

Status – IOMASA AMSU-A assimilation at met.no June 2005

WP 2.3 Prepare real-time assimilation WP 2.4 Validation of NWP assimilation

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Background - NWP assimilation activities (as before)



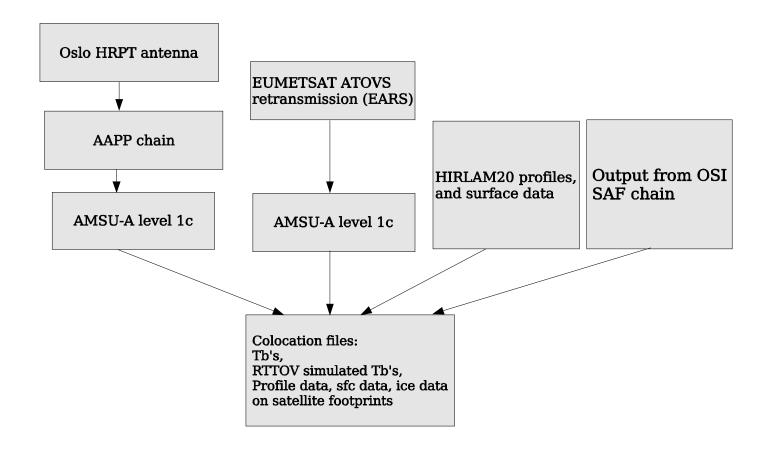
- Goal: Improve utilization of sounding data over the Arctic
- Arctic is a data sparse area higher potential for impact of satellite observations
- SMHI: AMSU-B moisture data,
- met.no: AMSU-A temperature data
- Improve use of lower tropospheric channels in RT forward model by ice surface emissivity modelling using prior ice information
- Set up HIRLAM 3D-VAR with a system for this. Perform impact studies.

Status - met.no



- HIRLAM 3D-Var has been adapted to use of AMSU-A brightness temperatures over sea ice
- Bugfixes, further tuning and impact studies ongoing
- 2 draft reports for deliverable 2.3 available: "AMSU-A assimilation over sea ice in HIRLAM 3D-Var – Impact studies for the period February-March 2005", Report on Quality Control methods

AMSU-A preprocessing and colocation chain (as before



New or modified elements of assimilation system



- Preprocessing
- Surface classification: determine ice/ocean/mixed
- Bias correction (bug fixed)
- Quality control, cloud contamination removal (new approach, short talk: Frank T.)
- Emissivities
- Bugfixes and tuning since last Project Meeting
- New impact studies performed
- Impact statistics for northern stations, case studies

Emissivities (as before)



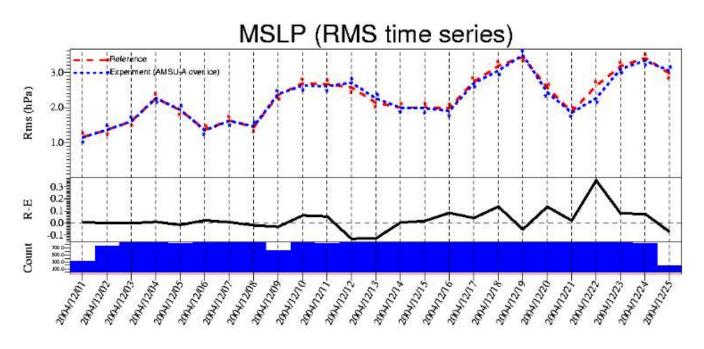
Initially: Use OSI SAF FY and MY ice concentrations with typical values of AMSU emissivities for these surfaces:

