# Further development of the ATOVS and AVHRR Processing Package (AAPP)

## including an initial assessment of EARS radiances

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# Contents

- Status of AAPP version 4
- Developments for NOAA-N,N' (version 5) and METOP
- Use of data from EUMETSAT ATOVS Retransmission Service (EARS)

 

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# AAPP Version 4 changes

1) Improved documentation
   - Scientific description (pdf)
   - Software description (pdf)
   - Data formats document (pdf)
   - AAPP Overview (pdf)
   - Installation guide (html)
2) Fortran 90 compatible
   - Compiles under selected F90 and F77 compilers, with no significant differences in output
3) Moon in AMSU-A space view
   - Detects and corrects moon contamination in AMSU-A space view (at 1b -> 1c stage)
   - Method used at Met Office for some time
   - Interpolate gain
   - Different from method to be implemented by NESDIS at 1b level (correction based on antenna patterns), but no conflict

 

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# AAPP Version 4 changes (cont.)

4) Antenna efficiencies

- `atovin/infdf.F` modified to allow different antenna efficiencies for different satellites

5) 'Bug' in surfelev.F

- Old code gave different answers for f77 & f90 compilers

Status:

- Valuable comments received from beta-testers at KNMI and Wisconsin
- Version 4 being distributed by EUMETSAT October 2003

 

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# Developments for NOAA-N, N'

NOAA-N launch expected summer 2004

Changes will be incorporated into AAPP version 5, to be released following NOAA-N launch

- Main differences from NOAA-KLM:
  - MHS instead of AMSU-B
  - HIRS/4 instead of HIRS/3
- Progress so far:
  - Code changes for MHS complete; being tested using NOAA-N thermal vacuum data

 

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# MHS

Main differences between MHS and AMSU-B:

- Channel 20: 190.31 GHz instead of 183.31±7
- Channel 17: 157 GHz instead of 150
- Channels 18 & 19: H polarization at nadir instead of V
- Spare local oscillators (LO-A, LO-B), characterized separately
- Spare processing electronics (PIE-A / PIE-B)
- Method of computing on-board target temperature (using 3 precision resistors)

In AAPP:

- Decode MHS data in HRPT data stream
  - MIU (MHS Interface Unit) on NOAA spacecraft outputs MHS data into HRPT words previously used for AMSU-B
- New 1b definition (`mhs1b.h`) and calibration program (`mhscl`)
- Otherwise, differences can be accommodated within existing structure. No changes at level 1c or beyond (use `amb1c.h`).

 

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# Other changes for Version 5

- Implement new HIRS calibration algorithm (v4.0) as an option
- Minor additions to AMSU-A 1b format (following NOAA recommendations)
- Improved navigation (2-line elements with SGP4)
- Moon detection in AMSU-B / MHS space view
  - Similar to that already implemented for AMSU-A, but at `amsubcl / mhscl` stage
  - Reject space view samples too close to predicted position of moon (up to 3 of the 4 samples)
  - Same method will be used by NESDIS (performs better than current NESDIS method)

 

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# Developments for METOP direct broadcast

- NWP SAF working with EUMETSAT on development of AAPP for the METOP era
- Instruments supported: ATOVS + IASI
- EPS user terminals:
  - Supplied by EUMETSAT
  - Software (written by industry) to receive direct broadcast
  - Interface for AAPP will be EUMETSAT level 0 (i.e. the EUMETSAT equivalent of NOAA level 1a)
  - SPOT-5 orbital prediction model to be used
  - The 'Admin' message will contain information related to navigation, spacecraft manoeuvres, etc.
- IASI code being developed by CNES

 

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# EARS Data Acquisition and comparison

Washington

West Freugh

EUMETCAST

Global
1b data

Local
HRPT

EARS
1a data

EARS
1c data

Not used

AAPP
Preproc

1c to European users

1d data

On HIRS
grid

AAPP
Decommutation
Calibration
Preproc

AAPP
Calibration
Preproc

Compare to Global

Kangerlussuaq (Greenland)
Maspalomas (Canaries)
Tromsø (Norway)
Edmonton (Canada)
Athens (Greece)
(also Bedford, Gander, Monterey)

