An Update on Observation Processing
Wk 27/ASM 2017

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~~An Update on Observation Processing~~
15 minutes on converting data from one format to another!
Wk 27/ASM 2017

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Outline

- Oulan vs Bator
- COPE
- SAPP
- BUFR TEMP
  - Another impact study

Oulan vs Bator

Motivation

- CY40 Bator processes many conventional BUFR types

- Do we still need Oulan?
- Can we use one tool to create ODBs?

- MF and WMO BUFR treated well in 40T1
- What about HIRLAM NMS and ECMWF BUFR?
  - Create a "database" of param.cfg files for users
  - Add functionality to Bator to treat these BUFR data

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Bator – the param file

- param.cfg:
  - definitions required for all flavours of all BUFR
  - each definition "instructs" Bator how and where to find observation information

- Maria Monteiro's 2016/7 LACE DA reports
  - http://www.rclace.eu/?page=11

```
BEGIN temp
1 0 1 21
codage    1  309052
offset    1  10
values    1  001001  WMO block number
values    2  001002  WMO station number
values    3  001011  station identifier
values    4  002011  Radiosonde type
values    9  004001  Year
values   15  005001  Latitude (high accuracy)
values   16  006001  Longitude (high accuracy)
  ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
values   38  011001  Wind direction
values   39  011002  Wind speed
END temp
```

```
BEGIN obname
A B C D
codage  A  BUFR descriptors
 ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
offset     B  Skip length for repeated obs
 ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
control  C  Other "instructions"
 ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
values   D  Values (FXXYYY)
 ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
 ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
 ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
 ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
 ::       ::  ::::::::::  ::::::::::::::::::::::::::::::::::
END obname
```

Bator tests

- odb/tools/Guessparamcfg.F90 tool available:

   GUESSPARAMCFG –i <bufr_file> -n <bufr number>

- ECMWF MARS, MetCoOp, KNMI and METIE BUFR tested
  - Sample data for 2016121212 tested
  - Oulan and Bator used to generate ECMA ODBs

- Some code changes required:
  - Time checking – some BUFR templates do not use seconds
  - "Old" ECMWF templates catered for

- CY43 TEMP code back-ported
 - Thinning
  - Drift information
  - More on this later …

Subroutine	BUFR template
Synop_8	307005, 307007
Temptac	309007
Tempstac	309196
Pilottac	301001
Buoytac	308003

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Comparison - Surface

Surface data availability: mcp(oulan)

Auto Land SYNOP (6574) · DRIBU (416) · SHIP (112)
Manual Land SYNOP (3451) · Auto SHIP (1216)

Surface data availability: mcp(bator)

Auto Land SYNOP (7074) · DRIBU (664) · SHIP (120)
Manual Land SYNOP (2973) · Auto SHIP (1350)
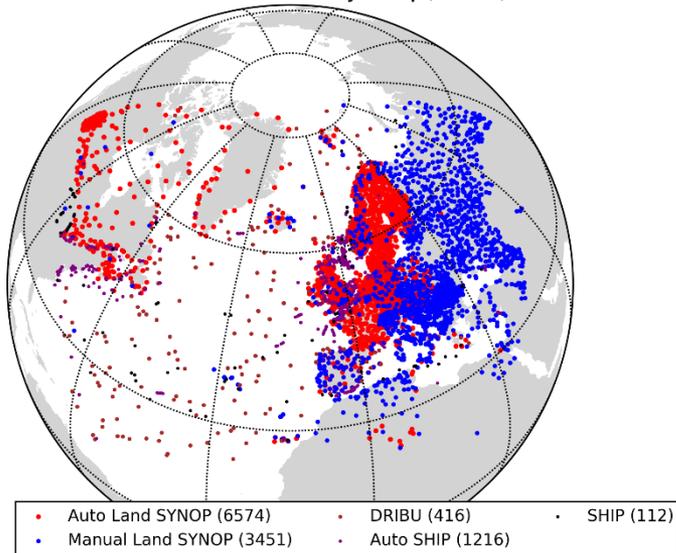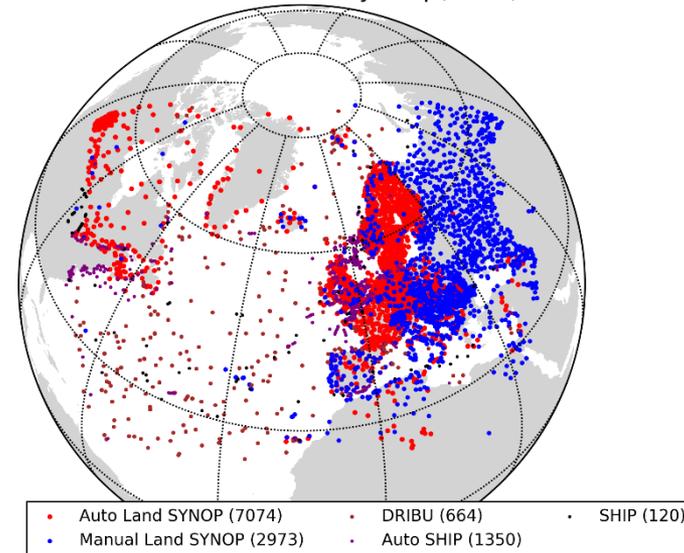
- No general differences
- More Auto SHIP processed by Bator

