Model performance and data impact over polar regions

F. Rabier, N. Saint-Ramond, F. Karbou, A. Vincensini, S. Guedj, V. Guidard, N. Fourrié, A. Doerenbecher	Météo-France
C. Cardinali, J.-N. Thépaut, P. Bauer, D. Richardson, M. Janusek, C. Sahin, A. Garcia-Mendez	ECMWF
R. Langland	NRL
R. Gelaro	NASA/GMAO
C. Parrett, R. Saunders	Met Office
A. Cress, U. Pfluger	DWD
G. Verner, P. Koclas	CMC
Y. Sato	JMA
T. August	EUMETSAT

Outline

General model performance and data impact

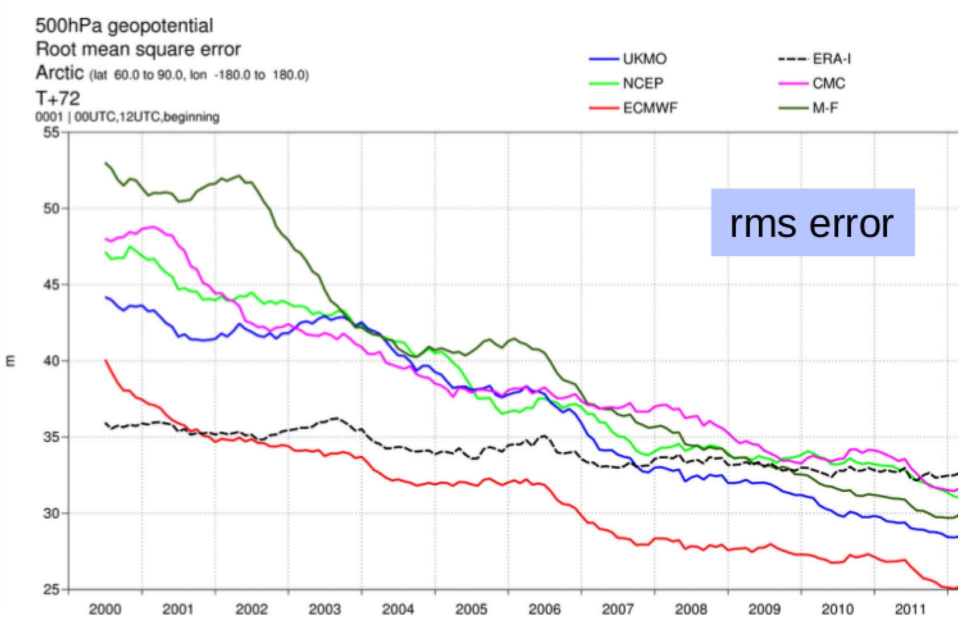
Dropsonde impact during Concordiasi

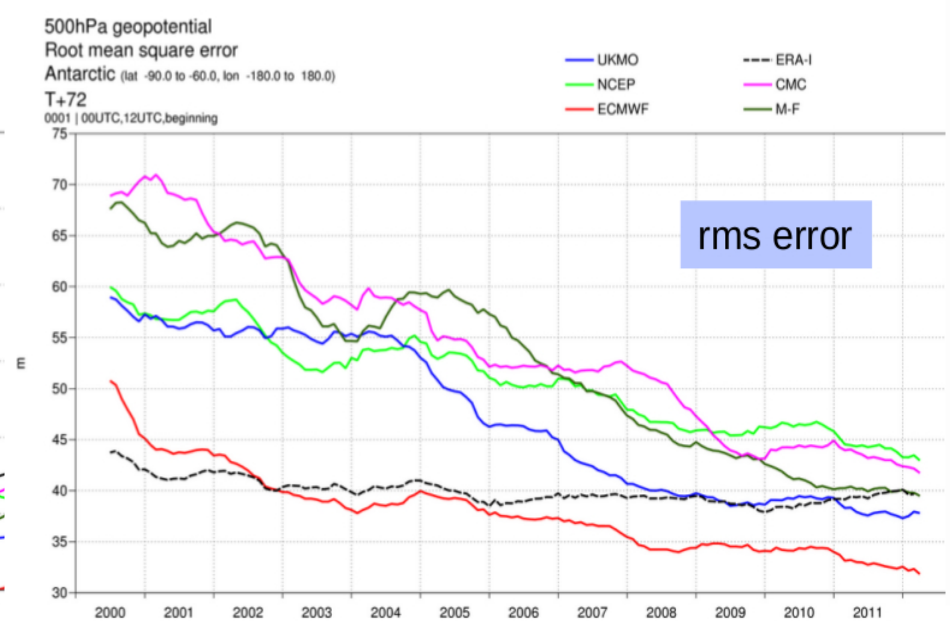
IASI over the plateau

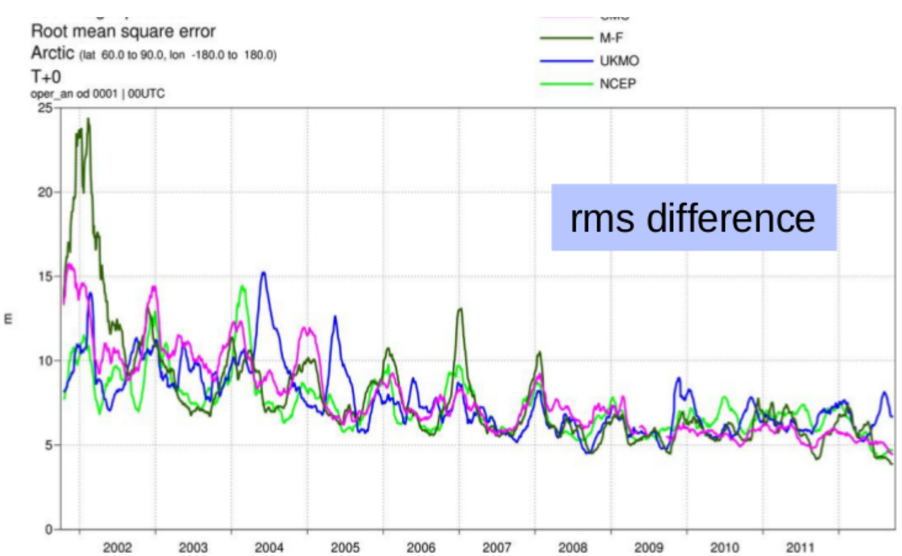
Microwave radiances over sea-ice

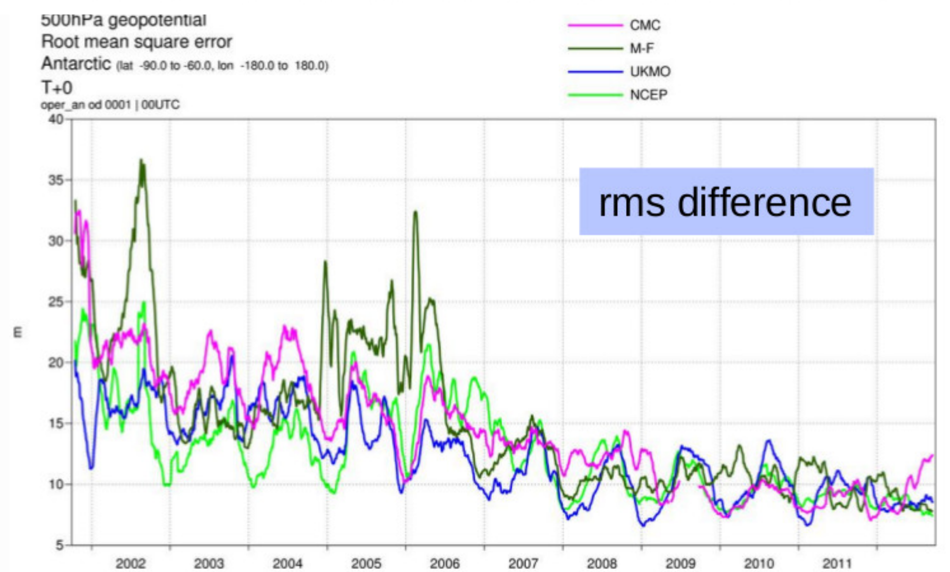
Concluding remarks

Polar scores wrt own analysis, and analysis differences







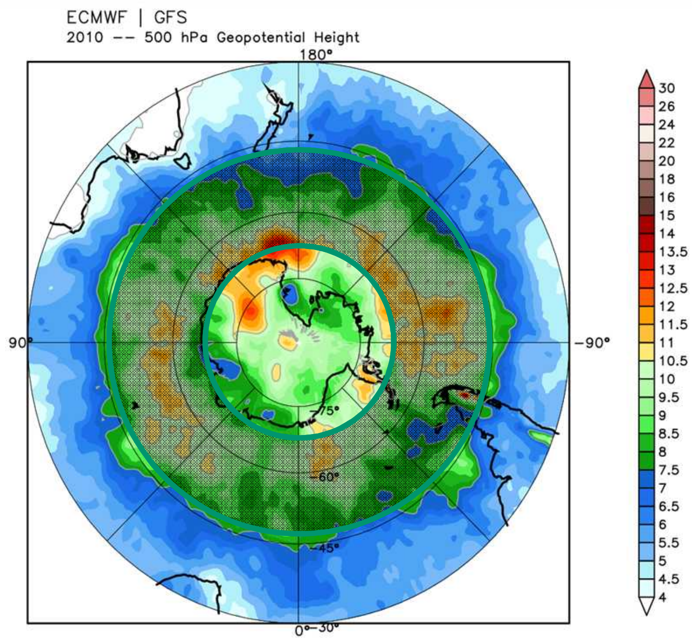


The ring of uncertainty 45 to 70 S

To the north: Geostationary satellite winds, ship surface obs, commercial aircraft routes

