



Norwegian  
Meteorological  
Institute



# HIRLAM upper-air data assimilation

Roger Randriamampianina  
with contribution of HIRLAM colleagues

LACE WD, 2018, Bucharest

# outline



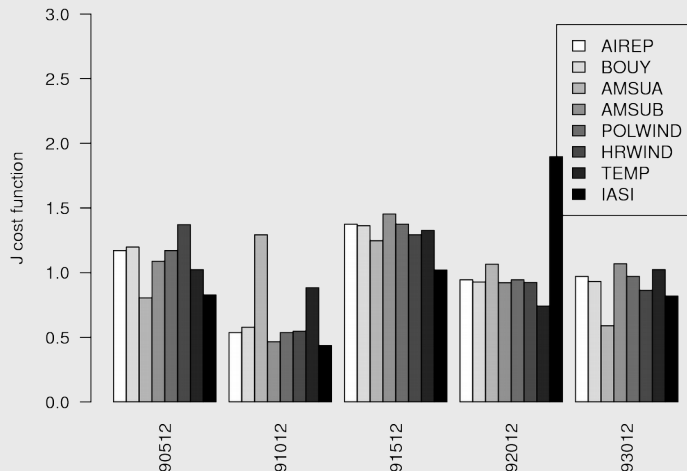
- Operational upper air data assimilation (UA-DA) systems in HIRLAM;
- Some reported issues with operational DA;
- Some development works related to UA-DA;

# Operational upper air data assimilation (UA-DA) systems



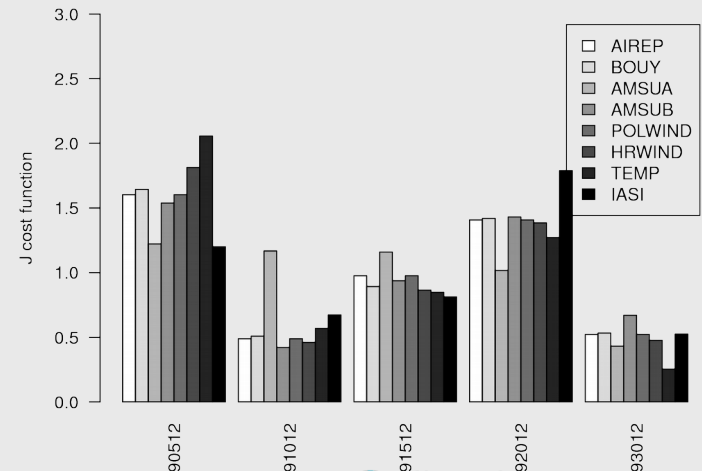
- **Assimilation scheme:** 3D-VAR;
- **Cycling Strategy:** 3 hourly;
- **Conventional observations:** SYNOP, SHIP, BUOY, AMDAR, AIREP, ACARS, ModeS EHS, Pilots, TEMP;
- **Satellite radiances:** AMSU-A, AMSU-B/MHS, ATMS, IASI;
- **Satellite retrievals:** Scatterometer, GNSS ZTD, GPS RO, **AMV**;
- **Radar observations:** Reflectivity;
- **Bias correction scheme:** Variational (VarBC).

Normalized variability of the cost function over different dates  
Forecast: 6 hours, Total Norm



Experiment run with AROME-MetCoOp  
Sensitivity of the forecast model to different observations

Normalised variability of the cost function over different dates  
Forecast: 48 hours, Total Norm



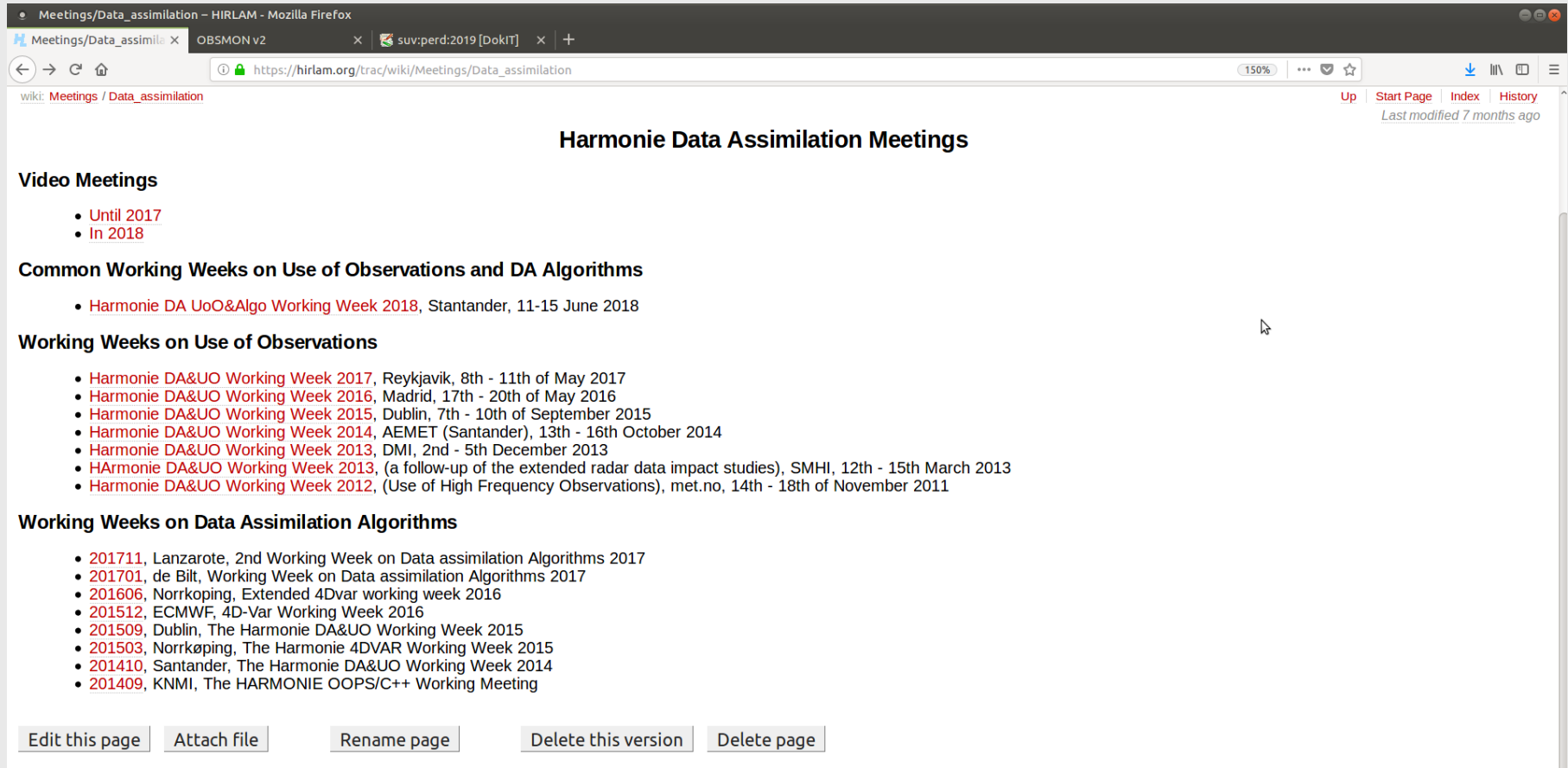
# Last time I had this Outlook – Just few of them ...

- Continue the local implementation of more observations ...;
- Testing with 1-h cycling and Rapid refresh, overlapping windows;
- Working with initialisation schemes: LHN, back & forth nudging, use of variational constraint, IAU;
- Find solution for the convergence problem in our variational scheme;
- Continue developing the 4D-VAR and EnVar schemes;
- Understand the quality control of radar data – ex. Baltrad vs Prorad tools;
- Bator for all observations and at the same time develop COPE to handle all observations;
- Diagnose B computation by checking Hirlam and MF/Aladin ways of computation;
- Better accounting of large scale information in initialisation and data assimilation;
- ....

