



Assimilation Of Low Level Humidity And Temperature Observations From AMSU-A & -B Over Land

F. Karbou*

In collaboration with:

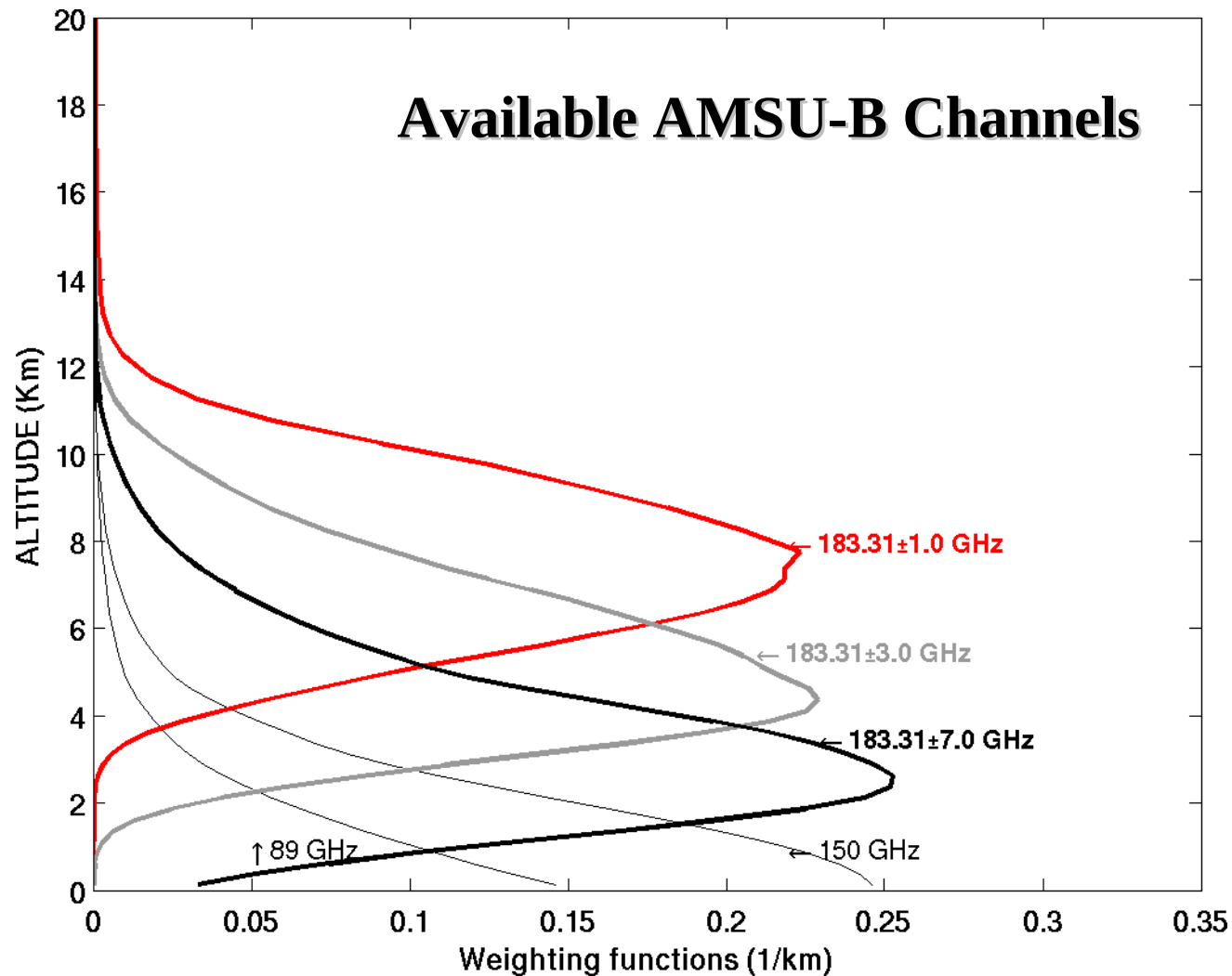
F. Rabier*, E. Gérard*, J-P. Lafore*, J-L. Redelsperger*, O. Bock[⊗]

*CNRM-GAME, Météo-France & CNRS

[⊗]IGN

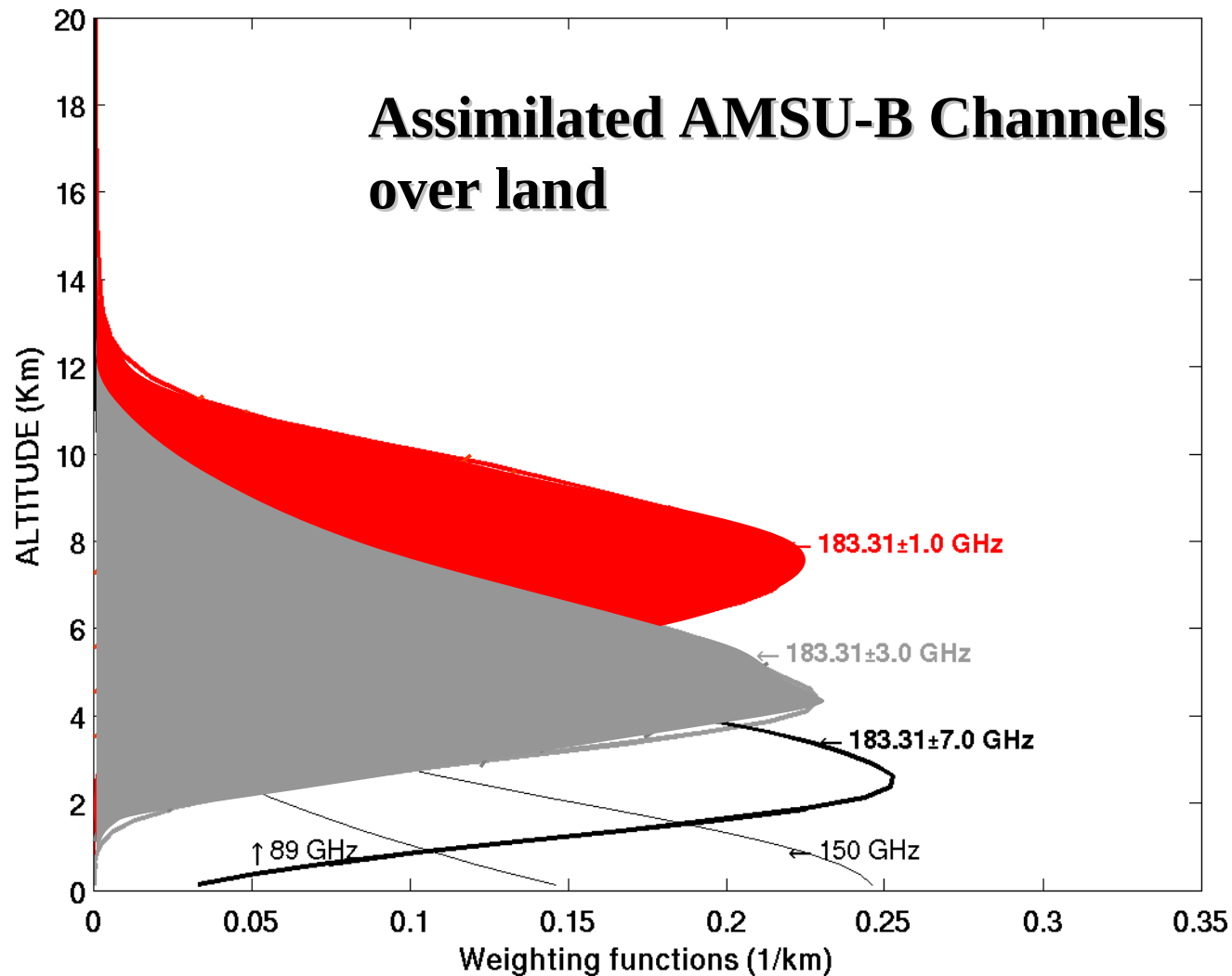
AMSU-A and AMSU-B observations

Indirect vertical measurements of temperature and humidity:

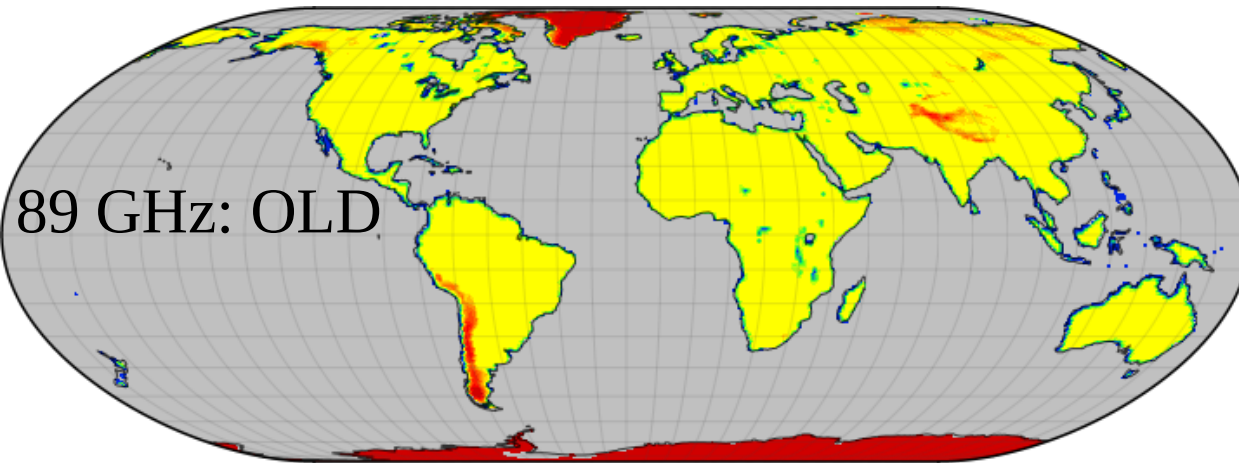


AMSU-A and AMSU-B observations

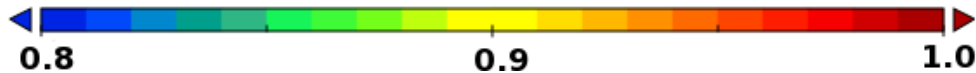
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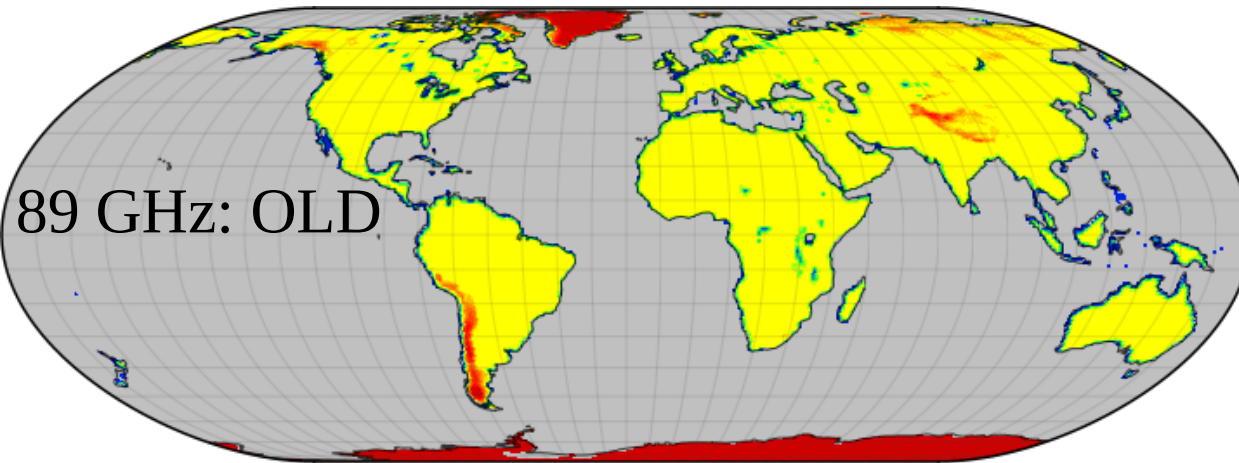
Land emissivity at AMSU-B frequencies



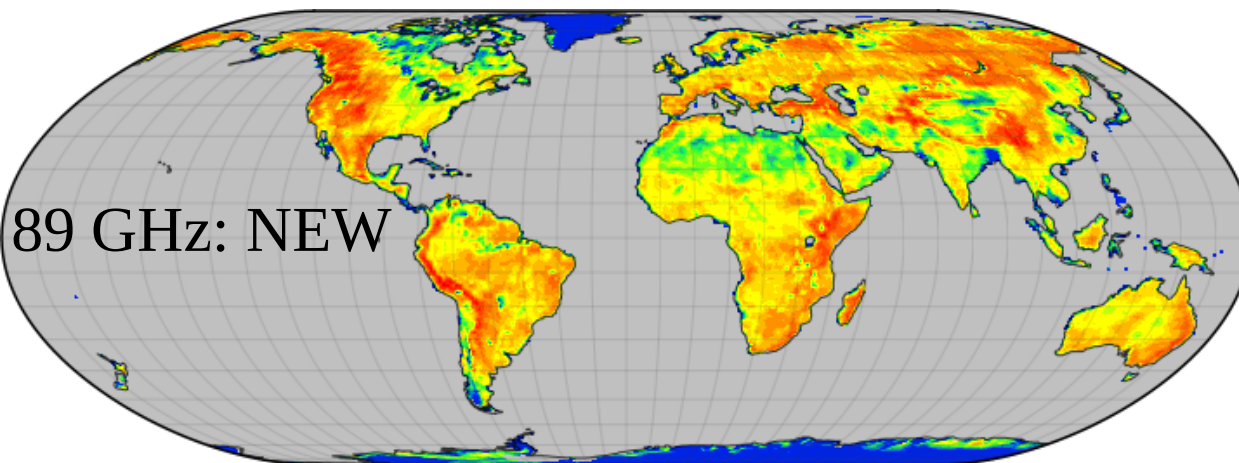
Land surface emissivity :
regression version of
models → eased the
assimilation of sounding
channels



