Modelling the surface emissivity to assimilate SSMI/S observations over Land

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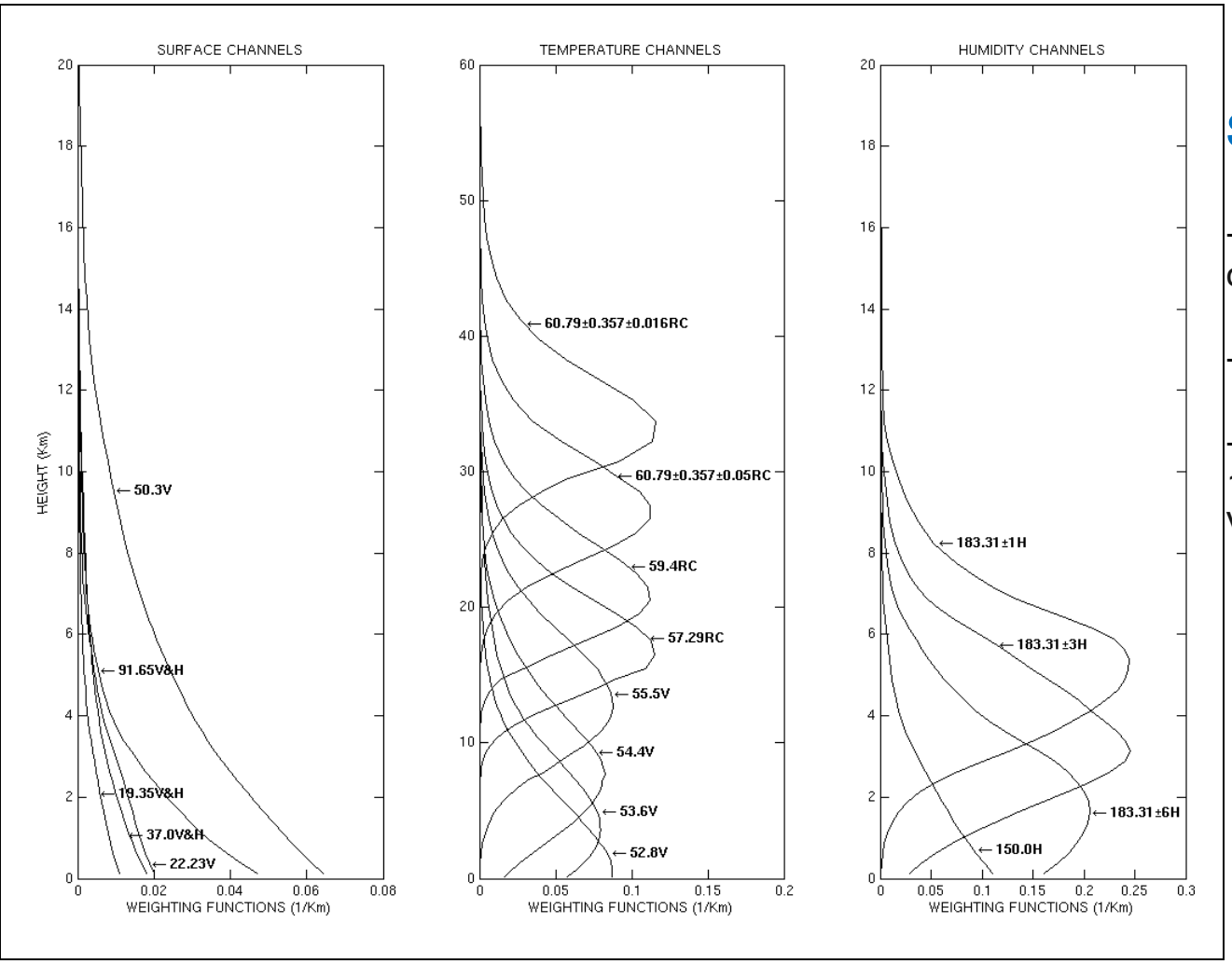
(1) SSMI/S observations

SSMI/S = AMSU-A + AMSU-B + SSM/I



SSMI/S:

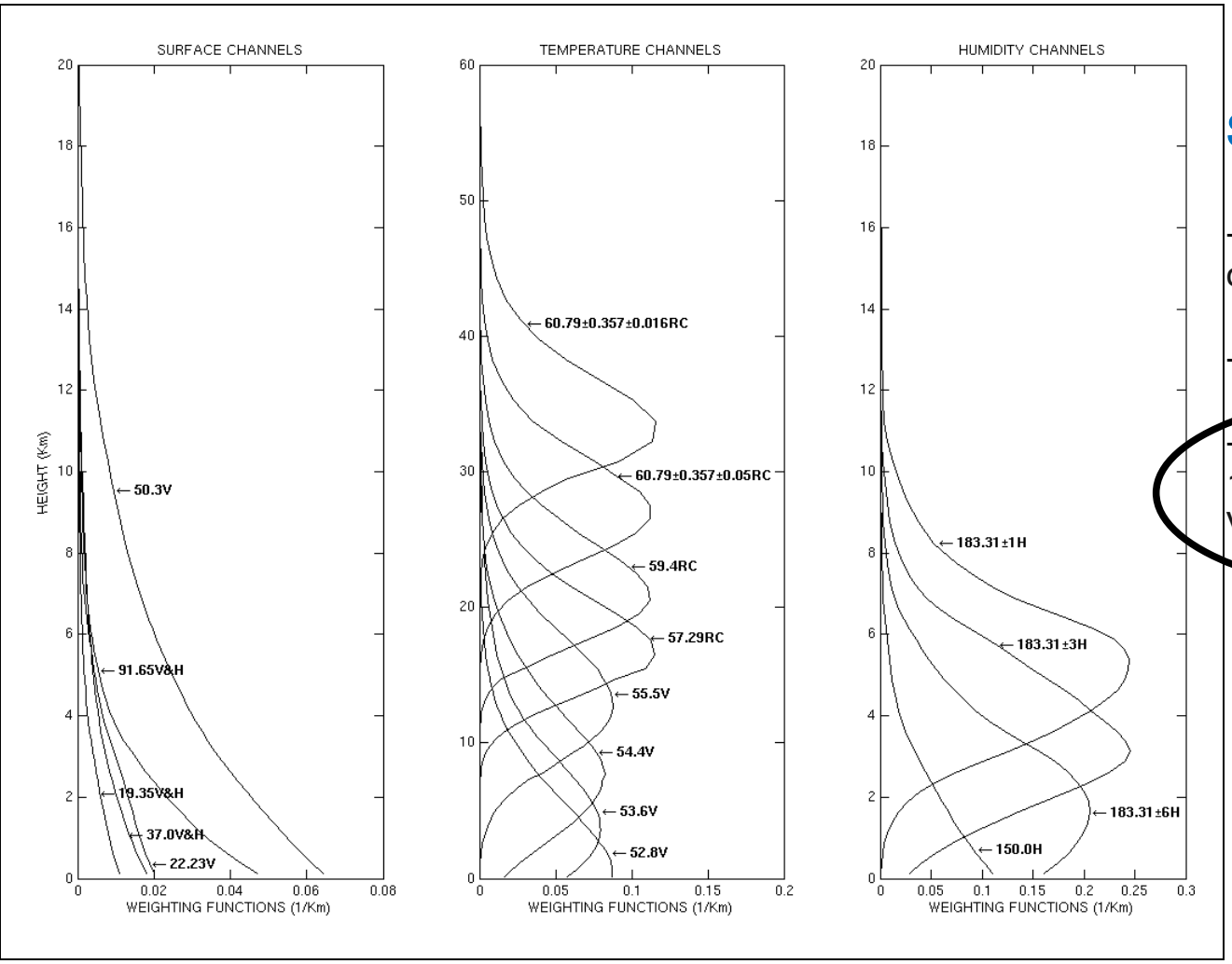
- conical scanning: fixed observation angle (53°)

