Norwegian
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Status – IOMASA AMSU-A assimilation at met.no
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WP 2.2 Improve high-resolution Arctic NWP

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Background - NWP assimilation activities

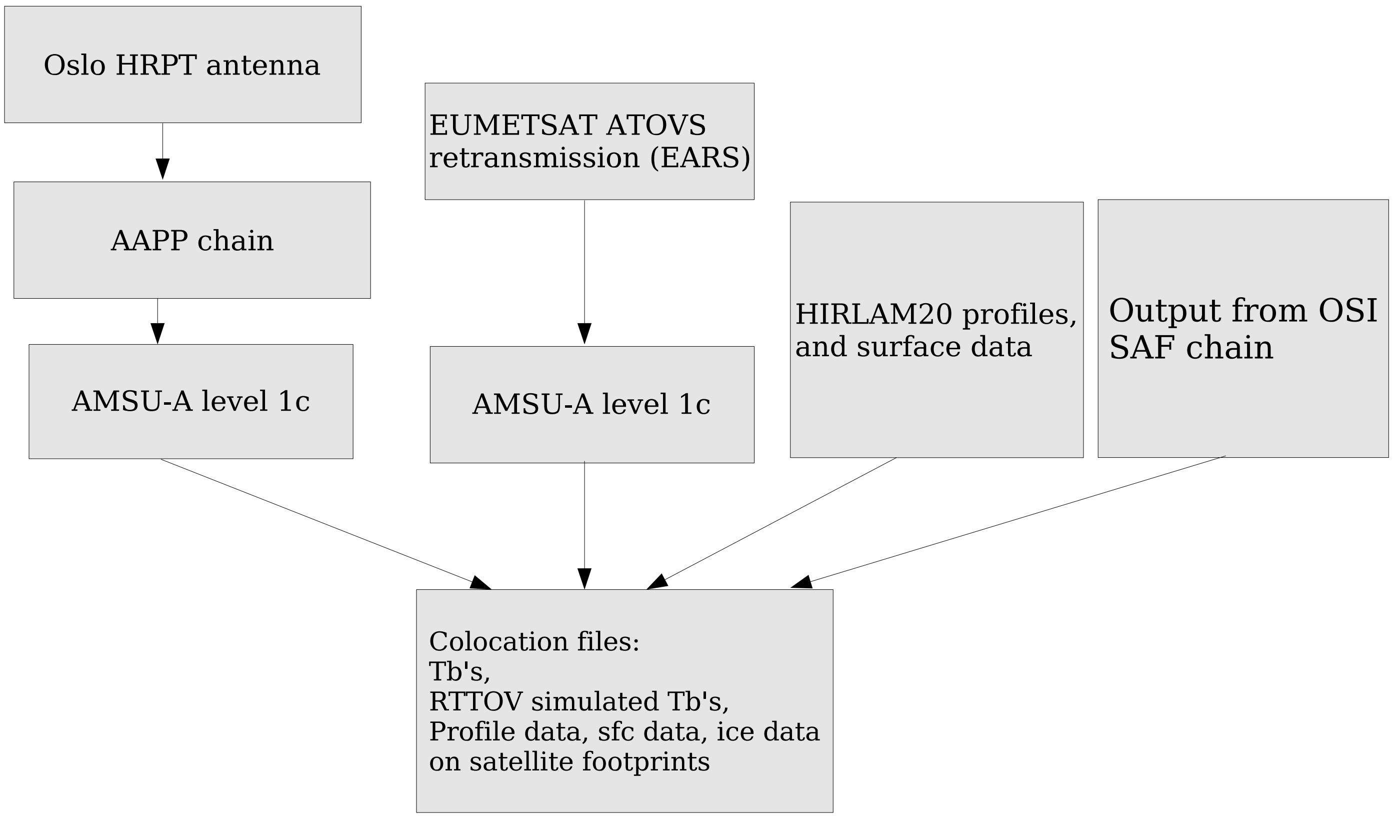
- Goal: Improve utilization of sounding data over the Arctic
- Arctic is a data sparse area - higher potential for impact of satellite observations
- SMHI: AMSU-B moisture data,
- met.no: AMSU-A temperature data
- Improve use of lower tropospheric channels in RT forward model by ice surface emissivity 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
- Tuning and impact studies ongoing

- Draft reports for deliverables 2.2.2 and 2.2.3 available:
  ”Assimilating AMSU-A over sea ice in HIRLAM 3D-Var – Initial method and some results”,
  ”Ice concentration input for assimilation of AMSU-A in HIRLAM 3D-Var”

AMSU-A preprocessing and colocation chain



New or modified elements of assimilation system

- Preprocessing
- Surface classification: determine ice/ocean/mixed
- Bias correction
- Quality control, cloud contamination removal
- Emissivities