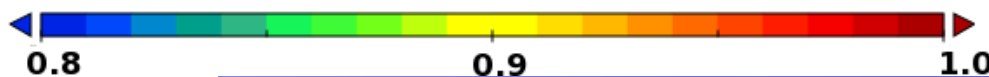
Land emissivity at AMSU-B frequencies



Land surface emissivity :
regression version of
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assimilation of sounding
channels



Since July 2008,
operational
implementation of a new
land surface emissivity
parameterization
(Karbou et al. 2006)



Land emissivity at AMSU frequencies

« dynamical land emissivity model » operational in ARPEGE since July 2008

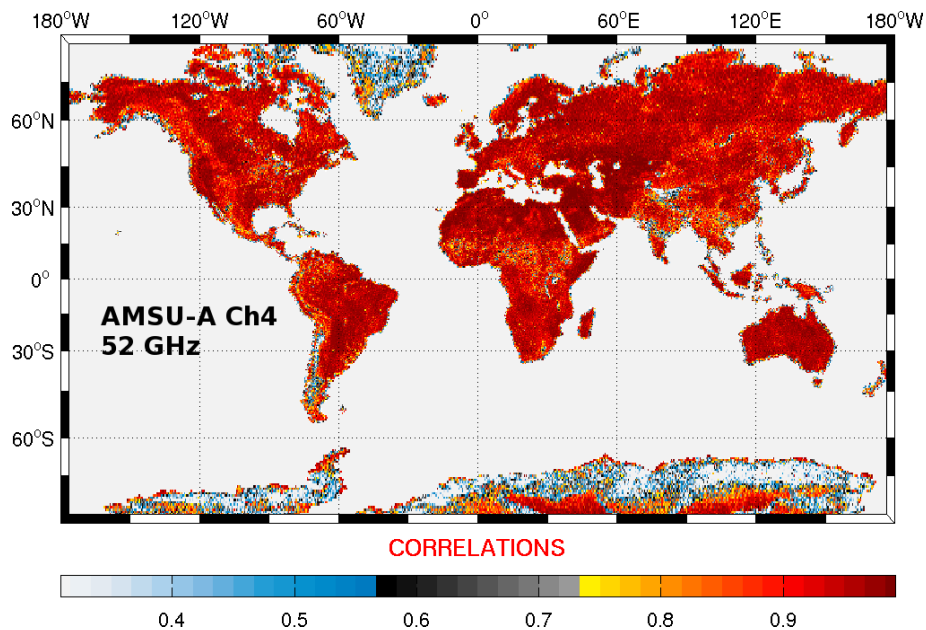
- Interfaced with RTTOV (Eyre 1991; Saunders et al. 1999; Matricardi et al. 2004)
- Land emissivity is computed from selected surface channels (AMSU-A ch3 (50 GHz) and from AMSU-B ch1 (89 GHz))
- Emissivity is dynamically updated for each atmo. & surface situations
- Large improvement of RTTOV performances (bias, std, correlations)

Land emissivity at AMSU frequencies

« dynamical land emissivity model » operational in ARPEGE since July 2008

Correlations between Obs and RTTOV Sim., AMSU-A ch4, August 2006

CTL

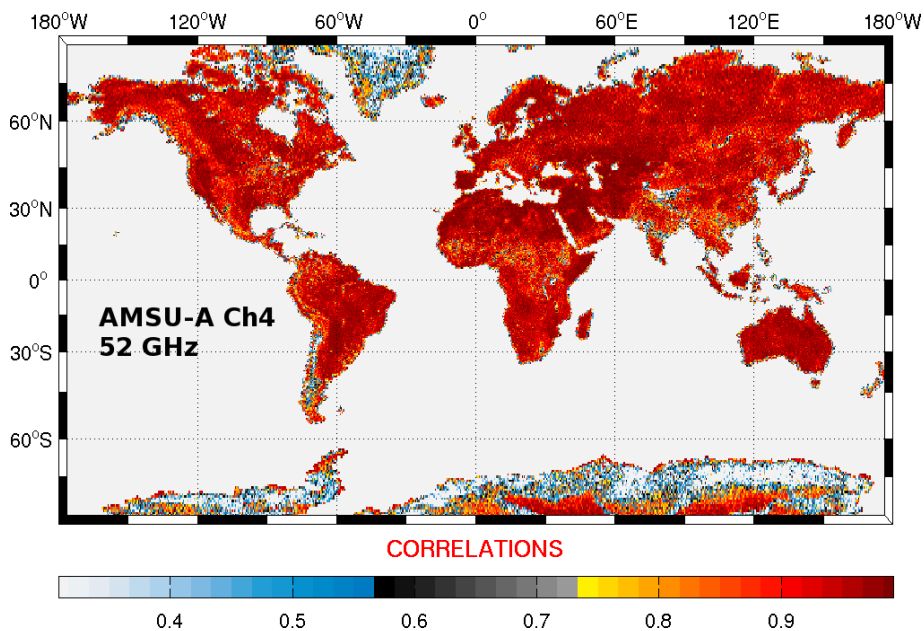


Land emissivity at AMSU frequencies

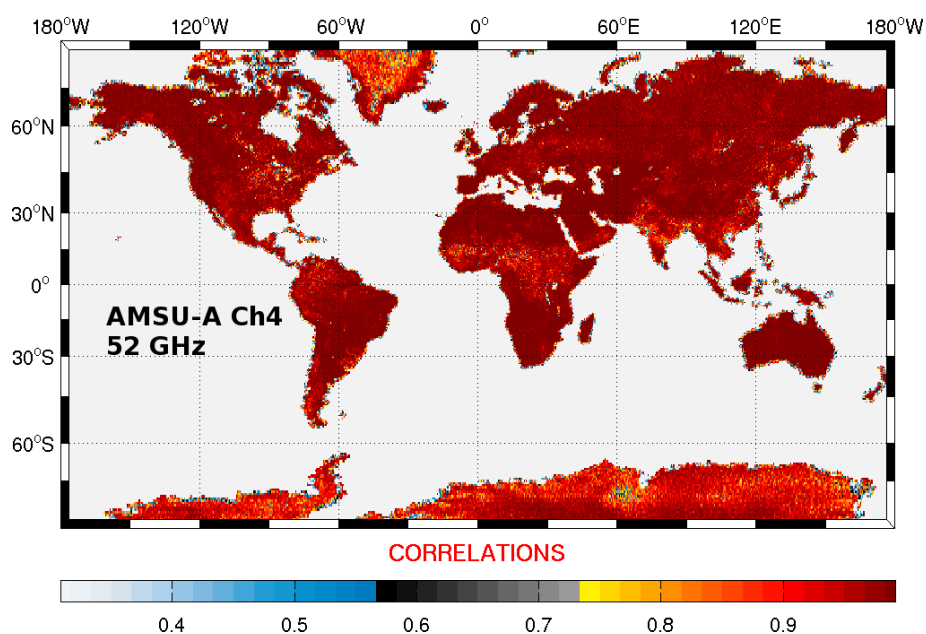
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Correlations between Obs and RTTOV Sim., AMSU-A ch4, August 2006

CTL



CTL + dynamical emis.