- Polarisation: V and/or H

- Window channels:
19.35 V&H, 22.23 V, 37 V&H, 50.3 V, 91.65 V&H GHz

(1) SSMI/S observations

Current use of SSMI/S at Météo-France



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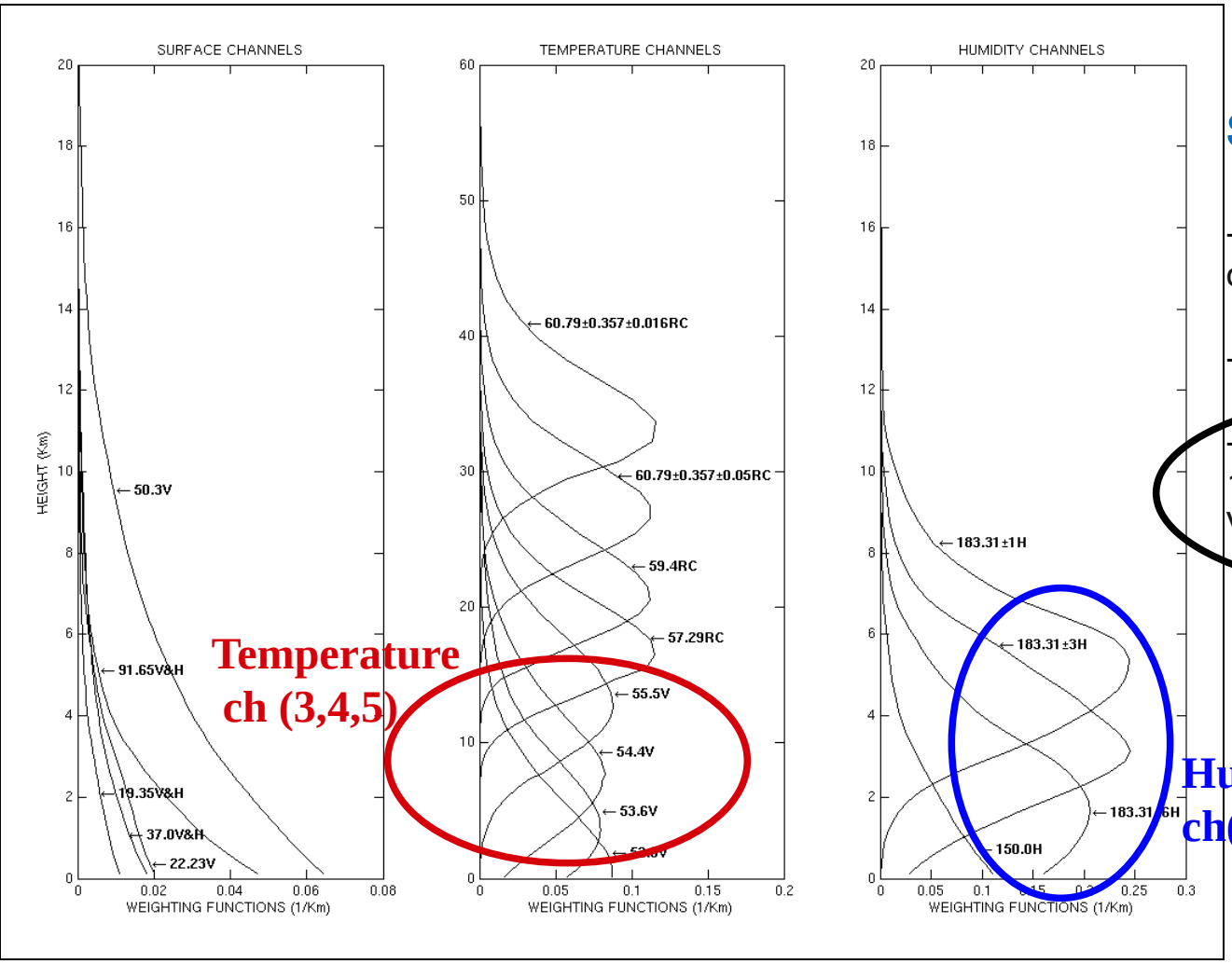
Over sea

