

Observation Pre-processing: Update

AKA: "Use of observations in HARMONIE (including WMO BUFR and COPE)"

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Eoin Whelan

Met Éireann



Outline

- COPE - an update
- GTS BUFR – changes in HARMONIE
- BUFR TEMP – “impact” study

COPE: Continuous Observation Processing Environment



COPE – Wk 24 / ASM 2014

- Introduction to COPE
- Framework for all obs processing & quality control
 - Make obs processing and QC more transparent
 - Perform observation processing before cut-off time
- Technical description/requirements
- C++ “filter” development
- Data flow description
- LAM specific issues

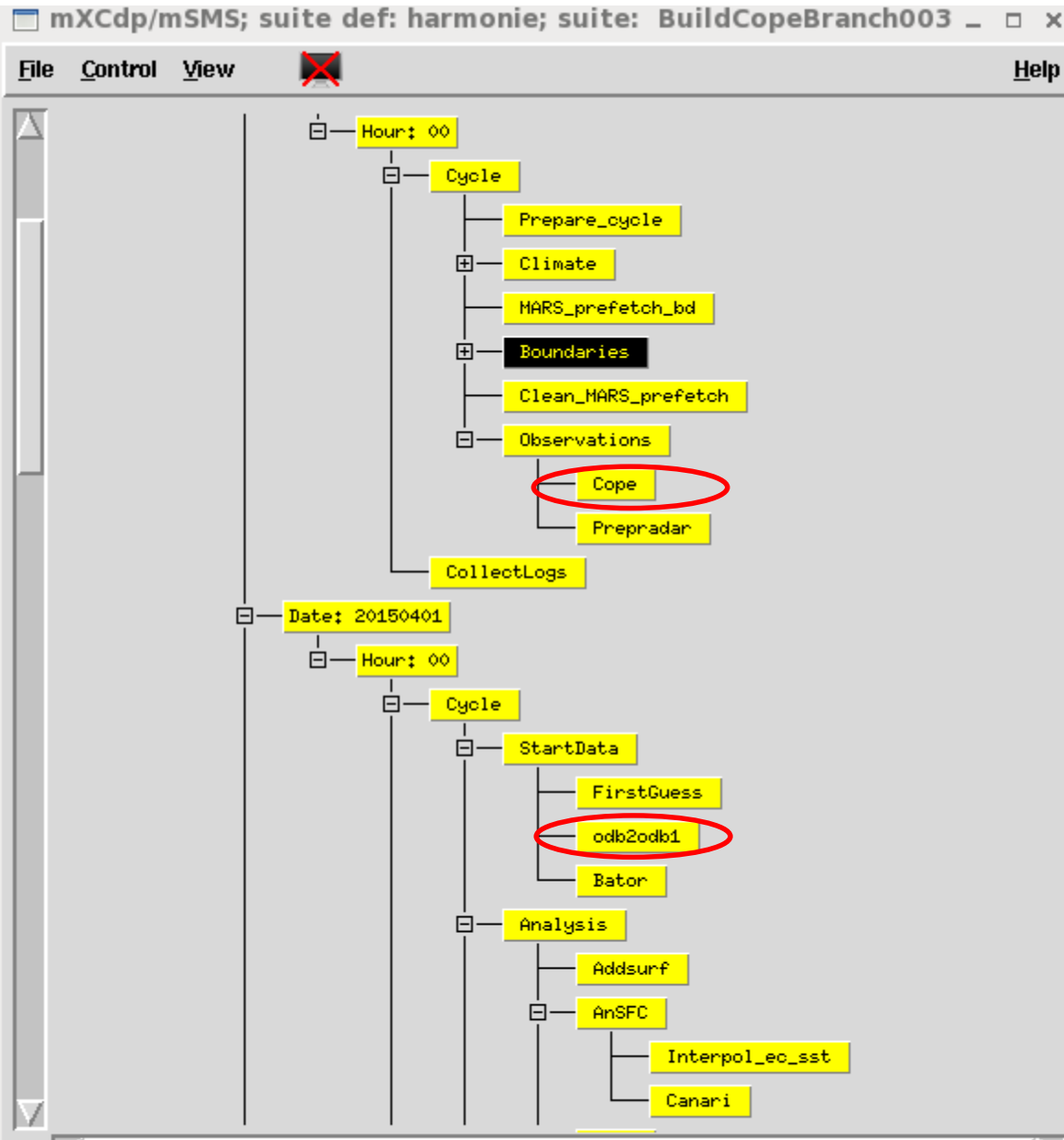
COPE: Status at ECMWF

- COPE operational in IFS for conventional obs
 - Operational since 40r3
 - AIREP, DRIBU, TEMP, PILOT, GPGPS, SYNOP, SHIP, American Profilers, European Profilers
- *b2o* software available as BUFR “loader” in COPE
- New BUFR to ODB converter being developed in ecCodes framework
- Better ODB-1/ODB-2 conversion tools on the way