# Upper air DA – More information on our wiki page

Upper-air DA wiki page:

[https://hirlam.org/trac/wiki/Meetings/Data\\_assimilation](https://hirlam.org/trac/wiki/Meetings/Data_assimilation)



The screenshot shows a Mozilla Firefox browser window with the URL [https://hirlam.org/trac/wiki/Meetings/Data\\_assimilation](https://hirlam.org/trac/wiki/Meetings/Data_assimilation). The page title is "Meetings/Data\_assimilation - HIRLAM - Mozilla Firefox". The content of the page is as follows:

**Harmonie Data Assimilation Meetings**

**Video Meetings**

- [Until 2017](#)
- [In 2018](#)

**Common Working Weeks on Use of Observations and DA Algorithms**

- [Harmonie DA UoO&Algo Working Week 2018](#), Stantander, 11-15 June 2018

**Working Weeks on Use of Observations**

- [Harmonie DA&UO Working Week 2017](#), Reykjavik, 8th - 11th of May 2017
- [Harmonie DA&UO Working Week 2016](#), Madrid, 17th - 20th of May 2016
- [Harmonie DA&UO Working Week 2015](#), Dublin, 7th - 10th of September 2015
- [Harmonie DA&UO Working Week 2014](#), AEMET (Santander), 13th - 16th October 2014
- [Harmonie DA&UO Working Week 2013](#), DMI, 2nd - 5th December 2013
- [HARmonie DA&UO Working Week 2013](#), (a follow-up of the extended radar data impact studies), SMHI, 12th - 15th March 2013
- [Harmonie DA&UO Working Week 2012](#), (Use of High Frequency Observations), met.no, 14th - 18th of November 2011

**Working Weeks on Data Assimilation Algorithms**

- [201711](#), Lanzarote, 2nd Working Week on Data assimilation Algorithms 2017
- [201701](#), de Bilt, Working Week on Data assimilation Algorithms 2017
- [201606](#), Norrköping, Extended 4Dvar working week 2016
- [201512](#), ECMWF, 4D-Var Working Week 2016
- [201509](#), Dublin, The Harmonie DA&UO Working Week 2015
- [201503](#), Norrköping, The Harmonie 4DVAR Working Week 2015
- [201410](#), Santander, The Harmonie DA&UO Working Week 2014
- [201409](#), KNMI, The HARMONIE OOPS/C++ Working Meeting

At the bottom of the page, there are four buttons: "Edit this page", "Attach file", "Rename page", and "Delete this version".


# Upper air DA – observed issues

## Operational systems failure

**Eoin W:** We experienced a failure in Screening in June of this year with an overflow in a Jo calculation. I haven't had time to get to the bottom of this one. We added a check in hjo.F90 to avoid this in future.

**Ulf Andrae:** – Need for blacklisting coastal snow stations to avoid (wrong) increments.

**Ulf Andrae**



OFFLINE  
Administrator  
Posts: 251  
Thank you received: 23

In the context of HarmonEPS over the METCOOP25B domain we've experienced two troublesome dates with crashes in CANARI, 2017-06-13 06Z and 2017-09-06 00Z. The crashes are reproducible with harmonie-40h1.1.bf1@cca on the first assimilation cycle. The traceback is shown below. Any suggestions from anyone?

Ulf

```
[myproc#4,tid#1,pid#18048,signal#8(SIGFPE)]: Received signal ::
tid#1 starting drhook traceback, time =1510918066.32
[myproc#4,tid#1,pid#18048]: 4425 MB (maxheap), 2158 MB (maxrss),
[myproc#4,tid#1,pid#18048]: MASTER
[myproc#4,tid#1,pid#18048]: CNT0<1>
[myproc#4,tid#1,pid#18048]: CAN1
[myproc#4,tid#1,pid#18048]: CANARI
[myproc#4,tid#1,pid#18048]: CADA VR
[myproc#4,tid#1,pid#18048]: STEPO
[myproc#4,tid#1,pid#18048]: OBSV
[myproc#4,tid#1,pid#18048]: TASKOB
[myproc#4,tid#1,pid#18048]: TASKOB>KSET_LOOP
[myproc#4,tid#1,pid#18048]: TASKOB>OBSGRP=01
[myproc#4,tid#1,pid#18048]: HOP
[myproc#4,tid#1,pid#18048]: PPOBSAC
[myproc#4,tid#1,pid#18048]: ACHMT
tid#1 starting sigdump traceback, time =1510918066.32
```

Last Edit: 9 months 4 weeks ago by Ulf Andrae

REPLY QUOTE

Crashes in CANARI 9 months 4 weeks ago #1983

# Highlight of the progress

## – Field Alignment (FA) & Variational Constraint (VC)

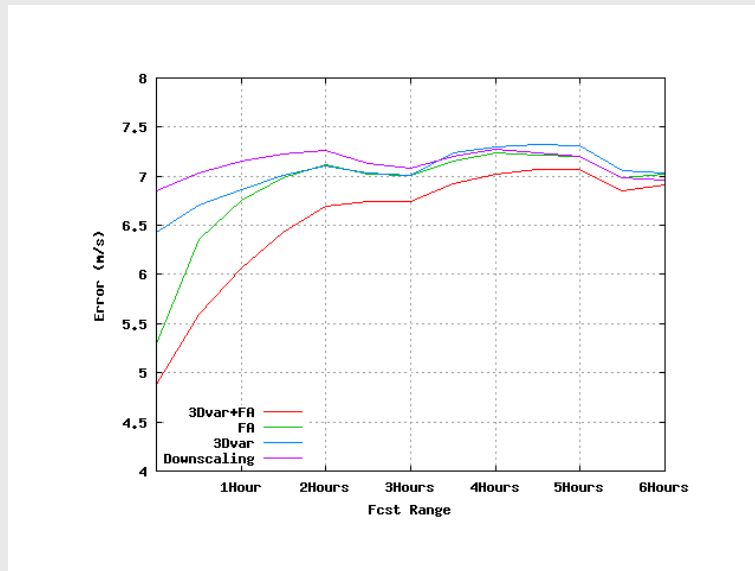
Carlos Geijo:

### Assimilation of Doppler Wind Radar Data in HARMONIE

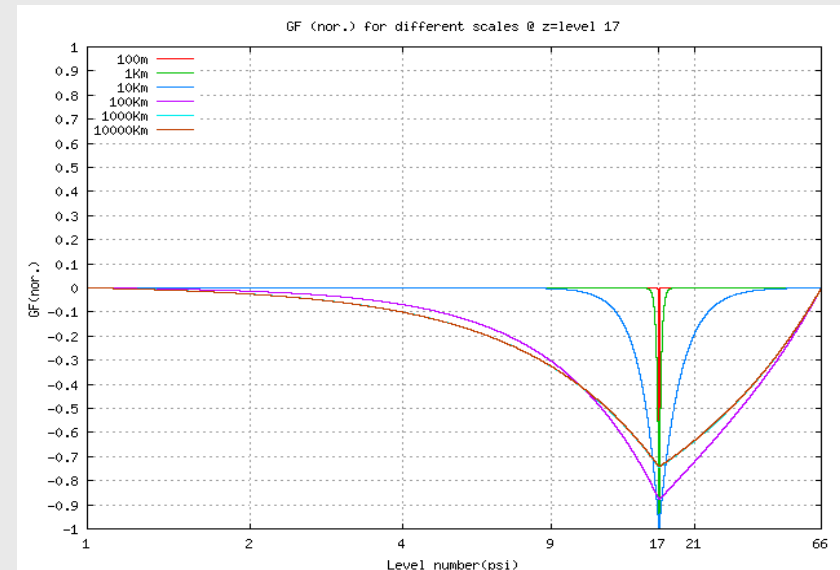
– Verification of forecasted radial wind using the own radar data:

$$\text{Error} \equiv \langle (\text{Fcst} - \text{Radar})^2 \rangle_{\text{PPI}=0.5}^{1/2} + \langle (\text{Fcst} - \text{Radar})^2 \rangle_{\text{PPI}=1.4}^{1/2}$$