(1) SSMI/S observations

Feasability studies to assimilate some SSMI/S sounding channels



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Over sea

(2) Emissivity issues for SSMI/S

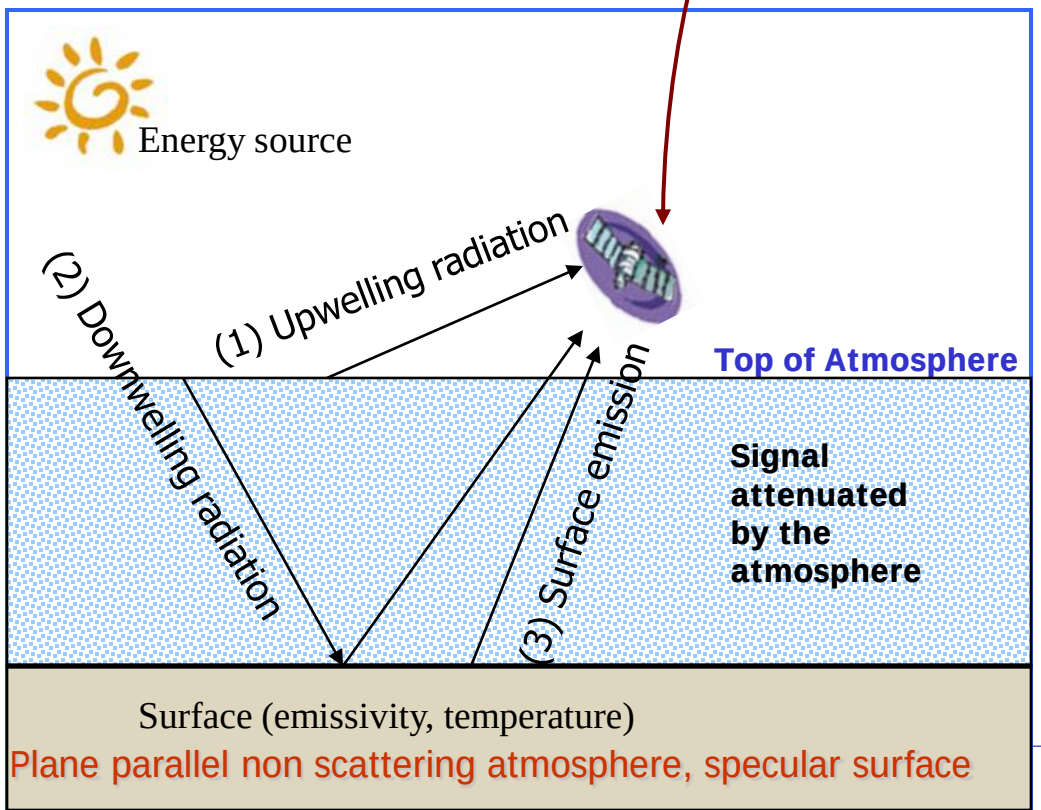
Sea: Fastem model (English, Hewison [1998], Deblonde, English [2000], Liu et al. [2010])

Land: Apply a similar method to that previously applied to AMSU measurements (Karbou et al. 2006)

> *Instantaneous emissivity retrieval at some selected channels as a guess for sounding channels*

(2) Emissivity issues for SSMI/S

$$T(p,\upsilon) = \varepsilon(p,\upsilon)\,T\,.\tau.+(1-\varepsilon(p,\upsilon)\;\tau.T(\upsilon,\downarrow)+T(\upsilon,\uparrow)$$



$$\varepsilon(p,\upsilon) = \frac{T(p,\upsilon) - T(\upsilon,\uparrow) - T(\upsilon,\downarrow)\times\tau}{\tau\times(Ts - T(\upsilon,\downarrow))}$$

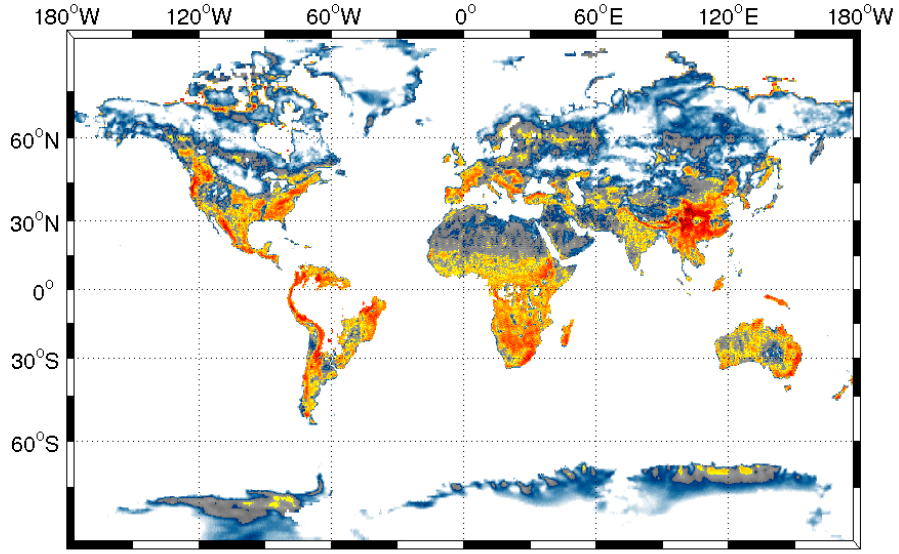
(3) Evaluation of emissivity retrievals

Emissivity retrievals at all SSMI/S window channels: 2 years of emissivity estimates

these data will soon be available on the CNRM emissivity webpage (http://www.cnrm.meteo.fr/spip.php?rubrique203&lang=fr)

