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

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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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- conical scanning: fixed observation angle (53°)
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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

Temperature ch (3,4,5)

Humidity ch(9,10,11)
(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

\[ T(p,\nu) = \varepsilon(p,\nu)T \cdot \tau + (1 - \varepsilon(p,\nu) \cdot \tau)T(\nu,\downarrow) + T(\nu,\uparrow) \]

\[ \varepsilon(p,\nu) = \frac{T(p,\nu) - T(\nu,\uparrow) - T(\nu,\downarrow) \times \tau}{\tau \times (T_s - T(\nu,\downarrow))} \]
(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

AMSU-A, 31 GHz

ITSC-18, Toulouse, March 2012
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July 2010

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

AMSU-A, 31 GHz

SSMIS 37 GHz, Jul2010

AMSU-A 31 GHz, Jul2010
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(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

exp:79C2 obstat / ref: 79C3 2011041000-2011042718(06)
SSMIS-1C dmsp-16 SSMIS Tb Tropics
used Tb

RMS

Channel Number

BIAS

exp - ref nobsexp

background departure o-b(ref)
background departure o-b
analysis departure o-a(ref)
analysis departure o-a
(4) Assimilation experiments

Fit to observations: Radiosondes

exp: 79C2 obst- ref: 79C3 2011041000-2011042718(06)
TEMP-q N.Hemis
used q

RMS

Bias

exp-ref nobsexp
0 0
0 0
0 0
0 0
+13 15352
-21 47137
+13 66293
-21 75189
-25 58903
-14 45396

x 0.001 1000 100 10
70 250 200 150 100 10 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1000 70

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(4) Assimilation experiments

Fit to observations: AMSU-B/MHS

exp: 79C2 obstat / ref: 79C3 2011041000-2011042718(06)
TOVS-1C MetOp-A MHS Tb N.Hemis
used Tb metop-2 mhs
(4) Assimilation experiments

Forecast errors: Wind, 18 situations, target: radiosondes

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**EUROPE**

72h

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ITSC-18, Toulouse, March 2012
(4) Assimilation experiments

Forecast errors: Wind, 18 situations, target: radiosondes

**EUROPE**

96h
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