On the importance of land surface emissivity to assimilate low level humidity and temperature observations over land

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In collaboration with:

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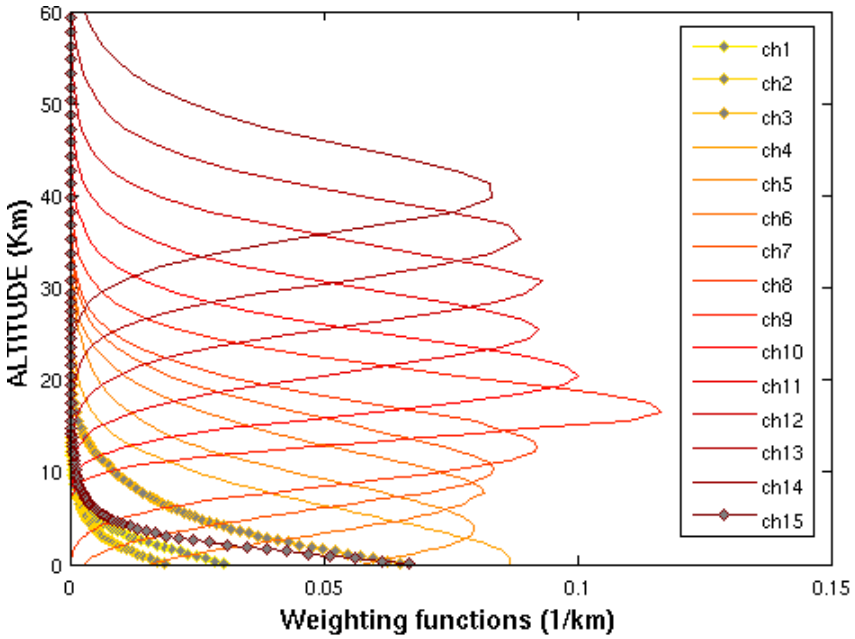
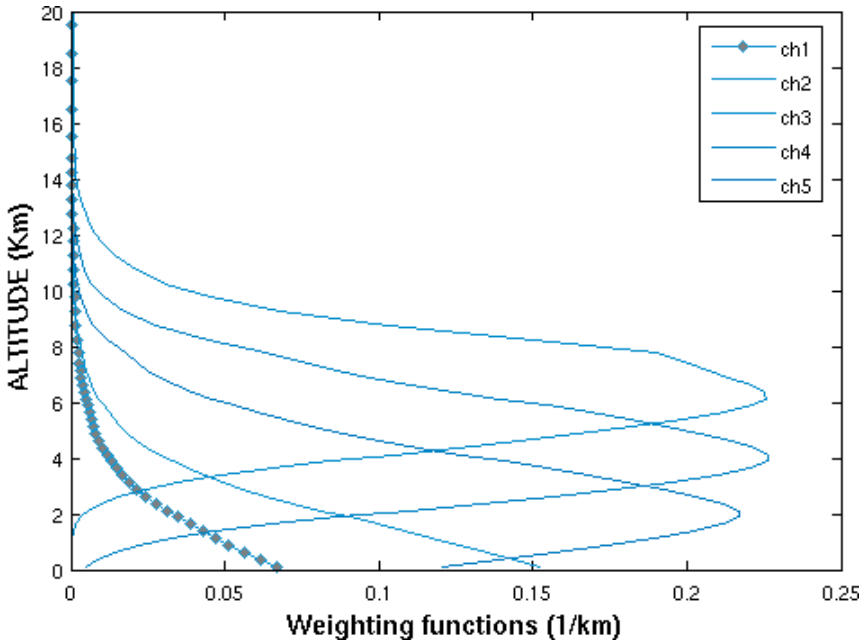
❂IGN

Indirect vertical measurements of Temperature & Humidity:

AMSU-A



AMSU-B



Indirect vertical measurements of Temperature & Humidity:

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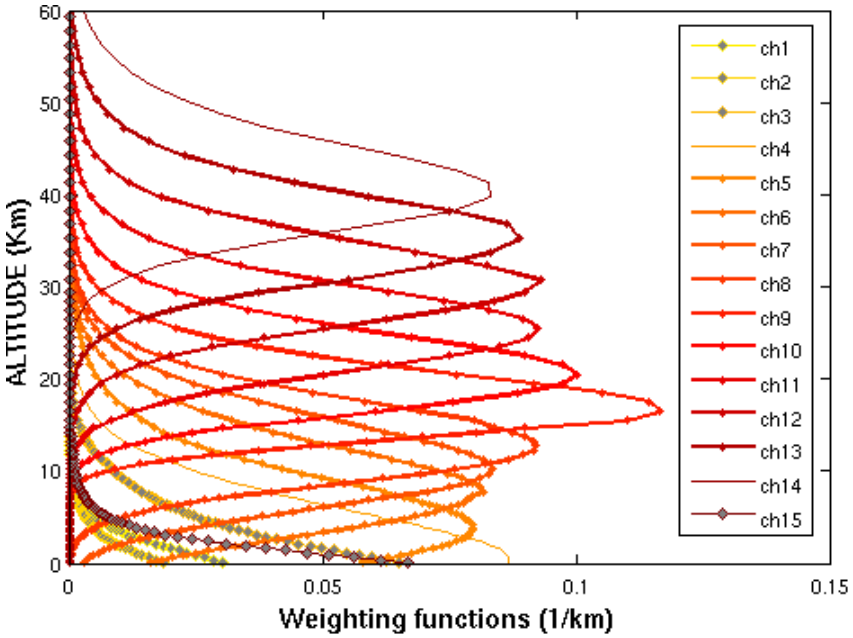
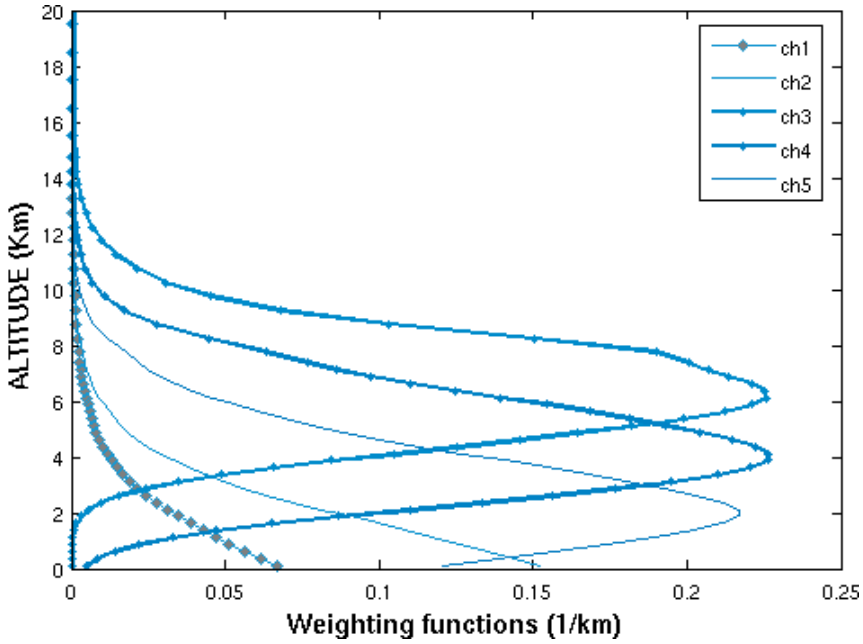
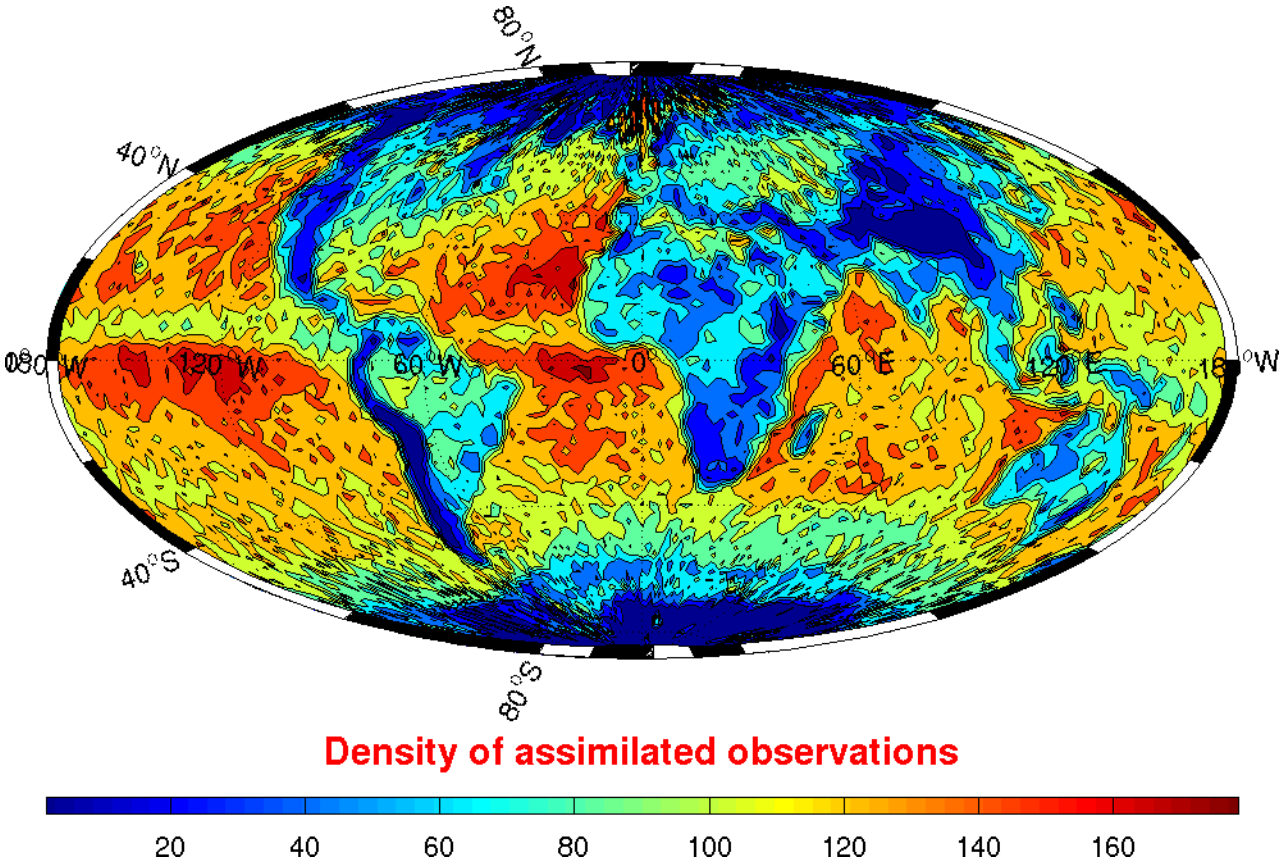


AMSU-B



Indirect vertical measurements of Temperature & Humidity:

AMSU-A, Ch7, Temperature (10km)



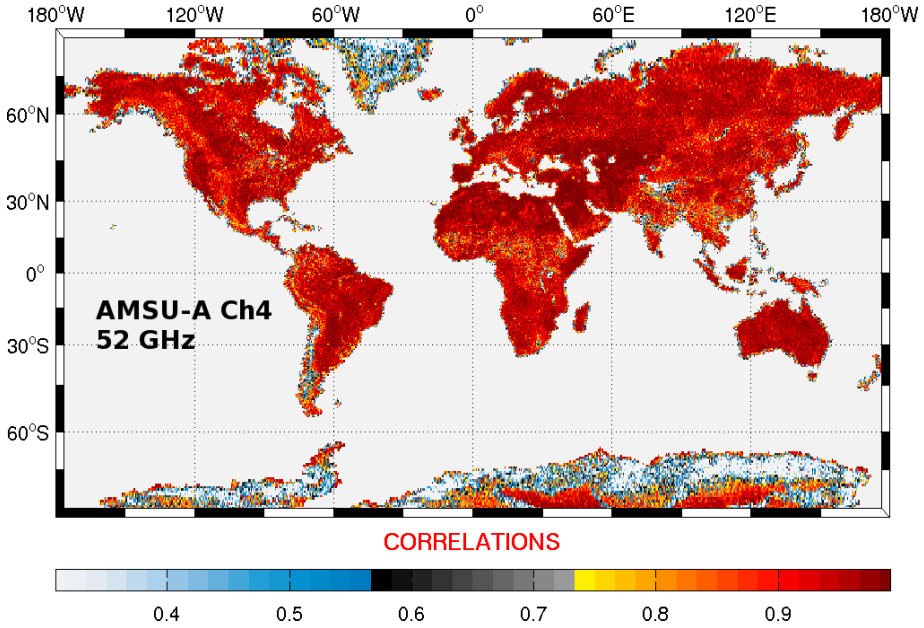
Land surface emissivity :
« dynamical land emissivity parameterization » operational since July 2008 (Karbou et al. 2006)