COPE: HARMONIE implementation

- Compare COPE ODB with Oulan/Bator ODB
 - Implemented in harmonie-40h1 based branch
- Implement local BUFR loaders in COPE (b2o)
 - Issues with DMI BUFR
 - OK with METIE BUFR
 - (OK with ECMWF BUFR)
- Develop LAM specific filters
 - Bjarne Amstrup has submitted a Lambert domain checker
 - Other LAM related filters also submitted
- (No progress with HDF5 loader or radar data filters)

Status: COPE in HARMONIE



- **Cope** replaces **Oulan**
- **odb2odb1** converts COPE ODB2 data to ODB1 ECMAs for AnSFC & AnUA
- **Bator** continues to deal with non-conventional (non-Oulan data)
- ODB2 to ODB1 conversion is "messy" at the moment
- **USECOPE** in sms/config_exp.h controls use of Cope or Oulan

HARMONIE Implementation

```
cope screen -s ${HM_LIB}/nam/conv.schema.sql \  
          -j ${HM_LIB}/nam/conv.json \  
          -i ${OBDIR}/ob${DTG} \  
          -o ob${DTG}.odb2 \  
          -l b2o
```

- cope task: screen or test
- -s: schema defines ODB layout to be used
- -j: JSON configuration file defines filters (with options)
- -i: input file (odb/BUFR defined by -l option)
- -o: output file
- -l: loader defines how to read input data (odb/b2o)

```
${BINDIR}/odb2_to_odb1_era.x -l $dbname -s $npools $itlist $rwlist $offset
```

- odb2odb1 script uses (edited) *src/odb/tools/Odb2_to_odb1_era.F90*
- Reads ODB2 input file(s) and writes ODB1 (ECMA) databases
- Messages in multiple pools not yet addressed correctly
- COPE ECMAs work with CANARI & 3DVAR

Status: HARMONIE Implementation

```
{
  "filters": [
    { "name": "LocationValidator", "disabled": true, "options": {"units": "degrees" } },
    { "name": "DateTimeValidator", "options": {
      "valid_datetime_range" : [201301010000,201312312359]} },
    { "name": "BatorLAMflag", "options": {
      "BatorDebug" : true,
      "LamRedzone" : 100.0,
      "LamRedzone_E" : -999.9, "LamRedzone_W" : -999.9,
      "LamRedzone_S" : -999.9, "LamRedzone_N" : -999.9,
      "LamZczone" : 0.0, "LamLvar" : true, "LamLat0" : 56.7,
      "LamLon0" : 25.0, "LamLatC" : 56.7, "LamLonC" : 8.2,
      "LamNlat" : 600, "LamNlon" : 800,
      "LamDelX" : 2500.0, "LamDelY" : 2500.0,
      "LamEzone" : 11, "ChkRegGrd" : true,
      "regular_west" : -25.0, "regular_east" : 45.0,
      "regular_north" : 68.0, "regular_south" : 45.0},
      "disabled": false}
    { "name": "InstrumentTypeAssigner" },
    { "name": "InitialErrorAssigner" },
    { "name": "HeightToPressureConverter" },
    { "name": "WindComponentsAssigner" },
    { "name": "PrescribedErrorAssigner", "options": {
      "statistics_file": "error_statistics.csv" } },
    { "name": "FinalErrorAssigner" },
    { "name": "DegreesToRadiansConverter", "disabled": false },
    { "name": "FinalChecker", "disabled": true }
  ]
}
```



Where to next?