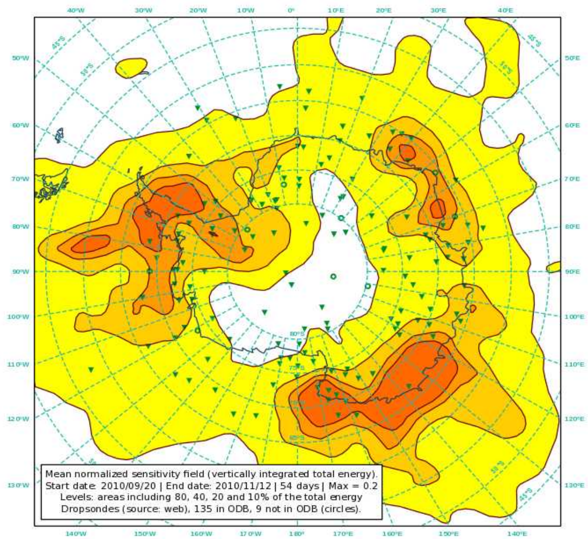
To the south: Antarctic raobs and land surface data, MODIS and AVHRR winds

Current satellite radiance observations are not sufficient to achieve low analysis errors



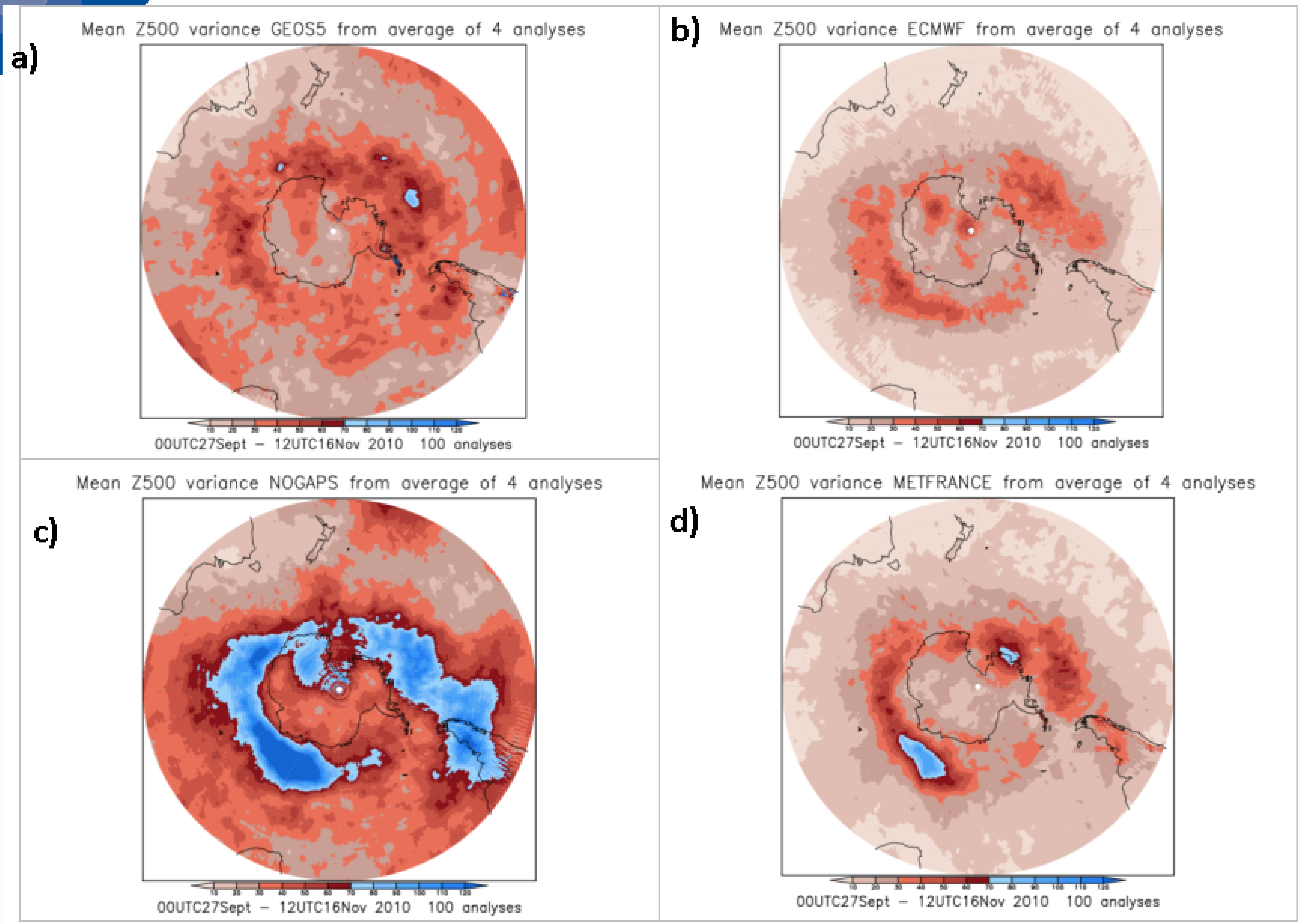
NRL

Singular vectors computed over the polar region show a good agreement with this ring of uncertainty