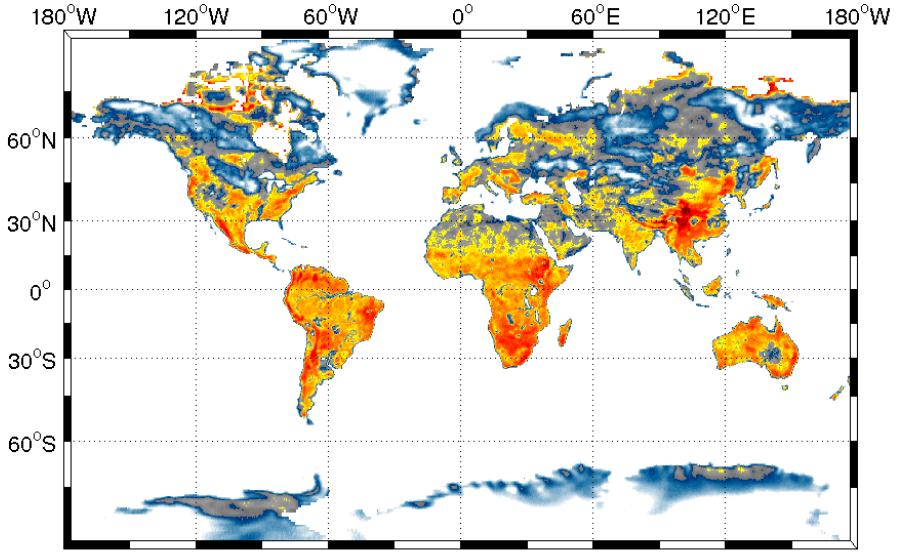
February 2010

SSMI/S, 37 GHz (V+H)/2



SSMIS 37 GHz, Feb2010

AMSU-A, 31 GHz



AMSU-A 31 GHz, Feb2010

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July 2010

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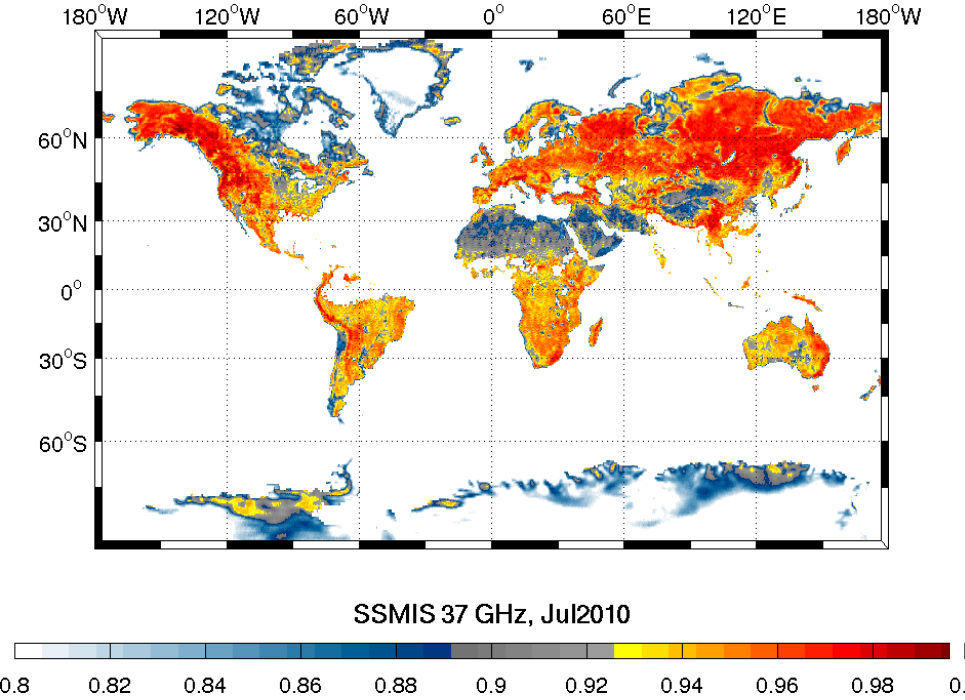
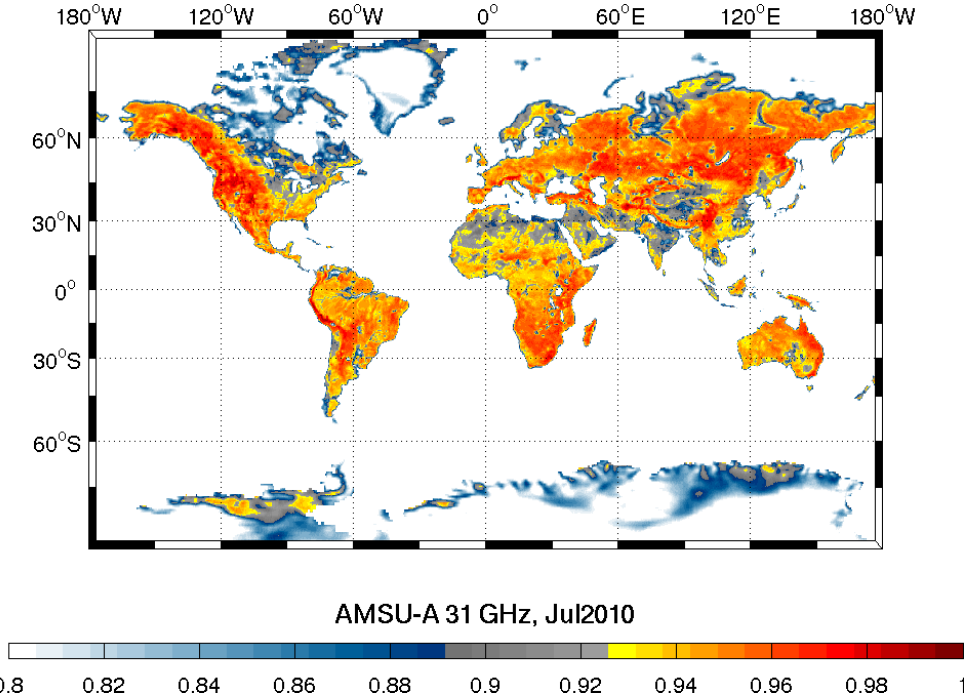