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Comparison - Aircraft


Aircraft data availability: mcp(oulan)

Aircraft data availability: mcp(bator)

- AIREP (0)   AMDAR (9327)   ACARS (0)
- AIREP (0)   AMDAR (9404)   ACARS (6373)
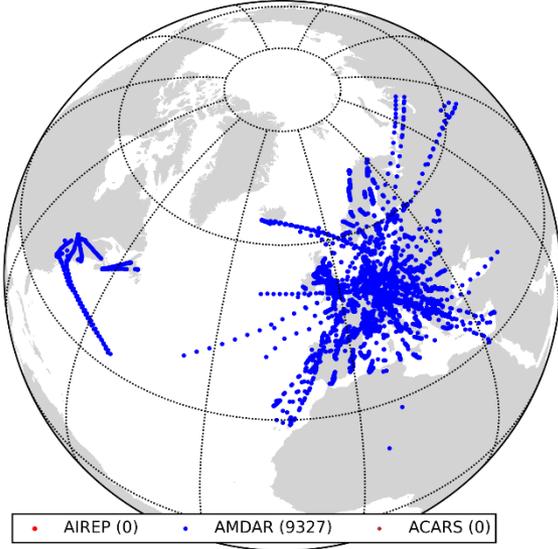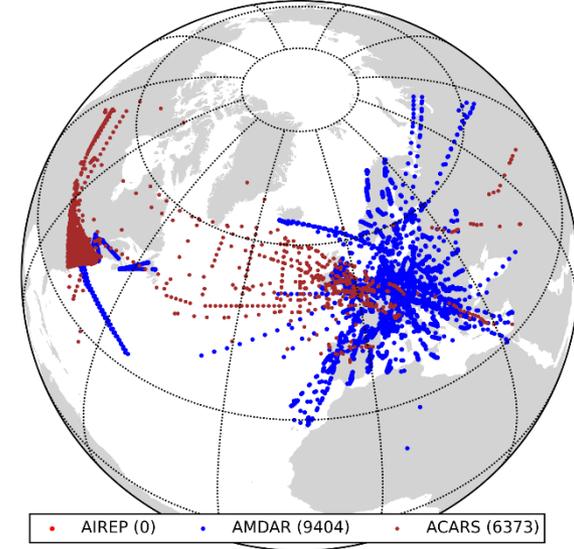
- No ACARS from Oulan

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Comparison – Upper-air

UpperAir data availability: mcp(oulan)

Land PILOT (41) · TEMP SHIP (4) · Land TEMP (86)

UpperAir data availability: mcp(bator)