$$\varepsilon = c_W \varepsilon_W + c_F \varepsilon_F + c_M \varepsilon_M,$$

$$c_W + c_F + c_M = 1.$$

Previous verification results (old) -neutral





From 2004/12/01 (06:00:0	0.00 to 200	4/12/25 0	0:00:0.00							
Station name	Count	Rms (m-o)	Std (m-a)	Bias (m-o)	8Rms (m-o)	Station name	Count	Fims (m-o)	Std (m-o)	Bias (m-o)	ŏRms (m-o)
1010 Andoya	184	4.128	3.443	-2 273	0.022	1010 Andoya	184	4.148	3.487	-2.246	0.023
1028 Sprnoya	186	3.987	3.987	0.049	0.020	1001 Jan Mayen	186	3.978	3.929	-0.625	0.021
1025 Tromso-Langues	186	3.980	3.327	-2 186	0.020	1025 Tromso-Langnes	186	3.966	3.326	-2.161	0.021
1001 Jan Mayen	186	3.898	3.876	-0.421	0.019	1160 Skrova fyr	164	4.058	3.321	-2.332	0.019
1160 Skrova fyr	164	3.989	3.214	-2.363	0.018	16153 Capo Mele	186	3.625	2.697	2.422	0.015
103 Other stations	18136	2307	2 260	-0.461	-0.072	103 Other stations	18128	2.272	2.209	-0.532	-0.073
16470 Pantelleria	178	1.504	1 500	0.108	-0.006	16360 S. Maria di Leuca	184	1.525	1.505	0.246	-0.006
16360 S. Maria di Leuca	184	1.498	1 473	0.273	-0:007	7070 Reims	186	1.520	1.514	-0.129	-0.006
16480 Cozzo Spadaro	186	1.492	1.385	0.556	-0.007	16320 Brindiei	186	1.514	1.475	0.344	-0.006
16320 Brindiai	186	1.490	1.445	0.364	-0.007	16480 Cozzo Spadaro	186	1.496	1.401	0.525	-0.007
7130 Rennes	186	1.381	1.355	0.263	-0.007	7130 Rennes	186	1.369	1.334	-0.306	-0.007
113 stations in total	19962	2.379	2.332	-0.473	×	113 stations in total	19982	2.345	2 287	-0.520	×

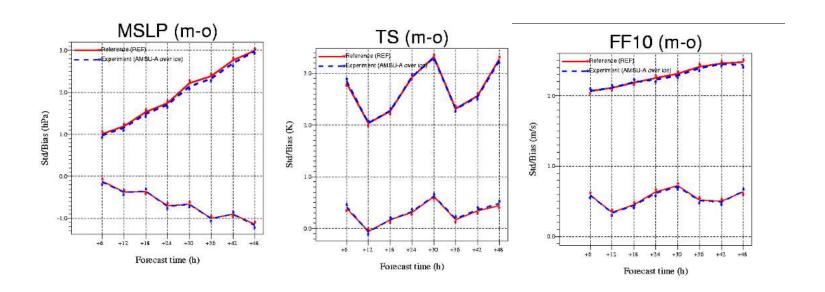
Experiment setup



- Period 8 February 31 March 2005
- "Reference": Uses all observations in operational run except QScat and AMSU-A over ocean
- "Experiment": AMSU-A over ice added
- 5 surface channels still only in "passive mode"

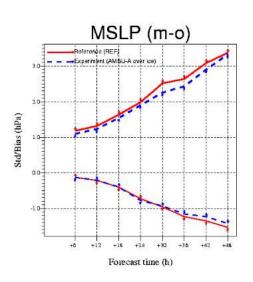


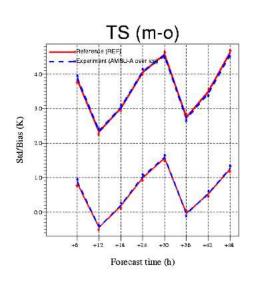
Verification against all EWGLAM stations