- 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
- Interfaced with RTTOV (Eyre 1991; Saunders et al. 1999; Matricardi et al. 2004)
- Large improvement of RTTOV performances (bias, std, correlations)

« dynamical land emissivity parameterization » operational since July 2008 (Karbou et al. 2006)

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

CTL

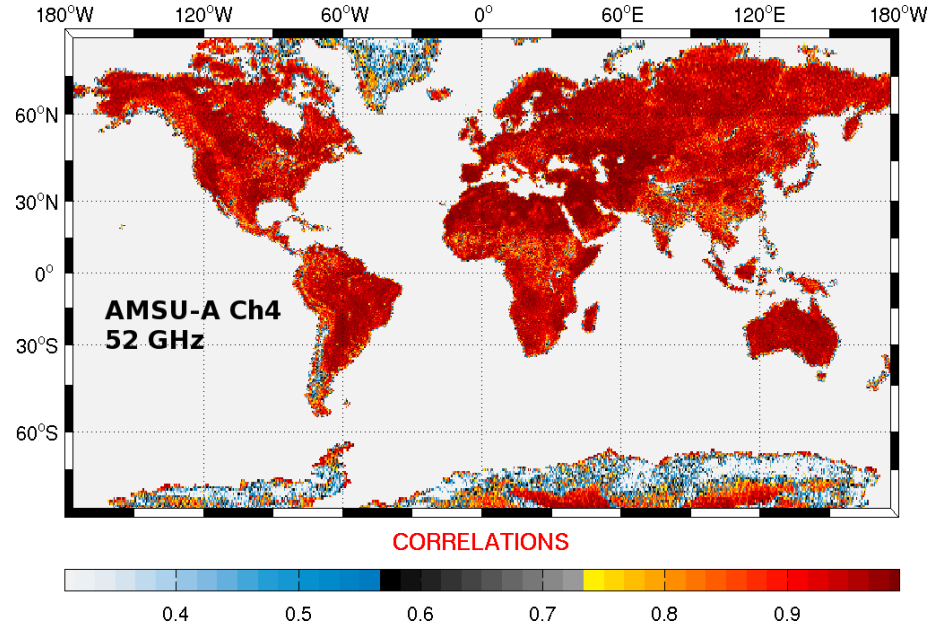


1- Introduction
b) Land surface emissivity

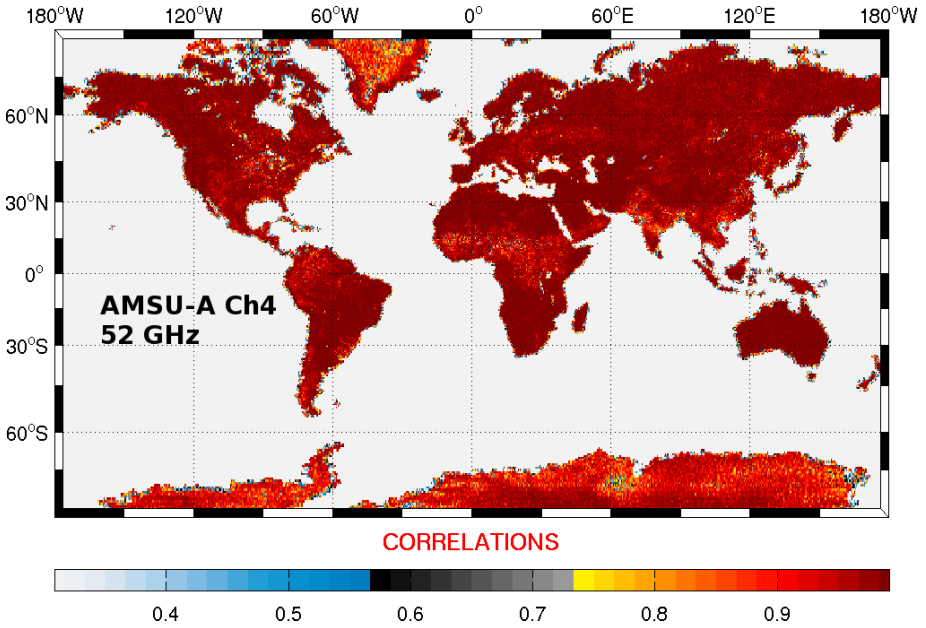
« dynamical land emissivity parameterization » operational since July 2008 (Karbou et al. 2006)

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

CTL

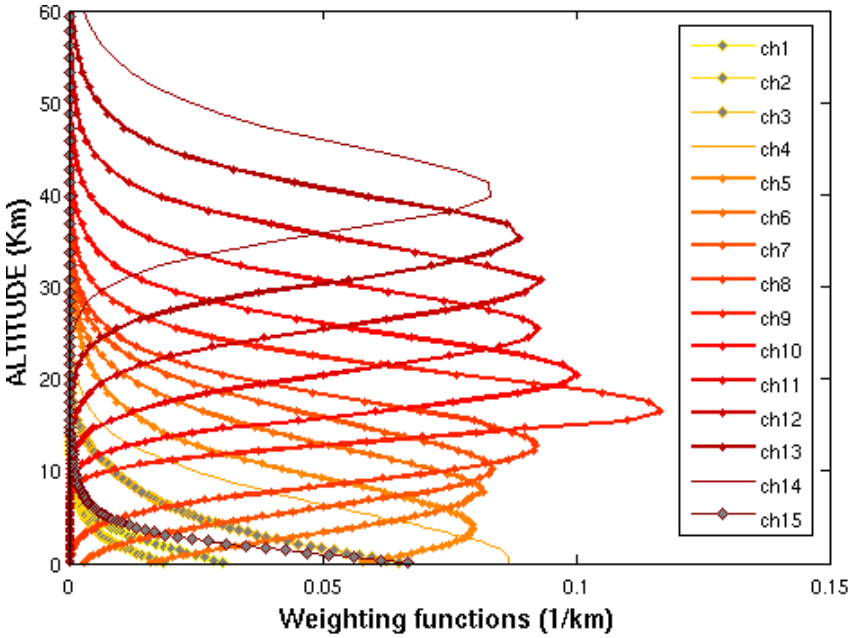


CTL + dynamical emis.