– Results averaged over more than 150 cases:



Testing the FA in HARMONIE system

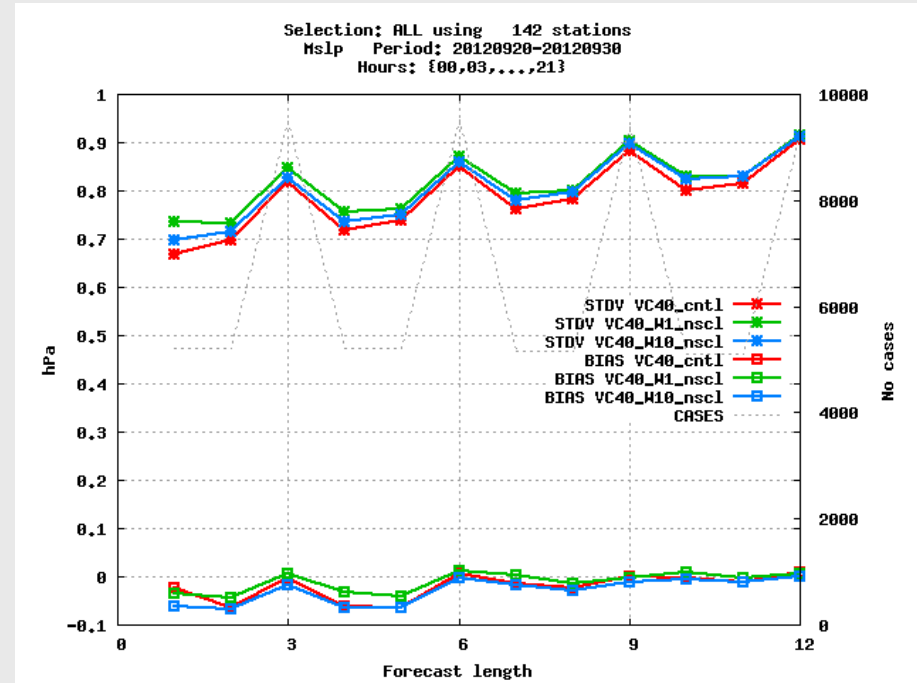
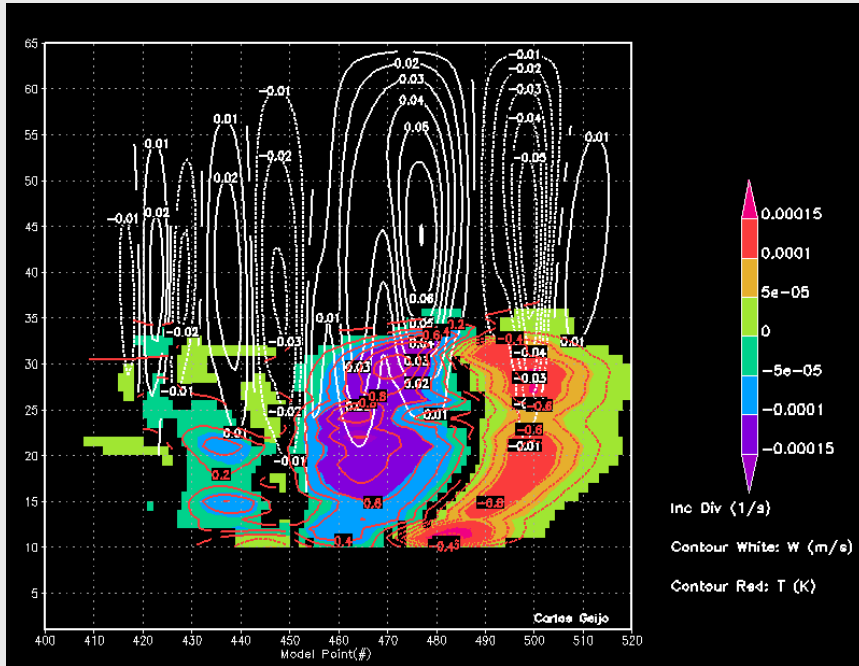


Property of the Green Function

# Upper air DA – FA and VC

## Carlos Geijo

### Balanced Vertical Motions



Still issue with horizontal spreading/  
balance

3h-DA cycles with conventional obs ( $\sim 3 \cdot 10^3$  obs/cycle) . No surface analysis.

**Control:** 3D-VAR

**Experiments:** 3D-VAR with no statbal (LUNIVARIATE=.T.) and VC for balancing

Verification using the standard HIRLAM "monitor" utility



# Upper air DA – Ensemble nowcasting – Xiaohua Yang

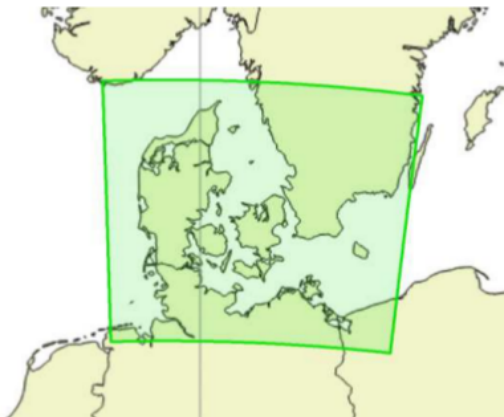
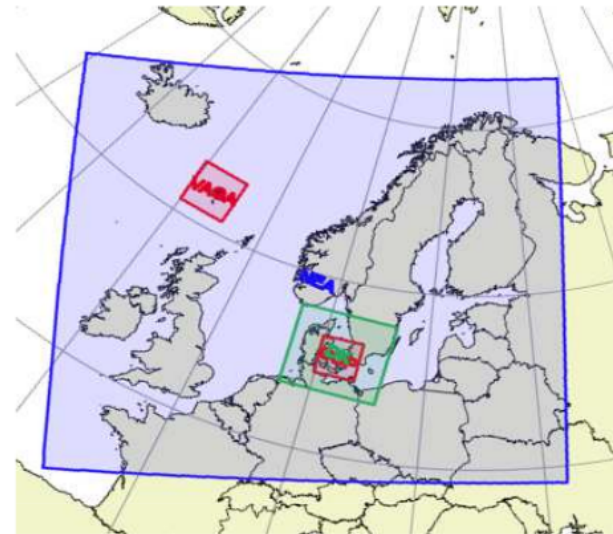
## Operational COMECS@DMI

24 +1 members, Harmonie-arome@2.5 km

1200x1080x65 gridmesh

Time-lagged EDA/EPS with

- hourly 3DVAR (control)
- 4 perturbed members each hour, 57h forecast
- Perturbation (EDA)
  - observation, multi-physics, surface, SLAF



## COMECS-nowcasting (prototype)

Basics: Ensemble Harmonie-arome @750m + radar extrapolation, 7 to 13 NWP members,, 800x720x65  
10 min update with time-lagged EDA/EPS