Land PILOT (41) · TEMP SHIP (4) · Land TEMP (135)
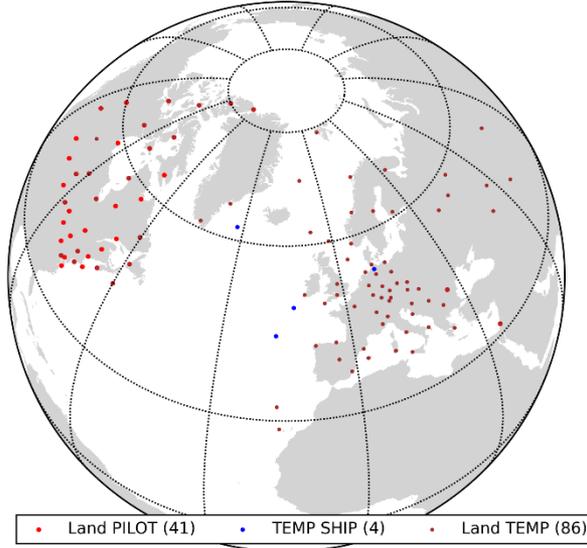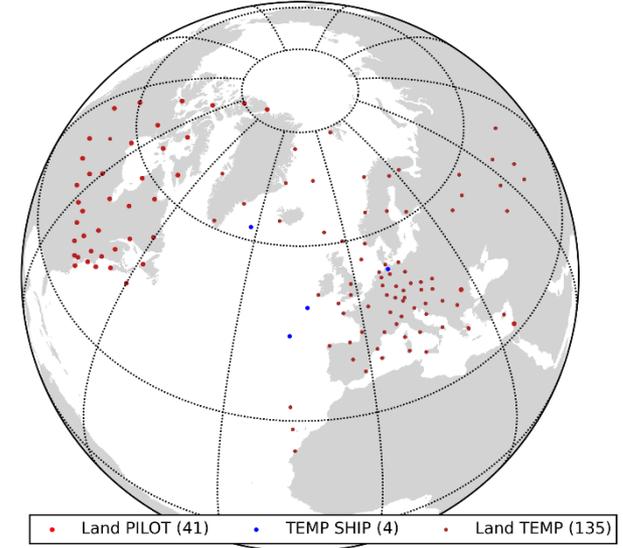
- Extra TEMP processed by Bator

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COPE

COPE:
Continuous
Observation
Processing
Environment

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COPE in the AHNS: Status

- Still working as prototype in cy40h1 branch
- ODB conversion less of an issue (ODB-API & ECML)
  - Limited testing and not well understood (by me!)
- **"Don't bother!"** – ECMWF
  - IFS reading of obs will be more flexible (ifsobs)

- HDF5 (radar) developments have started
  - Dedicated b2o HDF5 branch (not yet pushed)
  - Plan to plug this in to COPE
- COPE has also been tested by ALADIN
  - Mohamed Anis Satouri & Alena Trojakova
- SAPP implementation to be considered

SAPP

GTS data processing and management

- Locally developed software
  - F77, BUFRDC
  - Inflexible and steep learning curve for new developers
  - Has not kept pace with ECMWF/WMO BUFR changes
- Is there a better alternative?
  - Modern
  - Flexible
  - Fits well with AHNS data assimilation software
- …

Scalable Acquisition and Pre-Processing (SAPP)

- Scalable: Implemented on a linux cluster
  - by adding new compute nodes the system is able to process more incoming observations.
- Continuous processing of observations optimised to provide short delay from acquisition to data assimilation system.
- Provides full monitoring of data flow and tracing of the data in all the processing stages.
- Designed to be configured from a web interface (django)
- Developed in python and mysql
- ecCodes has been developed to support the system in decoding GTS headers, BUFR and GRIB

SAPP software

- **Open source**
  - Mysql
  - Python
    - Django (web interface)
    - Supervisor (services administration)
  - gcc, gfortran (at the moment pgi fortran is used)
  - VMware to run the virtual machine
- **ECMWF software**
  - Python scripts (acq_scanner, proc_dispatcher, …)
  - preproc (deqc and converter, fortran programs)
  - ecCodes
  - BUFRDC
  - Bufr_toolbox
  - ecflow

GTS data processing and management

- ….
- Is there a better alternative?
- SAPP VM provided by ECMWF for testing/evaluation
- Working in less than half a day
- SAPP Workshop held in Dublin, March 2017
- ECMWF do not have the staff resources to support an export version
- Agenda item for *WG1: Recent upper-air DA issues*

BUFR TEMP, again

WMO migration from TAC to BUFR

- Traditional Alphanumeric Codes → BUFR
- Information on radiosonde displacement in space and time available in BUFR TEMP GTS messages
- Increase in number of levels reported (~5000)
- Can we make use of this extra information?
  - more accurate location and number of observations
  - more accurate time information for RUC/4DVAR