Emissivities

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

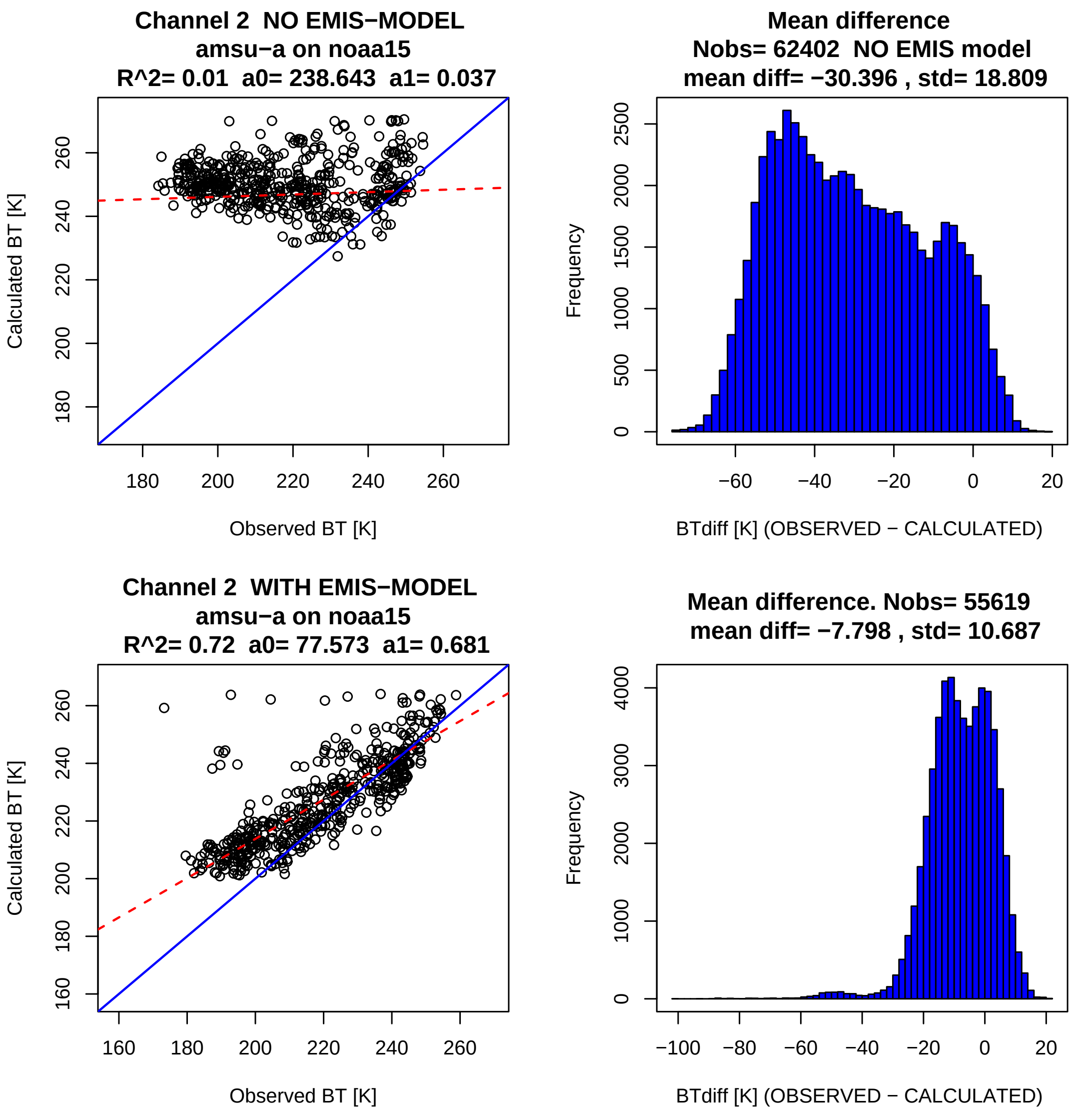
$$\varepsilon = c_W \varepsilon_W + c_F \varepsilon_F + c_M \varepsilon_M,$$

