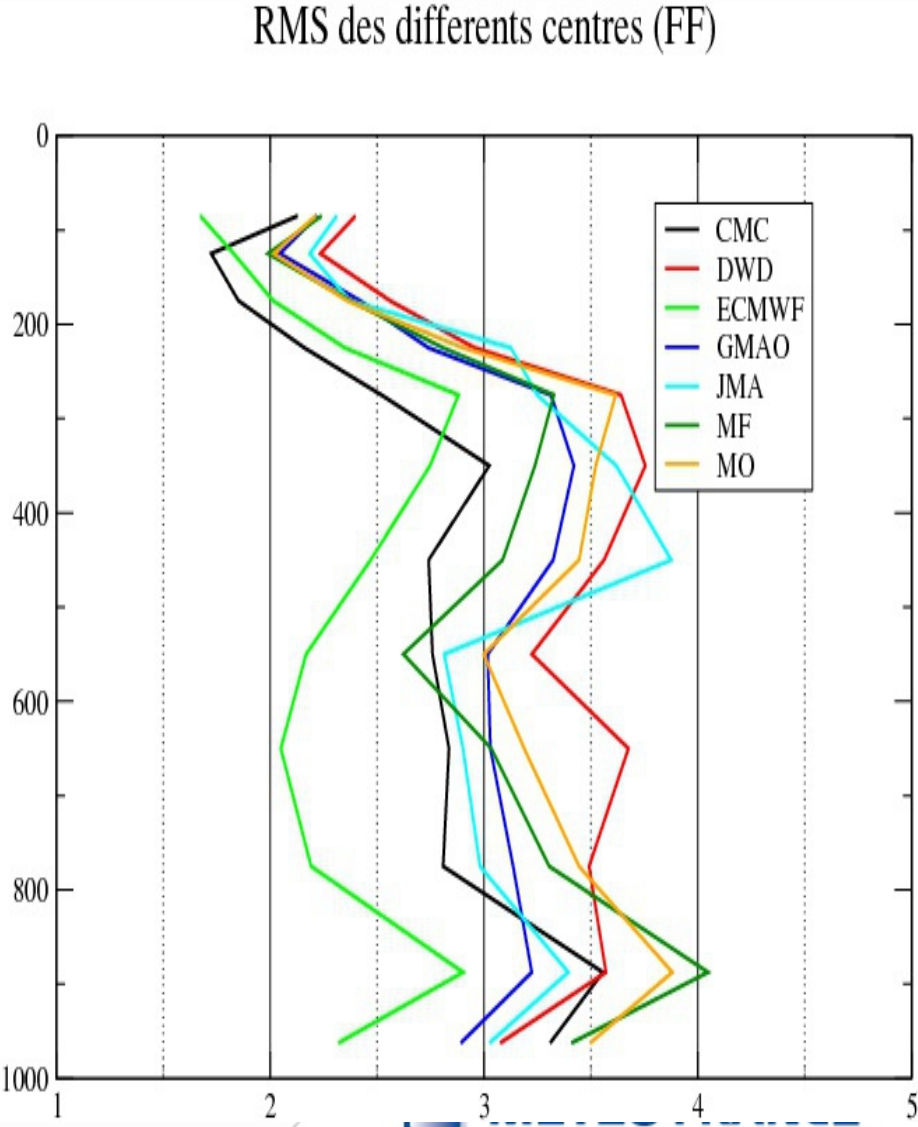
Various centres participated, and provided statistics for both Antarctic radiosondes and Concordiasi dropsondes