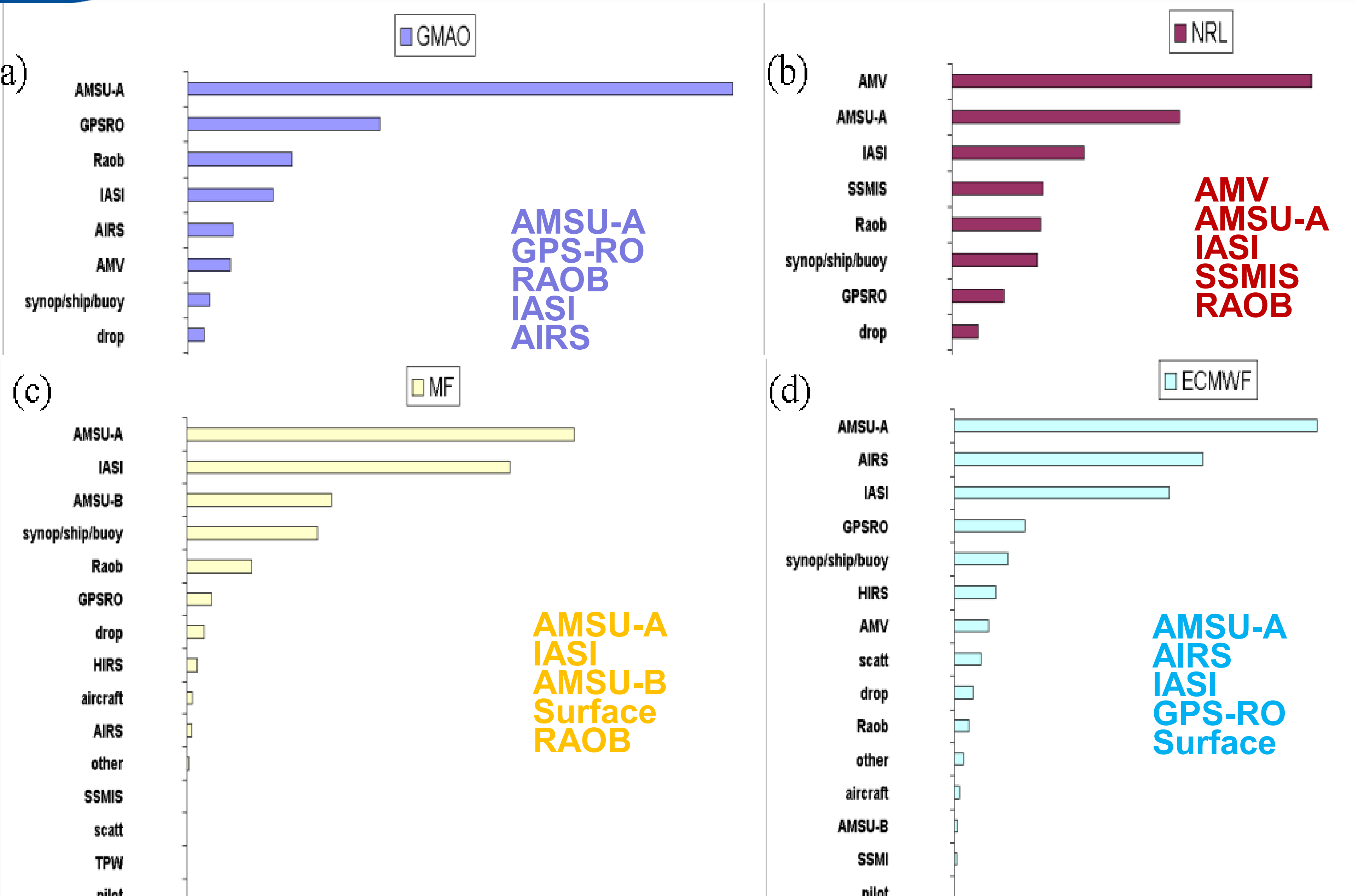
ECMWF

Variance of analysis fields wrt average analysis



NRL

Impact of observations in forecast performance



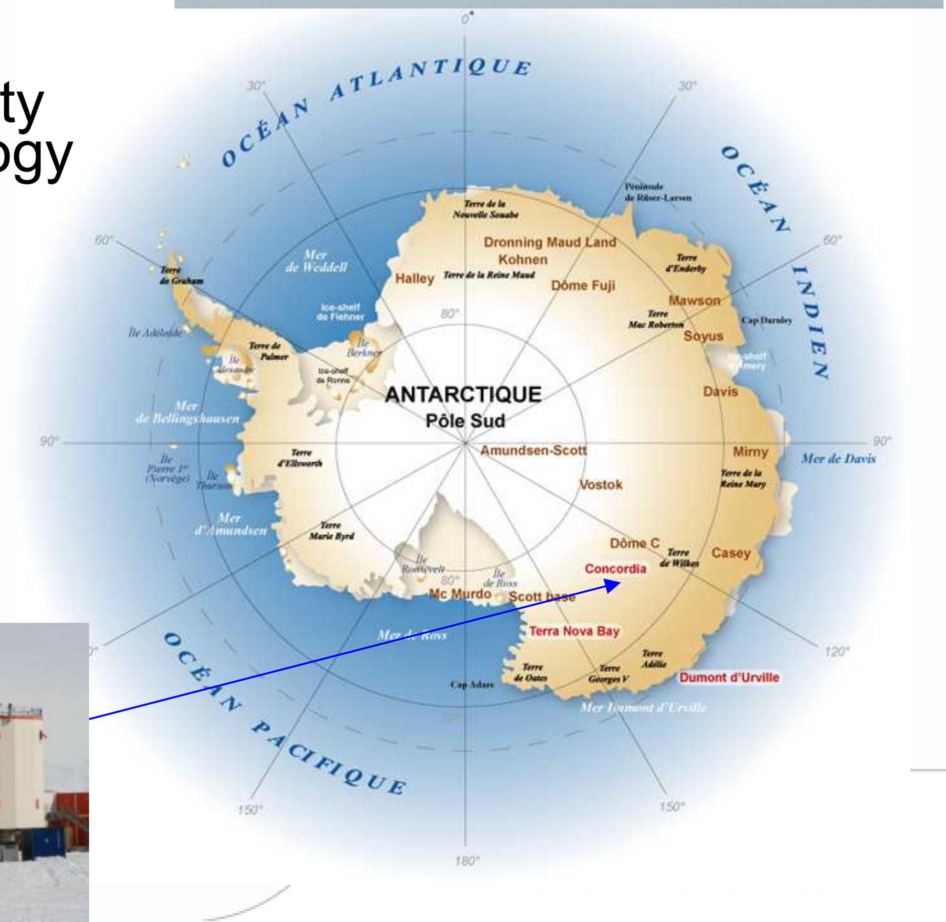
Concordiasi

A THORPEX-IPY initiative for meteorology over Antarctica and at global scale

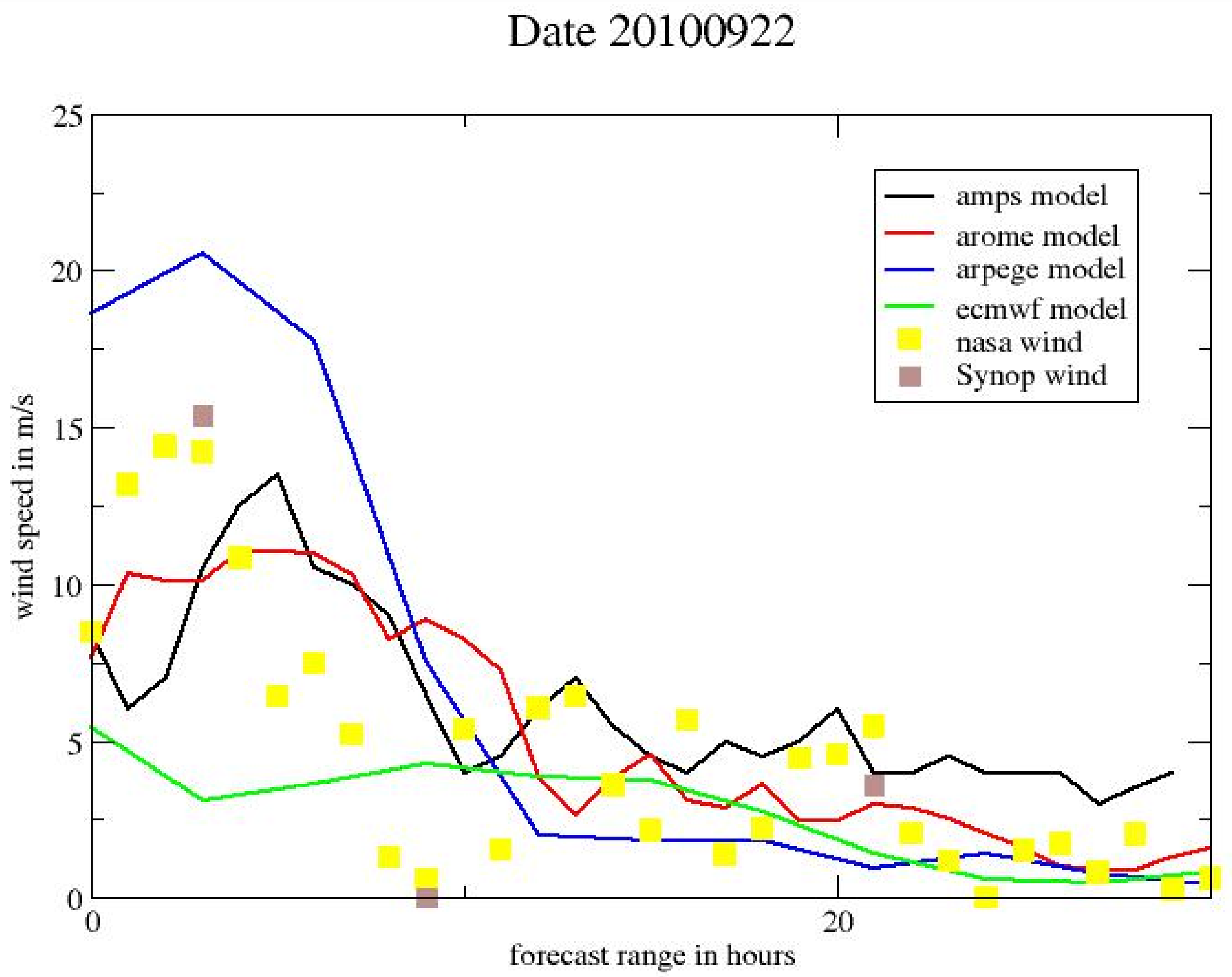
Improve the use of space-borne atmospheric sounders, study gravity waves, ozone depletion, meteorology over plateau

