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Observation Preprocessing

From GTS data to NWP input

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Motivation

GTS data transmitted in TAC-format
(WMO defined ASCII code)

TAC gradually replaced by BUFR

Each institute should ask themselves:
GTS BUFR-data to NWP input, can we handle it

SMHI needed to work on it

Together with met.no in Norway.

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The migration schedule

Code Migration Schedule

Category →	**Cat.1: common**	**Cat.2: satellite observations**	**Cat.3: aviation[1]**	**Cat. 4: maritime**	**Cat. 5[2]: miscellaneous**	**Cat. 6[2]: almost obsolete**
Lists of → Traditional code forms	SYNOP SYNOP MOBIL PILOT PILOT MOBIL TEMP TEMP MOBIL TEMP DROP CLIMAT	SAREP SATEM SARAD SATOB	METAR SPECI TAF AMDAR ROFOR	BUOY TRACKOB BATHY TESAC WAVEOB SHIP CLIMAT SHIP PILOT SHIP TEMP SHIP	RADOB IAC IAC FLEET GRID*(to GRIB)* RADOF	CODAR ICEAN GRAF NACLI etc. SFAZI SFLOC SFAZU RADREP ROCOB
Schedule ↓	CLIMAT TEMP			CLIMAT TEMP SHIP		ROCOB SHIP ARFOR WINTEM MAFOR HYDRA HYFOR
Start experimental Exchange[3]	**Nov. 2002** for some data (AWS SYNOP, TEMP USA)	Current at some Centres	**2006** **2002** at some Centres for AMDAR	**2005** **2003** for Argos data (BUOY, sub-surface floats, XBT/XCTD)	**2004**	Not applicable
Start operational exchange[3]	**Nov. 2005**	Current at some Centres	**2008** **2003** for AMDAR	**2007** **2003** for Argos data (BUOY, sub-surface floats, XBT/XCTD)	**2006**	Not applicable
Migration complete	**Nov. 2010**	**Nov. 2006**	**2016** **2005** for AMDAR	**2012** **2008** for Argos data (BUOY, sub-surface floats, XBT/XCTD)	**2008**	Not applicable

Notes:

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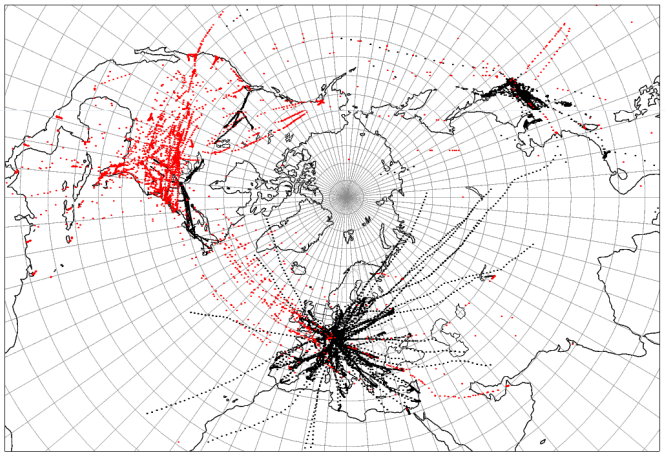
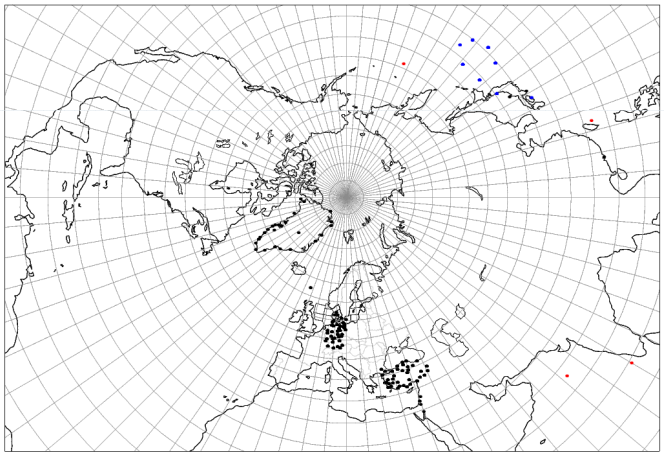
Arriving in BUFR