CMC
DWD
ECMWF
GMAO
Meteo-France
Met Office
JMA



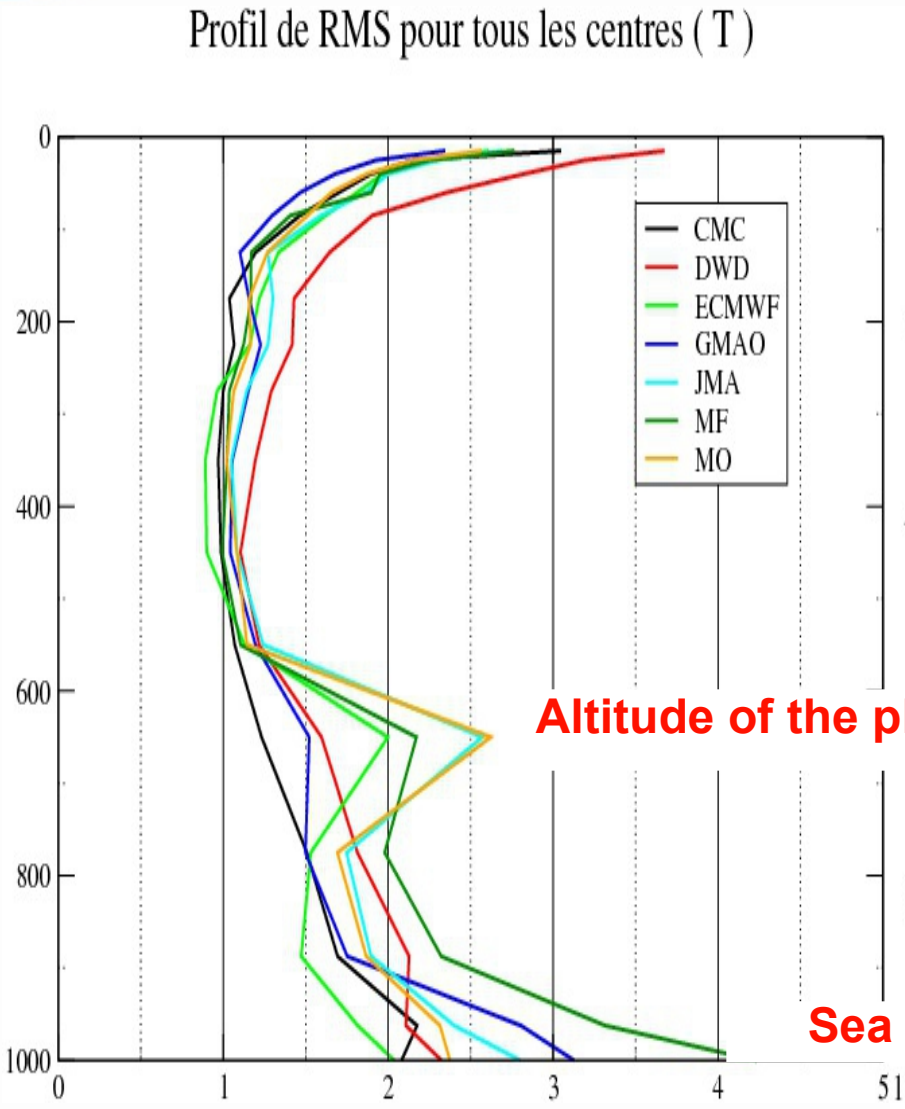
Comparison of O-G for radiosondes and dropsondes