Benefit from the continental French-Italian station Concordia

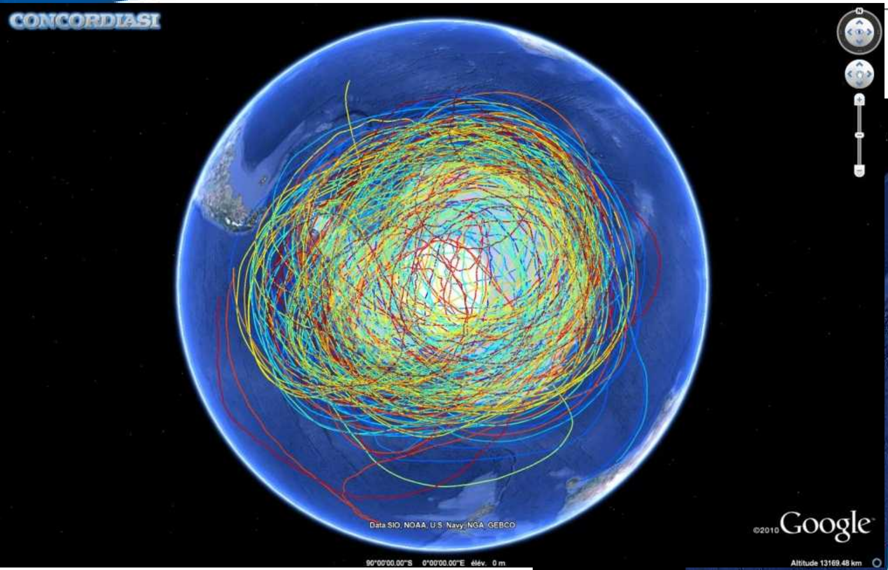
And from super-pressure balloons (CNES)

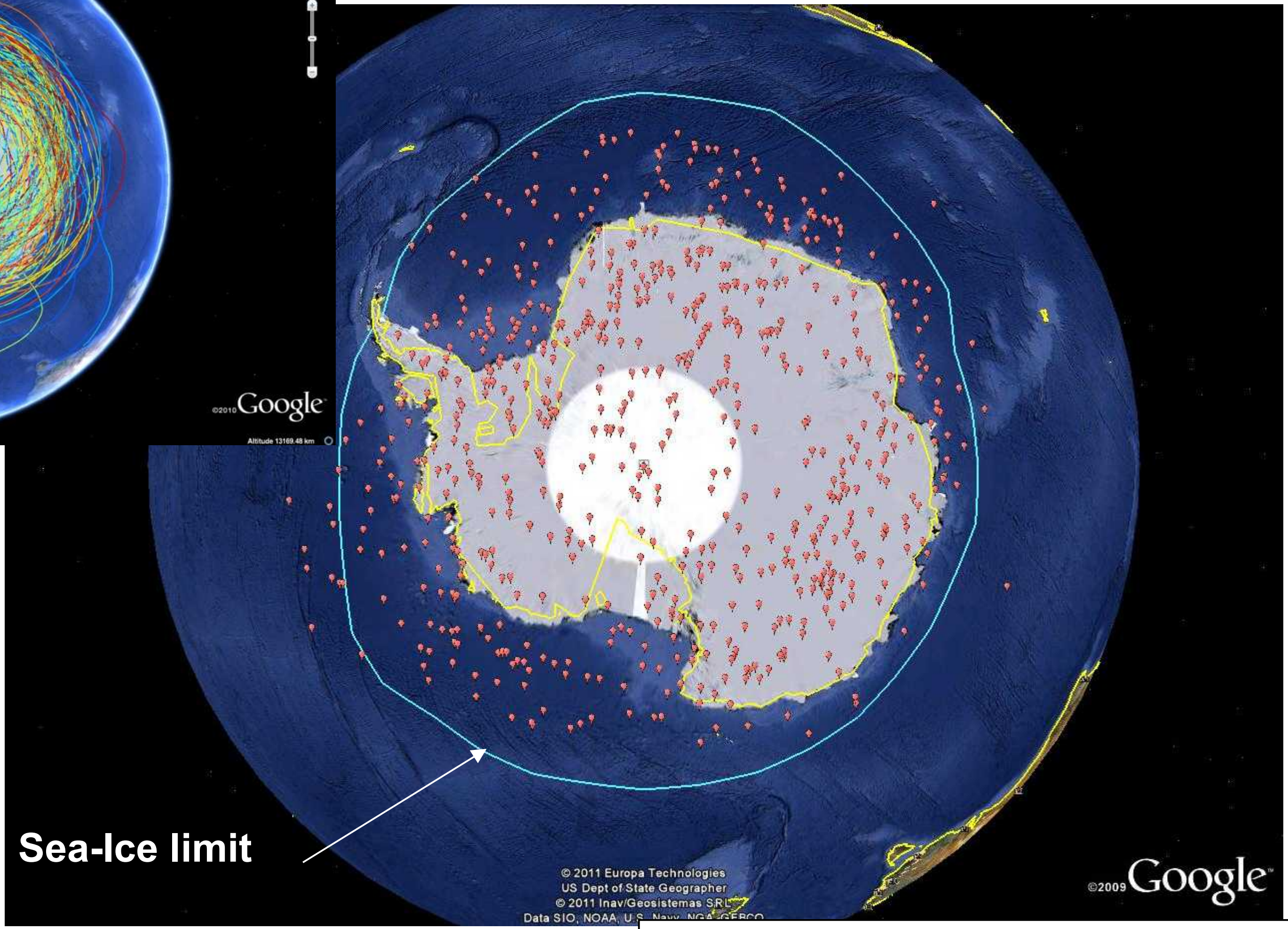


Forecast models in support of the field operations at McMurdo: Wind speed must be less than 4m/s



13 driftsondes provided 640 Dropsondes (2010/09-2010/12)