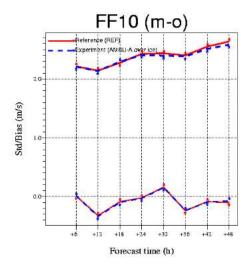




Verification against northern EWGLAM stations

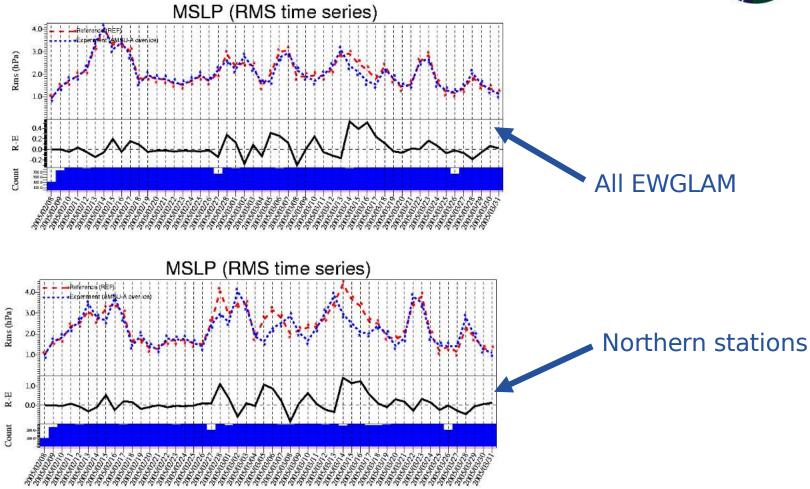






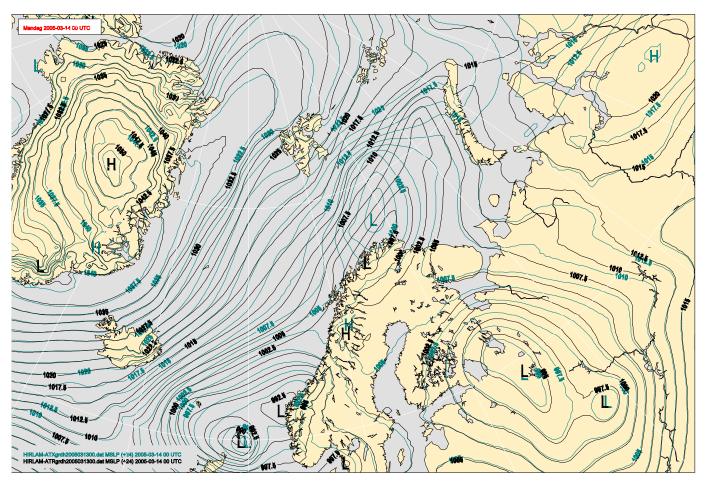
Timeseries, pressure verification





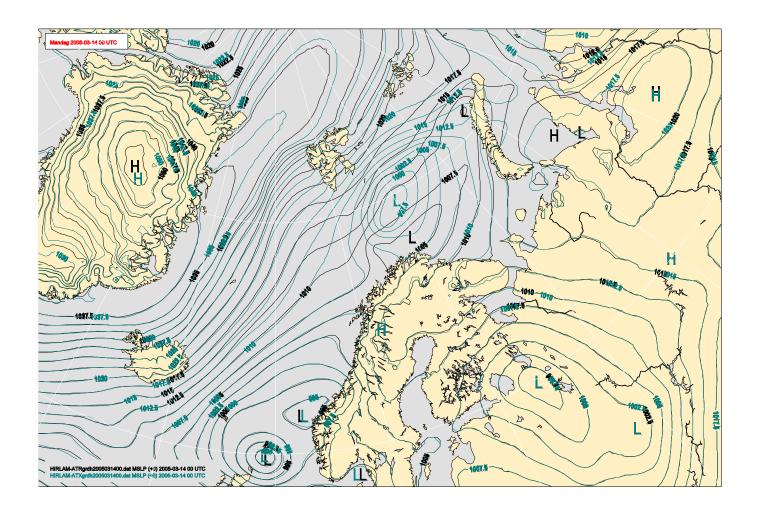
Case study 14 March 2005 00Z (+24hrs)





Case study 14 March 2005 (ana)