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

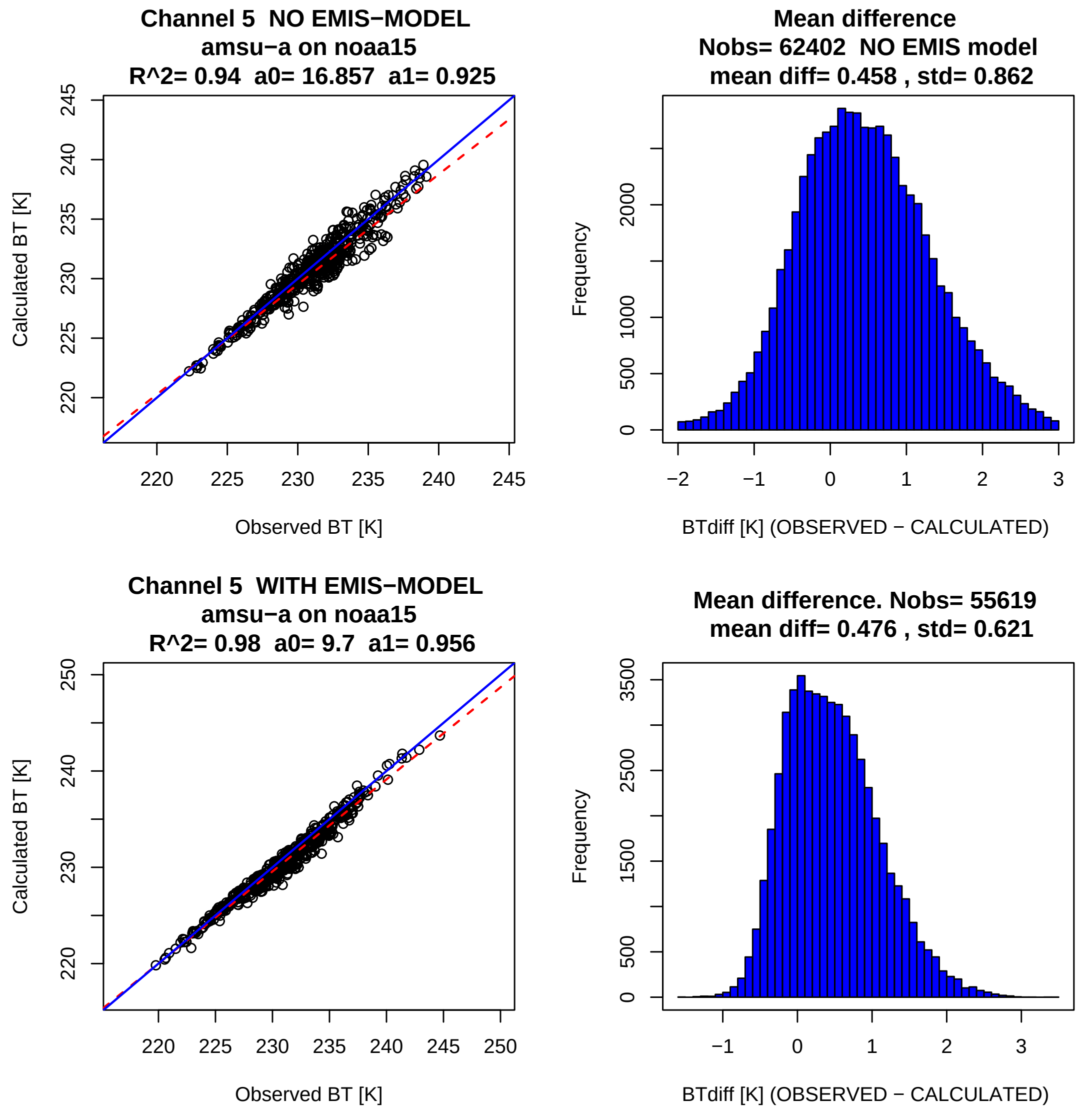
Emissivity values from Toudal

AMSU-A channel	First year ice	Multi year ice
1	0.971	0.874
2	0.970	0.829
3	0.928	0.796
4	0.928	0.796
5	0.928	0.796
6	0.928	0.796
7	0.928	0.796
8	0.928	0.796
9	0.928	0.796
10	0.928	0.796
11	0.928	0.796
12	0.928	0.796
13	0.928	0.796
14	0.928	0.796
15	0.913	0.744