- 3DVAR every 10 min, 9 h forecast
- COMECS@2.5 km as LBC

# Upper air DA – Ensemble nowcasting – Xiaohua Yang



## Toward a nowcasting RUC at sub-km

**Motivation:** DMI wishes to develop a forecast capability to warn rapidly developing convection which often is characterised by a **very short life cycle ( 1-3 h), very small scales (few km).**

**Approach: an ensemble RUC with NWP-based sub-km resolution nowcasting + radar extrapolation (in first hour)**

- **Model:** sub-km Harmonie-arome with capability for small scale convection; possibly + nudging
- **Assimilation:** variational approach with 3DVAR/4DVAR
- **Ensemble:** a time lagged EDA with RUC on overlapping windows

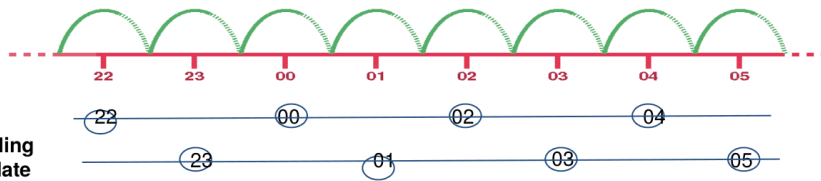
**Extension of DMI-COMEPS from hourly, 2.5 km system toward sub-hourly and sub-km**

Also use of more observations from crowd can be considered



How to achieve frequent analysis update

### Cycling strategy with intermittent DA

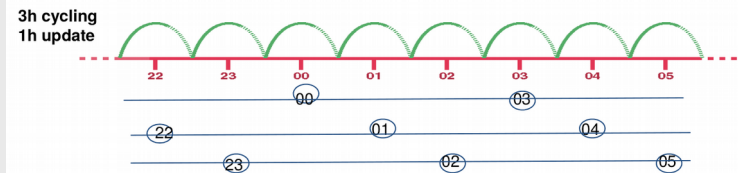


Assimilation window **2h**, data between **-1** and **1 h**  
Background from **2h** forecast of previous cycle



How to achieve frequent analysis update

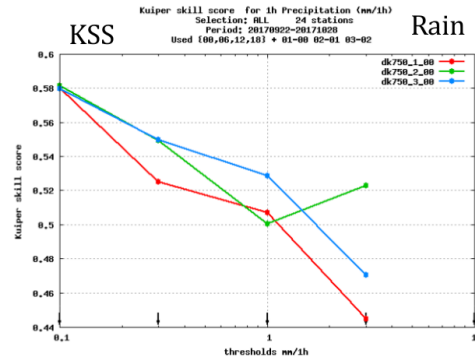
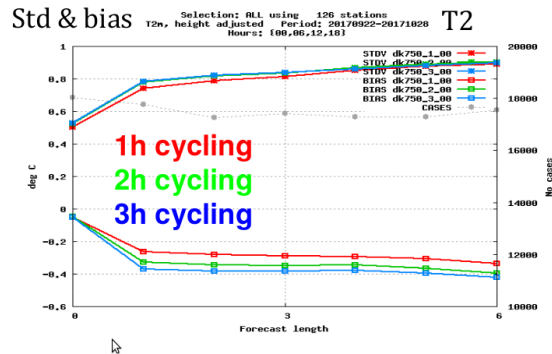
### Cycling strategy with intermittent DA



- + **extended use of obs (longer window, less thinning)**
- + **reduced spin-up**
- + **feasible for larger, time lagged ensemble**
- + **better load balance for ensemble model**

Assimilation window **3h**, ( **-1.5** and **1.5 h**)  
Background from **3h** forecast of previous cycle

# Upper air DA – Ensemble nowcasting – Xiaohua Yang



As it is for today's system accuracy!

**Dilemma about assimilation window length & cycling frequency**

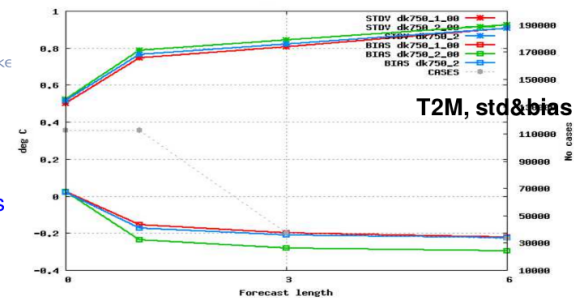
1h cycling clearly advantageous for dry surface parameters like MSLP/T2m  
But for cloud and precipitation, 1h cycling is less optimal compared to 2h/3h

The situation may depend on obs data, analysis schemes, ...

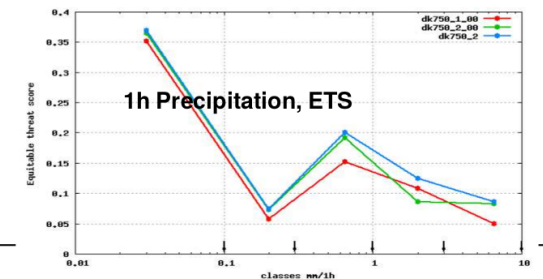
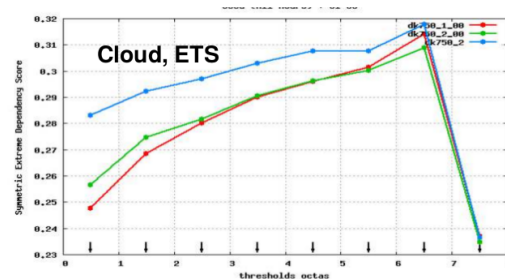
Reducing the moisture spinup!



Partial coupling between adjacent suites



1 hour cycling (red)  
2 hour cycling, parallel (green)  
2 hour cycling, partially connected (blue)



# Upper air DA – 4D-Var development

## Nils Gustafsson & Jan Barkmeijer

### HARMONIE Multi-incremental 4D-Var – some technical steps

#### Done:

Treat the humidity in spectral space:

- Increment for TL model = 0 at first iteration (code re-inserted)
- Handling of VARBC coefficients in control vector file (code re-inserted)
- Problem with skin temperature for AMSU assimilation in second outer loop – “fixed” by using model skin temperature. Using skin temperature and emissivity as “slack variables” during minimization could be considered.
- Script and SMS changes for multi-incremental minimization (different resolutions in different outer loops) – seems to work OK
- **“EZONE” has to be increased in case of very coarse resolution outer loops**
- Shorter period test runs (Magnus has got radar and GPS in!)