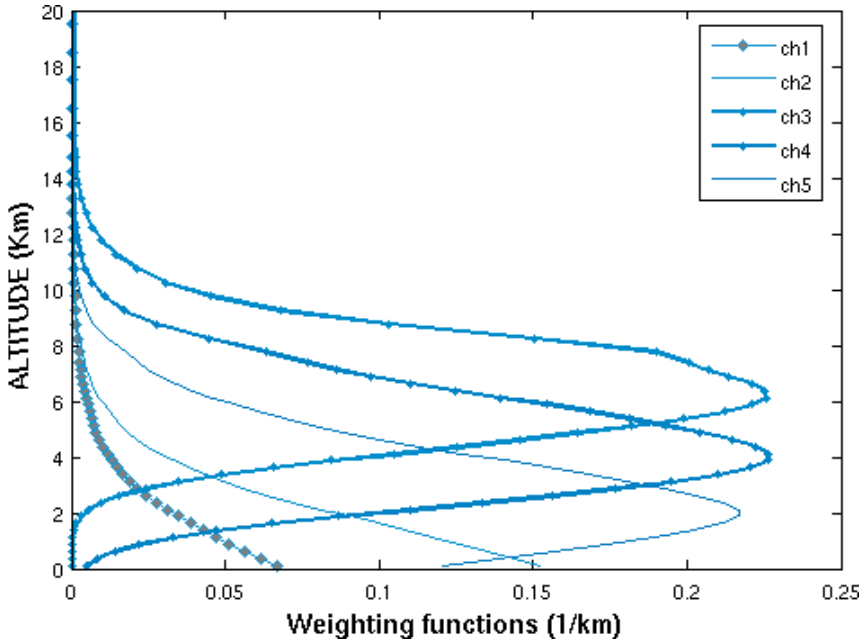


First assimilation experiments to study the impact of assimilating surface sensitive observations

AMSU-A



AMSU-B

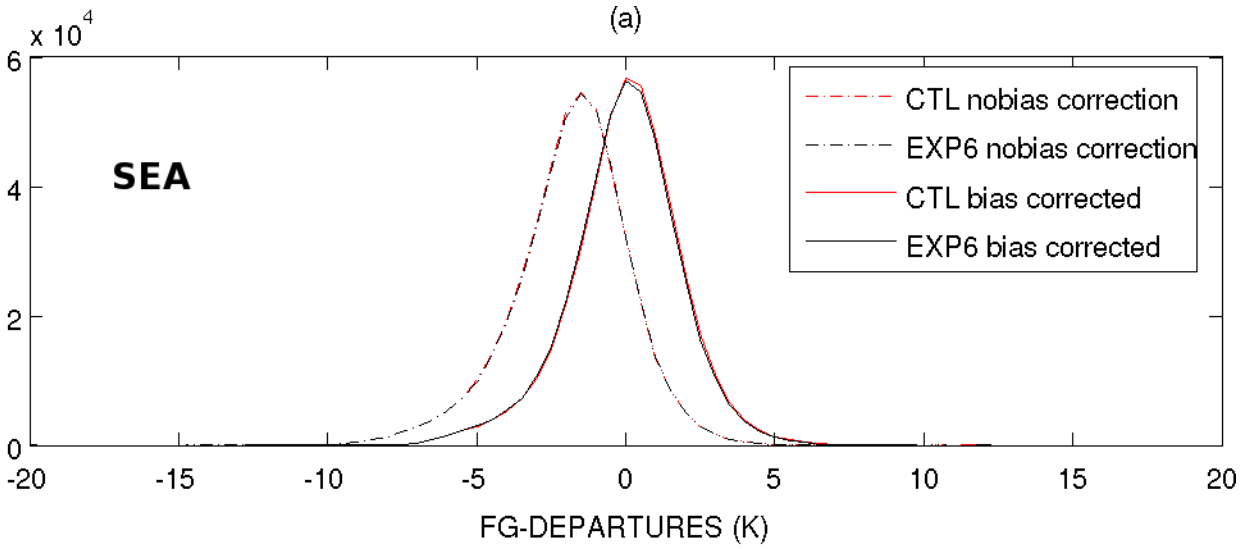


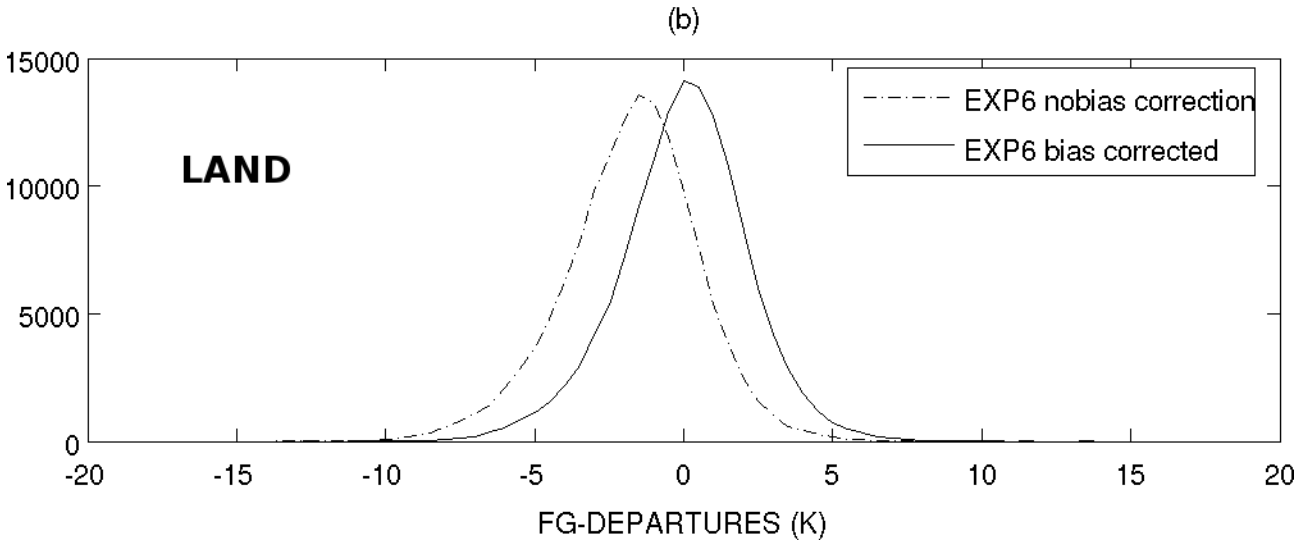
4 experiments, 2month period (summer 2006), different configurations for selecting AMSU surface sensitive channels