- Stage 3 of COPE
 - SAPP delivering ODB2 to ODB Server
 - ODB Server implementation
 - Observation Screening Facility
 - (Real time monitoring)
 - ODB2 format improvements
- HARMONIE:
 - Resolve ODB2 → ODB1 conversion issues
 - Get started with HDF5 loader and radar related filters
 - Test non-conventional observation types
 - Stage 3 will involve OOPS/refactoring developments

GTS BUFR

Oulan developments



WMO migration from TAC to BUFR

- Traditional Alphanumeric Codes → BUFR
- “Switch-off” of TAC well underway
- See: <https://software.ecmwf.int/wiki/display/TCBUF>
- How are NMSs handling new BUFR messages?
 - Convert all messages to “old” BUFR?
 - Convert all messages to “new” BUFR?
 - Maintain both streams of data?
- How should Oulan handle new BUFR?
- How flexible should Oulan be?

Oulan developments

- ShuffleBufR now identifies BUFR by:
 - dataCategory (type)
 - dataSubCategory (sub-type)
 - internationalDataSubCategory (BUFR 4 only)
- GTS BUFR read directly by Oulan
- Multi-subset BUFR correctly processed
- At the moment Oulan will only process either “old” or “new” BUFR
- TEMP increments (time & space) now used
- Updated Oulan documentation:
<https://hirlam.org/trac/wiki/HarmonieSystemDocumentation/ObservationPreprocessing>

BUFR TEMP “impact” study

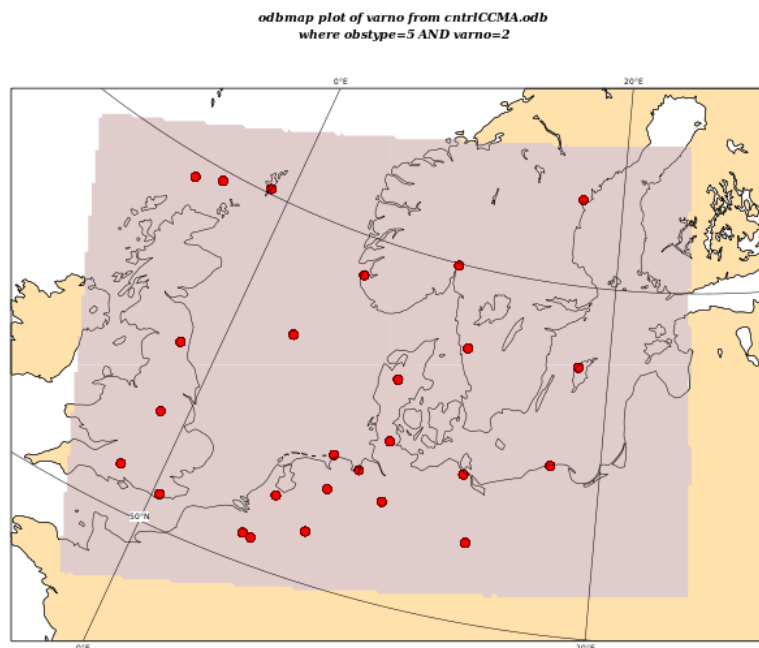


WMO migration from TAC to BUFR

- 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
- However ...
 - Not all radiosondes reported in BUFR on GTS
 - Not all TEMP BUFR is correctly encoded
 - Some TEMP BUFR has just been converted from TAC
- ... we must be careful