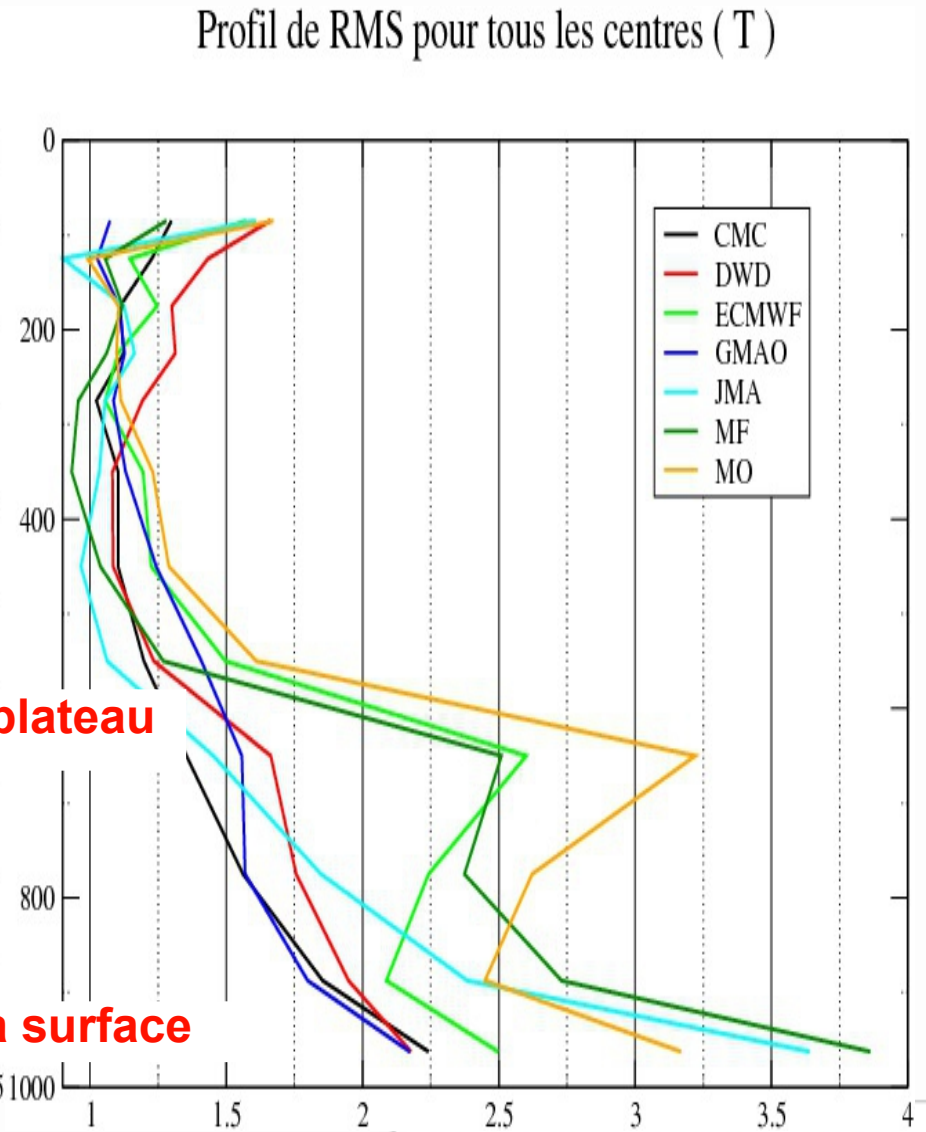




Wind speed in m/s

Comparison of O-G for radiosondes and dropsondes





Altitude of the plateau

Sea surface

Temperature in K