 

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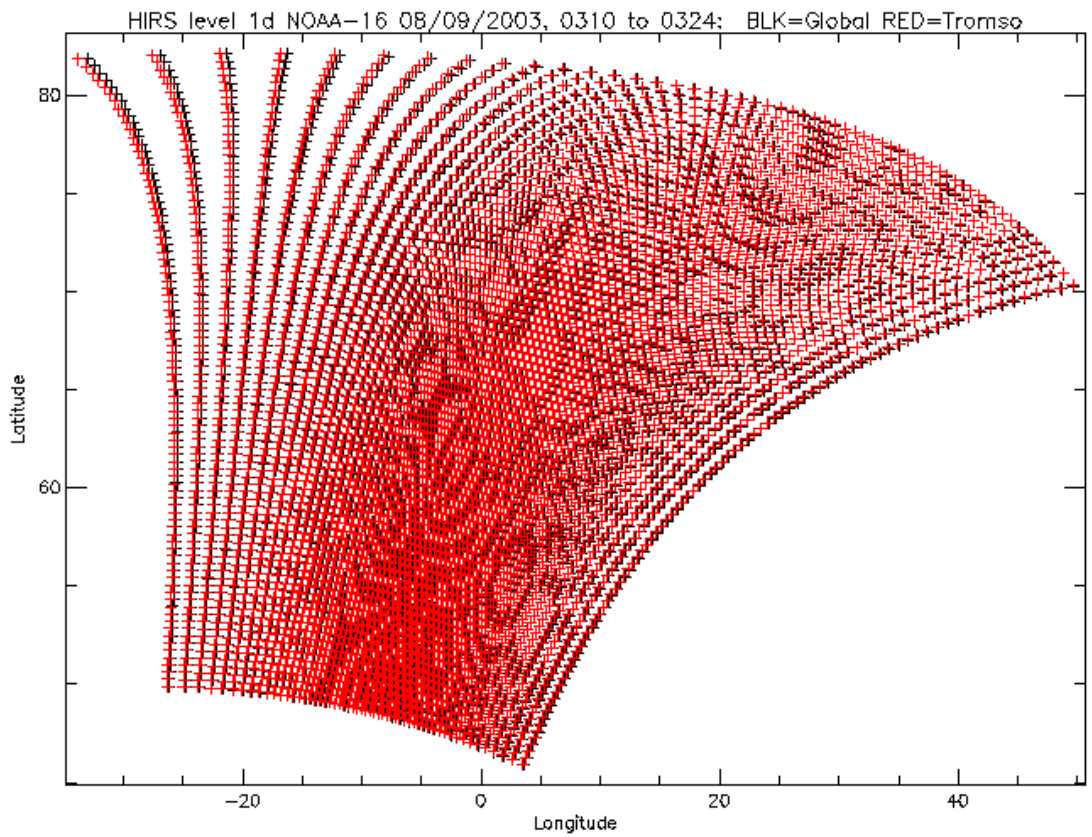
# Mapping Compared to Global

## Tromsø Data




Black=Global

Red=EARS

Latitude

Longitude

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# Reasons for mapping differences

- Orbit prediction
  - Met Office: TBUS received daily via GTS
  - EARS 1c: TBUS info from NOAA web site http://noaasis.noaa.gov/NOAASIS/ml/navigation.html
  - NESDIS global: more sophisticated US military data
- Re-mapping to HIRS
  - NOAA-16 & NOAA-17 HIRS misaligned
  - NESDIS assume 1.8 deg for both
  - AAPP assumes 2.0° & 1.7° respectively, based on comparisons with AVHRR (hard-coded in `include/timang.h`)

 