Impact study

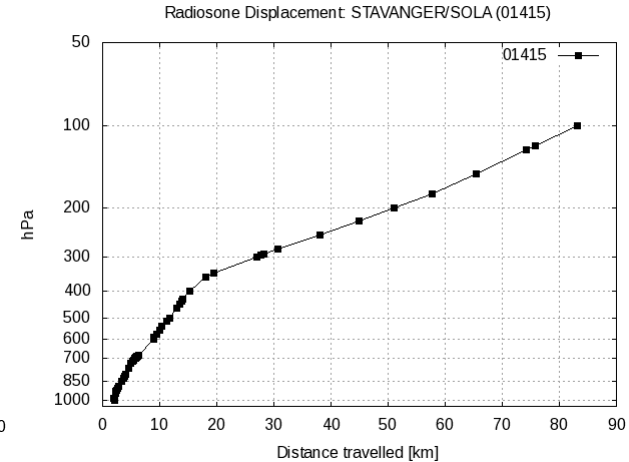
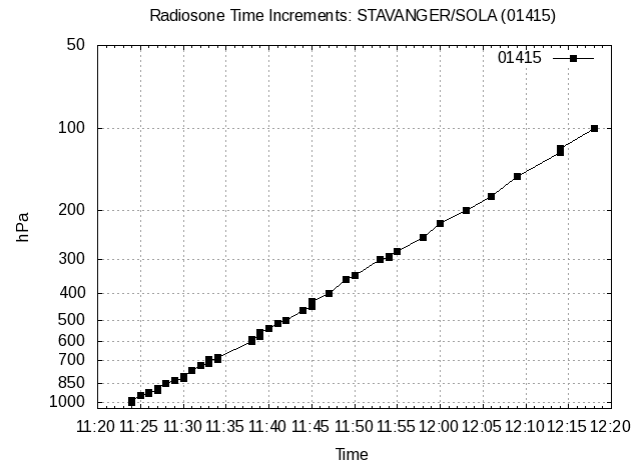
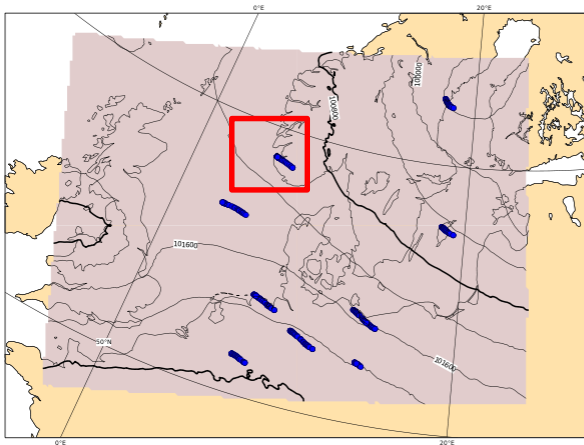
- harmonie-40h1.beta.5
 - CNTRL: 3DVAR+blending, conventional observations only
 - BFRRS: CNTRL but use BUFR TEMP instead of TAC TEMP
- 3-hour cycle, 24 hour forecast at 00z and 12z
- MARS observations used for both experiments
- Danish DKA domain
- November 15th 2015
 - December 31st 2015



Observation processing

- Oulan now reads TEMP BUFR
 - (LNEWTEMPBUFR=.TRUE. in NADIRS)
- Oulan uses (space & time) displacement information
- Only significant & standard levels written to OBSOUL

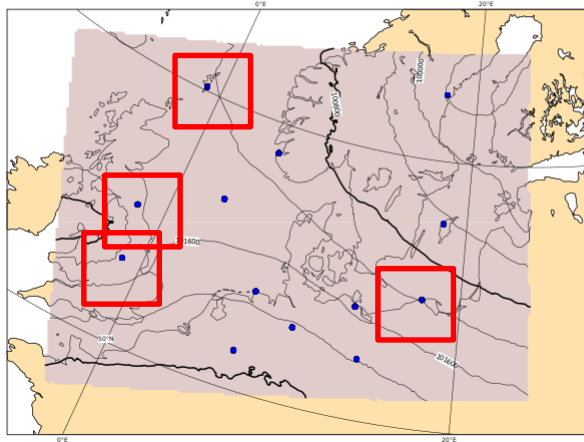
odbmap plot of varno from odb/40b1p5bfrs/2015/12/12/3dVCCMAconv2015121212.odb
where obstype=5 AND varno=2



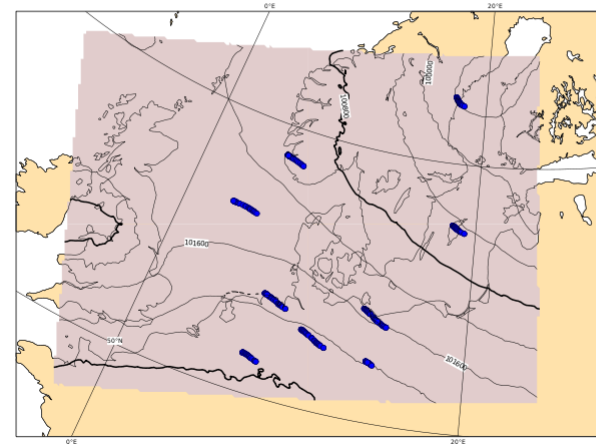
Data Issues (in MARS at least)