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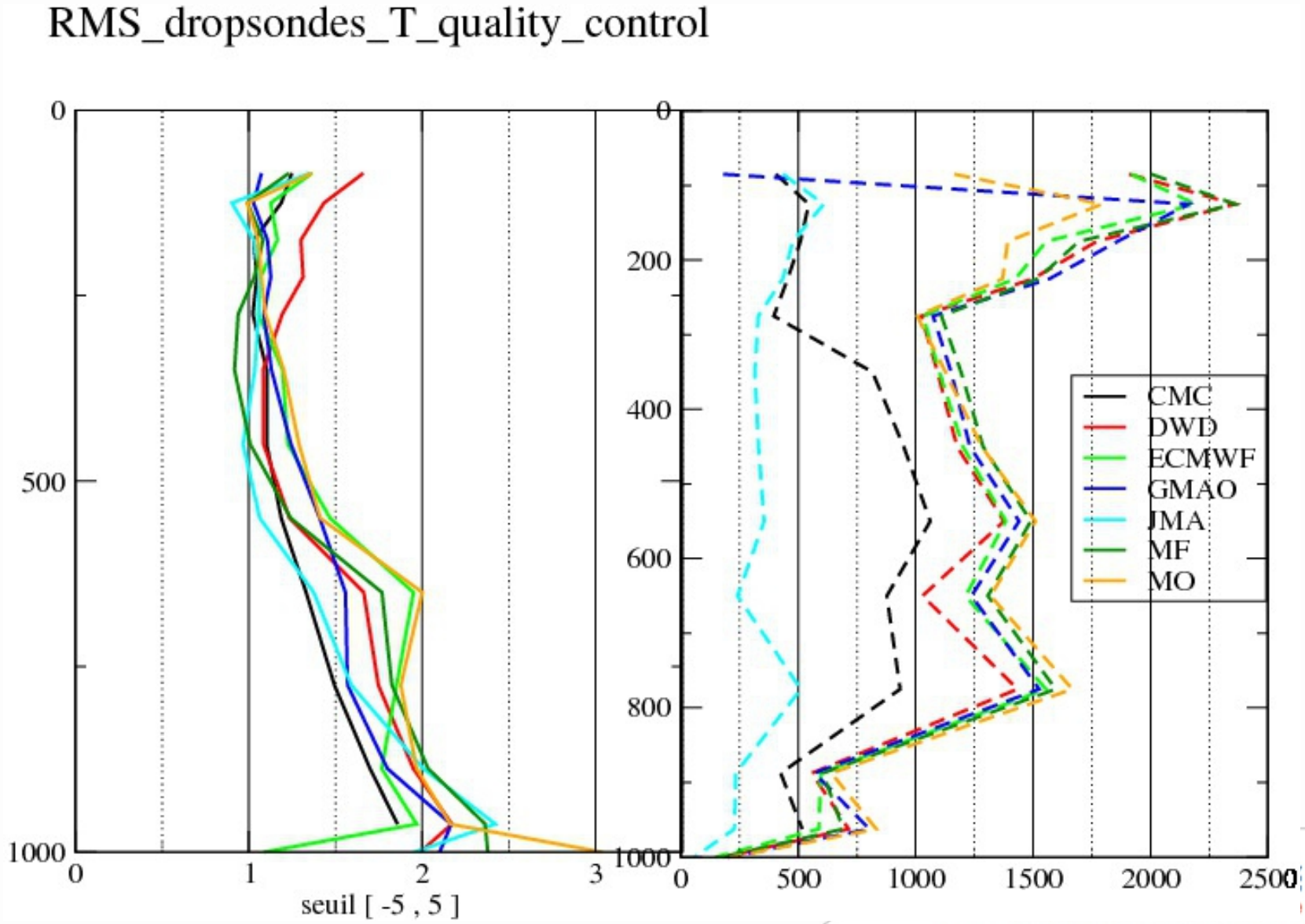
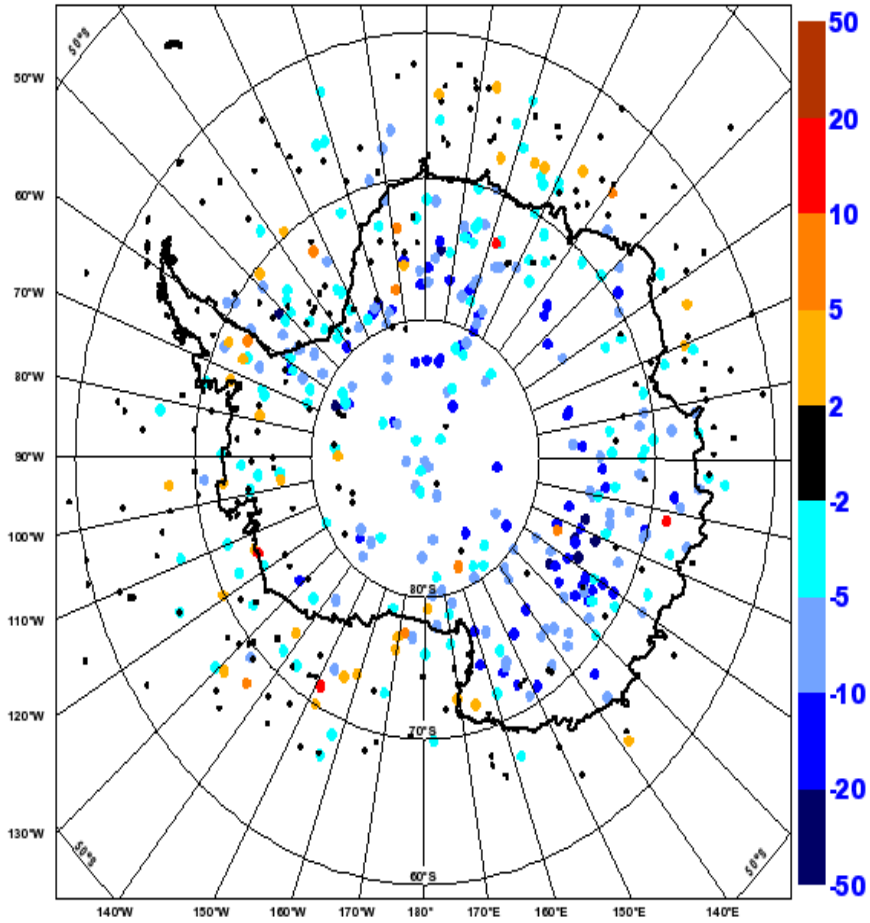
But some centres had applied a priori QC, other stats with maximum QC