Fg-departures (obs-guess), AMSU-B channel 5 (183.31±7 GHz)

CTL

EXP: CTL +
AMB2, AMB5
AMA4





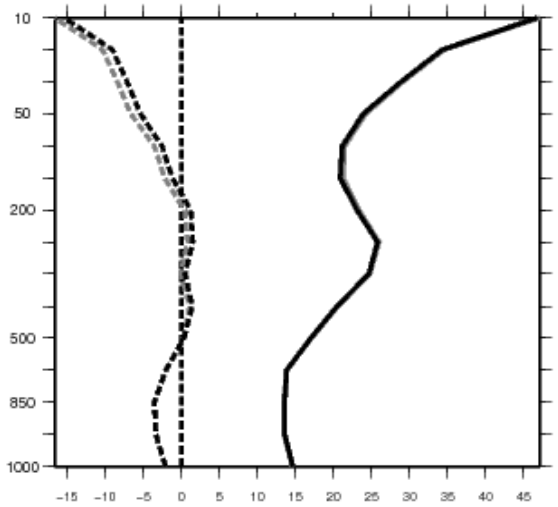
2- Assimilation experiments
b) Forecast scores

Scores geopotential height / Radiosondes, 48h

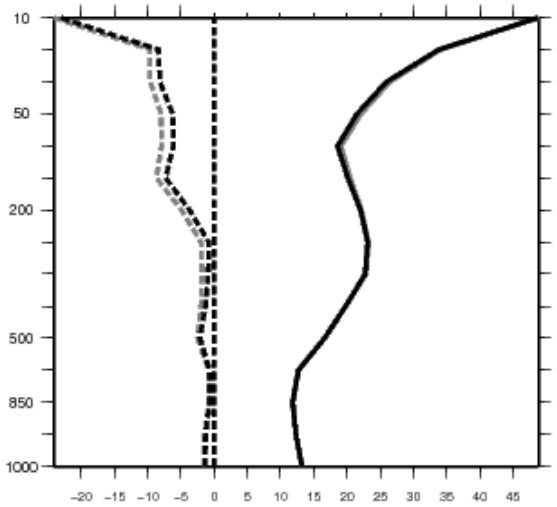
CTL --- BIAS
__ RMSE

EXP --- BIAS
__RMSE

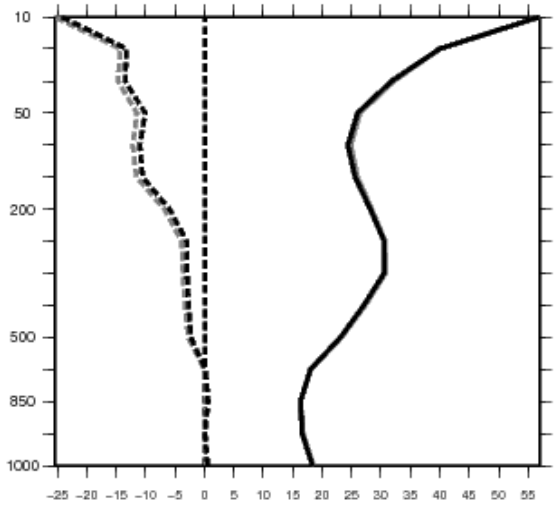
N20



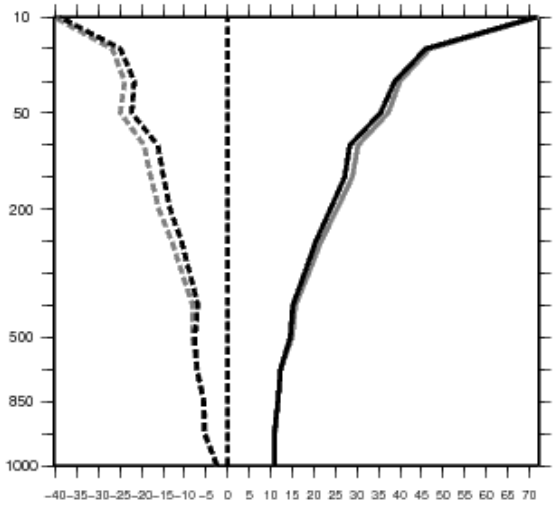
AUS-NZ



S20



TROPIQ



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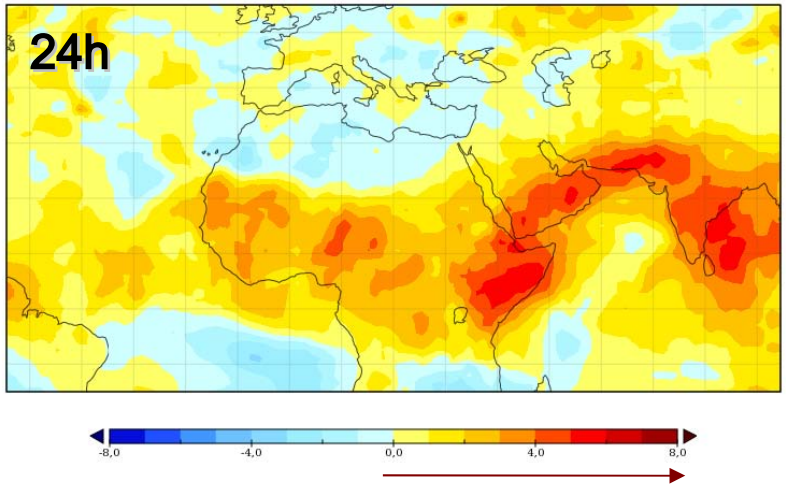
Differences of geopotential forecast errors with respect to ECMWF analyses (CTL-EXP), 200hPa, 1month