AMDAR, ACAR 20090913 12UTC



SYNOP, SHIP, BUOY 20090913 12UTC



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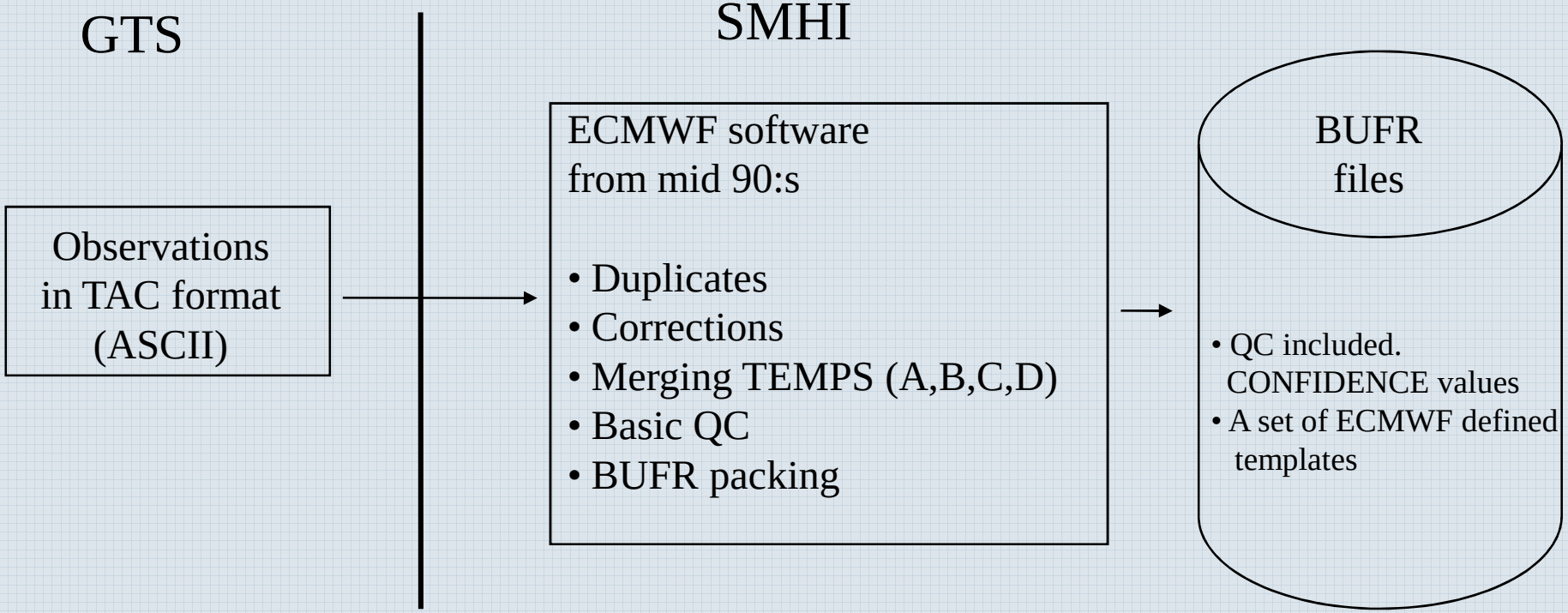
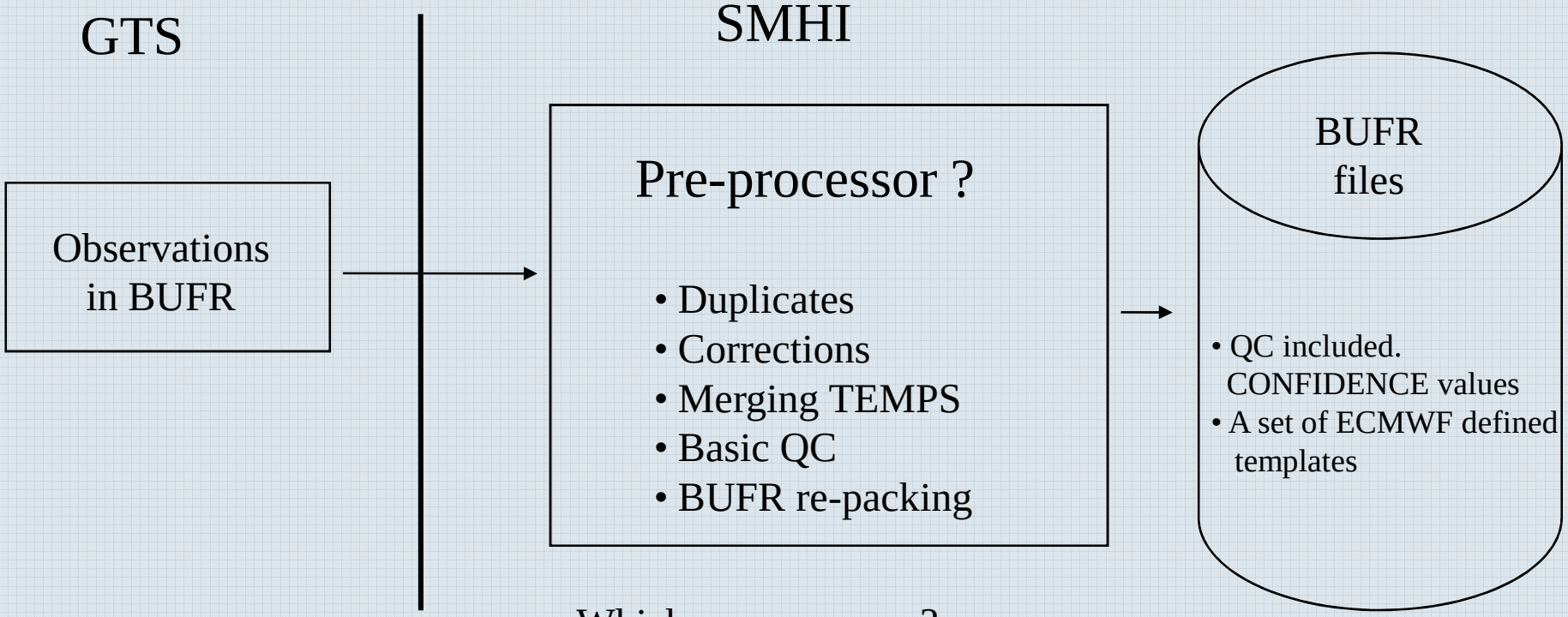
Current Situation At SMHI