Case study 14 March 2005, ana+obs HIRLAM-ATRgrdh2005031400.dat MSLP (+0) 2005-03-14 00 UTC HIRLAM-ATXgrdh2005031400.dat MSLP (+0) 2005-03-14 00 UTC SYNOP DRIBU 2005-03-14 00:00 (22:30 - 01:30)

Poster presentation at ITSC-14 in Beijing





Vibeke W. Thyness, Harald Schyberg, Frank T. Tveter (Norwegian Meteorological Institute / met.no)
Leif Toudol Pedersen (Technical University of Denmark / DTU)

Introduction

In the IOMASA (Integrated Observing and Modeling of the Audio Sea ice and Afmosohere) project Norwegian Meteodologica Institute (rest no) and partners develop methods for assimilating AMSU-A brightness temperatures over sea les euroteces in HRILAM 3C-Var.

The scalidly of conventional observations over the Actor makes observations for satisfies, and in particular to an ordering relationary from the AMBUA historiance. If an accordance to the process of th

This poster presents recent developments in six we emissively estimation and some results from a parallel experiment in which AMSUA radiances over see lice is assimilated by the HIRLAM 20 model at metion.

Operational set-up and data flow





Brightness Temperatures using the HIRLAM model profiles and the corresponding observed values, and are used for quality control of the observations and be emissivity calculations.

PARTICIPATION NAME OF THE PARTY NAME OF THE PART It is necessary to ensure that the observations are

It is repressary to ensure that the observations are unconfaminated by clouds, as a beasured by RTTOV7, and to bring the observation error characteristics close to Sourchin, as is assumed by the assimilation system. As a first approach, each AMSU-A bean is assigned a mactrum and rim mum value for the departure between observed and colourable digitaries temperature. The thresholds are counted to publicative impression of a long number of colourable coheractions from a first properties.

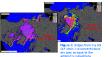


Surface Emissivity of Sea Ice

As an initial approach we let the emissivity depend on daily retrevals of multi-year and first-year ses too corresponding from the Ocean are dash let Satellite Application Pacifity of EUMETSAT (CGI SAY). Andto sea the retrevals on a 10 km grid, backd maily on 88W size exhibited daily, and how activities in extending the contention of the processing of of

 $C = C_0 C_1 + C_4 C_4$

The micdelled emissivities are used by the RTTOV7 forward model to calculate radiances from the HIRLAM model profiles. Figure 4 shows the effect of using modelec emissivities compared to running RTTOV7 with a fixed value of s = 1.



An investigation of the fit between observations and brightness temperatures modelled with these sensistivities is organing. In the near future we expect to improve the similar of calculations and also take into account strongsheric vector vegous and temperature profiles, incidence angle capandance will also be included in the entractivity model.



Empirical determination of FY and MY loe emissiviti

We use aimplified theory for increases radiative transfer, where the main assumptions are that inhall attended the attended to the attended to the attended to the attended to an absorption one fident and an effective atmospheric temperature 1, in the water vopour total is in minal so the main contribution to the absorption is from outgoin.

Then the surface emissivity can be estimated from th

- $T_b = \alpha T_c = (1 \alpha)\alpha T_c = T_w(1 \alpha)^2$ $T_{\nu}(1-\alpha) - \alpha T_{\nu}(1-\alpha) - T_{\nu\nu}(1-\alpha)^2$
- where the absorption coefficient σ is defined as: $\sigma = \frac{T_{\mu_i} T_{\mu_i}}{T_{\alpha} T_{\alpha}}$

Conclusion and future work

Saxilite observations are the main source of observation information in MAP over the ice covered Arctic regions. Immoving methods for using the information helps improve the initial state of the HIRLAM NWP model, and is expected to be beneficial for foregating with Europe.

A surface missivity estimator of some accuracy is most important for the lower channels, but it inclinedly affocts all channels through the cloud check on the collegance class. Jav one and rularing triply referred red cloud mass on the AMSULA data, it is important from the tries notes for the process error closer case ast in an agrinish way, and this is dependent of a good emission, which inclined the accordance of the three clouds.