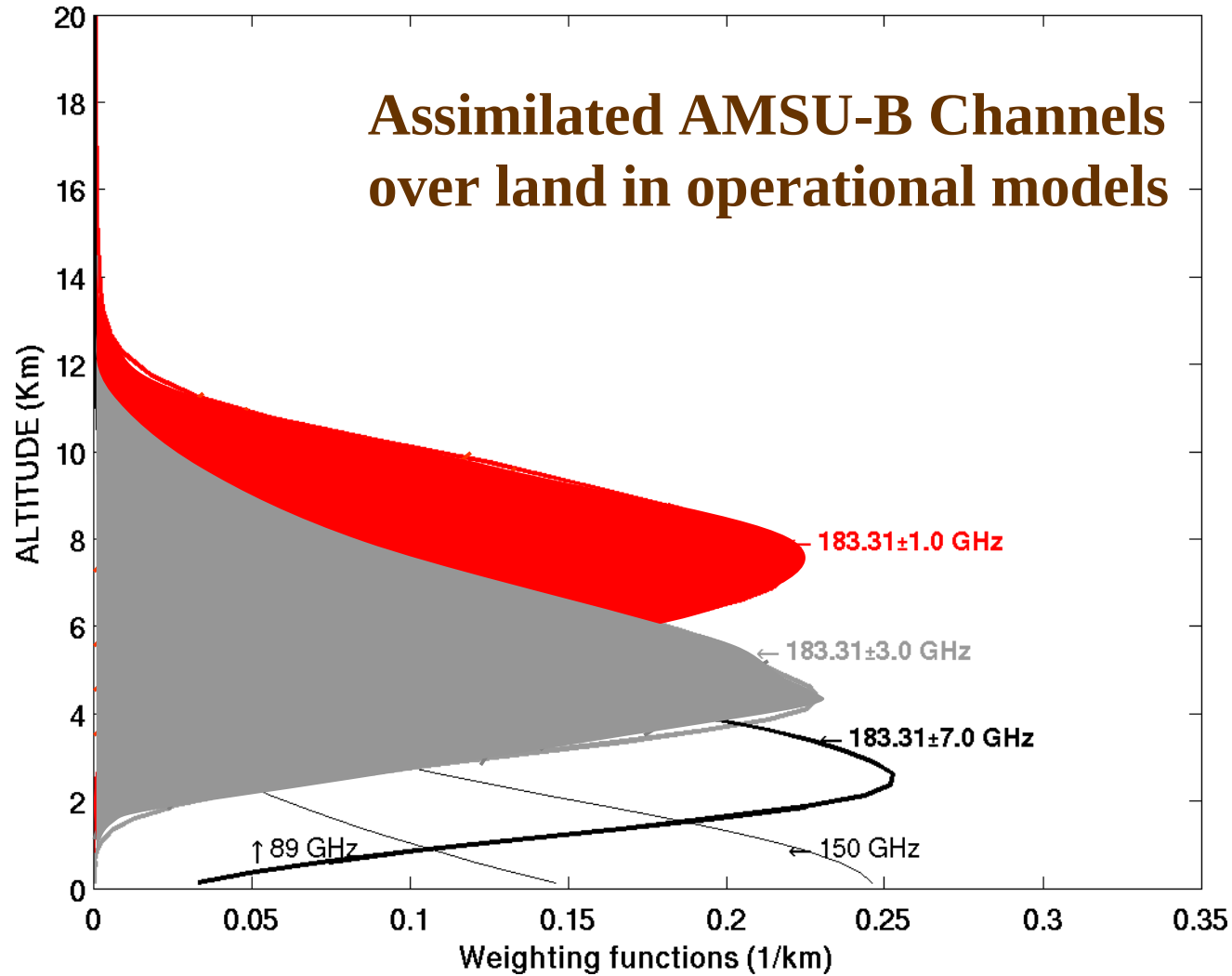


Land emissivity at AMSU frequencies

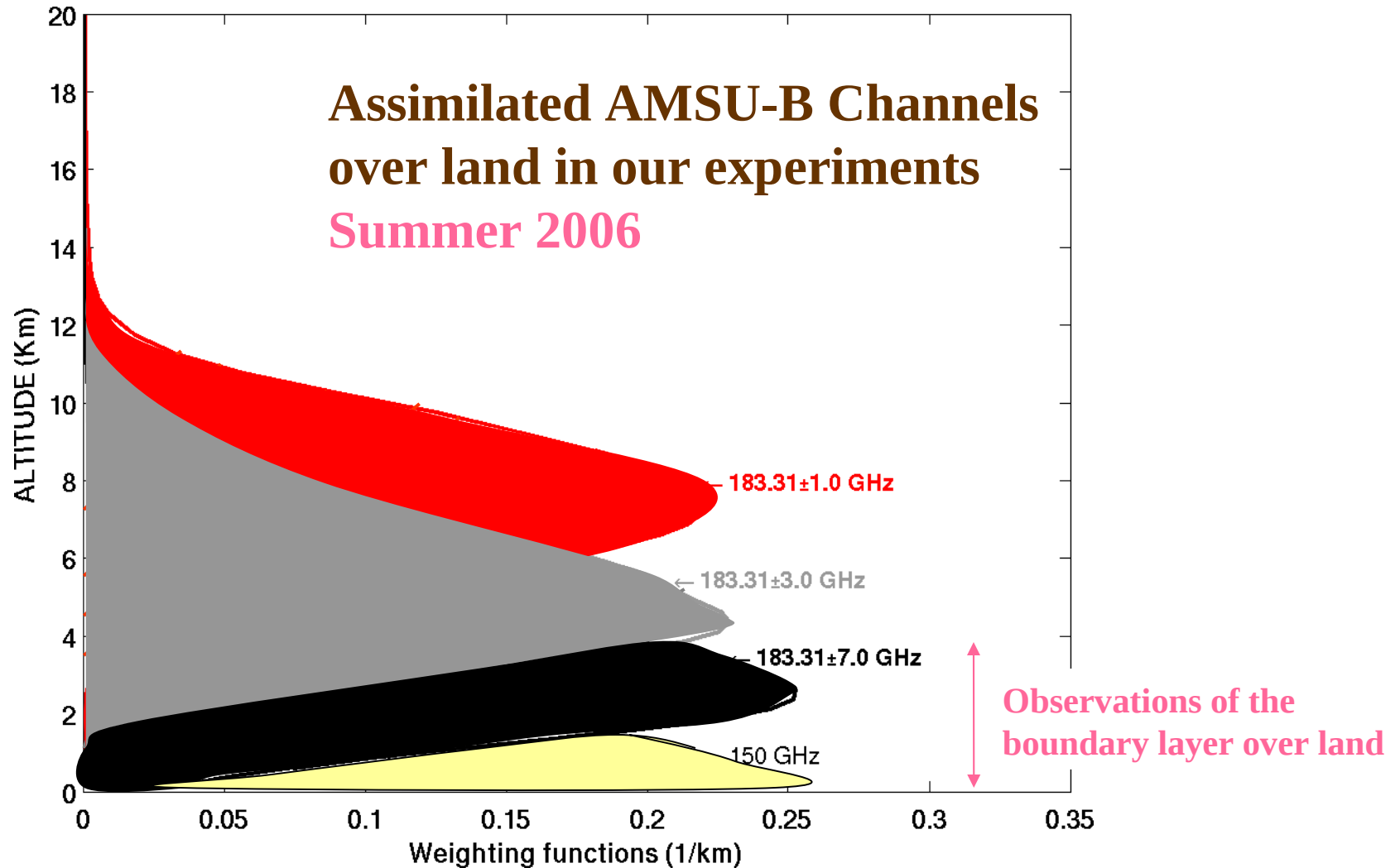
« dynamical land emissivity model » operational in ARPEGE since July 2008