AMSU-A, 31 GHz



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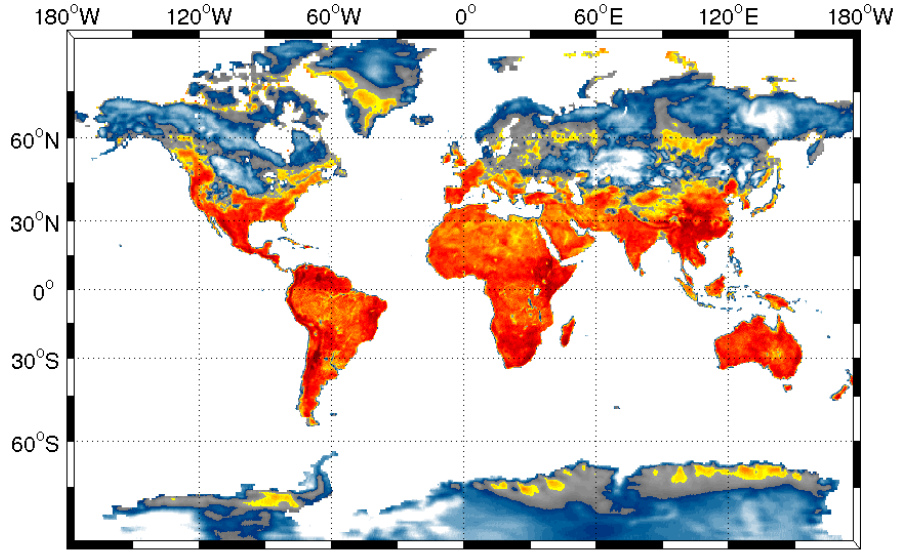
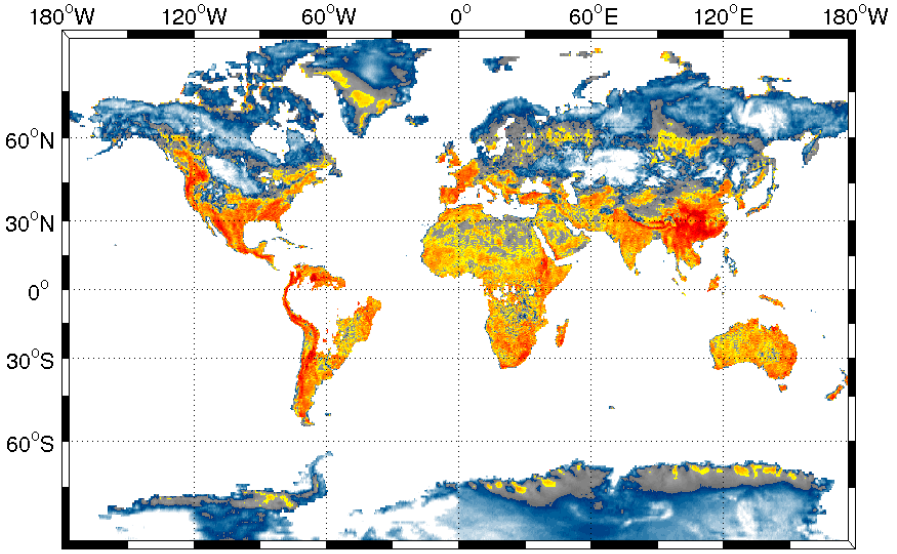
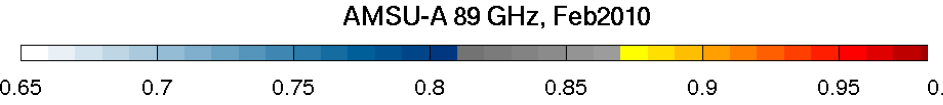
February 2010

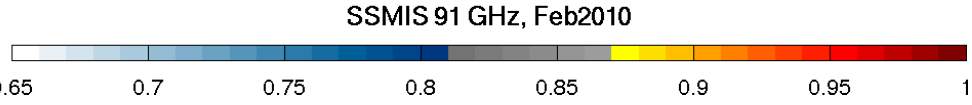
SSMI/S, 91 GHz (V+H)/2



AMSU-A, 89 GHz







(4) Assimilation experiments

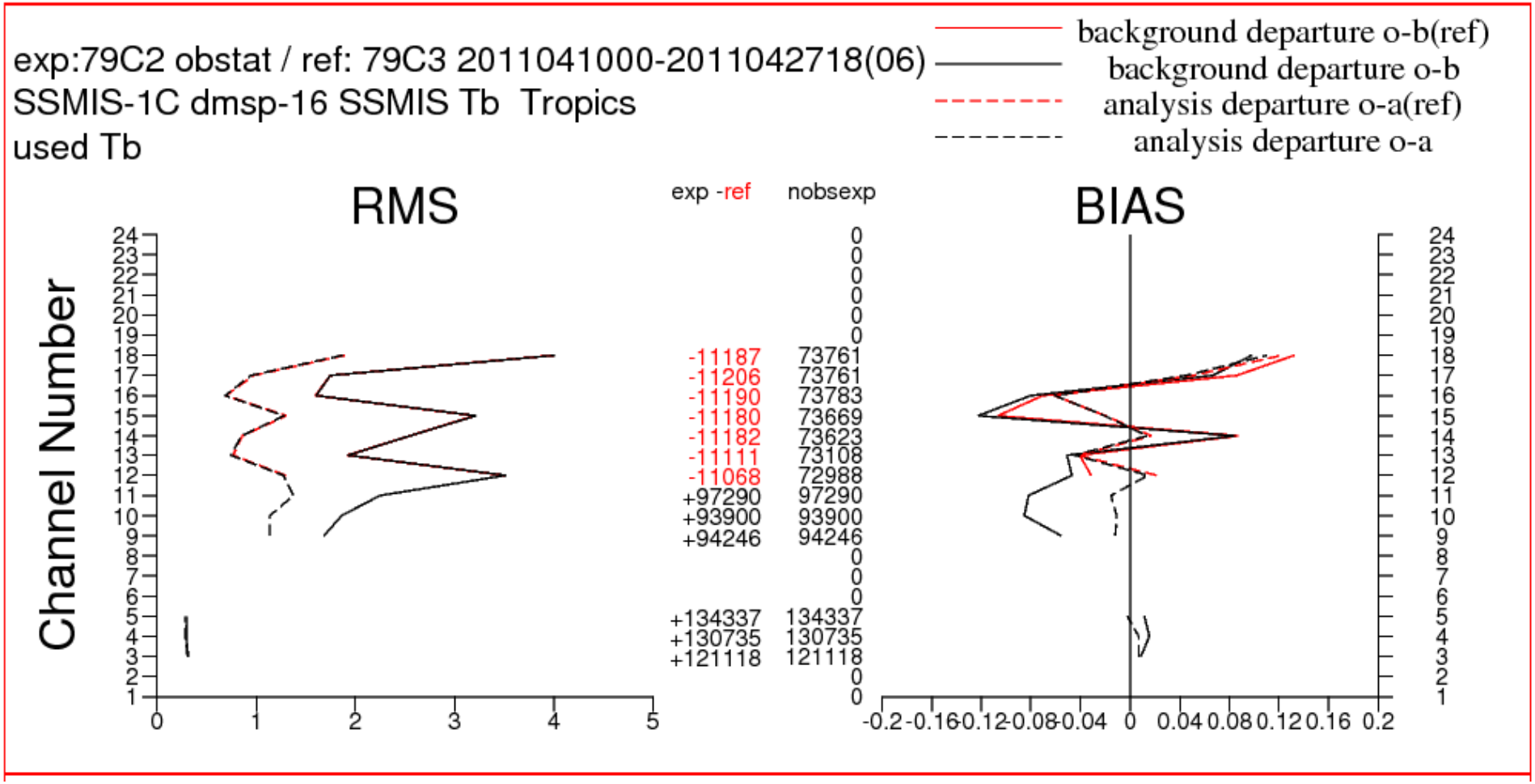
Emissivity (~183 GHz) = Emissivity at 91H GHz (ch18)
Emissivity (~54-60 GHz) = Emissivity at 50V GHz (ch1)