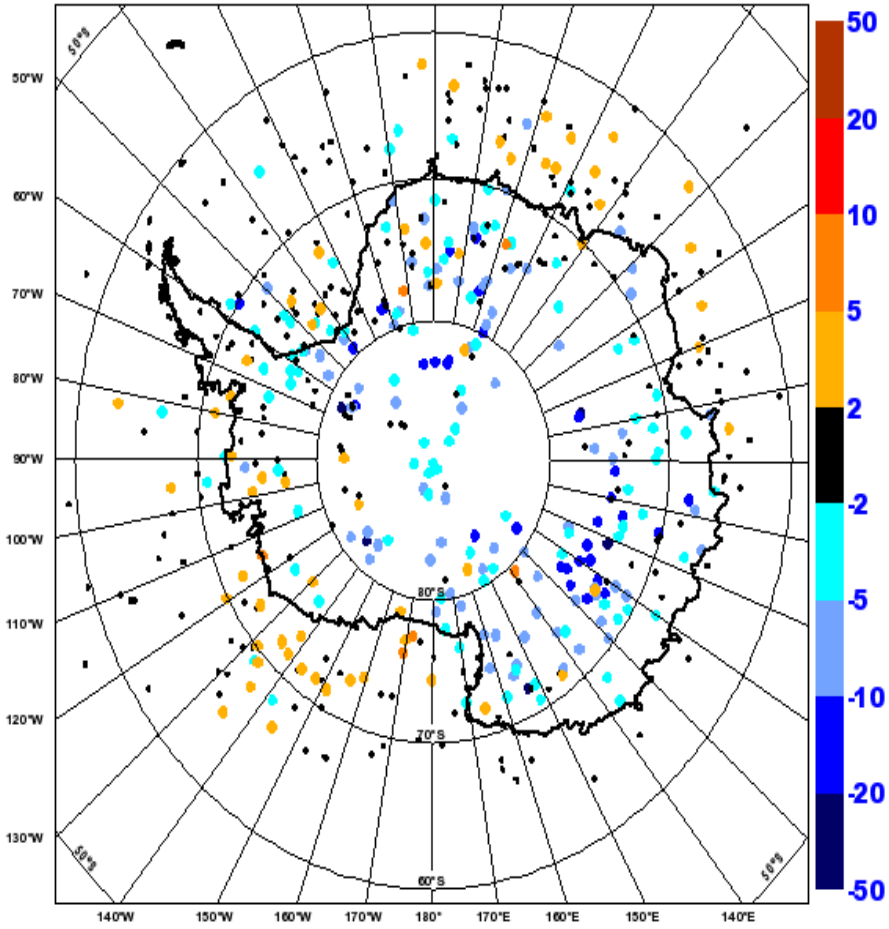


Largest errors in temperature near the surface: models not cold enough over inland Antarctica