- Sounding channels: to assimilate as many observations over land as over sea
- Make it possible to assimilate surface sensitive channels from AMSU over land

Assimilation of surface sensitive channels over land



Assimilation of surface sensitive channels over land





Assimilation of surface sensitive channels over land

Main results when AMSU surface channels are assimilated in 4D-Var:

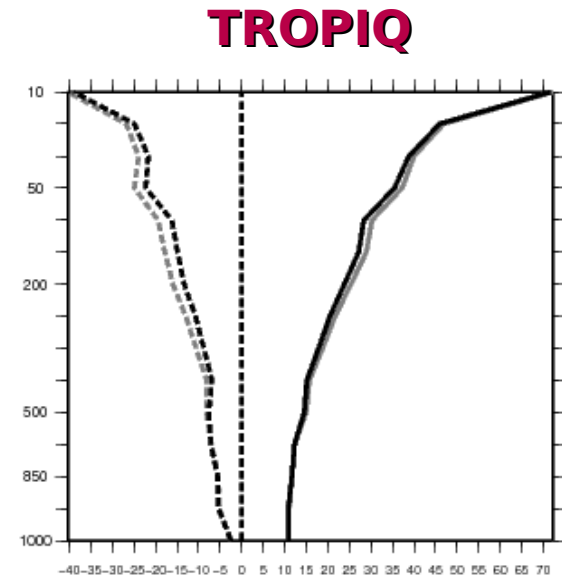
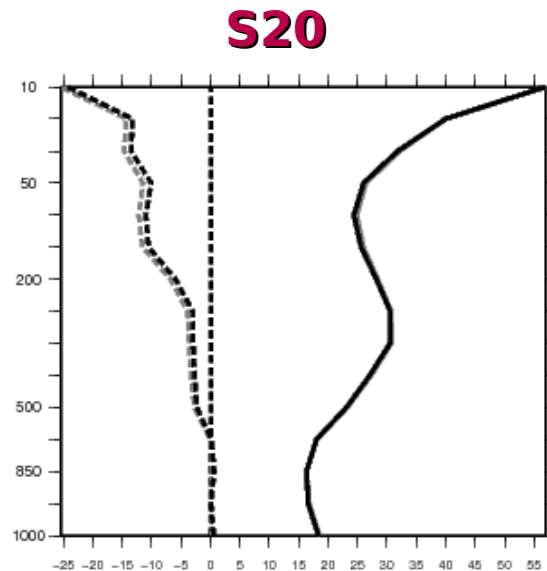
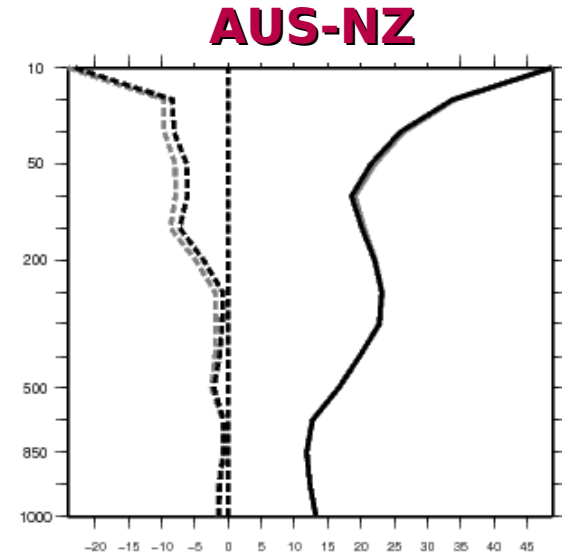
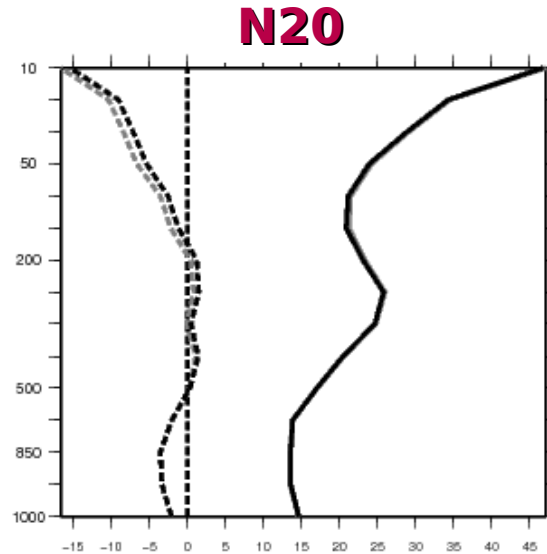
- Forecast errors with respect to radiosondes and ECMWF analyses
- Impact on analysis of humidity, evaluation against independent GPS measurements from AMMA network

Assimilation of surface sensitive channels over land: **Effect on forecasts**

Scores geopotential
height / Radiosondes,
48h, 1 month

CTL --- BIAS
_ RMSE

EXP --- BIAS
_ RMSE



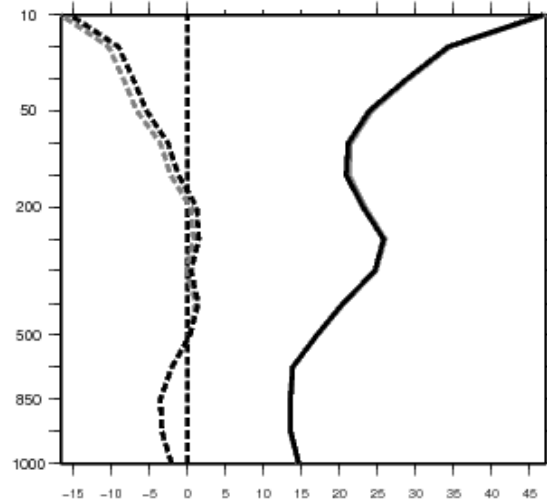
Assimilation of surface sensitive channels over land: **Effect on forecasts**