Contact: Vibeke W. Thyness, Norwesian Meteorological Institute,

The Control run (REF) is a version of HRLAM 20 without any assimilation of AMSU-A o

The verification is performed against the EWLGAM observation station set over Europe. The virtualistic is periorities against an Exercise of better a slightly positive impact or the 48-hour forecast in the test period of Pibburs y art disach 2006. Continued work is going on to trust the model and improve bias correction and glosse error directs.



This confi has been done at least for the CU Infib Transveck hogomers-project KMSA, Intervised Disserving and Modeling or the Arctic bea for all Amorphane, young transfer NOT-1998-10154.

**Homophane, young transfer NOT-1998-10154.

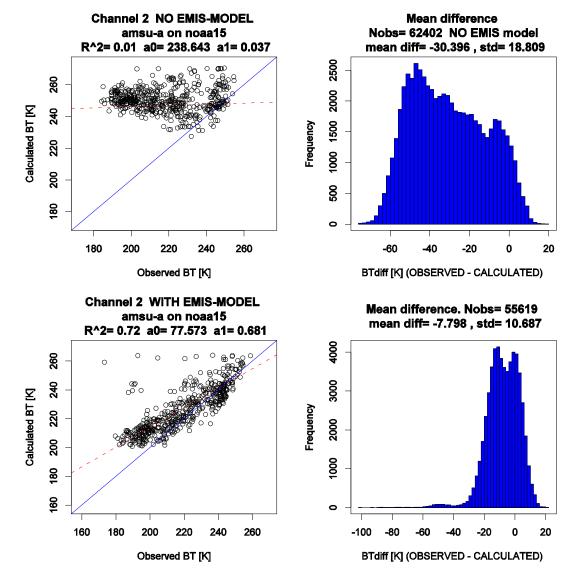


Emissivity values from Toudal

First year ice	Multi year ice			
0.971	0.874			
0.970	0.829			
0.928	0.796			
0.928	0.796			
0.928	0.796			
0.928	0.796			
0.928	0.796			
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0.928	0.796			
0.913	0.744			
	0.970 0.928 0.928 0.928 0.928 0.928 0.928 0.928 0.928 0.928 0.928 0.928 0.928			

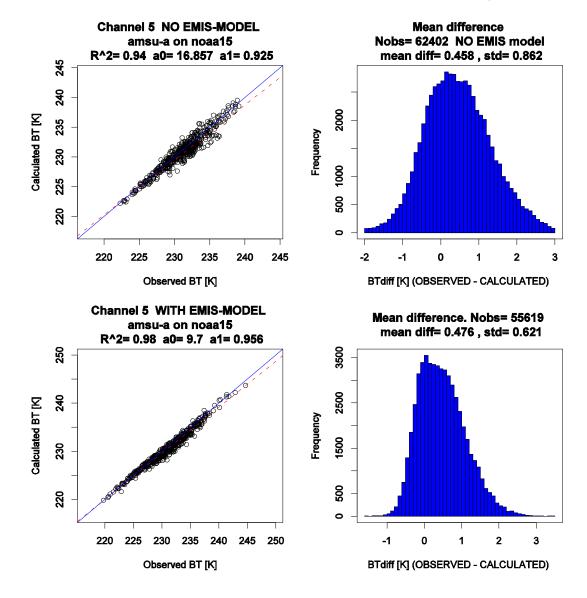
Comparison with constant emissivity, channel 2





Comparison with constant emissivity, channel 5





Possble further developments on emissivities



- Further tuning and adjustment of emissivities using background departure statistics
- Add regional/seasonal dependence to pure FY and MY AMSU emissivities? U. Bremen dataset? Others?
- Emissivity in control variable?
- Feedback of obs departures?
- Correlations of emissivities between channels?
- Other ideas?

Summary, further work



- Data assimilation system prepared technically, impact studies show positive impact
- Channels with surface contribution to be included
- Tuning of QC and obs error statistics to be continued
- Further refinements of emissivity formulation
- New impact studies to be performed as the system is modified