# Upper air DA – 4D-Var development

## Nils Gustafsson & Jan Barkmeijer

### Some early (probably too good) results - 1.

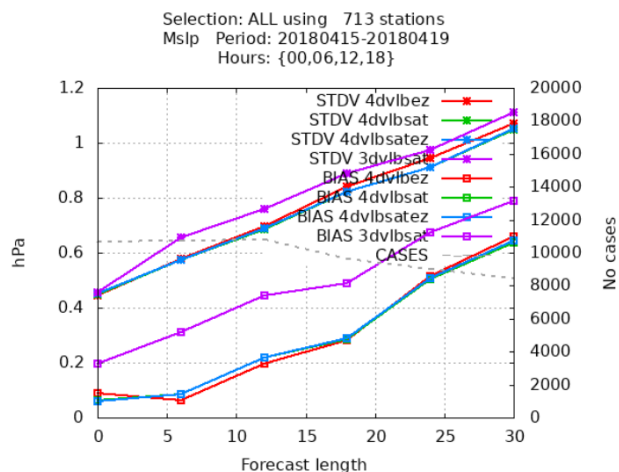
Bi computer, 15-19 April 2018

**4dvlbez:** 4dvar; cheap (EZONE=25); Conv. Obs;

**4dvlbsat:** 4dvar, expensive (EZONE=11); Conv. + sat. obs.

**4dvlbsatez:** 4dvar, cheap (EZONE=25); Conv. + sat. obs.

**3dvlbsat:** 3Dvar (EZONE=11); Conv. + sat. obs.



### Some early (probably too good) results - 2.

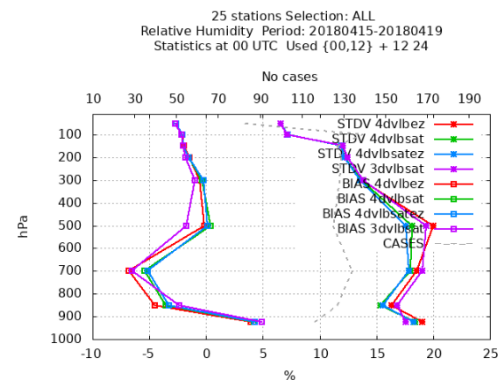
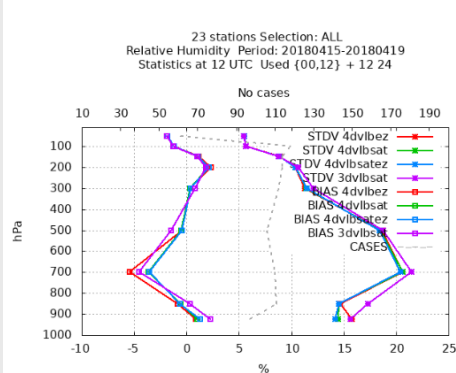
Bi computer, 15-19 April 2018

**4dvlbez:** 4dvar; cheap (EZONE=25); Conv. Obs;

**4dvlbsat:** 4dvar, expensive (EZONE=11); Conv. + sat. obs.

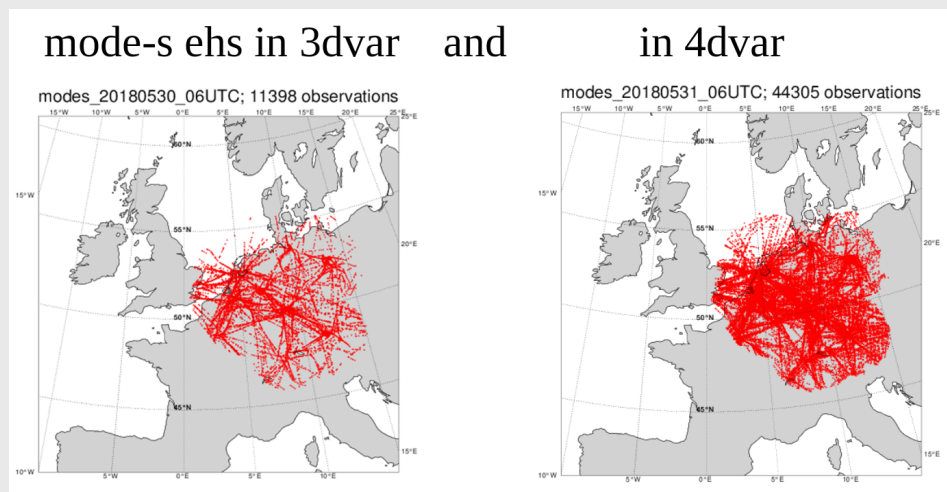
**4dvlbsatez:** 4dvar, cheap (EZONE=25); Conv. + sat. obs.

**3dvlbsat:** 3Dvar (EZONE=11); Conv. + sat. obs.

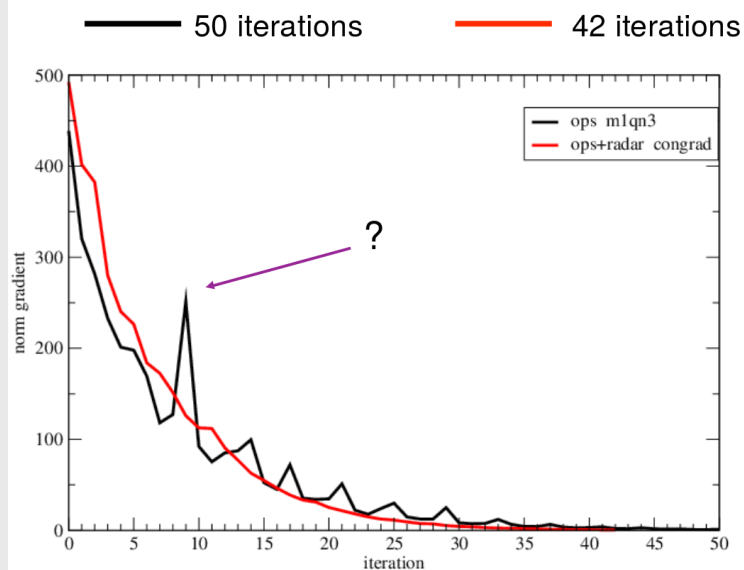
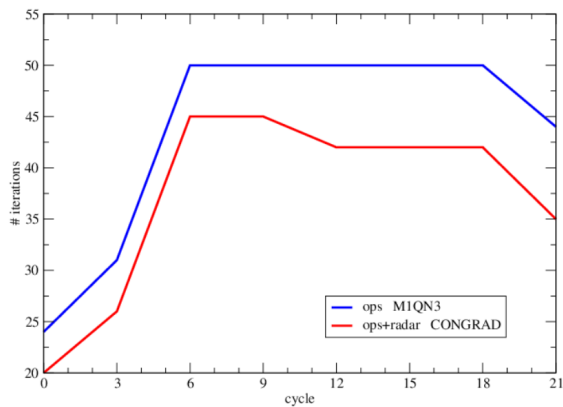


# Upper air DA – 4D-Var development

## Nils Gustafsson & Jan Barkmeijer



Average number of iterations (1 month) used in the 3dvar minimization for each analysis cycle (max=50) for two minimizers: M1QN3 (default) and CONGRAD



At exit, J for conventional obs is the same for both set-ups

# Upper air DA – LETKF

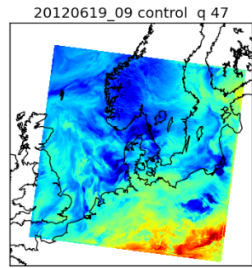
## Pau Escriba

- LETKF is quite mature after several tuning but still not finished;
- In a 8 day (short) verification period the LETKF performance is comparable to 3DVAR, even better in some parameters when assimilating only conventional observations. More verification with other and longer periods is needed;
- Many short-period testing have been done.

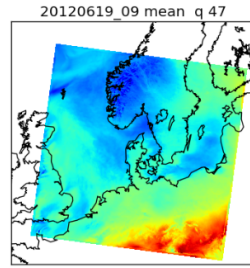
More about the tests and the results can be found on our last working week page

# Upper air DA – EnVar and Brand: A perturbation technique

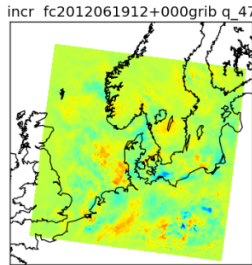
## Jelena Bojarova



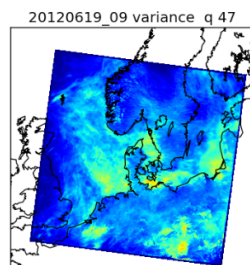
First Guess HybridEnVar



Mean BRAND "after" (+03h)



Analysis Increment



STD BRAND "after" (+03h)

		Hybrid EnVar (BRAND "after" Small spread)		Hybrid EnVar (BRAND "after" Large spread)		20120613 00 UTC	
		#obs	"o-b"	"o-a"	"o-b"	"o-a"	
SYNOP	LAND	Z	87	18.03	4.61	15.53	2.23
		Z	297	47.98	12.44	53.56	6.39
	SHIP	Z	16	2.49	1.22	7.06	0.82
		U	10	8.84	6.16	8.25	3.82
		Z	28	10.37	6.31	11.27	2.95
		U	16	13.08	9.11	13.79	4.59
AIREP	AMDAR	U	124	37.86	11.99	44.28	4.28
		T	62	10.36	6.07	13.08	2.32
DRIBU		Z	1	0.01	0.02	0.07	0.01
TEMP		U	2362	960.48	669.28	1098.07	629.02
		T	613	618.36	485.95	648.85	463.03
		Q	345	366.04	126.73	478.10	114.29
J	Jo	3961	2093.96	1339.93	2391.96	1233.79	
	Jb			120.42		82.31	
	Je			60.85		84.85	

**EnVar:** coding following Gustafsson and Bojarova 2014 is done and testing and further development of the scheme is ongoing.