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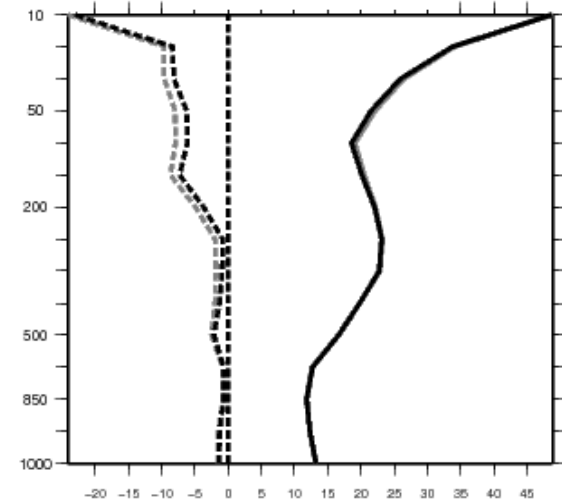
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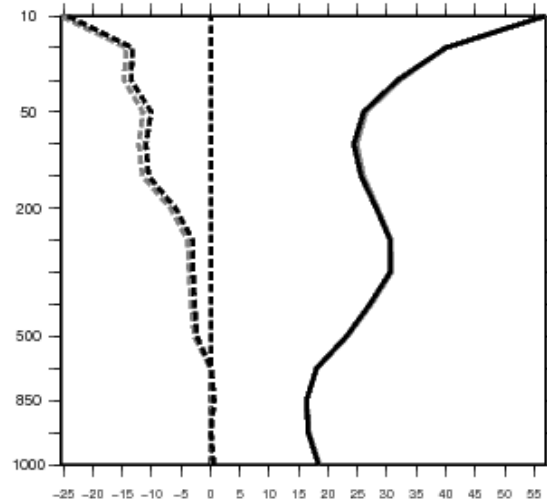
N20



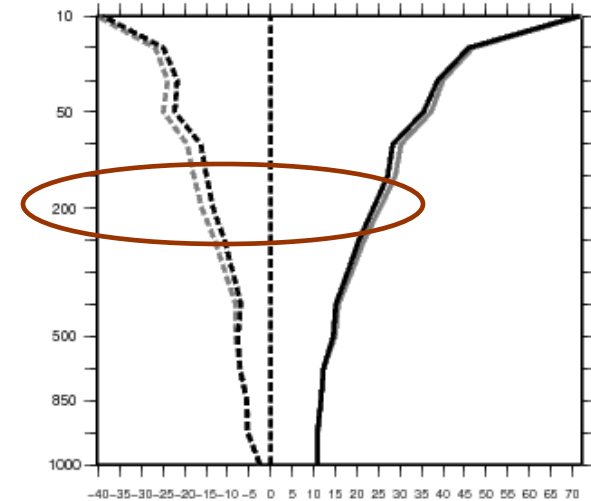
AUS-NZ



S20

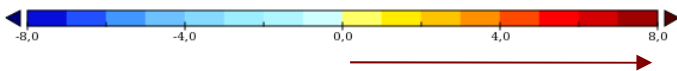
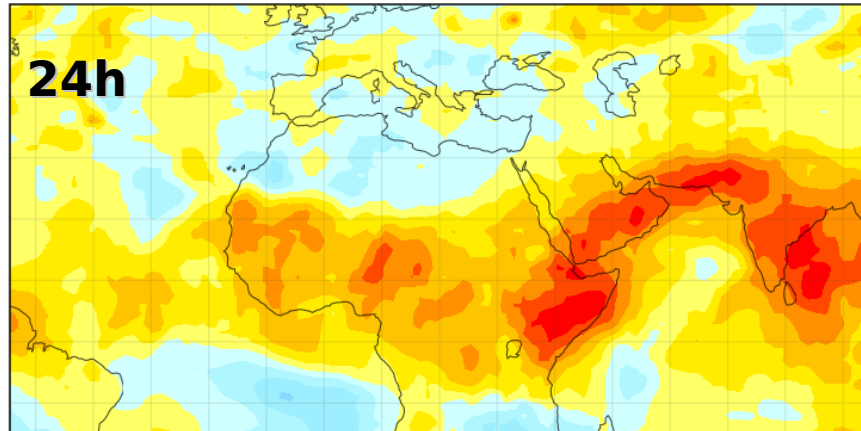


TROPIQ



Assimilation of surface sensitive channels over land: **Effect on forecasts**

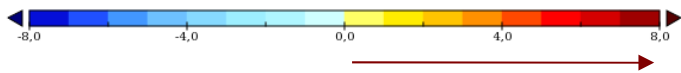
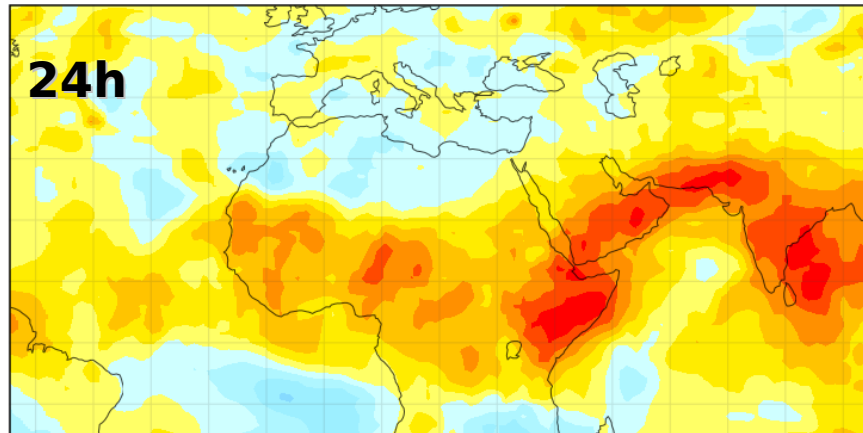
Differences of geopotential forecast errors with respect to ECMWF analyses (CTL-EXP), 200hPa, 1month



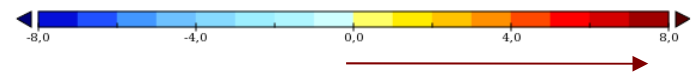
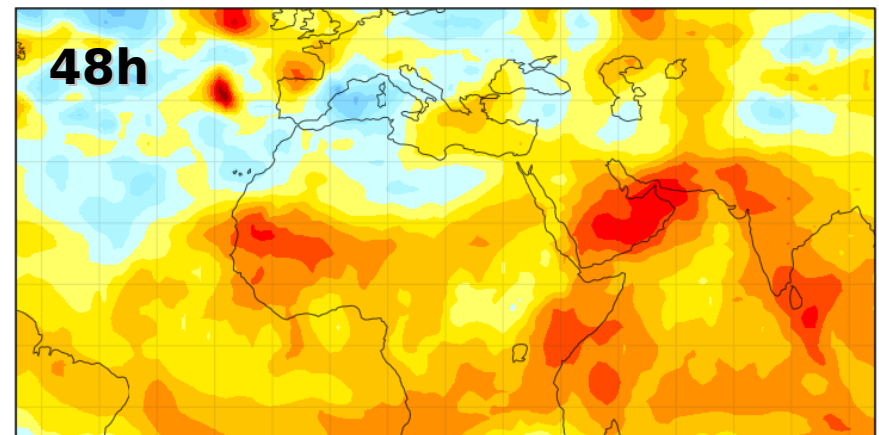
**Smaller errors in
EXP**