Impact study: 2016 results and conclusions

- Initial results: underwhelming
- Cleaner comparisons needed
  - Switch off blending
  - More careful selection of obs
- Crude thinning of data
  - Investigate MF approach
- Bator instead of Oulan

odbmap plot of varno from allECMA.odb
where obstype=5 AND varno=2
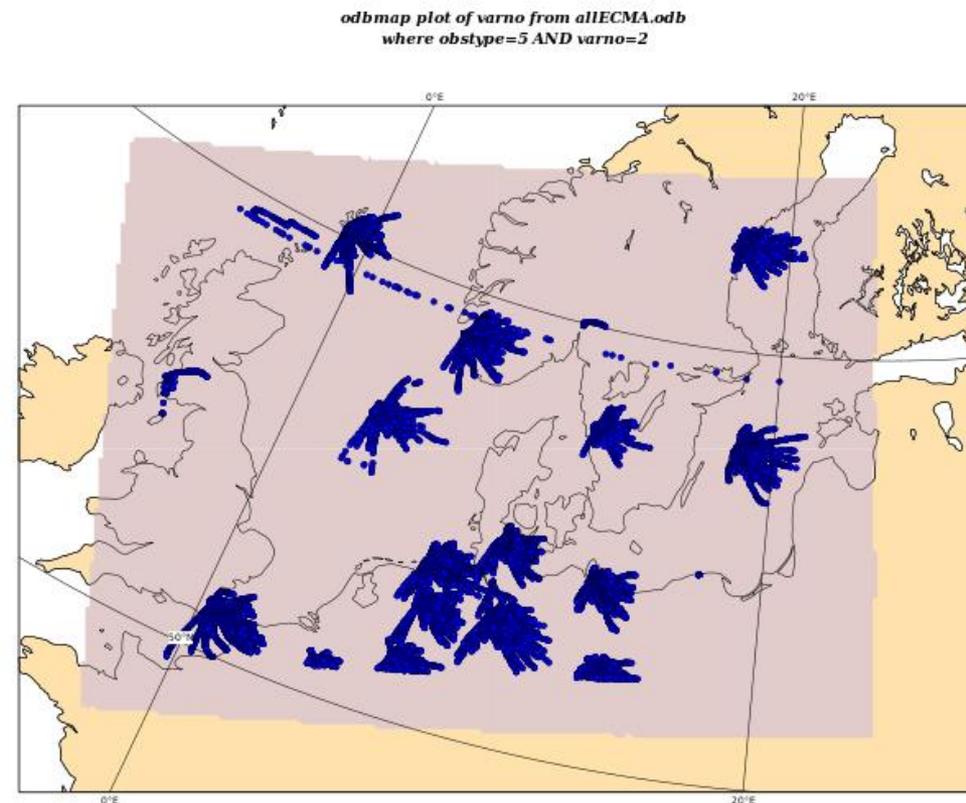
Bator updates

- Radiosonde updates backported from CY43
- New options available for testing:
  - TempSondOrTraj   ! true = sondage vertical, false = trajectoire
  - ElimTemp0   ! suppression des TEMP sans delta lat/lon/time
  - NFREQVERT_TPHR   ! Thinning factor
- Test these new options for the same period

Bator options

- NFREQVERT_TPHR=100

03953: Radiosonde observations (ECMA)

03953: Radiosonde observations (ECMA)