- # TAC sondes \neq # BUFR sonde

odtmap plot of varno from odb/40b1p5cntr1/2015/12/12/3dvCCMAconv2015121212.odt
where obstype=5 AND varno=2

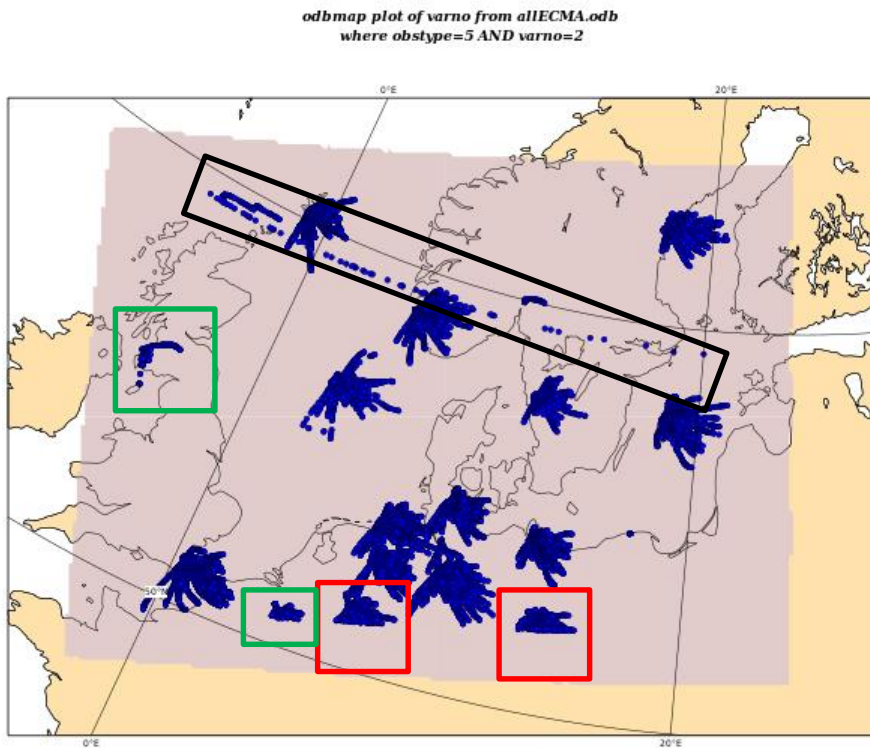


odtmap plot of varno from odb/40b1p5bfrs/2015/12/12/3dvCCMAconv2015121212.odt
where obstype=5 AND varno=2



Data Issues (in general)