Assimilation of surface sensitive channels over land: **Effect on forecasts**

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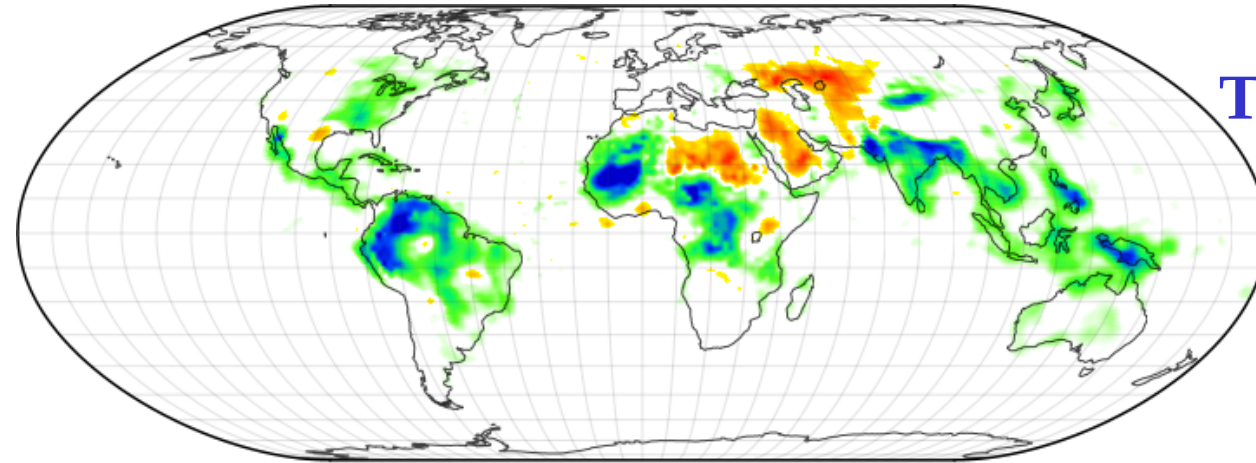


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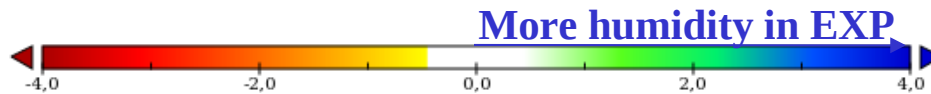


**Smaller errors in
EXP**

Assimilation of surface sensitive channels over land: **Effect on analyses**



TCWV (EXP-CTL)

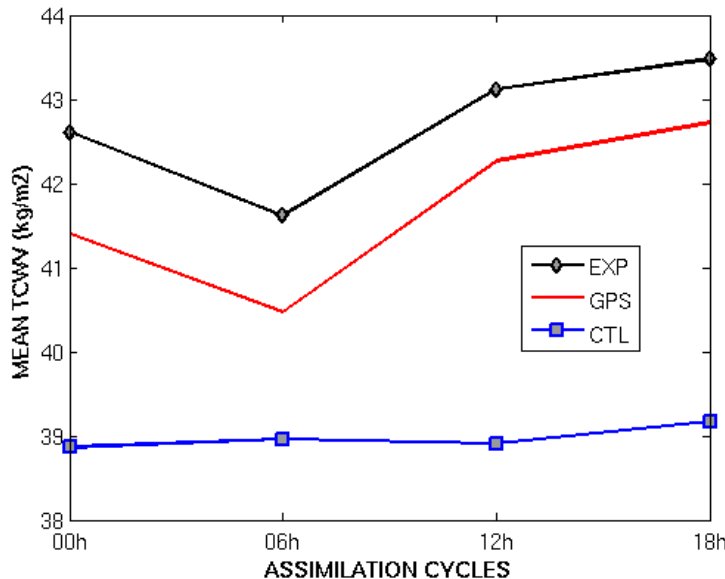
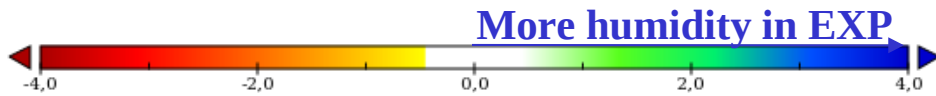


Similar humidity features observed when assimilating TCWV from ENVISAT MERIS over land in IFS (Bauer, 2009)

Assimilation of surface sensitive channels over land: **Effect on analyses**

TCWV (EXP-CTL)

**Evaluation against
GPS measurements**

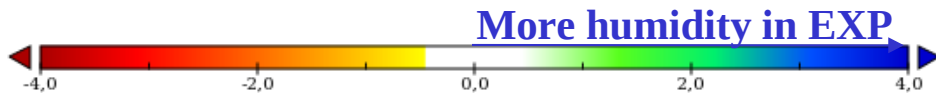


**TCWV diurnal cycle, Timbuktu
(MALI)**

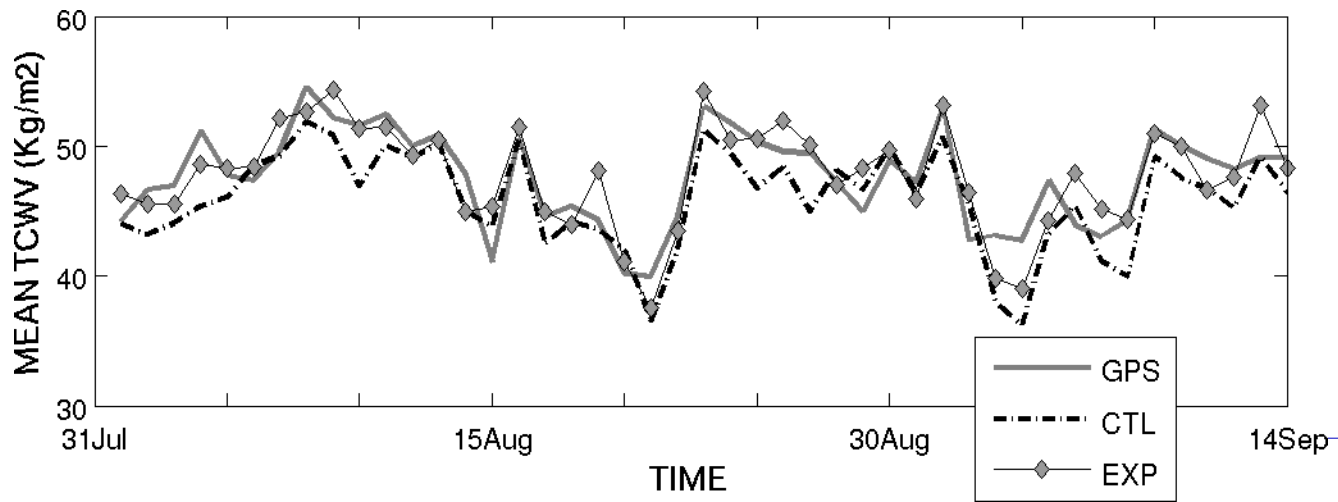
Assimilation of surface sensitive channels over land: **Effect on analyses**

TCWV (EXP-CTL)