Smaller errors in EXP

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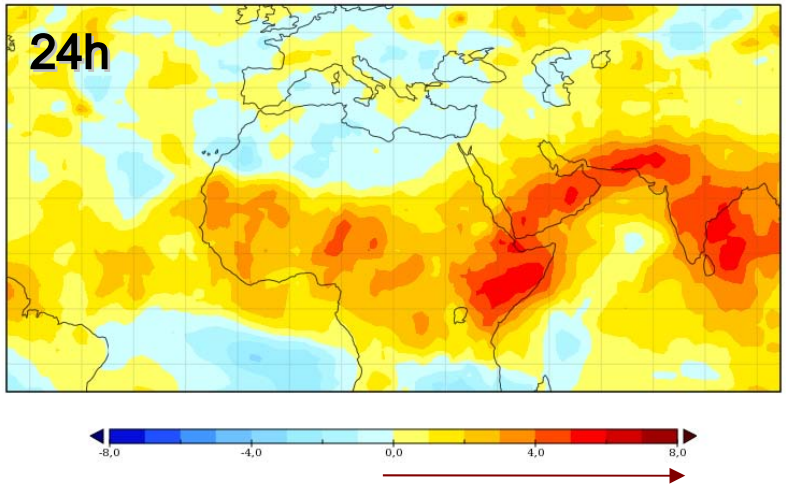

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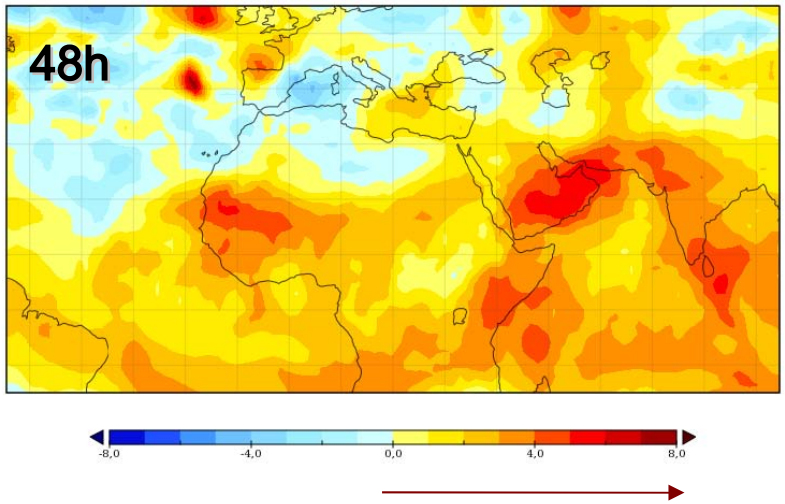

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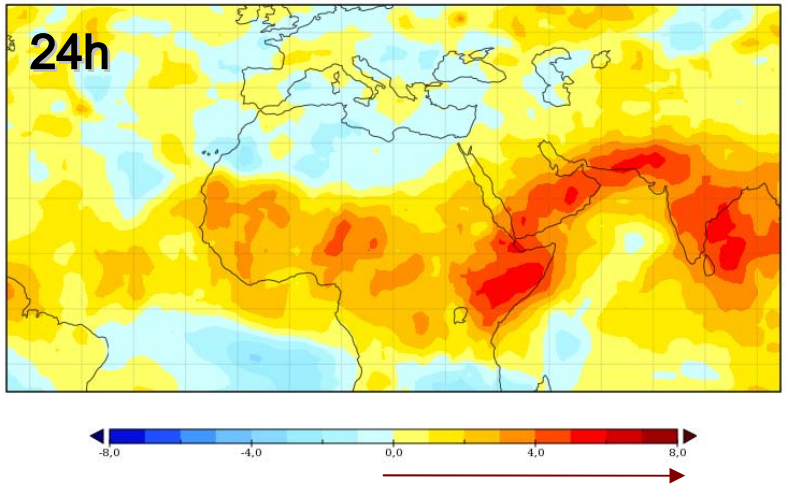

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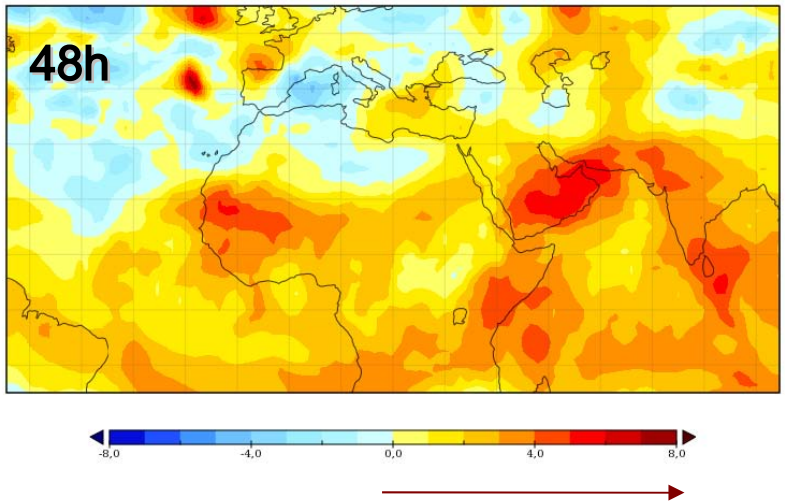