observation minus model first-guess for surface temperature
UK MetOffice



observation minus model first-guess for surface temperature
ECMWF



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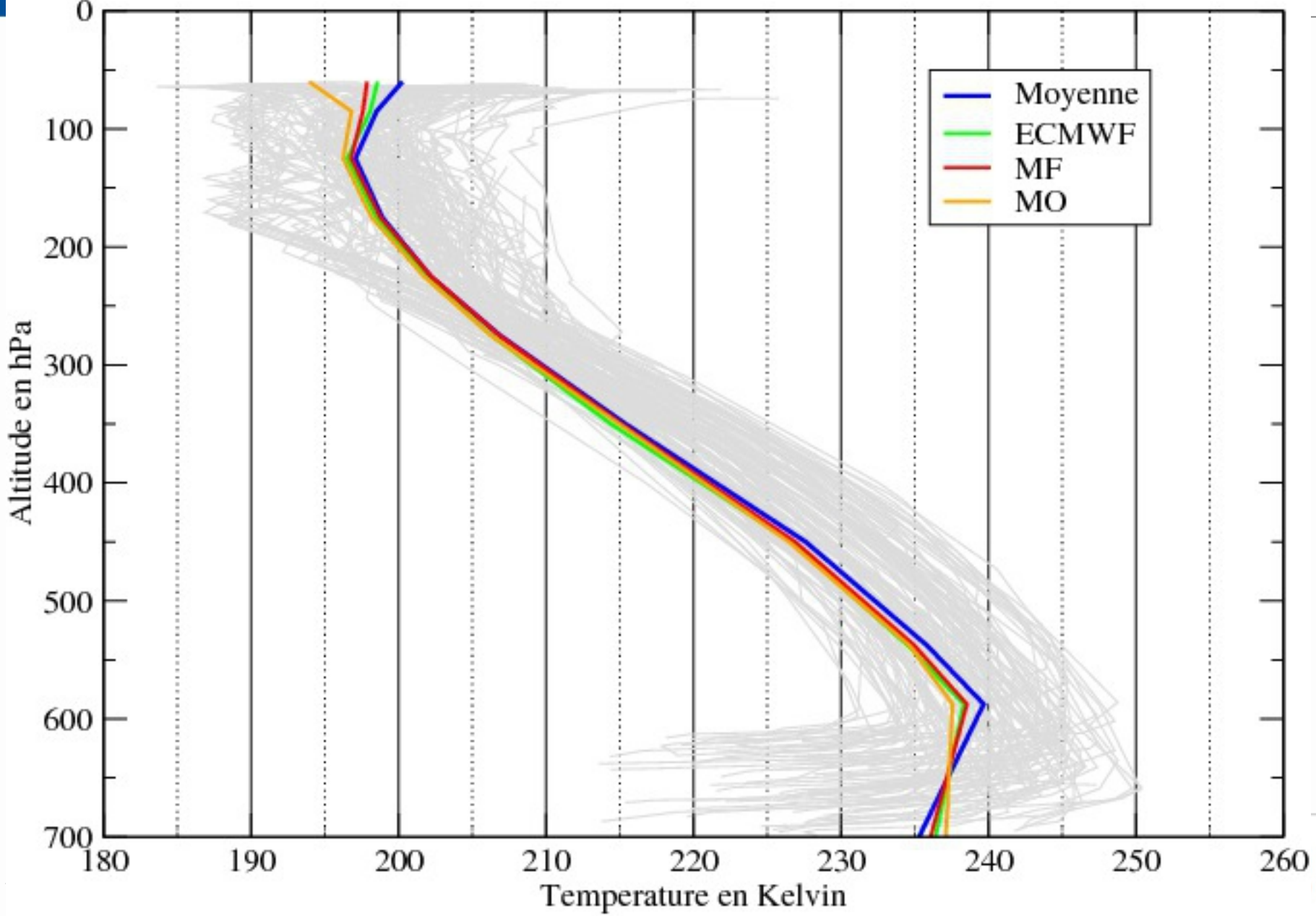
Obs & Guess (Plateau)



Concluding remarks

Concordiasi provided an unprecedented data coverage of meteorological observations over Antarctica

Both dropsonde and gondola information seem to have a positive impact on forecast performance (preliminary results from NRL, DWD and MF)

Gondola temperature data at 60hPa shows the largest model errors in areas of strong gravity-wave activity

Dropsonde information confirms statistics obtained with radiosondes and provide a more global view

Most models have problems predicting the lowest level temperatures

Papers on Concordiasi so far…

Rabier, F., A. Bouchard, E. Brun, A. Doerenbecher, S. Guedj, V. Guidard, F. Karbou, V.-H. Peuch, L. E. Amraoui, D. Puech, C. Genthon, G. Picard, M. Town, A. Hertzog, F. Vial, P. Cocquerez, S. Cohn, T. Hock, H. Cole, J. Fox, D. Parsons, J. Powers, K. Romberg, J. VanAndel, T. Deshler, J. Mercer, J. Haase, L. Avallone, L. Kalnajsand, C. R.Mechoso, A. Tangborn, A. Pellegrini, Y. Frenot, A. McNally, J.-N. Thépaut, G. Balsamo and P. Steinle, 2010 : "The Concordiasi project in Antarctica" Bulletin of the American Meteorological Society. Bulletin of the American Meteorological Society, January 2010, 69-86.

Guedj S., F. Karbou, F. Rabier, A. Bouchard, 2010: Toward a better modelling of surface emissivity to improve AMSU data assimilation over Antarctica. IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING, Vol. 48, NO. 4, 1976-1985.

Bouchard A, F. Rabier, V. Guidard & F. Karbou, 2010 : Enhancements of satellite data assimilation over Antarctica. MWR, June 2010, 138, 2149-2173.

Brun, E., D. Six, G. Picard, V. Vionnet, L. Arnaud, E. Bazile, A. Boone, A. Bouchard, C. Genthon, V. Guidard, P Le Moigne, F. Rabier, Y. Seity, 2011: Snow-atmosphere coupled simulation at Dome C, Antarctica. Accepted in Journal of Glaciology.

Vincensini, A., A. Bouchard, F. Rabier, V. Guidard, and N. Fourrié, 2011: IASI retrievals over Concordia within the framework of the Concordiasi programme in Antarctica. Submitted to TGRS