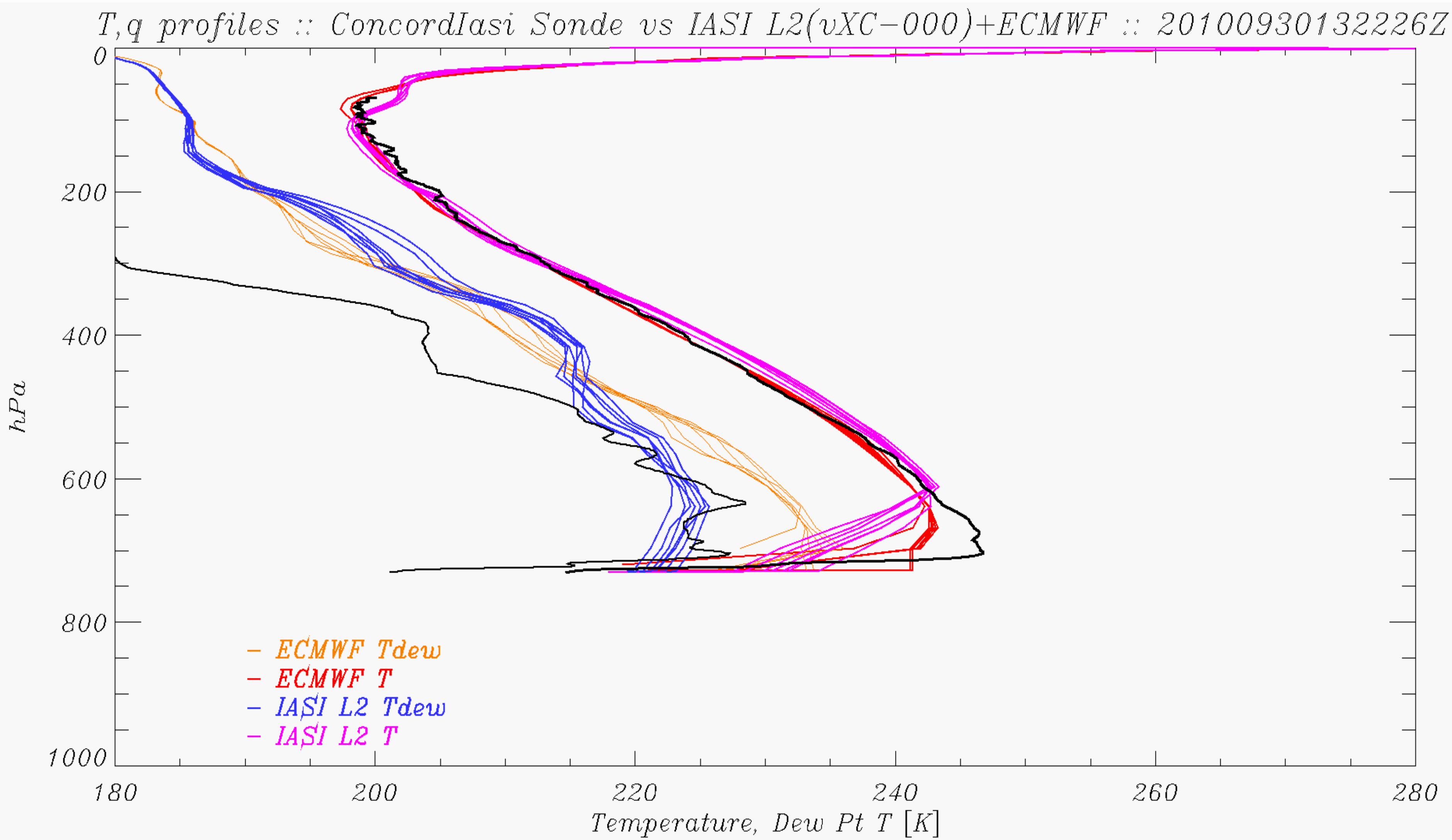




NCAR

CONCORDIASI

EUMETSAT: comparison of IASI retrievals, model and sondes



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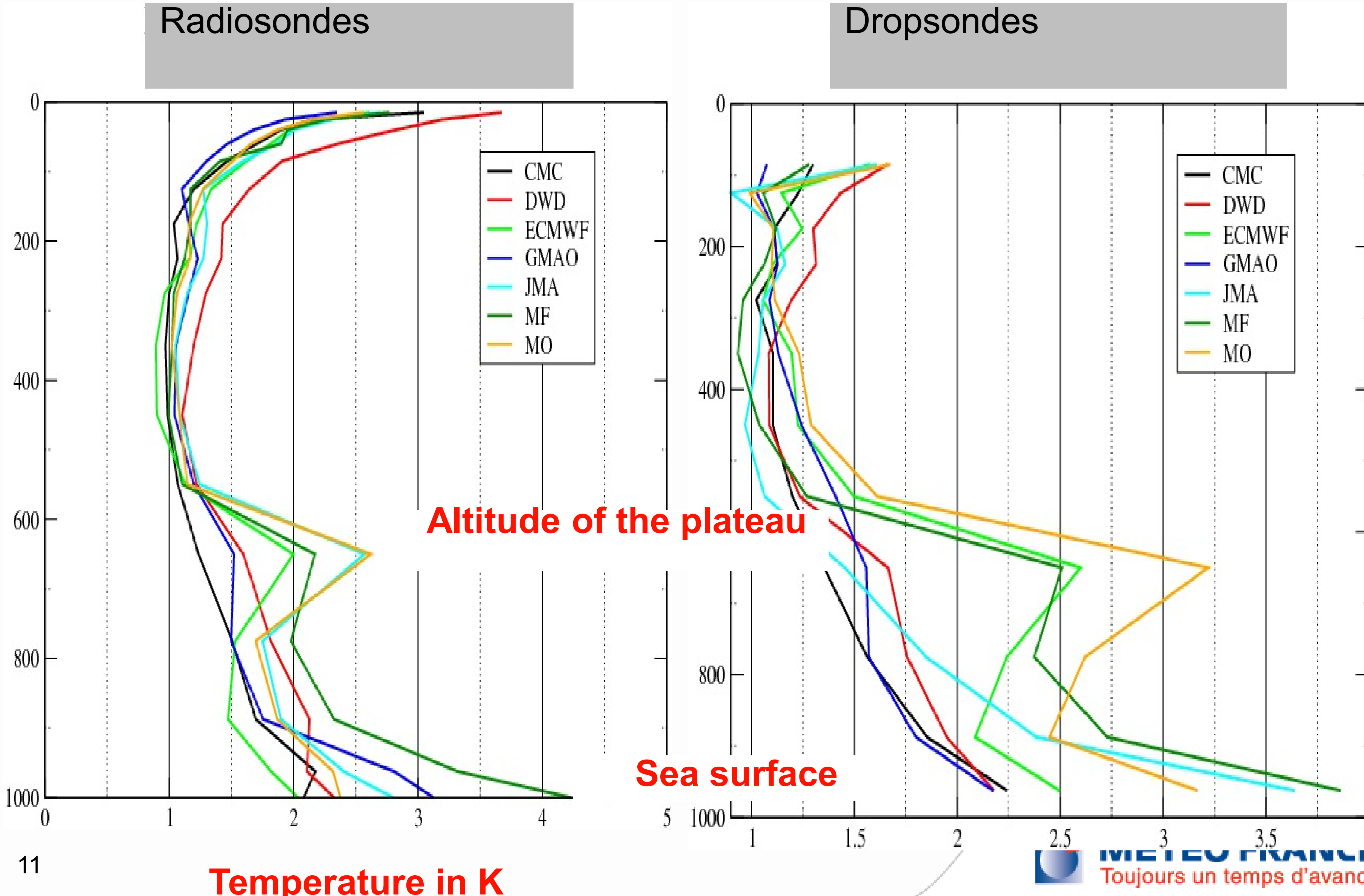
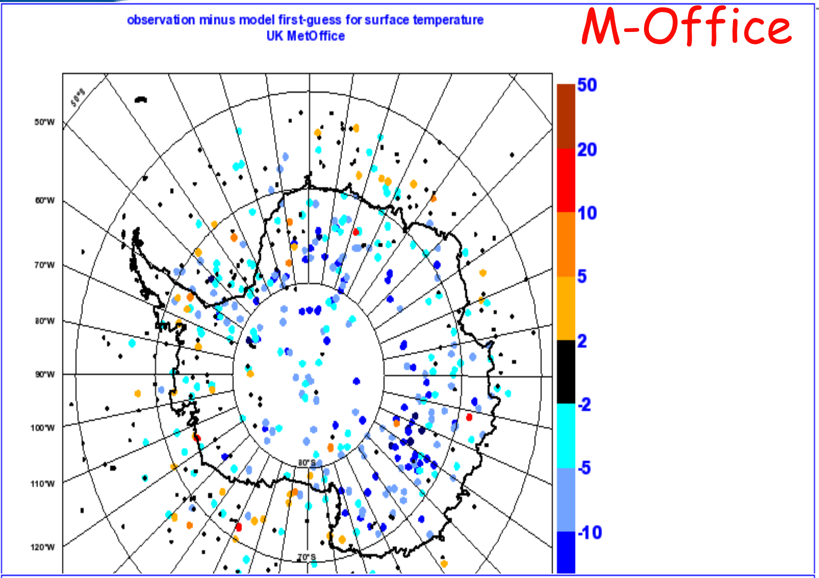
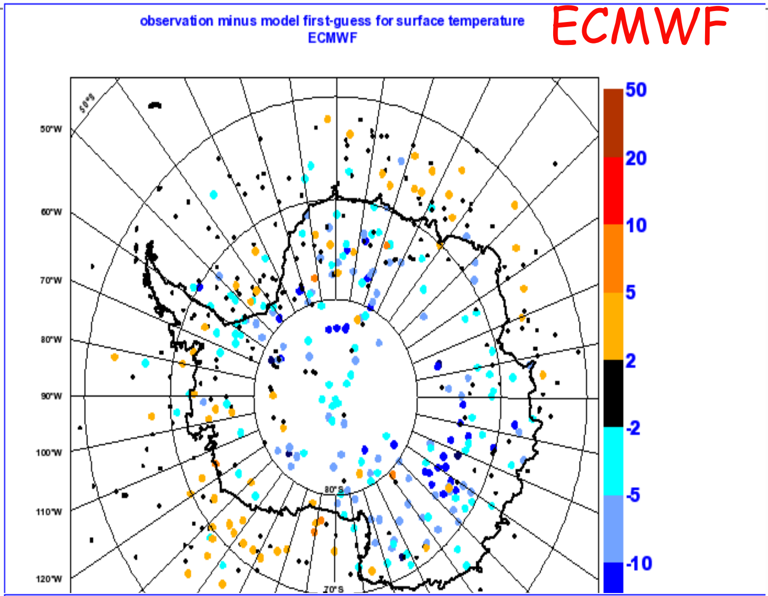
Comparison of Obs-Model for radiosondes and dropsondes using all levels (different for each centre)