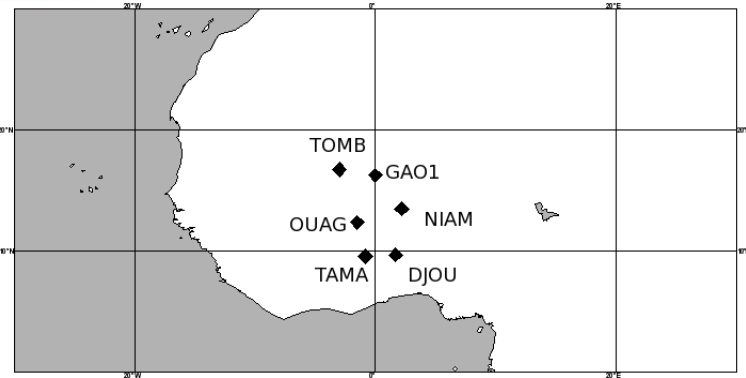
**Evaluation against
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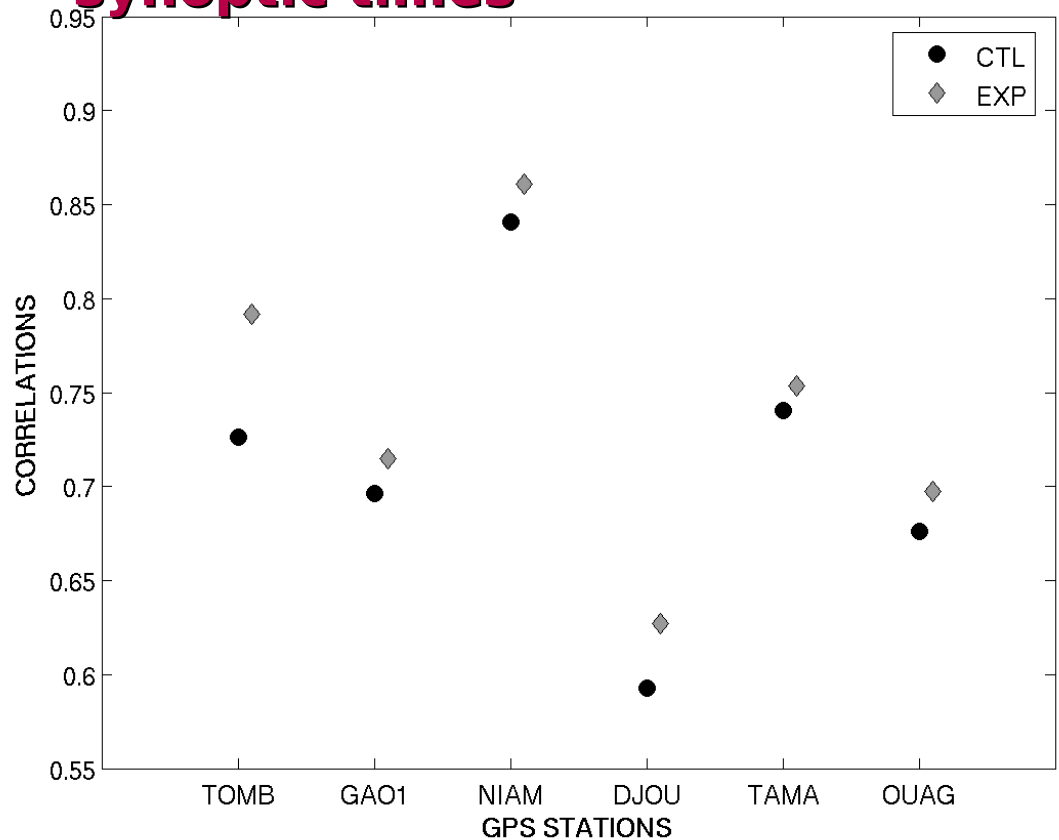
TCWV daily time series, Ouagadougou



Assimilation of surface sensitive channels over land: **Effect on analyses**



Correlations with GPS, 45 days, synoptic times



Conclusions

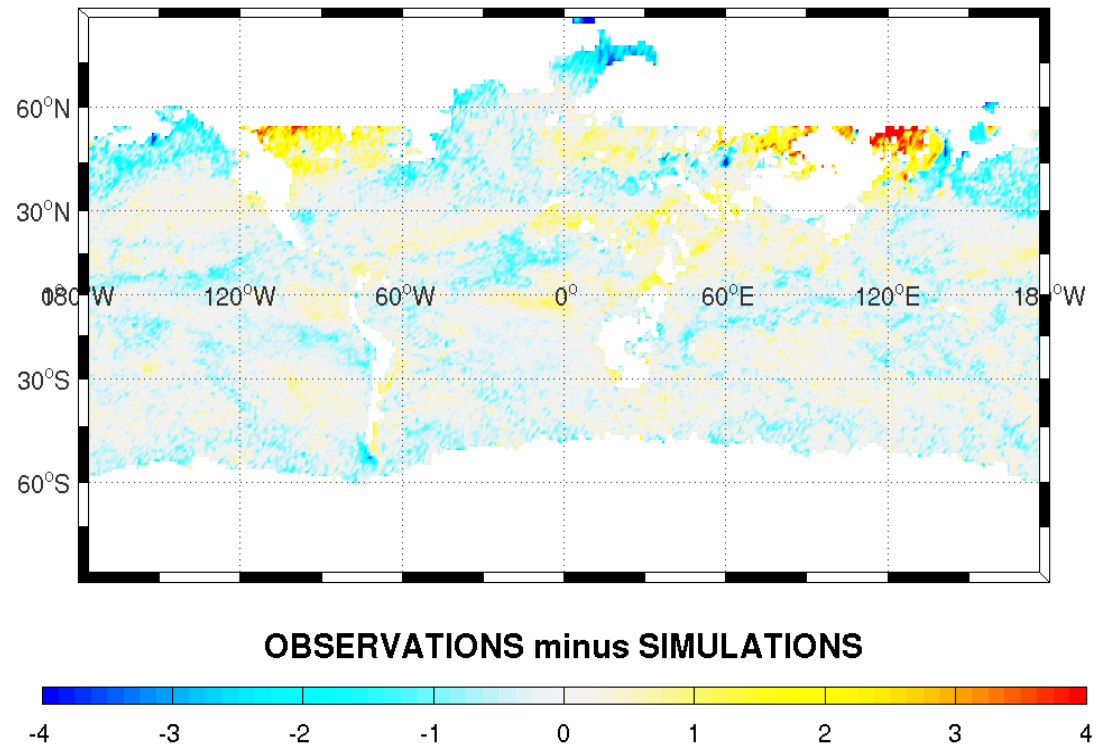
- A good representation of land surface emissivity motivated assimilation studies to assimilate low level humidity observations (usually blacklisted)
- The assimilation of these channels:
 - Positive impact in scores wrt radiosondes, ECMWF analyses
 - Large impact on humidity analysis (& temp., wind) over the Tropics: low to mid-levels
 - TCWV Change evaluated against independent GPS measurements
- More results in Karbou et al. 2010a-b (Weather and Forecasting)

Assimilation of AMSU surface sensitive observations: operational at Météo-France since 6th April 2010.

Issues

- The issue of snow emissivity at AMSU-B frequencies
 - effect of the surface assumption ? Harlow (2009), Guedj et al. (2010)
 - Need for a frequency parametrization ?
 - the assimilation of surface sensitive observations limited to $\pm 55\text{deg}$

**“OBS minus BG” for
assimilated AMSU-B ch5
(183.31 ± 7.0 GHz)
2weeks (January 2009)**



- Improve the bias correction over land (new predictors ?), Gérard et al. 2010
- Improve the representation of the skin temperature
- Better understand the effect of humidity observations over land: Comparaison between IFS and ARPEGE with the assimilation of MERIS-AMSUB (P. Bauer), evaluate the humidity fields against dropsonde data (P. Drobinski)