**Brand:** Implementation is finished. Tuning of the technique is needed.



# Upper air DA – Jk

## Jelena Bojarova & Mats Dahlbom

```
NEMJK=>{
'LEJK' => '.TRUE.,',
'NSMAXJK' => '23,',
'PRESINFJK' => '60,',
'PRESUPJK' => '55,',
'ALPHAKP' => '0.0,',
'ALPHAKT' => '3.0,',
'ALPHAKQ' => '0.0,',
'ALPHAKVOR' => '18.0,',
'ALPHAKDIV' => '16.0,',
},
```

The main problem of crash in  
CARRA :

NMSMAX is assumed to be larger than NSMAX

This does not hold for CARRA

$NMSMAX \rightarrow NCMAX = \max(NMSMAX, NSMAX)$

Some inconsistencies might be left !

```
NEMJK=>{
'LEJK' => '.TRUE.,',
'NSMAXJK' => '23,',
'PRESINFJK' => '65500.0,',
'PRESUPJK' => '50000.0,',
'ALPHAKP' => '0.0,',
'ALPHAKT' => '0.25,',
'ALPHAKQ' => '0.0,',
'ALPHAKVOR' => '0.01,',
'ALPHAKDIV' => '0.01,',
},
```

ALT JVAR = 1 COST = 1180.58  
 ALT JVAR = 2 COST = 1480.33  
 ALT JVAR = 3 COST = 11950.3  
 1004            453.0568429331

Converges in 14 iterations

ALT JVAR = 1 COST = 670.42  
 ALT JVAR = 2 COST = 445.86  
 ALT JVAR = 3 COST = 1546.03  
 Jb = 2591.5  
 1004            161.2399975236

# Upper air DA – VarBC for aircraft data

## Magnus Lindskog

AIREP VARBC



VARBC files accumulating to be of huge size. After one month:

```
3767150 Jun 8 15:28 VARBC.cycle_2016122100
5095493 Jun 8 15:28 VARBC.cycle_2016122200
6031833 Jun 8 15:28 VARBC.cycle_2016122300
6859334 Jun 8 15:28 VARBC.cycle_2016122400
7828353 Jun 8 15:28 VARBC.cycle_2016122500
8187657 Jun 8 15:28 VARBC.cycle_2016122600
8634058 Jun 8 15:28 VARBC.cycle_2016122700
9385337 Jun 8 15:28 VARBC.cycle_2016122800
9831752 Jun 8 15:28 VARBC.cycle_2016122900
10103966 Jun 8 15:29 VARBC.cycle_2016123000
10376152 Jun 8 15:29 VARBC.cycle_2016123100
10681009 Jun 8 15:29 VARBC.cycle_2017010100
11214582 Jun 8 15:29 VARBC.cycle_2017010200
12564950 Jun 8 15:29 VARBC.cycle_2017010300
13577720 Jun 8 15:29 VARBC.cycle_2017010400
13915296 Jun 8 15:29 VARBC.cycle_2017010500
14154897 Jun 8 15:30 VARBC.cycle_2017010600
14448940 Jun 8 15:30 VARBC.cycle_2017010700
14666796 Jun 8 15:30 VARBC.cycle_2017010800
14971633 Jun 8 15:30 VARBC.cycle_2017010900
15178536 Jun 8 15:30 VARBC.cycle_2017011000
15298326 Jun 8 15:30 VARBC.cycle_2017011100
15450793 Jun 8 15:31 VARBC.cycle_2017011200
15579582 Jun 8 15:31 VARBC.cycle_2017011300
15777486 Jun 8 15:31 VARBC.cycle_2017011400
16017873 Jun 8 15:31 VARBC.cycle_2017011500
16191319 Jun 8 15:31 VARBC.cycle_2017011600
16332883 Jun 8 15:31 VARBC.cycle_2017011700
16463576 Jun 8 15:32 VARBC.cycle_2017011800
16589354 Jun 8 15:32 VARBC.cycle_2017011900
16692260 Jun 8 15:32 VARBC.cycle_2017012000
16986283 Jun 8 15:32 VARBC.cycle_2017012100
17149626 Jun 8 15:32 VARBC.cycle_2017012200
17334762 Jun 8 15:33 VARBC.cycle_2017012300
17432808 Jun 8 15:33 VARBC.cycle_2017012400
17476374 Jun 8 15:33 VARBC.cycle_2017012500
17650601 Jun 8 15:33 VARBC.cycle_2017012600
17792178 Jun 8 15:33 VARBC.cycle_2017012700
18020846 Jun 8 15:33 VARBC.cycle_2017012800
18140623 Jun 8 15:34 VARBC.cycle_2017012900
```

```
ix=1
class=airep
key=ACA810      141
label=AIREP    statid=ACA810  sensor=141
ndata=0
npred=1
predcs=0
param= 2.714E-01
params= 2.714E-01

ix=1533
class=airep
key=N151QS     141
label=AIREP    statid=N151QS  sensor=141
ndata=10
npred=1
predcs=0
param= 0.000E+00
params= 2.796E-02
```

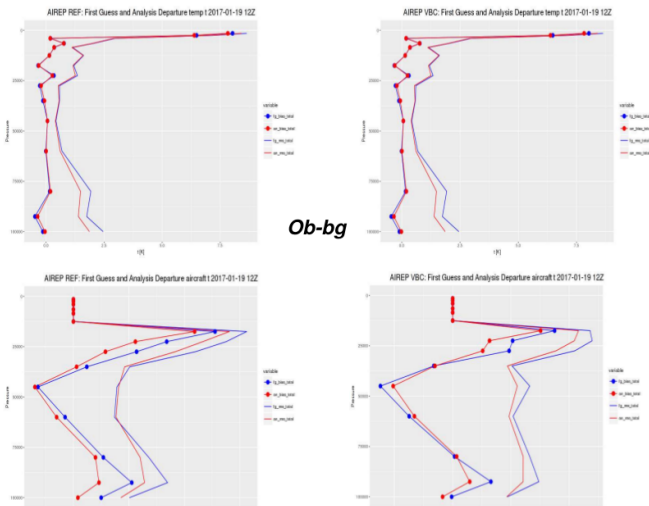
missing station ids in same ix

- Test with the off-set only;
- Seems to work well and do the bias corr.;
- Promising positive impact;
- Growing file size is worrying;