HIRLAM accepts only these specific templates

Some QC from pre-processor, CONFIDENCE, are used in data-assimilation

When migration is completed



Which pre-processor?

1. New ECMWF software?
2. Write a new one?
3. Rewrite HIRLAM to read GTS-BUFR?
4. Something else…(?)

1: Install updated ECMWF software

- *Relies on ECMWF IT-infrastructure: RDB-database etc.*
- *Difficult to implement in our experience*
- *Has become a black box after initial implementation*
- *Difficult to maintain*

2: Write a new one

+ *Will have good knowledge about the code*
+ *Easier to maintain, hopefully*
- *Quite a task to write!*

3: Rewrite HIRLAM to read GTS-BUFR

- *Still need to take care of duplicates etc*
- *HIRLAM is to be replaced, at some time*

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Task for met.no

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Met.no: Write two generic converters (FORTRAN)

Aircraft data GTS-BUFR → amdarbufr2hirbufr.x → AMDAR, ACAR, ecmwf templates

Sea and land-surface data. GTS-BUFR → surfacebufr2hirbufr.x → SYNOP, SHIP, DRIBU, ecmwf templates

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Output of converters Technical details

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amdarbufr2hirbufr.x and surfacebufr2hirbufr.x output

	Obs type	Subtype
SYNOP	0	1
SHIP	1	11
DRIBU	1	21
AMDAR	4	144
ACAR	4	145

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NWPNord
Task for SMHI

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SMHI: Add most important QC, encoded as CONFIDENCE values in the output BUFR

That's the deal between Norway and Sweden!

SMHI need generic handling of GTS-BUFR telegrams and TEMPS

Duplicates, corrections, merging etc.

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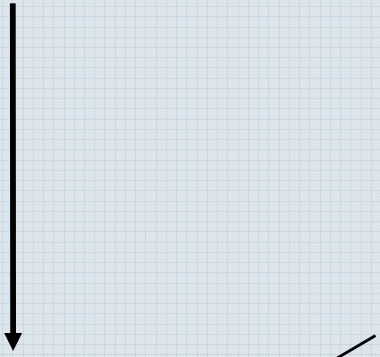
New SMHI pre-processor

BUFR telegrams



Preprocessor

aircraft_yyyymmddhh.bfr
aircraft_yyyymmddhh.index

landsurf_yyyymmddhh.bfr
landsurf_yyyymmddhh.index

seasurf_yyyymmddhh.bfr
seasurf_yyyymmddhh.index

Preprocessor

- Bourne-shell
- FORTRAN
- C
- libbufr.a

Index files (ascii) has all info needed to choose the “best one”

SMHI pre-processor TEMPS

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BUFR telegrams

Preprocessor

temp_yyyymmddhh.bfr

temp_yyyymmddhh.index

Preprocessor

Screening procedure also includes building a complete TEMP from several reports

Thank You

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At SMHI:
All GTS data in WMO-BUFR