Data impact studies for evaluation:

- **Period: 01/04/2011 to 29/05/2011**
- **CTL: the current operational system**
- **EXP: CTL + assimilation of SSMIS channels 3-5 & 9-11 over sea and land**
- **Data from DMSP-16 and -17**
- **Quality control: SSMIS ch2 (52V, 0.7K) and SSMIS ch8 (150H, 2.7K)**
- **Obs error: 0.5K & 2K**

(4) Assimilation experiments

Fit to observations : SSMIS



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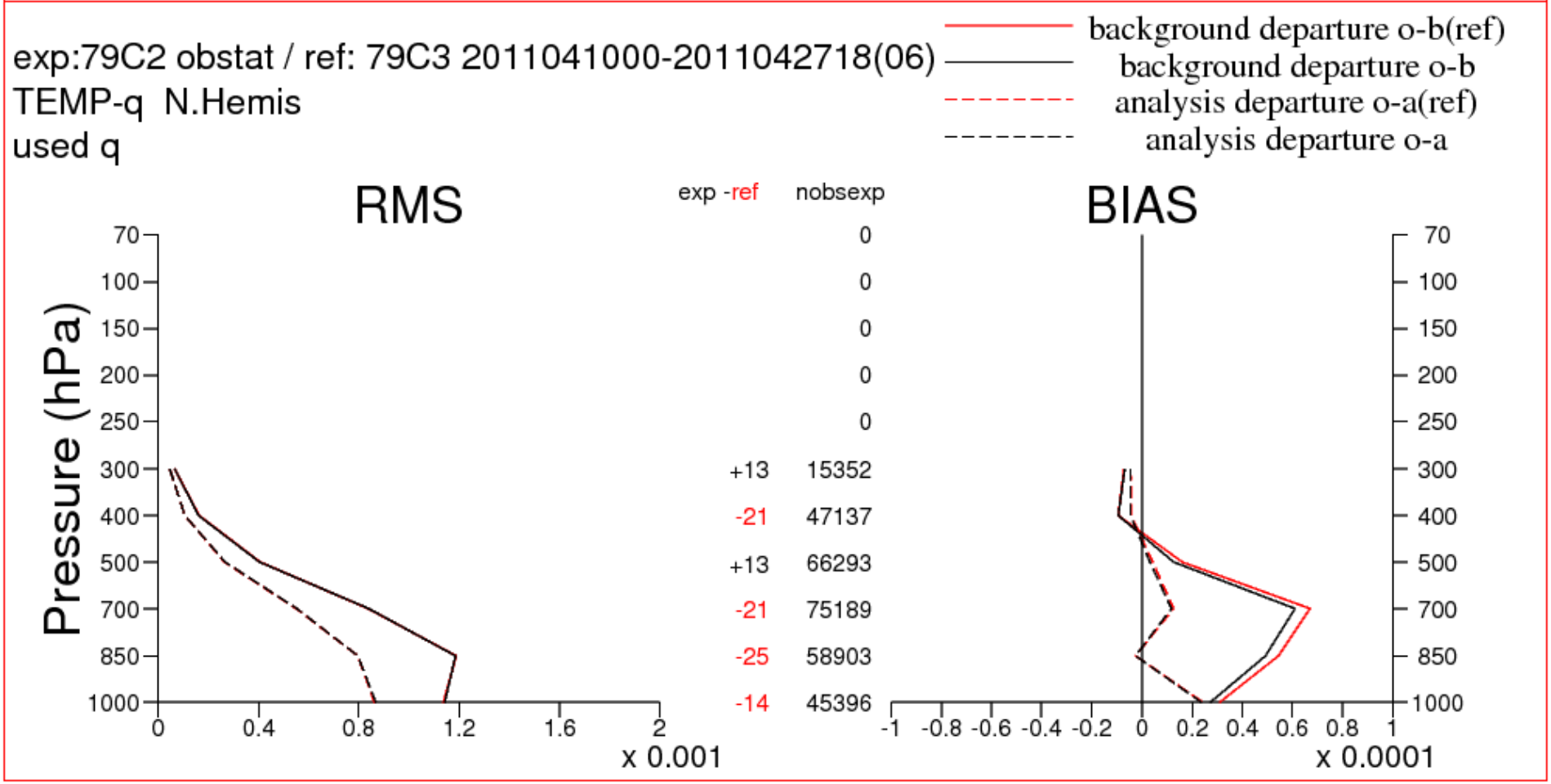
Fit to observations : Radiosondes