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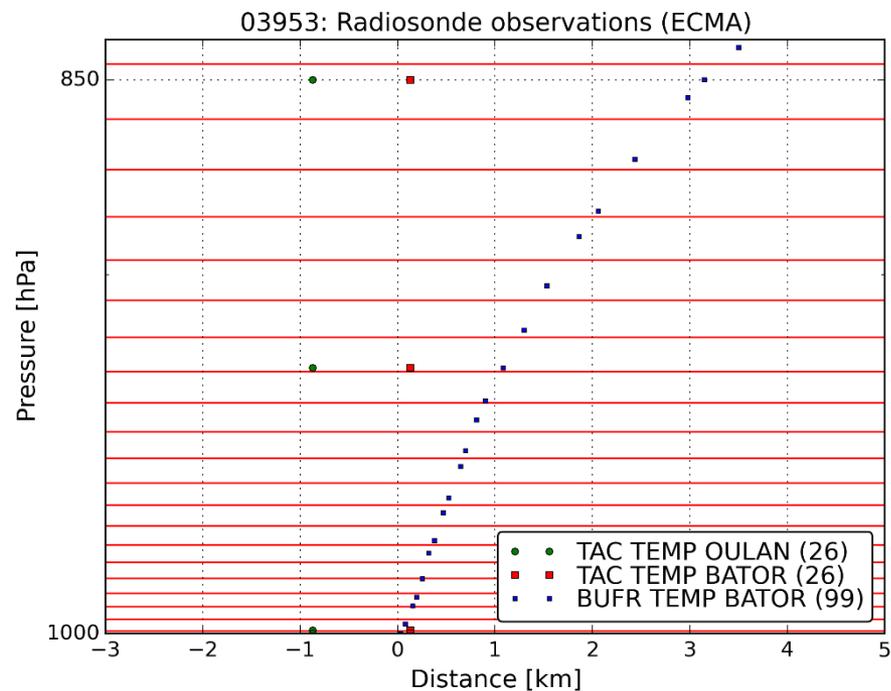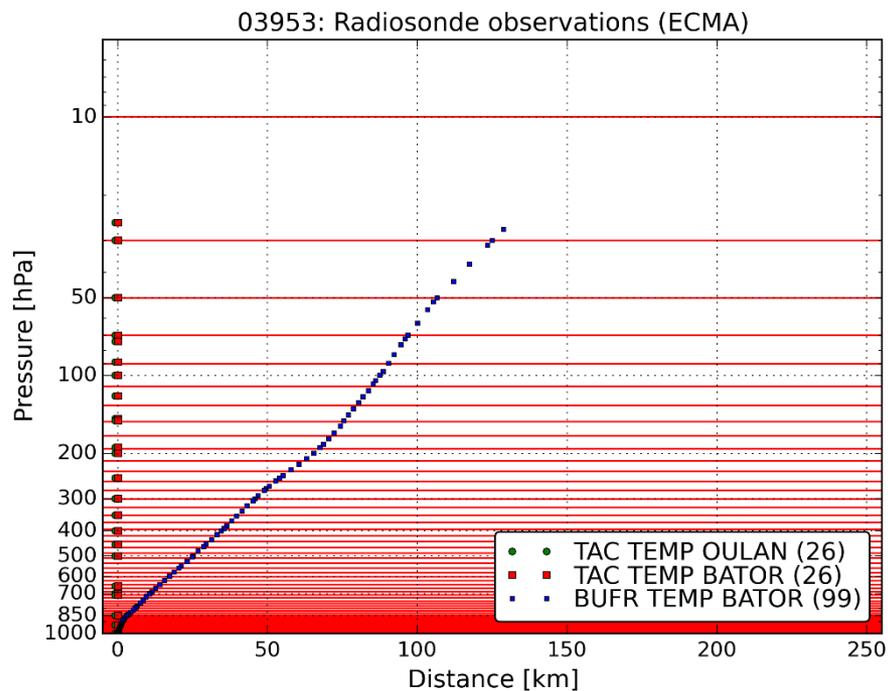
Bator options