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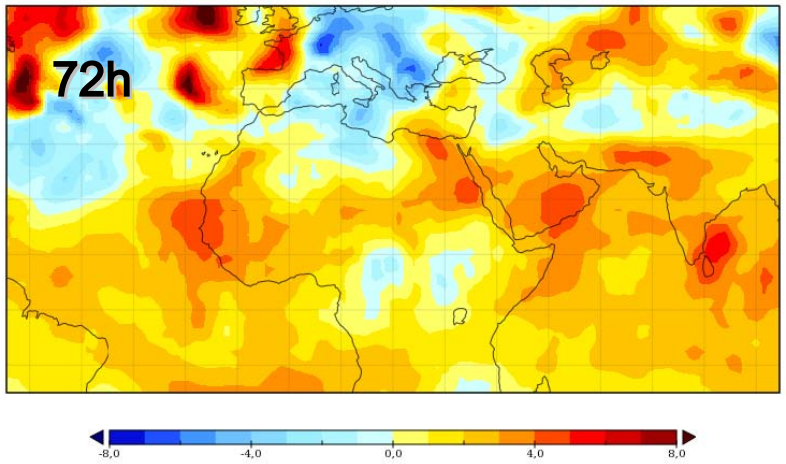
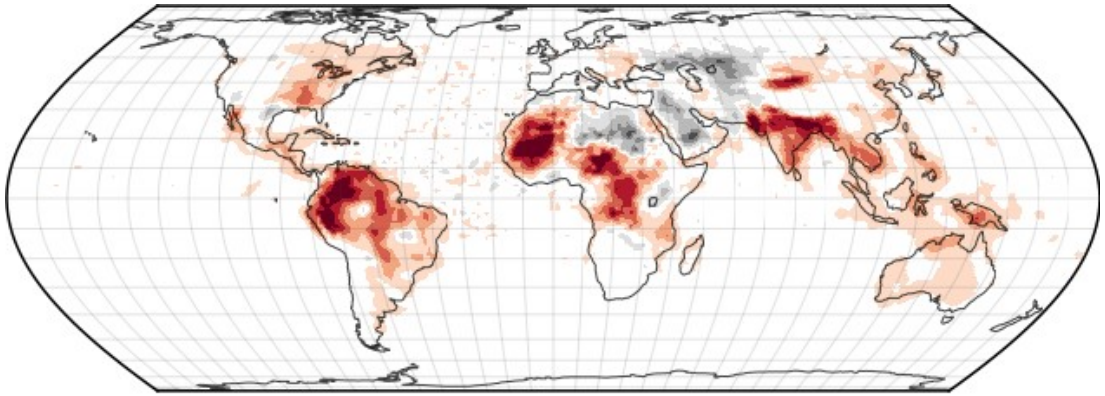
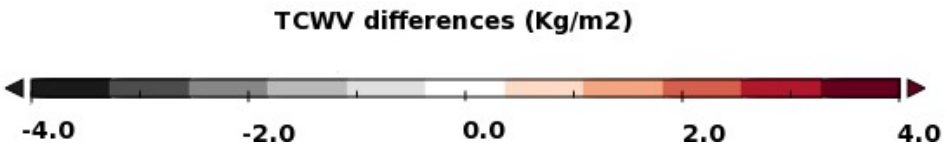


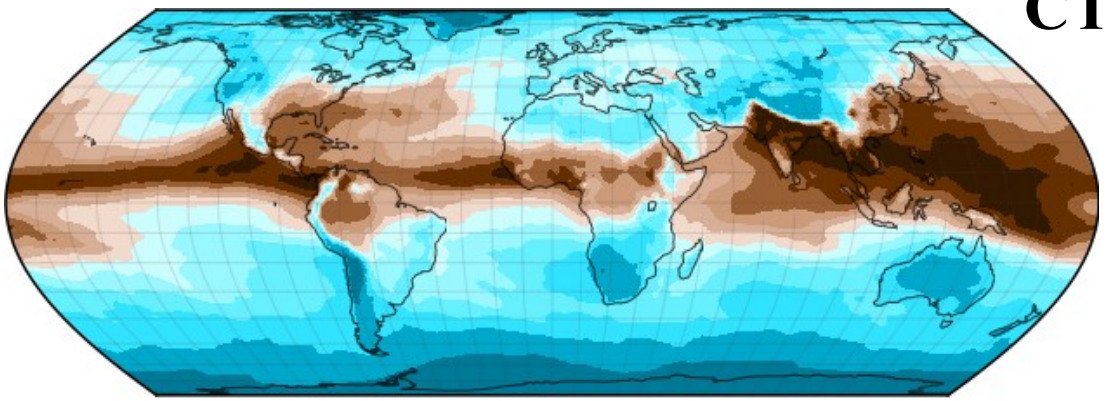
2- Assimilation experiments
c) Impact on humidity analysis