### Observation fit statistics



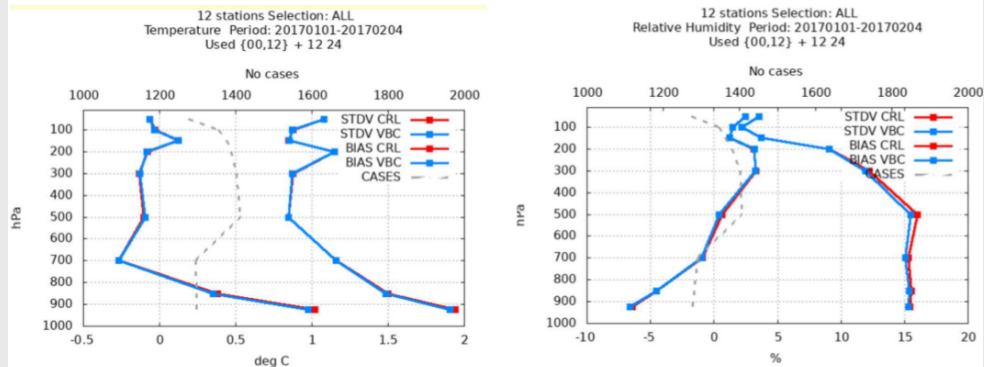
#### Observation fit statistics 2019 01 19 12 Z



Ob-bg

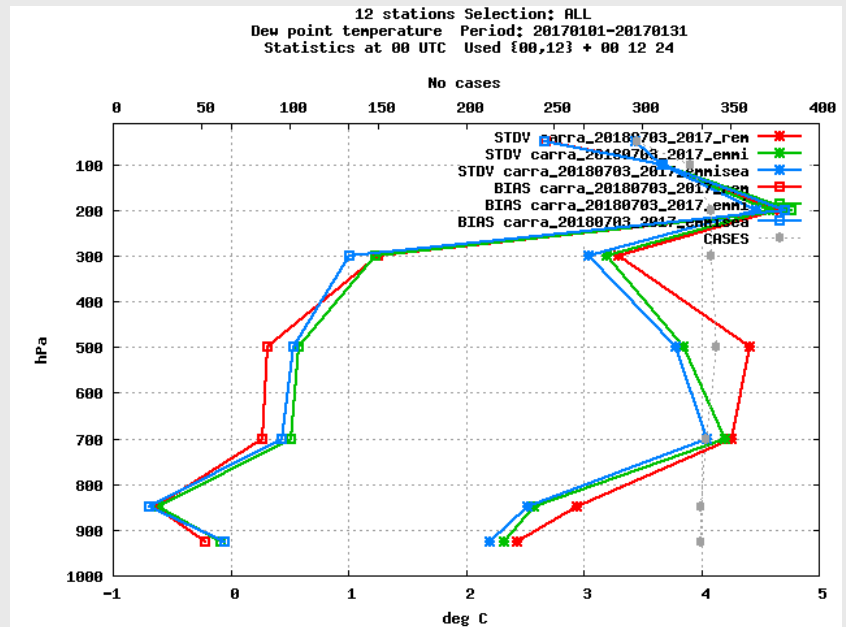
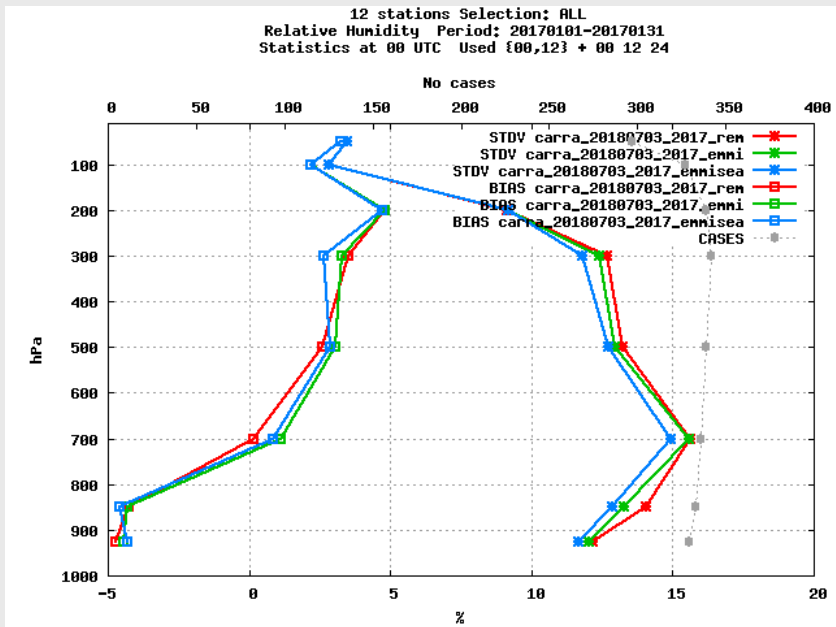
Airep T-Ob to warm, VARBC helps to handle

### Verification scores



# Upper air DA – Use of emissivity Atlas in microwave radiance assimilation

## Sigurdur Thorsteinsson & Roger Randriamampianina



Very promising results!

- Blue – use of emissivity over sea only;
- Green – use of emissivity over sea and land;
- Red – Not using the emissivity atlas.

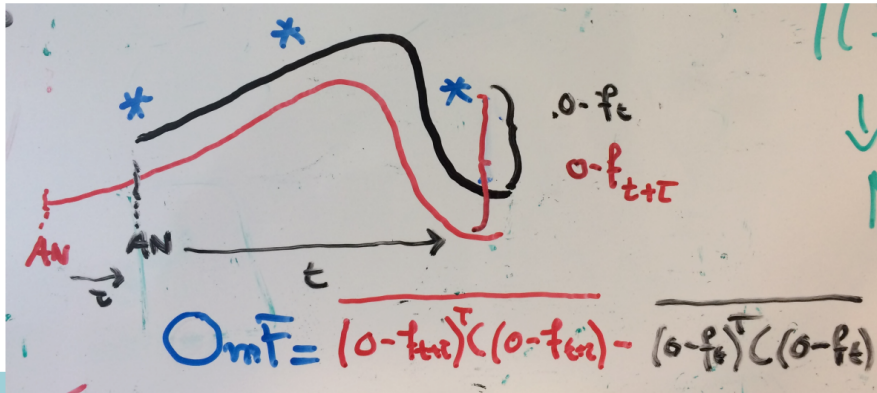
# Upper air DA – Verification / observation impact

Observations minus  
Forecast residuals



Todling (2012)

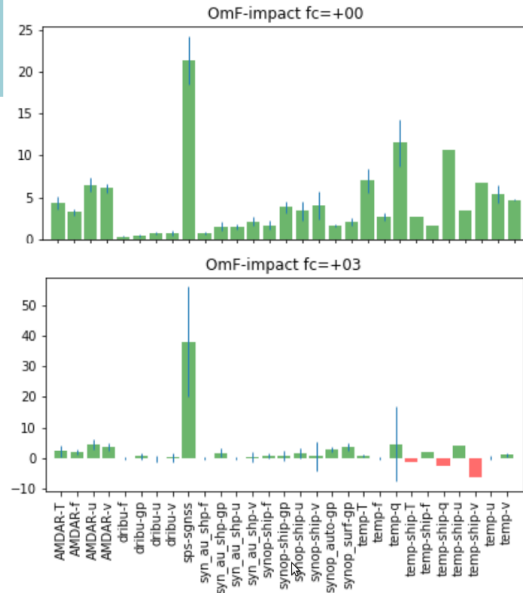
- assessment of the impact of observations
- simple: no need for denial experiment
- utilising "Screening" : all observations