- NFREQVERT_TPHR=200
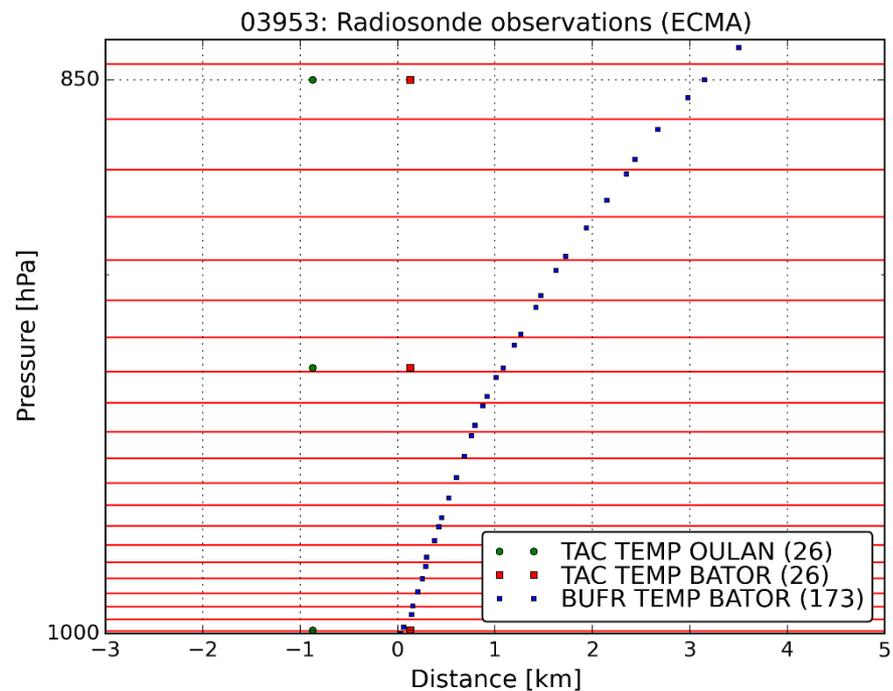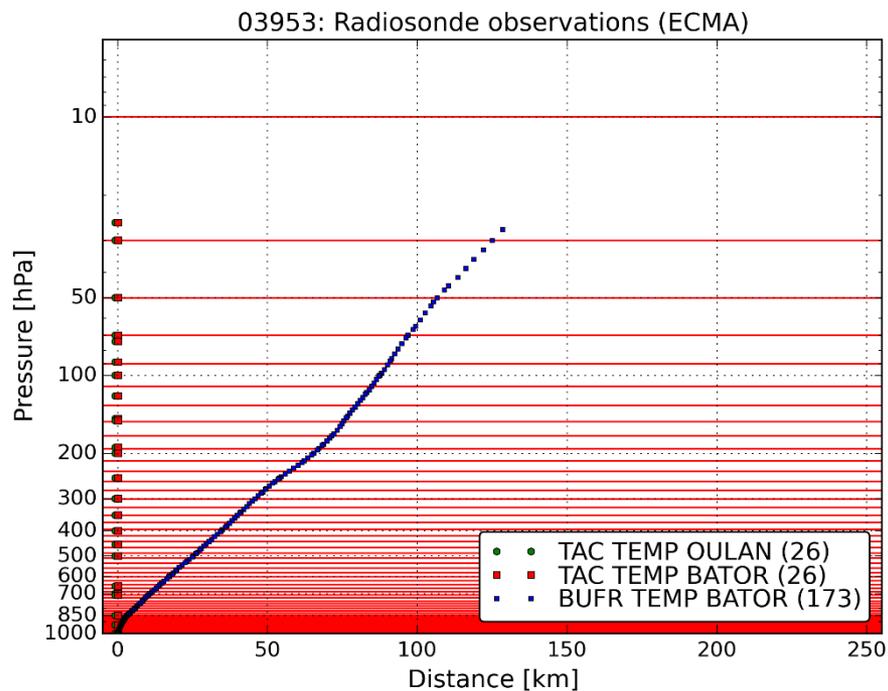
Impact study

- trunk 15795+ (nearly harmonie-40h1.2)
  - DFLT: 3DVAR, no blending, conventional obs, TAC TEMP
  - S100/S200: DFLT but use BUFR TEMP, SondOrTraj=.T., NFERQVERT_TPHR=100/200
  - S100/S200: DFLT but use BUFR TEMP, SondOrTraj=.F., NFERQVERT_TPHR=100/200
- 3-hour cycle, 48 hour forecast at 00z and 12z
- MARS (AI) observations used
- LISTE_LOC used to control use of TEMP/BUFR TEMP
- LISTE_NOIRE used to blacklist one problem sonde
- Danish DKA domain
- December 1st 2015 – December 13th 2015
  - 10 day "warm-up"

Observations

TAC (codetype=35)

odbmap plot of datum_status from 40h1t100/ECMA_40h1t100.odb
*odb select: 'varno=2 and obstype=5 and codetype=35'*
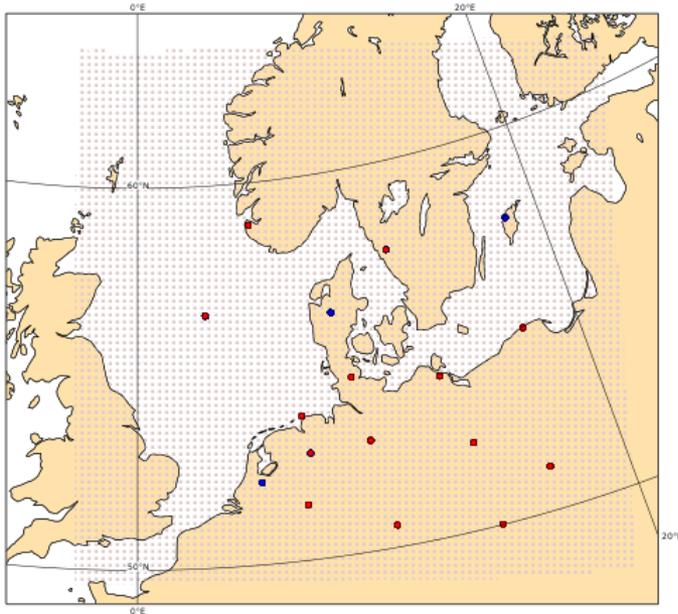
BUFR (codetype=109)