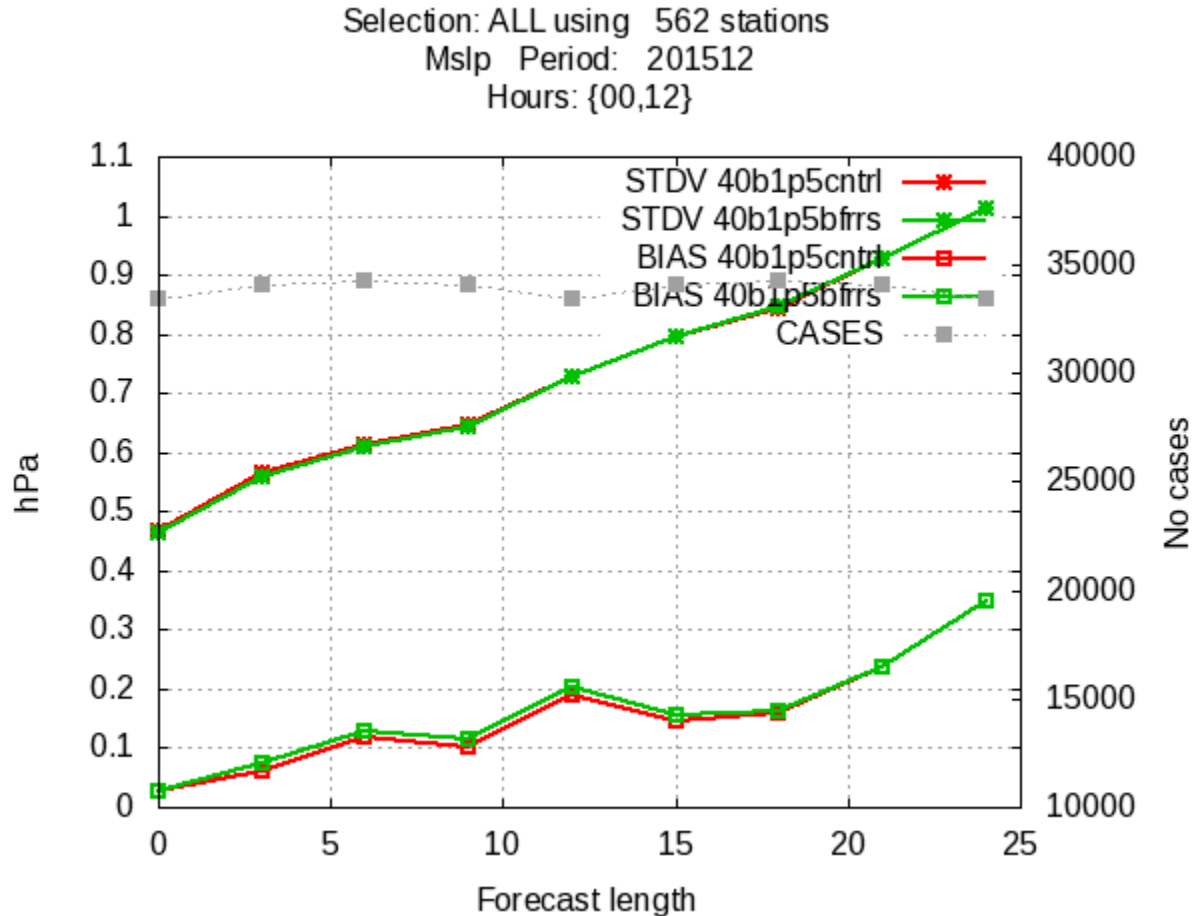
- Extra data from sondes outside of domain
- Less data from sondes drifting out of domain
- Bad data