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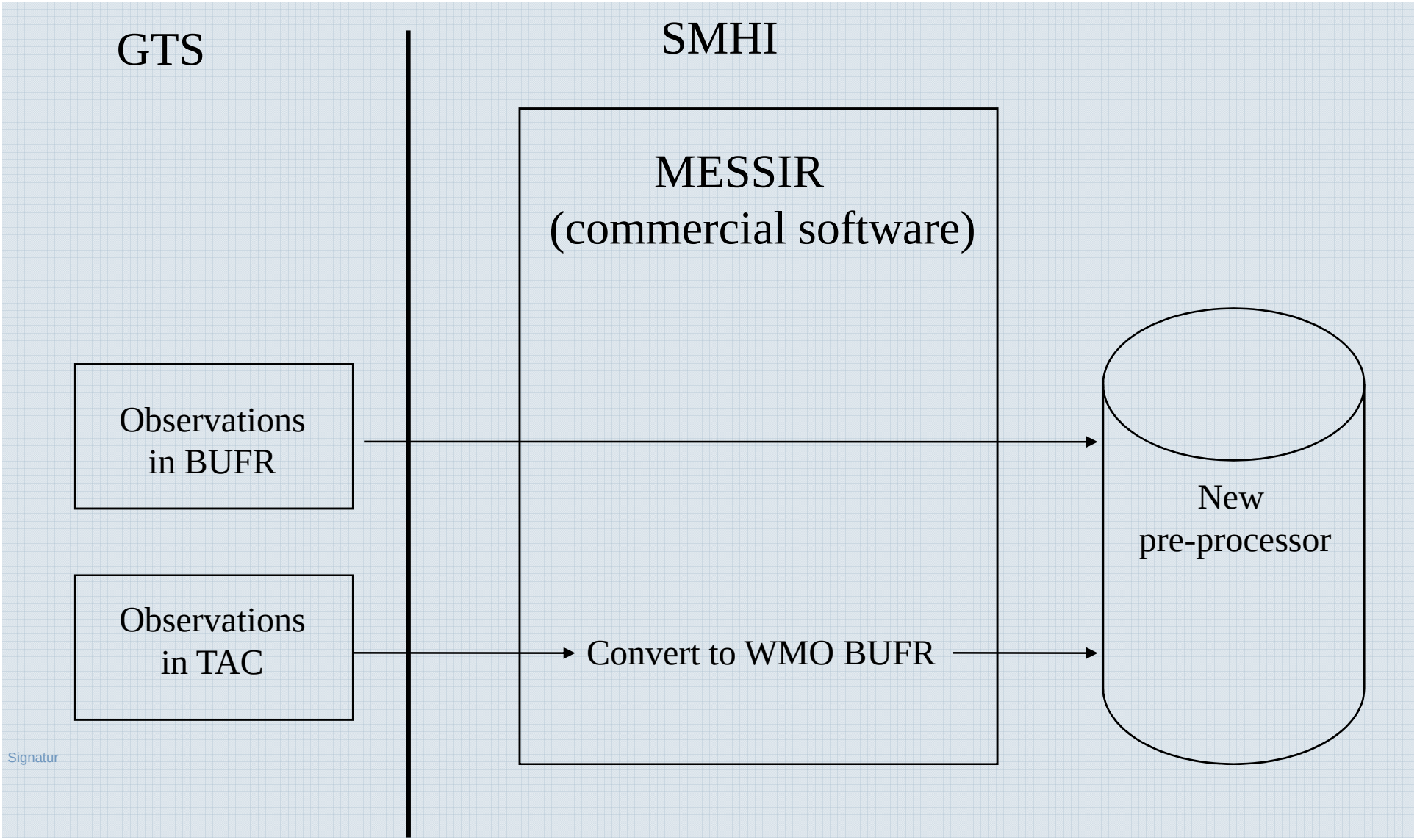

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Real time decoding

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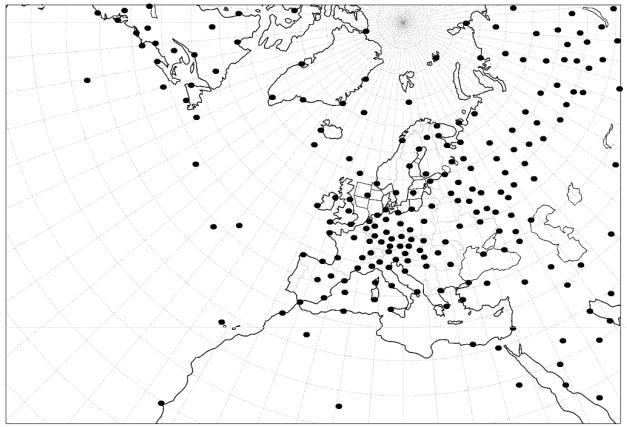
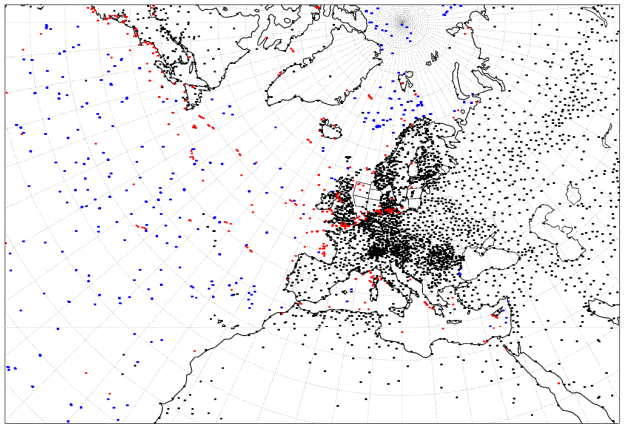
Testing our system with full data-streams