odbmap plot of datum_status from 40h1t100/ECMA_40h1t100.odb
odb select: 'varno=2 and obstype=5 and codetype=109'
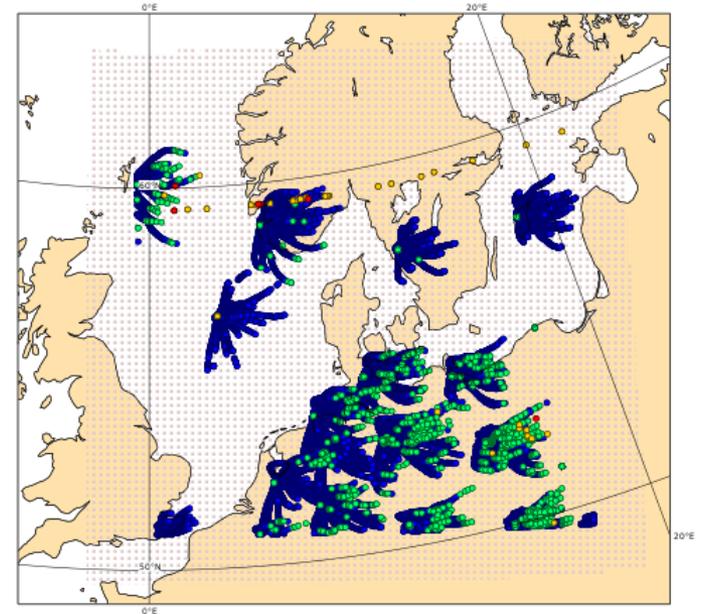


- **Active**
- **Blacklisted**
- **Rejected**
- **Rejected + blacklisted**

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Impact: O-B, O-A statistics

O-B(Solid) O-A(Dashed) var=t
DFLT: RED, T100: BLACK
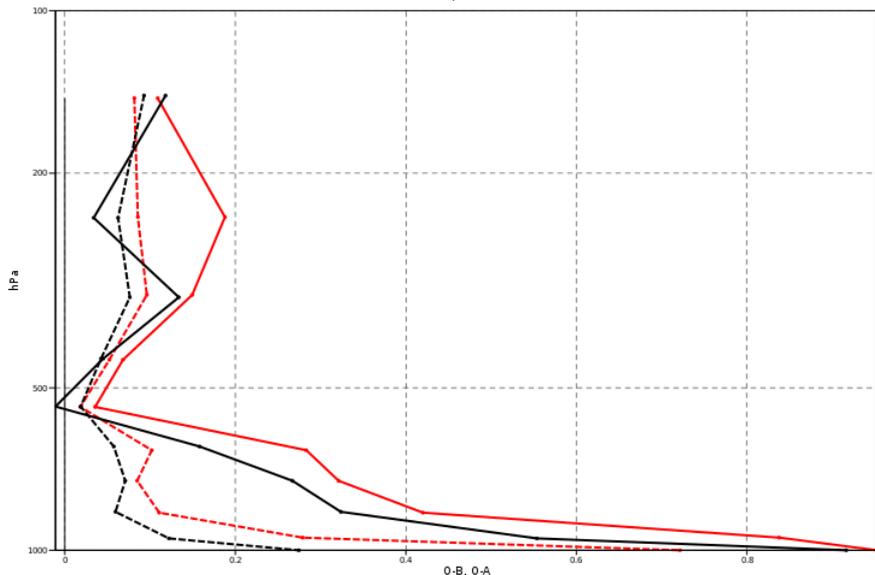
O-B(Solid) O-A(Dashed) var=t
DFLT: RED, T100: BLACK