Impact: Point verification at the surface

40b1p5cntrl: CNTRL – TAC TEMP

40b1p5bfrs: EXPT – BUFR TEMP

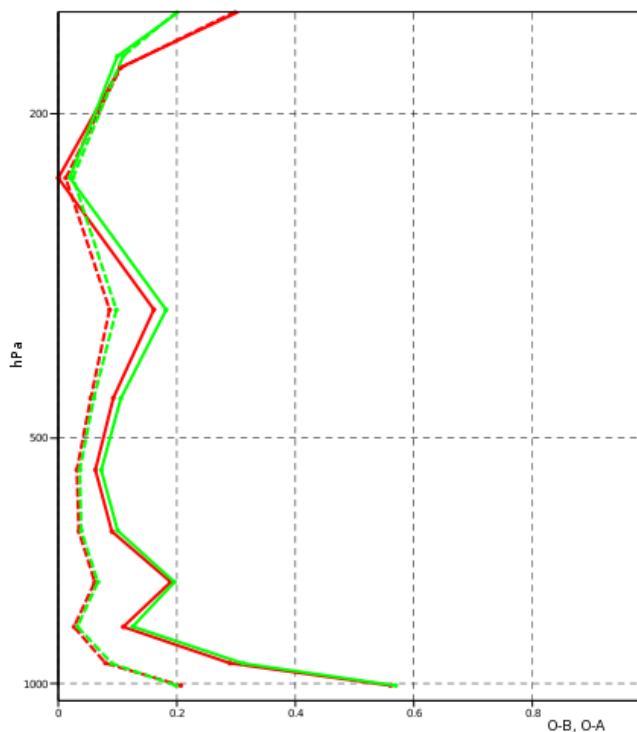


Impact: O-B, O-A statistics

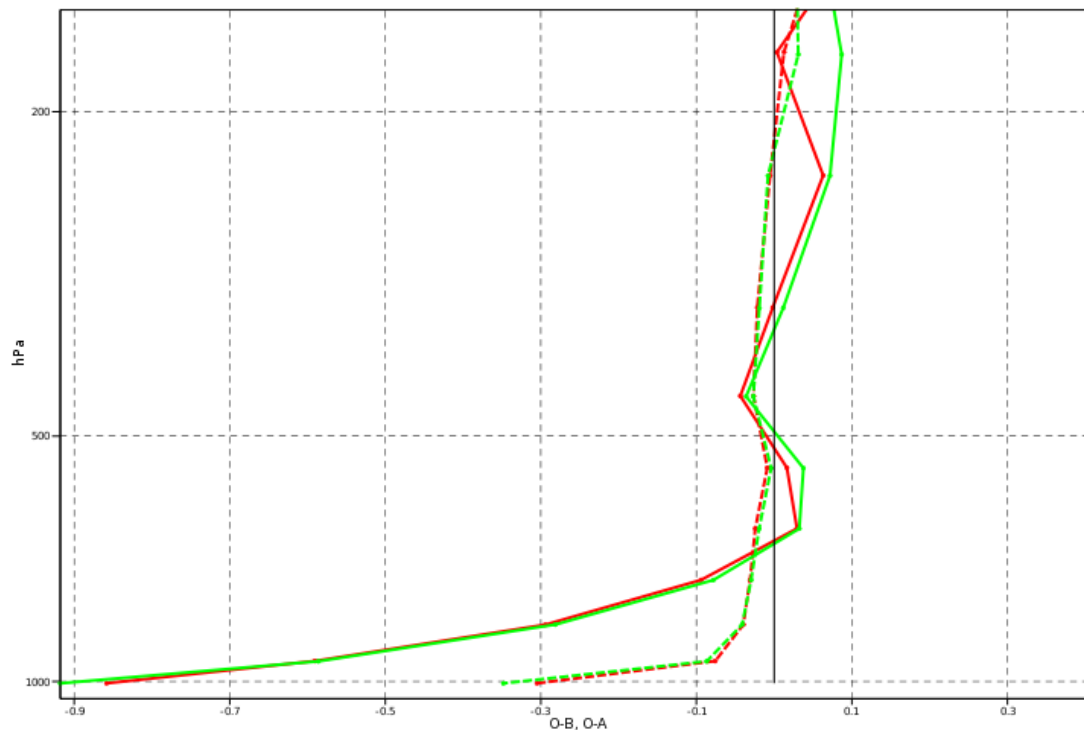
40b1p5cntrl: CNTRL – TAC TEMP

40b1p5bfrs: EXPT – BUFR TEMP

O-B(Solid) O-A(Dashed) var=t
CNTRL: RED, BFRS: GREEN

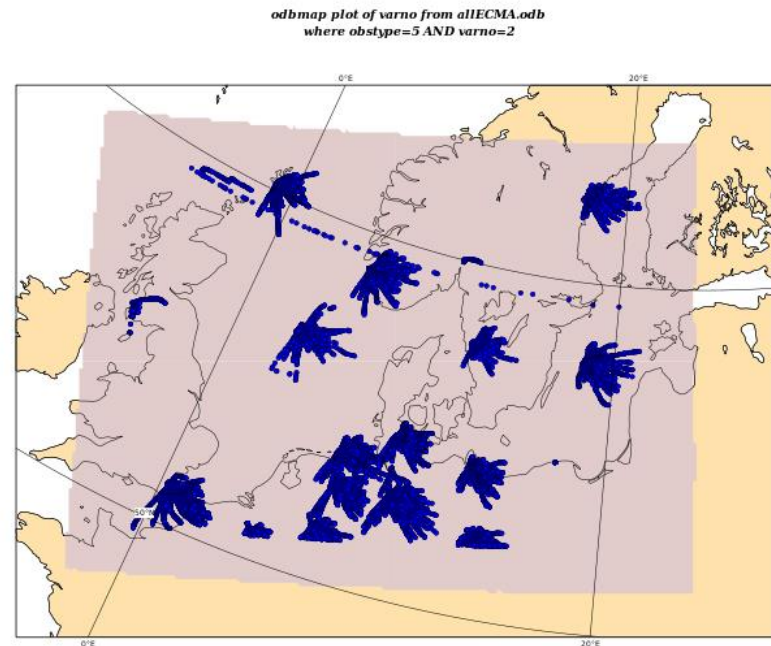


O-B(Solid) O-A(Dashed) var=u
CNTRL: RED, BFRS: GREEN



Impact study: results and conclusions

- Initial results: underwhelming
- Cleaner comparisons needed
 - Switch off blending
 - More careful selection of observations
- Thinning of data – be less brutal!
 - Investigate MF approach



Thank you for your attention

Questions?