Large model errors near the surface: models too warm





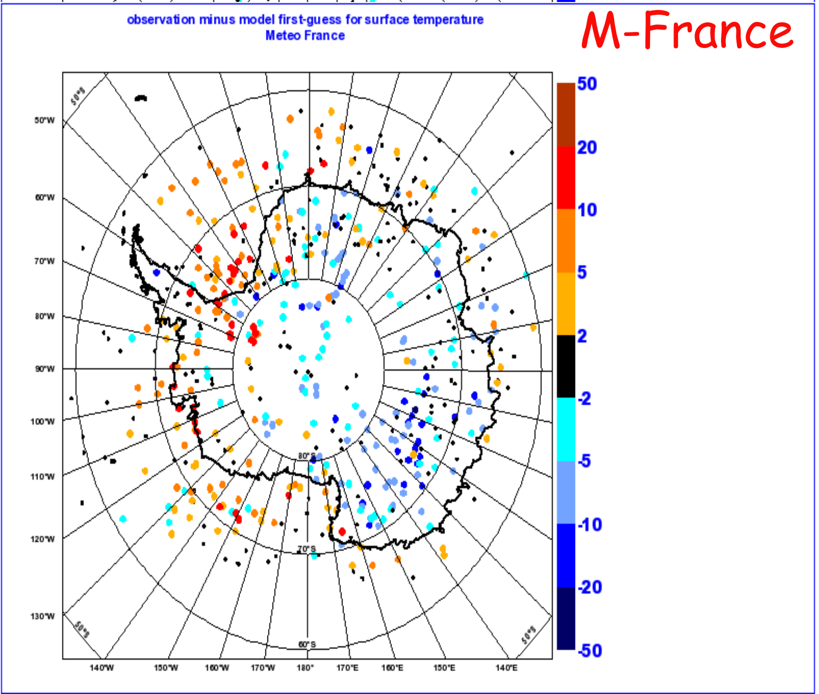
Ecarts

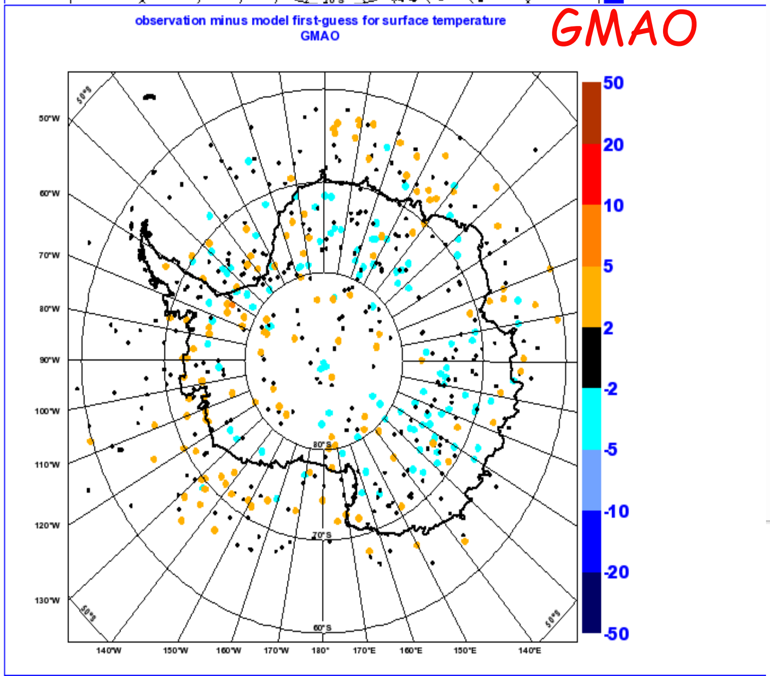
Obs-model,

at the lowest

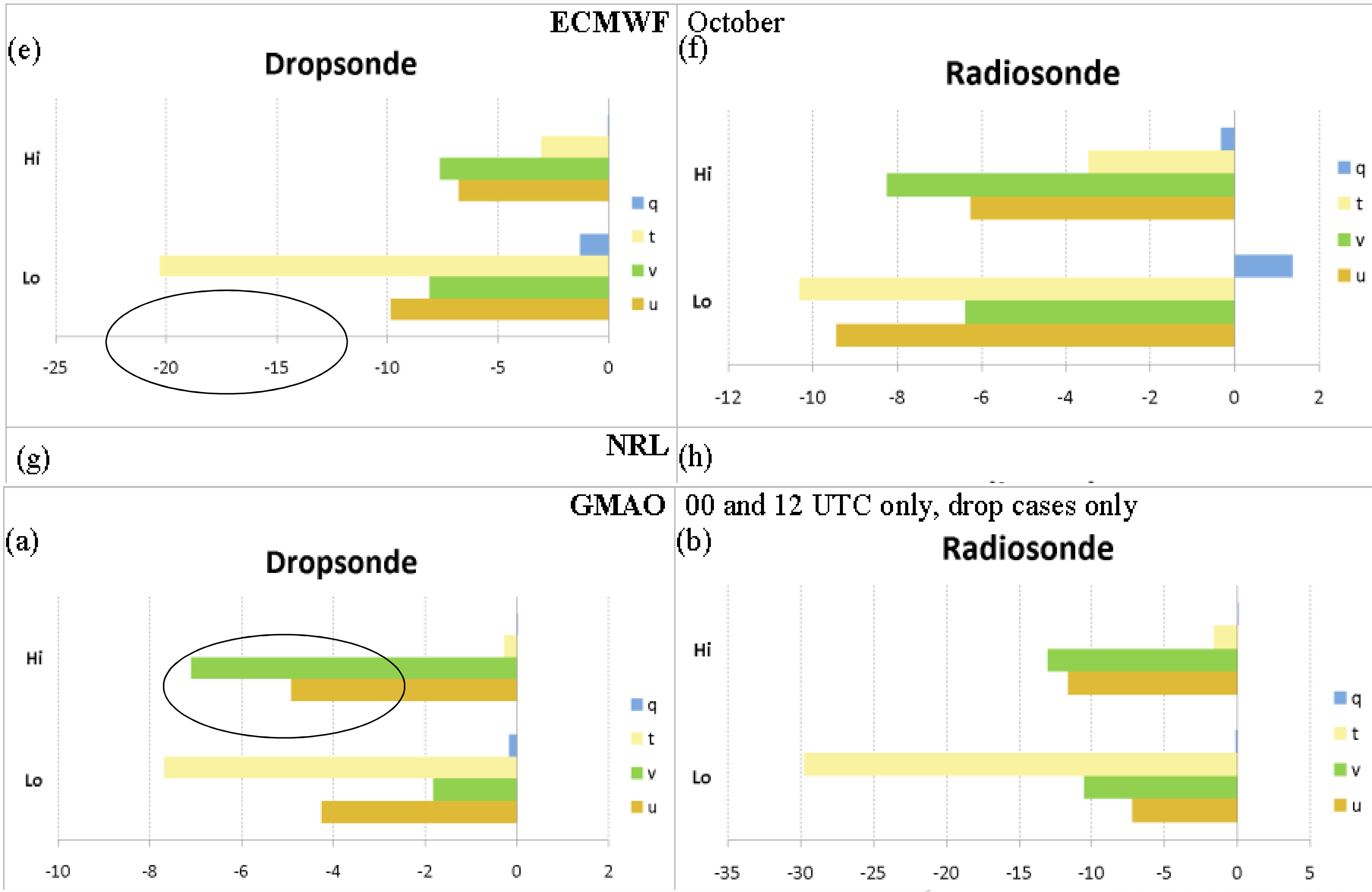
dropsonde

level





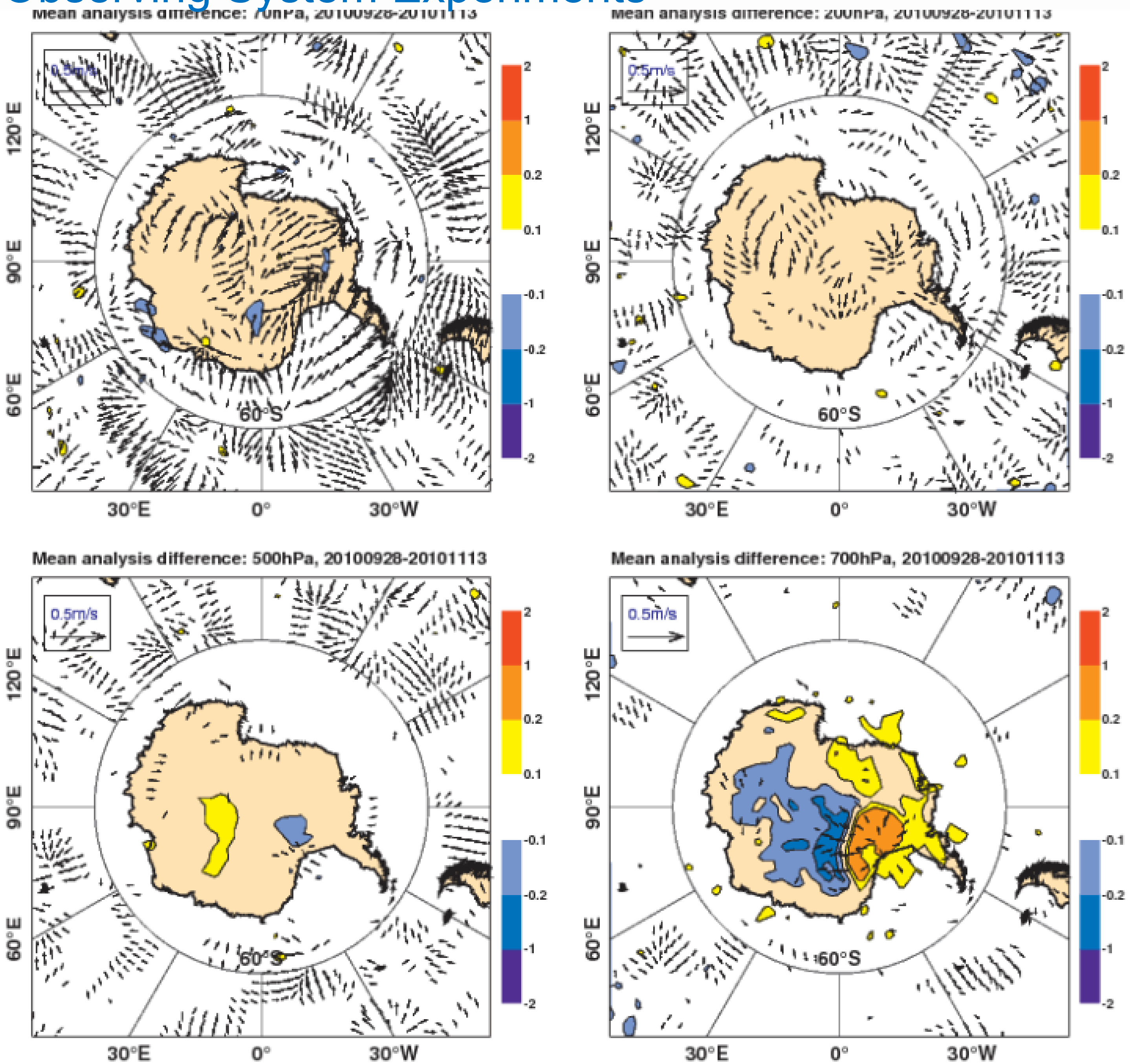
Sonde impact in two different systems



Observing System Experiments

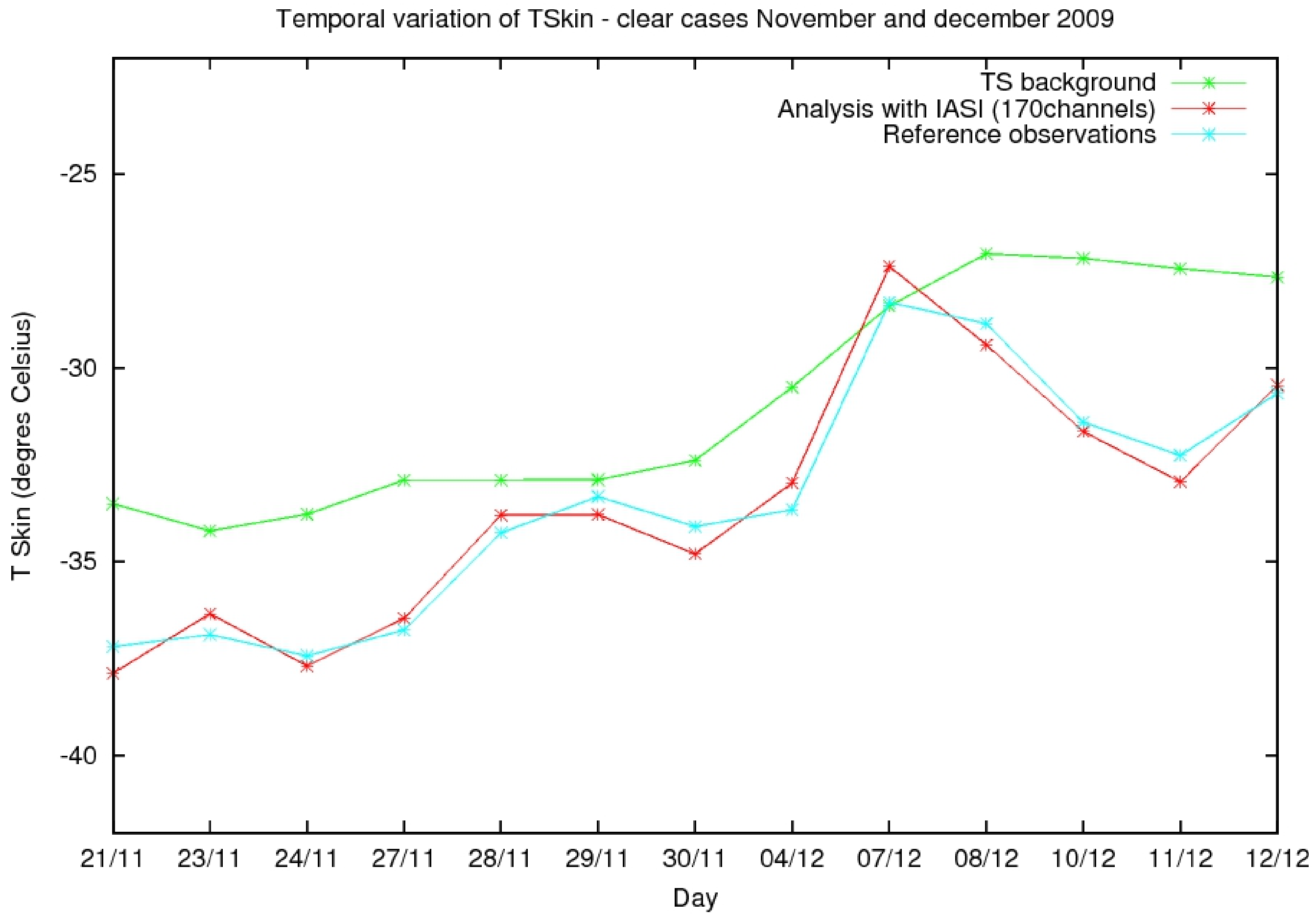