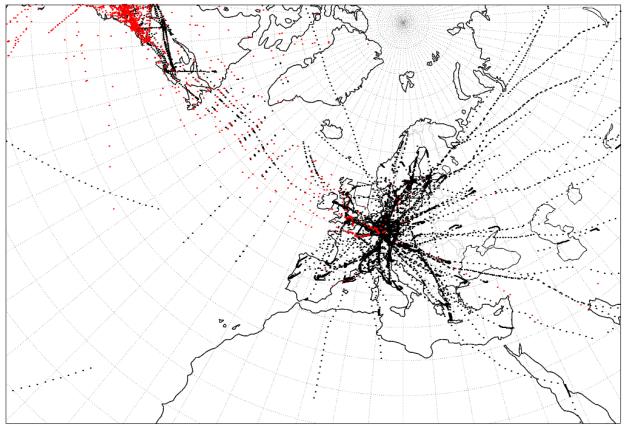
TEMP 20090911 00UTC



SYNOP, SHIP, BUOY 20090910 18UTC



AMDAR, ACAR 20090910 18UTC



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Index file for synop

```
   1
20090913 11:36
ISMD50_OJAM_131200__05014358bfr
000 002 082 000 001
   142     8    0
 20090913 12:00   30.167    35.783     40310
================================
   2
20090913 11:44
ISMH01_FQMA_131200__05014470bfr
000 002 082 000 001
   168    19    0
 20090913 12:00  -12.983    40.533     67215
================================
   3
20090913 11:52
ISMA01_EGRR_131200__05014634bfr
000 002 082 000 001
   168    10    0
 20090913 11:50   36.150    -5.350     08495
================================
```

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Index file for aircraft

```
   1
20090913 11:34
IUAD02_EGRR_131133__05014304bfr
004 020 082 004 144
   110    5   0
 20090913 11:31  62.550    7.467 003380   EU5529
================================
   2
20090913 11:34
IUAD02_EGRR_131133__05014304bfr
004 020 082 004 144
   110    5   0
 20090913 11:31  62.500    7.550 003900   EU5529
================================
   3
20090913 11:34
IUAD02_EGRR_131133__05014304bfr
004 020 082 004 144
   110    5   0
 20090913 11:32  62.467    7.650 004330   EU5529
================================
```

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Index file for TEMP

```
1
IXXX00_XXXX_000000_XXX_00000000bfr
20090914 02:30
002 005 082
000295 000
009 001
20090913 10:56  42.500  -64.600   ASDE01
001 1009.000 -999.000   1  1  1  1     1
002 1000.000    0.104   1  1  0  0     2
003  982.000 -999.000   1  1  0  0
004  925.000    0.772   1  1  0  0     2
005  850.000    1.487   1  1  0  0     2
006  818.000 -999.000   1  1  0  0
007  775.000 -999.000   1  1  0  0
008  700.000    3.087   1  1  0  0     2
009  686.000 -999.000   1  1  0  0
================================
2
IXXX00_XXXX_000000_XXX_00000000bfr
20090914 02:30
002 005 082
001786 000
080 001
20090913 10:35  36.700  -21.300   ASDE02
001 1023.000 -999.000   1  1  1  1     1
002 1000.000    0.208   1  1  1  1     2
003  992.000 -999.000   1  1  0  0
004  925.000    0.880   1  1  1  1     2
005  885.000 -999.000   1  1  0  0
006  852.000 -999.000   1  1  0  0
007  850.000    1.596   1  1  1  1     2
008  797.000 -999.000   1  1  0  0
009  763.000 -999.000   1  1  0  0
010  749.000 -999.000   1  1  0  0
011  725.000 -999.000   1  1  0  0
012  701.000 -999.000   1  1  0  0
013  700.000    3.206   1  1  1  1     2
014  688.000 -999.000   1  1  0  0
```

Signatu