Model performance and data impact over polar regions

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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

Singular vectors computed over the polar region show a good agreement with this ring of uncertainty
Variance of analysis fields wrt average analysis
Impact of observations in forecast performance

(a) AMSU-A
GPSRO
Raob
IASI
AIRS
AMV
synop/ship/buoy
drop

(b) AMV
AMSU-A
IASI
SSMIS
Raob
synop/ship/buoy
GPSRO
drop

(c) AMSU-A
IASI
AMSU-B
synop/ship/buoy
Raob
GPSRO
drop
HIRS
aircraft
AIRS
other
SSMIS
scatt
TPW
pilot

(d) AMSU-A
AIRS
IASI
GPSRO
HIRS
AMV
catt
drop
Raob
other
aircraft
AMSU-B
SSMI
pilot

GMAO
NRL
ECMWF
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)
EUMETSAT:
comparison of IASI retrievals, model and sondes

\[ T, q \text{ profiles :: ConcordIasi Sonde vs IASI L2(νXC−000)+ECMWF :: 20100930132226Z} \]
Comparison of Obs-Model for radiosondes and dropsondes using all levels (different for each centre)

Temperature in K

Altitude of the plateau

Sea surface

Radiosondes

Dropsondes
Large model errors near the surface: models too warm

Ecarts Obs-model, at the lowest dropsonde level
Sonde impact in two different systems

**ECMWF**: October

**NRL**

**GMAO**

00 and 12 UTC only, drop cases only
Impact of using Concordiasi Dropsondes

Mean analysis Differences
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

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

January 2009
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…


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


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