Impact of using Concordiasi Dropsondes

Mean analysis Differences



ECMWF

IASI retrievals at Concordia

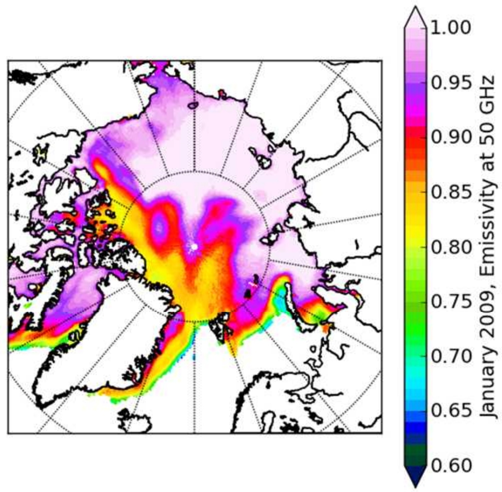


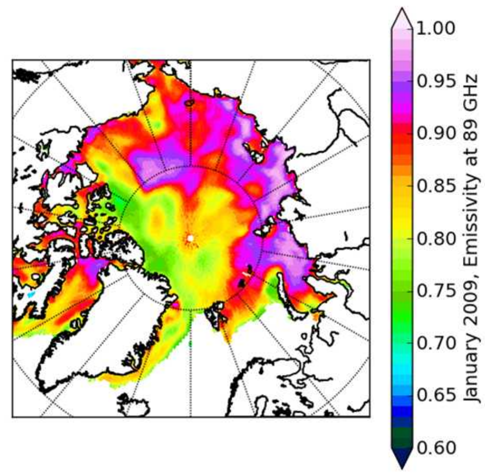
Good agreement of retrievals for Skin Temperature, compared to in situ data (BSRN, manual measurements)

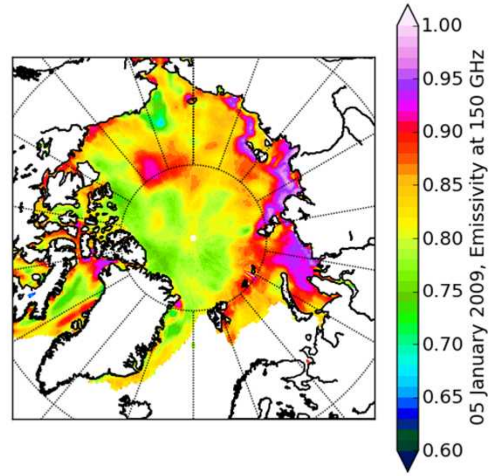
But IASI data often classified as cloudy, and thus not used down to surface