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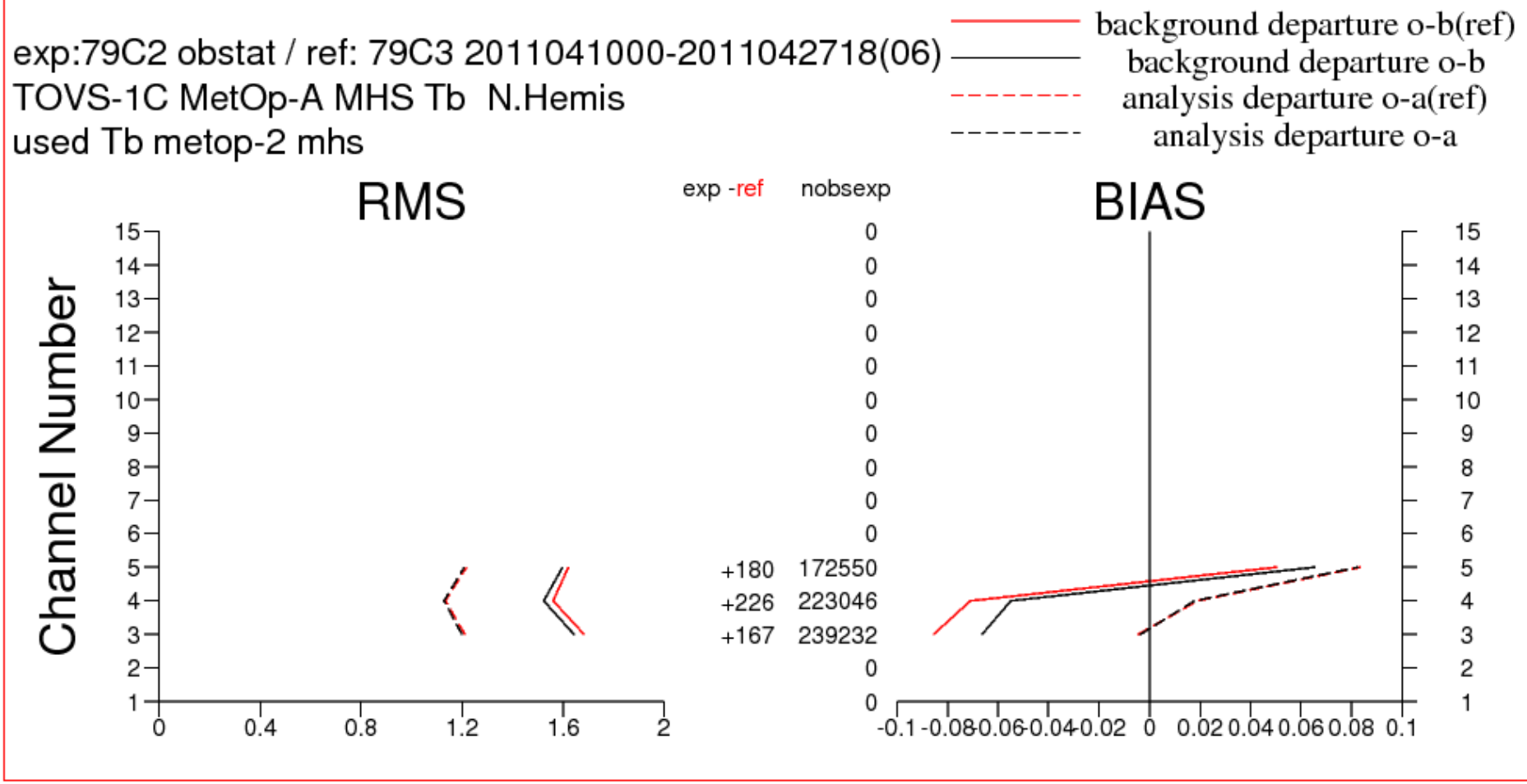
Fit to observations : AMSU-B/MHS



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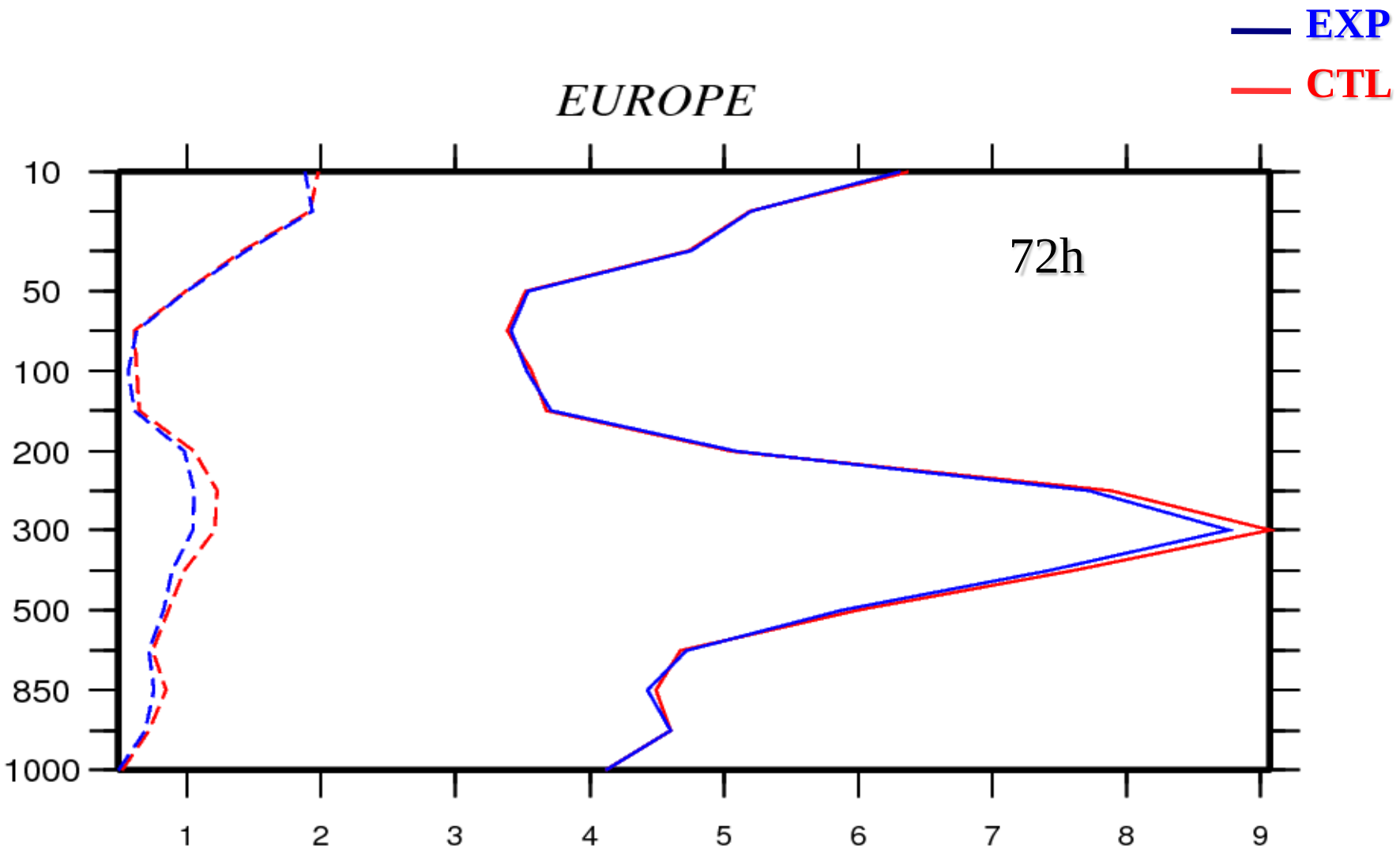
Forecast errors : Wind, 18 situations, target : radiosondes