BIAS
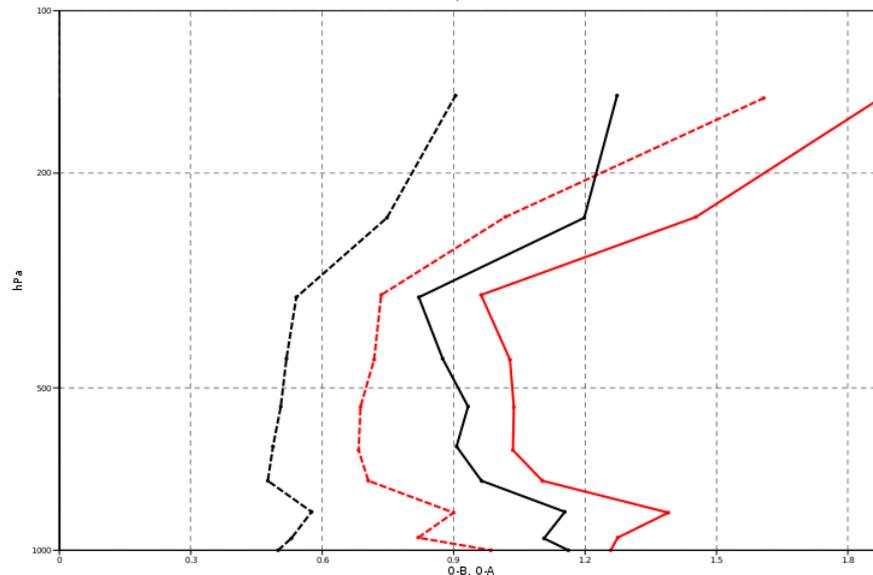
STDEV

Impact: Point verification at the surface
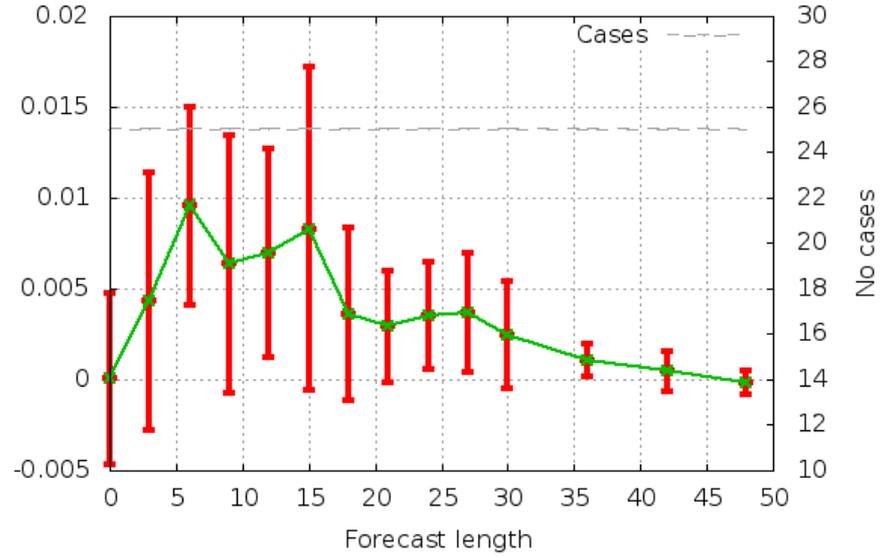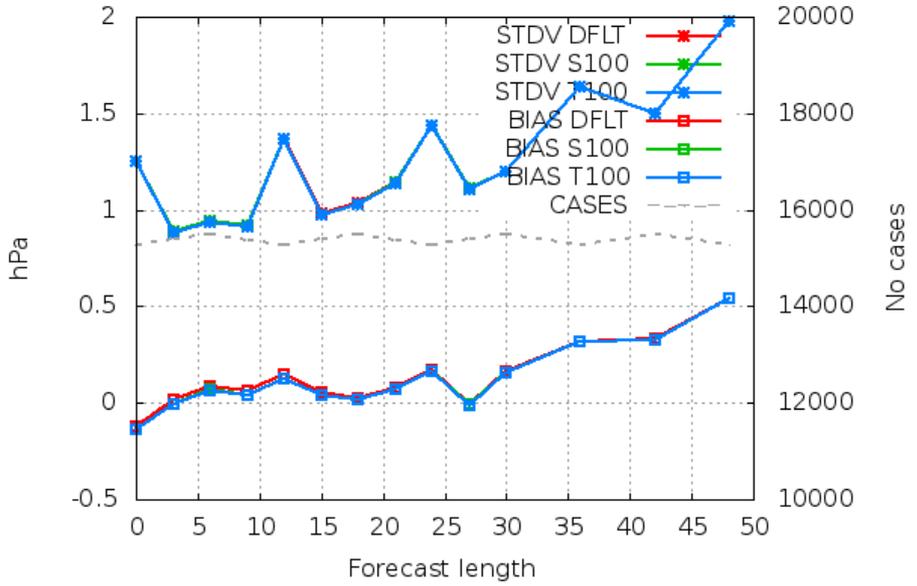
Conclusions

- Bator is a usable alternative
- COPE will need to be re-evaluated in the context of future IFS observations reading changes

- BUFR TEMP observations can have a positive impact on forecasts