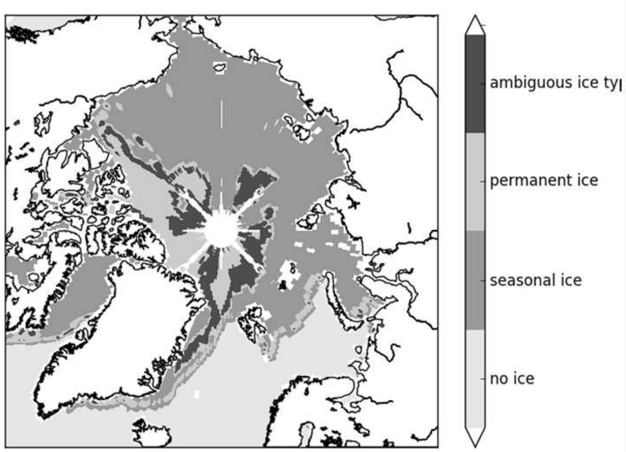
Improvements in snow model showed better use of IASI data

Variability of microwave emissivity: frequency, ice-type









EUMETSAT
OSI SAF

January 2009

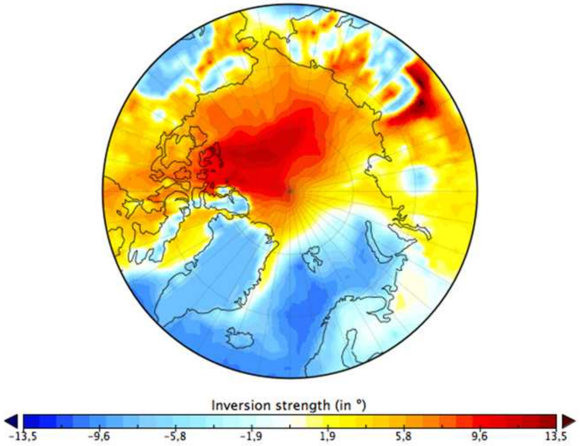
For AMSU-A, 50GHz emissivity used for 52-55 GHz obs

For AMSU-B, a parametrisation of 150 GHz emissivity from 89 and 150 GHz information used for 183GHz obs

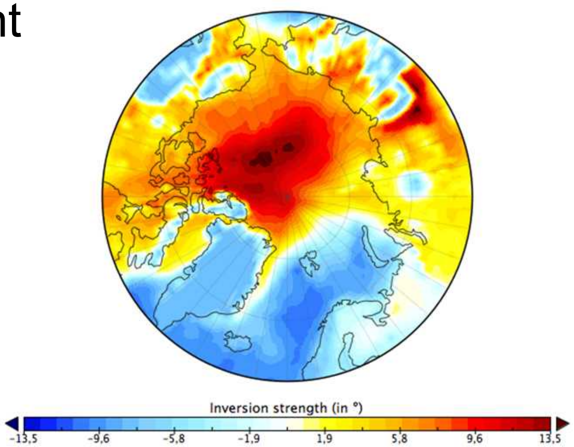
Improvement in forecast scores

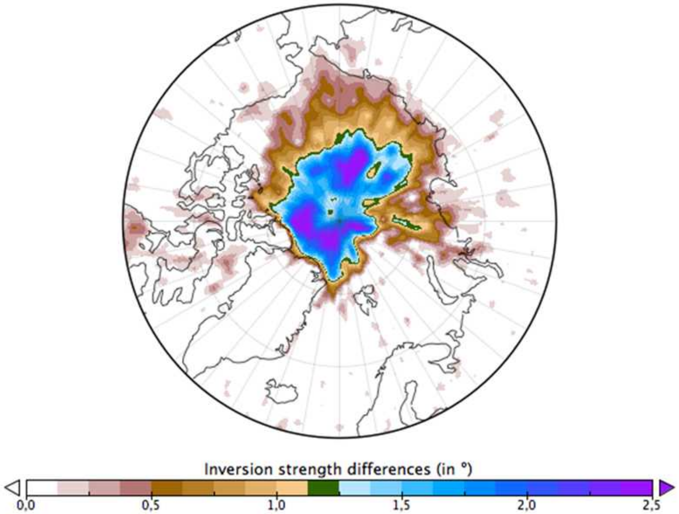
Average inversion strength (layer 850-1000 hPa)

Control



Experiment using AMSU over sea-ice





Difference in inversion strength brought by a larger warming at 850hPa than at 1000 hPa

Concluding remarks

Large improvement in model performance over the last decade

Large impact of AMSU, IASI, AIRS, GPS-RO, RAOB, surface and AMV data

Results show that models suffer from deficiencies in representing near-surface temperature over the Antarctic high terrain

Sounding data over Antarctica: large impact of temperature at low levels, large impact of winds at high levels

Potential of satellite data to correct surface temperature, but because of the very strong thermal inversion, IR data often wrongly classified as cloudy and thus poorly used. A better snow model can help…

Need to properly account for microwave emissivity to use data over sea-ice. Use of AMSU strengthens the thermal inversion over Northern Polar area and improves scores

To go further over snow-covered surfaces, one might need to change physical assumptions (specular vs Lambertian reflection)

Papers on Concordiasi so far…

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. Journal of Glaciology, Vol. 52, No. 204, 2011

Genthon, C., D. Six, V**. Favier**, M. Lazzara, et L. Keller, 2011. Atmospheric temperature measurement biases on the Antarctic plateau, Atm. Oceanic Technol., DOI 10.1175/JTECH-D-11-00095.1, Vol. 28, No. 12, 1598-1605.

Genthon C., H. Gallée, D. Six, P. Grigioni, et A. Pellegrini, 2012. The lower atmospheric boundary layer at Dome C, high Antarctic plateau. Part I: Two years of meteorological observation on a 45-m tower and comparison with meteorological analyzes and model, J. Geophys. Res., submitted.

Genthon, C., M. S. Town, D. Six, V. Favier, S. Argentini, et A. Pellegrini, 2010. Meteorological atmospheric boundary layer measurements and ECMWF analyses during summer at Dome C, Antarctica, J. Geophys. Res., 115, D05104, doi:10.1029/2009JD012741

Ricaud, P., C. Genthon, J.-L. Attié, J.-F. Vanacker, L. Moggio, Y. Courcoux, A. Pellegrini, and T. Rose, 2012. Summer to winter variabilities of temperature and water vapor in the surface atmosphere as observed by HAMSTRAD over Dome C, Antarctica., Bound. Layer Met., DOI: 10.1007/s10546-011-9673-6

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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.

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. IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING, VOL. 50, NO. 8, AUGUST 2012. 2923-2933.

Haase, J. S., J. Maldonado-Vargas, F. Rabier, P. Cocquerez, M. Minois, V. Guidard, P. Wyss, and A. V. Johnson (2012), A proof-of-concept balloon-borne Global Positioning System radio occultation profiling instrument for polar studies, Geophys. Res. Lett., 39, L02803, doi:10.1029/2011GL049982.

Rabier F, S Cohn, P Cocquerez, A Hertzog, L Avallone, T Deshler, J Haase, T Hock, A Doerenbecher, J Wang, V Guidard, JN Thépaut, R Langland, A Tangborn, G Balsamo, E Brun, D Parsons, J Bordereau, C Cardinali, F Danis, JP Escarnot, N Fourrié, R Gelaro, C Genthon, K Ide, L Kalnajs, C Martin, L-F Meunier, J-M Nicot, T Perttula, N Potts, P Ragazzo, D Richardson, S Sosa-Sesma, A Vargas, 2012 : The Concordiasi field experiment over Antarctica: first results from innovative atmospheric measurements. BAMS meeting summary. doi: 10.1175/BAMS-D-12-00005.1

Cohn, S., T. Hock, P. Cocquerez, J. Wang, F. Rabier, D. Parsons, P. Harr, C-C Wu, P ; Drobinski, F. Karbou, S. Venel, A. Vargas, N. Fourrié, N. Saint-Ramond, V. Guidard, A. Doerenbecher, H-H Hsu , M-D Chou, J-L Redelsperger, C. Martin, J. Fox, N. Potts, K. Young, H. Cole, 2013: Driftsondes: providing in-situ long-duration dropsonde observations over remote regions. Accepted at the Bulletin of the American Meteorological Society

Wang J., T. Hock, S. A. Cohn, C. Martin, N. Potts, T. Reale, B. Sun, F. Tilley, 2013: Unprecedented upper-air dropsonde observations over Antarctica from the 2010 Concordiasi Experiment: Validation of satellite-retrieved temperature profiles. GRL, Vol 40, 1-6, doi: 10.1002/grl.50246.

Karbou, F., F. Rabier and C. Prigent, 2013: The assimilation of observations from the Advanced Microwave Sounding Unit over sea ice in the French Numerical Weather Prediction system. In revision for MWR

(http://www.cnrm.meteo.fr/concordiasi/)