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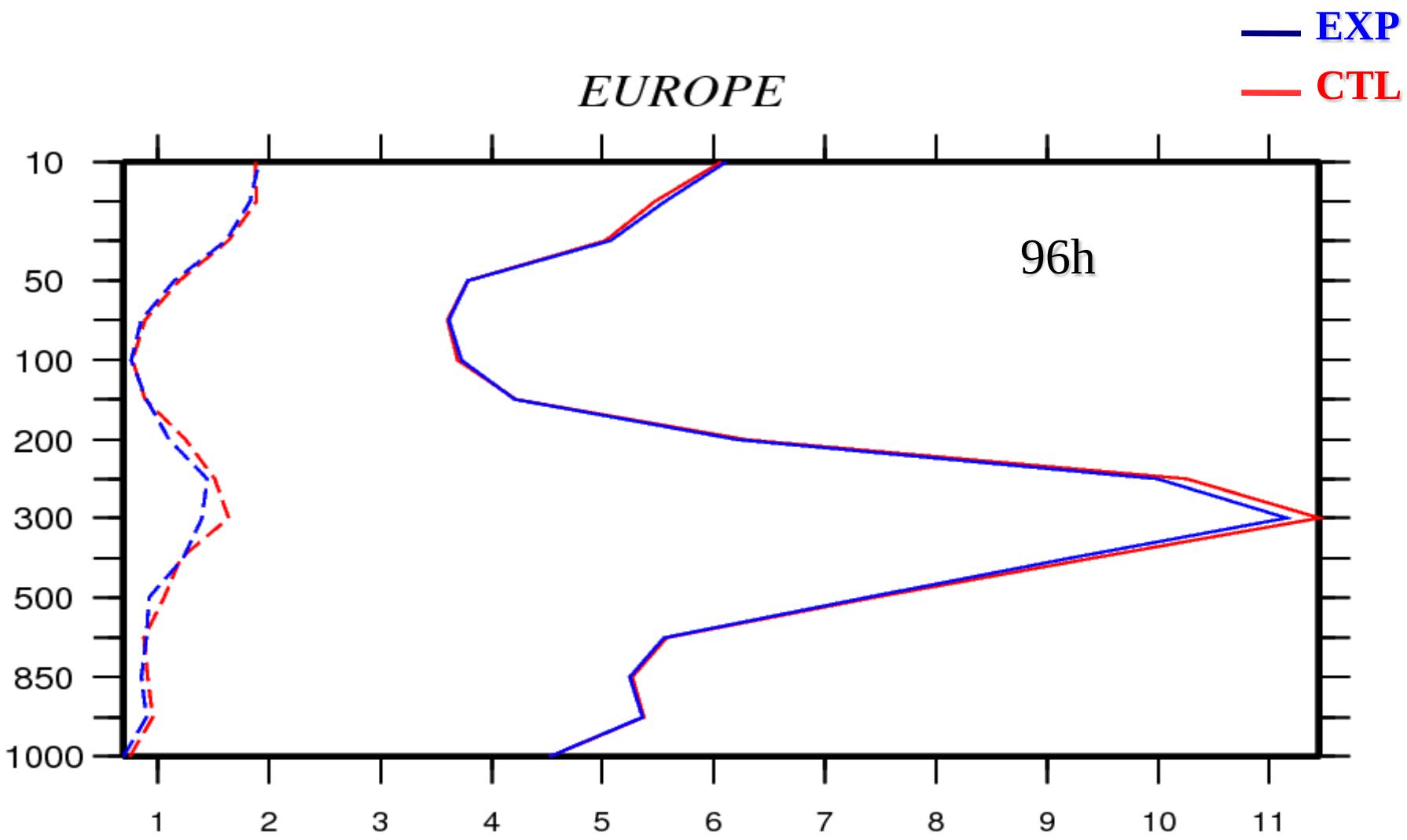

Conclusions

- Test the feasibility of assimilating some SSMIS channels over sea and land

- The land surface emissivity retrieved at SSMIS window channels are found in good agreement with AMSU estimates

- Preliminary results show that the assimilation of surface sensitive SSMI/S data is possible avec sea/land and brings positive impacts (fit to observations, forecast scores)

- Developments are ongoing:

- more in depth evaluation of the land surface emissivity over a longer period (day to day variability, target surfaces)
- Evaluate the contributions of T and H channels separately; idem for land/sea surface
- Evaluate the forecast scores over longer periods
- Bias correction