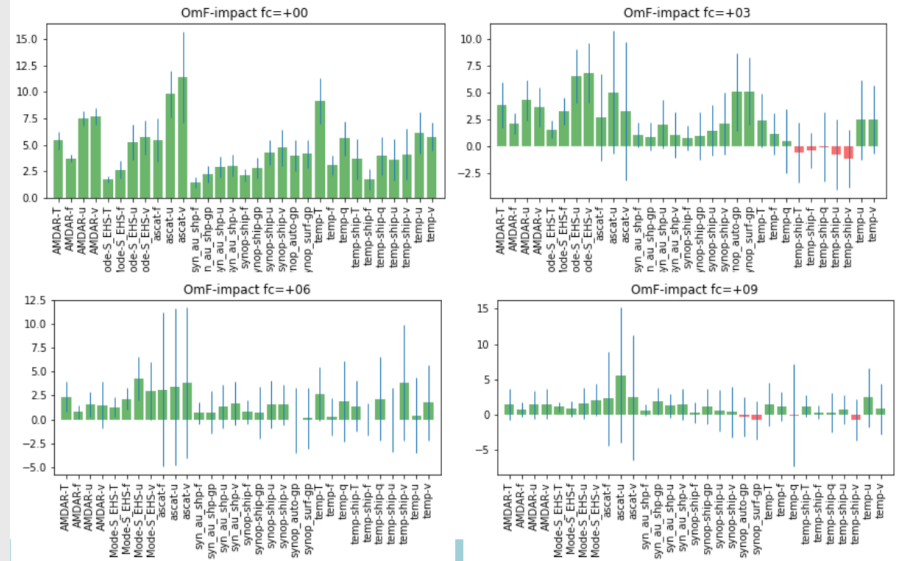
Very fresh result

only a few days

3DVAR...



h40 exp  
data 2018/08



<https://www.ecmwf.int/en/newsletter/152/meteorology/Assessing-impact-observations-using-observation-minus-forecast>

Dahoui M, L Isaksen, G Radnoti, ECMWF implementation of the technique....

# The new cycle – CY43

Last modified 3 days ago

## harmonie-cy43 status

### Overview

This page describes the status and ongoing activities with harmonie-cy43.

### Platform/compiler/domain status

Platform	Compiler	domain	Status	Who's on it
cca	gnu/5.3.0	DKCOEXP	abort: Canari (wrm/ippa.F90)	Eoin
cca	gnu/6.3.0	DKCOEXP	AROME_3DVAR OK	Eoin
cca	gnu/7.3.0	DKCOEXP	AROME_3DVAR OK	Eoin
cca	gnu/7.3.0	DKCOEXP	AROME_3DVAR OK	Ulf
cca	intel/17.0.3.053	DKCOEXP	fails in gl_bd	Ulf
bi	intel/15.0.1.133	DKCOEXP	AROME_3DVAR OK	Ulf
bi	intel/15.0.1.133	METCOOP25C	AROME_3DVAR, 2patch, SICE, FLAKE (one thread only)	Ulf
elvis	intel/15.0.1.133	METCOOP25C	AROME_3DVAR OK	Trygve
METIE.LinuxRH7gnu	gnu/4.8.5	IRELAND150	AROME_3DVAR/AROME_1D/AROME OK	Eoin
METIE.LinuxRH7gnu-dev	gnu/4.8.5	IRELAND150	Does not compile - issue linking HDF5	Eoin
METIE.LinuxRH7gnu-dev	gnu/5.3.1	IRELAND150	AROME_3DVAR/AROME_1D/AROME OK	Eoin
METIE.LinuxRH7gnu-dev	gnu/6.3.1	IRELAND150	AROME_3DVAR/AROME_1D/AROME OK	Eoin
METIE.LinuxRH7gnu-dev	gnu/7.3.1	IRELAND150	abort:Prepare_pgd_fa (readsurf.F90)	Eoin

### Testbed status

Configuration	Platform(s)	STATUS
AROME_3DVAR	cca	Working.
AROME	cca	Working.
AROME_1D	cca	Working.
AROME_MUSC	cca	Working.
AROME_3DVAR_MARSOBS	cca	Working.
AROME_3DVAR_ALLOBS	METIE Linux	Working locally.
AROME_3DVAR_BATOR	cca	Pending.
ALARO_3DVAR	cca	What do we want to do with ALARO? e001_ALARO-1_CY43T2bf09_commented.nam is available. Does ALARO-0 exist in CY43T2 code and do we want to support it? No action on these (Ulf)
HarmonEPS	cca	Pertsfc does not produce correct output files.

Some further comments:

- Derivation of structure functions using harmonie-43h1.pre-alpha.1 has not been tested.
- SURFEX\_LSELECT=yes not working

### harmonie-cy43 status

#### Overview

[Platform/compiler/domain status](#)

[Testbed status](#)

[Observation status](#)

[DA algorithm status](#)

[SURFEX status](#)

[Physiography/climate generation status](#)

[Trunk status](#)

[Misc](#)

[Candidates for cleaning](#)

**Outstanding tasks as of 2018-06-15**

**Conflicts resolution during the merging of branches/cy43\_t2 and ...**

**List of conflicts in src**

# The new cycle – CY43

## Observation status

harmonie-40h1 Bator changes have been merged in to harmonie-43h1.pre-alpha.1. Below is a table summarising the status of the processing of various observation types.

TYPE		SOURCE	STATUS
SURFACE-LAND	MOST	mars/mcp/metie	Working. synop_old implemented in Bator to process SYNOP TM307005, TM307007.
SURFACE-LAND	GBGPS	mars/mcp/metie	Working. ASCII COST format not tested
SURFACE-SEA	ALL	mars/mcp/metie	Working. buoy_old implemented in Bator to process TM308003.
SOUNDING	TEMP	mars/mcp/metie	temp_old implemented in Bator to process TM309007. temps_old implemented to process TM309196.
SOUNDING	PILOT	mars/mcp/metie	Treatment of PILOT BUFR TM301001 (pilot_old) not implemented.
AIREP	ALL	mars/mcp/metie	amdaromm now treats the latest AMDAR BUFR TM311010.
SATOB	GEOWIND/AMV	ears	Working technically.
SOUNDING-SAT	AMSUA	ears	Working technically.
SOUNDING-SAT	AMSUB/MHS	ears	Working technically. Investigate use of mask.amsub file?
SOUNDING-SAT	HIRS	ears	Working technically.
SOUNDING-SAT	IASI	ears	Working technically.
SOUNDING-SAT	ATMS	ears	Fails in Screening (AT_AVG_STDEV_FILTER). mask.atms added to nam.
SOUNDING-SAT	CRIS	ears	Fails in Screening (RADTR_ML: Error in channel subsetting for RTTOV.
SOUNDING-SAT	SEV	ears	Working technically. METEOSAT 11 csr (SEVIRI) data passes through OK
SOUNDING-SAT	GPSRO		Not tested.
RADAR	Z	OPERA	Working and inspected
RADAR	Vr vol	OPERA/???	Not tested.

Some further comments:

- CY43T2 DA const files have been downloaded from hendrix (Météo France) and have been tested. Best treatment of IASI (and other) rtoef files to be discussed/decided.
- obsmon not working with ODB\_IO\_METHOD=4 - more testing required.
- Is LL\_ECMWF still needed in src/odb/cma2odb/shuffle\_odb.F90?
- Is LMFBUFR still needed in Bator?
- VARBC table format has changed, 5->6, Roger will send question about converter to MF

## DA algorithm status

TYPE	ALGORITHM	STATUS
SFC	CANARI_OI_MAIN	Working.
SFC	CANARI_EKF_SURFEX	Not tested.
SFC	CANARI	Not tested.
SFC	OI	Not tested.
SFC	EKF	Not tested.
SFC	fgcopy	Working.
UA	3DVAR	Working.
UA	4DVAR	Not tested.
UA	blending	Working.
UA	LETKF	Code not merged.
UA	HYBRID	Code not merged.

Thank you