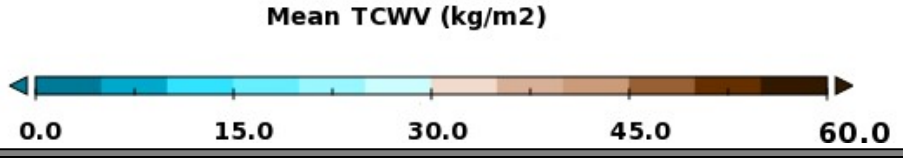


EXP-CTL



CTL





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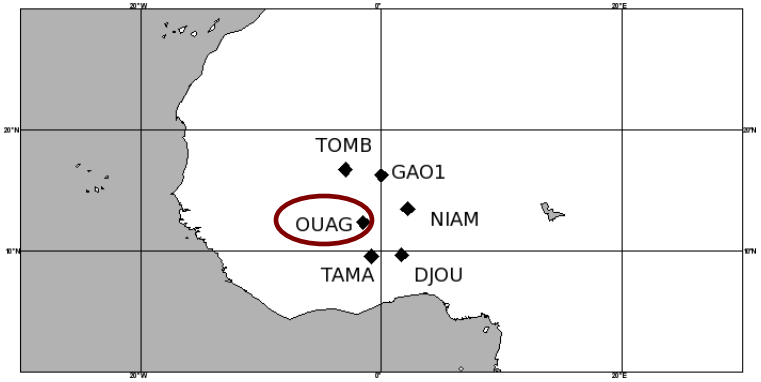
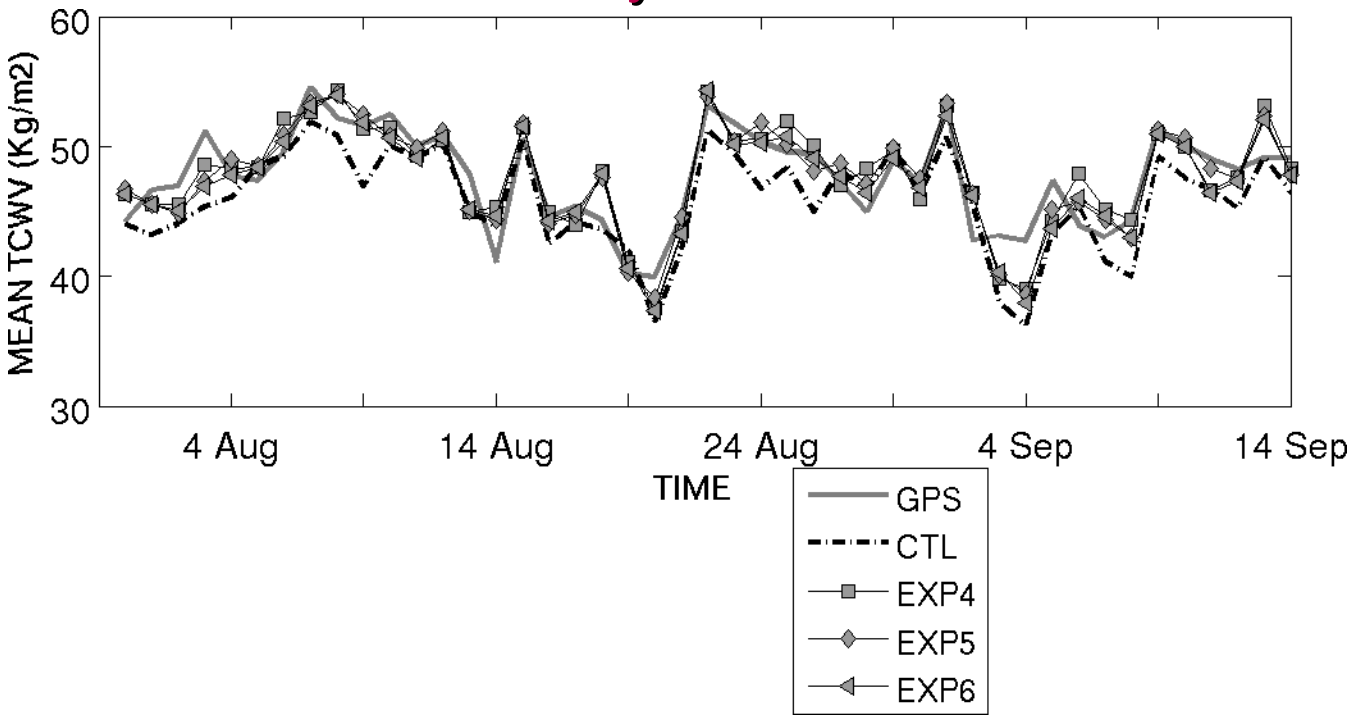


TCWV Daily time series at OUAG



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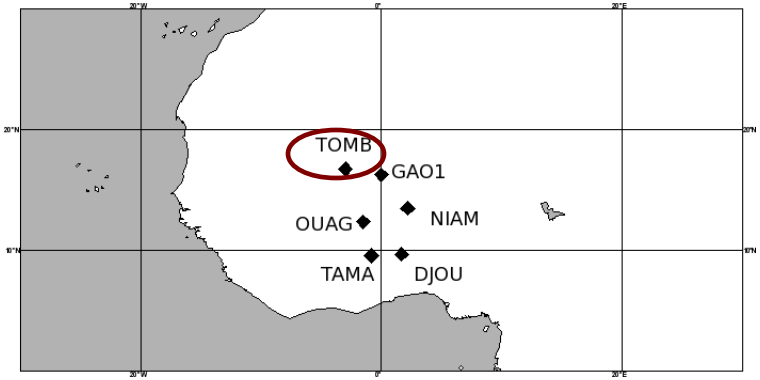
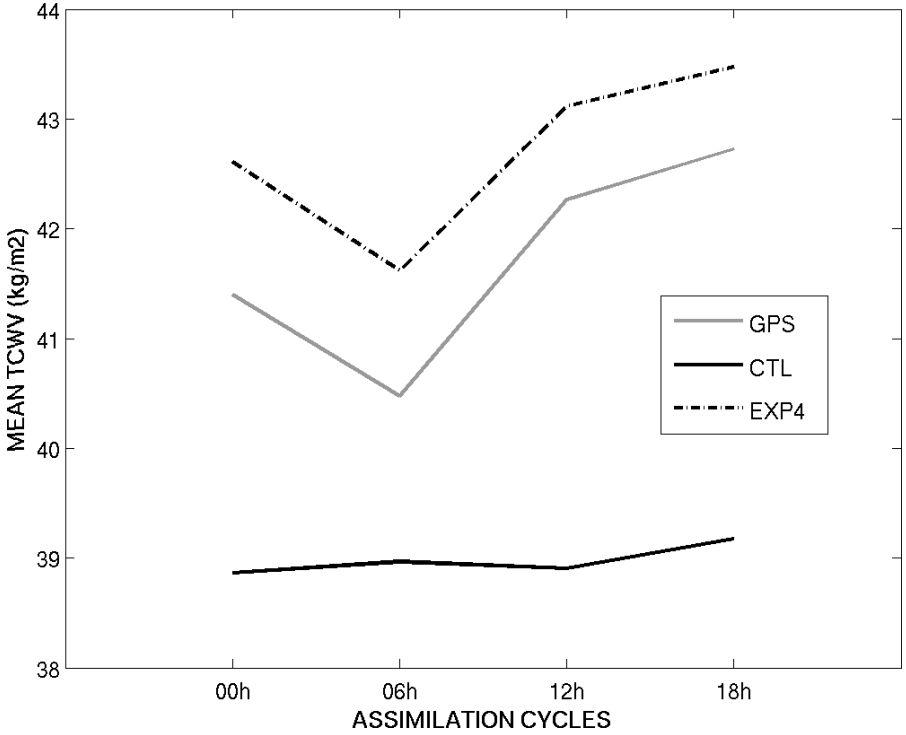


TCWV diurnal cycle at TOMB, 45 days



Conclusion & perspectives

• A good representation of land surface emissivity motivated assimilation studies to assimilate low level humidity & temperature observations (usually blacklisted)

• The assimilation of these channels:

- Positive impact in scores % radiosondes : all domains
- Positive impact in scores % ECMWF analysis (500hPa, 200hPa): all domains
- Large impact on humidity analysis (& temp., wind) over the Tropics: low to mid-levels
- TCWV Change evaluated against independent GPS measurements
- Change in OLR and rain forecasts in better agreement with independent data

• Emissivity is one issue but surface temperature is as important as emissivity (see E. Gerard's talk)

• More results in Karbou et al. 2009a-b (revised for Weather and Forecasting)

Conclusion & perspectives

• **Next steps:** More in depth studies to better understand the humidity change in the Tropics (in collaboration with P. Bauer (ECMWF)

Observation System Experiments (OSE): MERIS (TCWV) versus AMSU-B