Comparison with constant emissivity, channel 2



Comparison with constant emissivity, channel 5



Possble further developments on emissivities

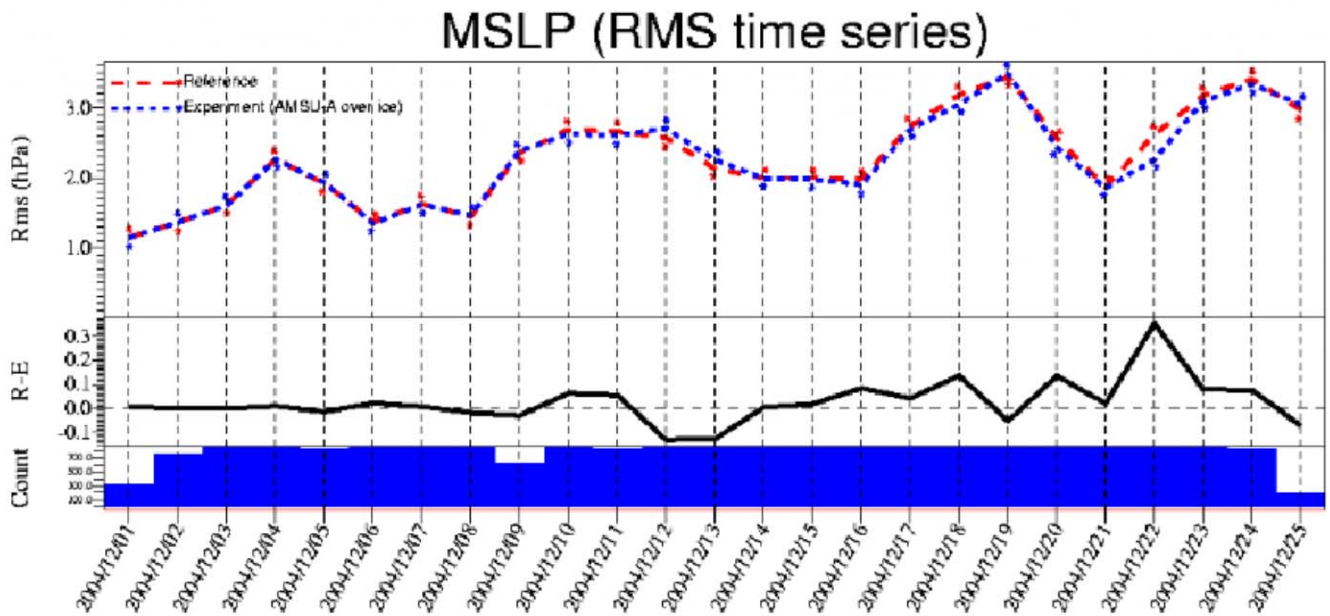
- Further tuning and adjustment of emissivities using background departure statistics
- Add regional/seasonal dependence to pure FY and MY AMSU emissivities? U. Bremen dataset? Others?
- Emissivity in control variable?
- Feedback of obs departures?
- Correlations of emissivities between channels?
- Other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

Assimilation experiments at met.no

First experiments:

- Establish reference with use of upper AMSU-A channels only, therefore emissivity set to one initially (including lower channels will be compared to this reference later)
- Allows also passive monitoring of lower channels
- Provides statistics for tuning of QC, bias correction, obs error statistics, testing of emissivity formulations, channel selection etc
- First run: December 2004, now also later period (more details from Vibeke)
- Verification statistics produced: Ref with no AMSU vs Exp with upper channels over sea ice, verified against observations (EWGLAM)

Example – verification results



From 2004/12/01 06:00: 0.00 to 2004/12/25 00:00: 0.00

Station name	Count	Rms (m-o)	Std (m-o)	Bias (m-o)	δRms (m-o)
1010 Andoya	184	4.126	3.443	-2.273	0.022
1028 Bjornoya	186	3.987	3.987	0.049	0.020
1025 Tromso-Langnes	186	3.960	3.327	-2.186	0.020
1001 Jan Mayen	186	3.898	3.876	-0.421	0.019
1160 Skrova fyr	164	3.989	3.214	-2.363	0.018
103 Other stations	18136	2.307	2.260	-0.461	-0.072
16470 Pantelleria	178	1.504	1.500	0.108	-0.006
16360 S. Maria di Leuca	184	1.498	1.473	0.273	-0.007
16480 Cozzo Spadaro	186	1.492	1.385	0.556	-0.007
16320 Brindisi	186	1.490	1.445	0.364	-0.007
7130 Rennes	186	1.381	1.355	-0.263	-0.007
113 stations in total	19962	2.379	2.332	-0.473	[illegible]

Station name	Count	Rms (m-o)	Std (m-o)	Bias (m-o)	δRms (m-o)
1010 Andoya	184	4.148	3.487	-2.246	0.023
1001 Jan Mayen	186	3.978	3.929	-0.625	0.021
1025 Tromso-Langnes	186	3.966	3.326	-2.161	0.021
1160 Skrova fyr	164	4.058	3.321	-2.332	0.019
16153 Capo Mele	186	3.625	2.697	2.422	0.015
103 Other stations	18128	2.272	2.209	-0.532	-0.073
16360 S. Maria di Leuca	184	1.525	1.505	0.246	-0.006
7070 Reims	186	1.520	1.514	-0.129	-0.006
16320 Brindisi	186	1.514	1.475	0.344	-0.006
16480 Cozzo Spadaro	186	1.496	1.401	0.525	-0.007
7130 Rennes	186	1.369	1.334	-0.306	-0.007
113 stations in total	19962	2.345	2.287	-0.520	[illegible]

Summary, further work

- Data assimilation system prepared technically, and first impact studies have been performed
- 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
- Results from will be presented at the ITSC-14 conference in Beijing 25-31 May 2005