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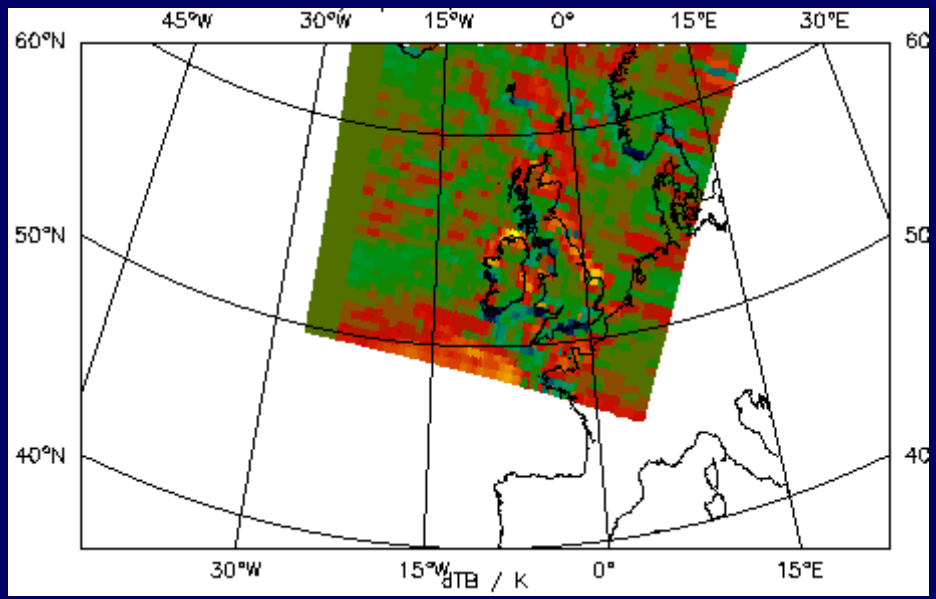
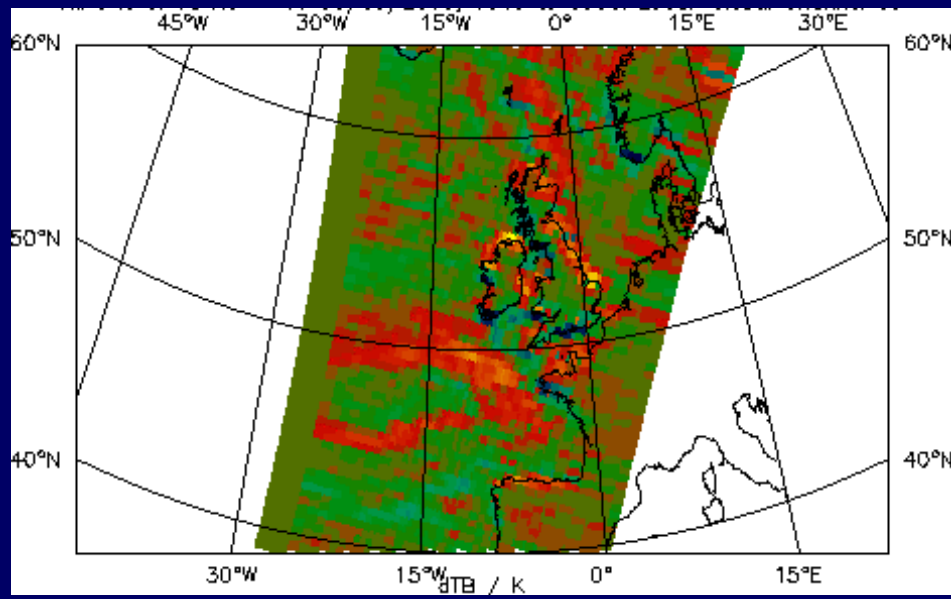
# Brightness Temperature Comparison

## AMSU-15

Global -Tromsø




Global -Local





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# Reasons for brightness temperature differences

- Re-mapping to HIRS grid
  - AMSU brightness temperatures are consistent to 0.01K at level 1c
- HIRS calibration
  - Partial super-swaths at start and end of overpass
  - Combine EARS 1a datasets before calibrating?
  - New NOAA HIRS calibration method (v4.0) may help. Météo-France updating calibration algorithm for AAPP.

 

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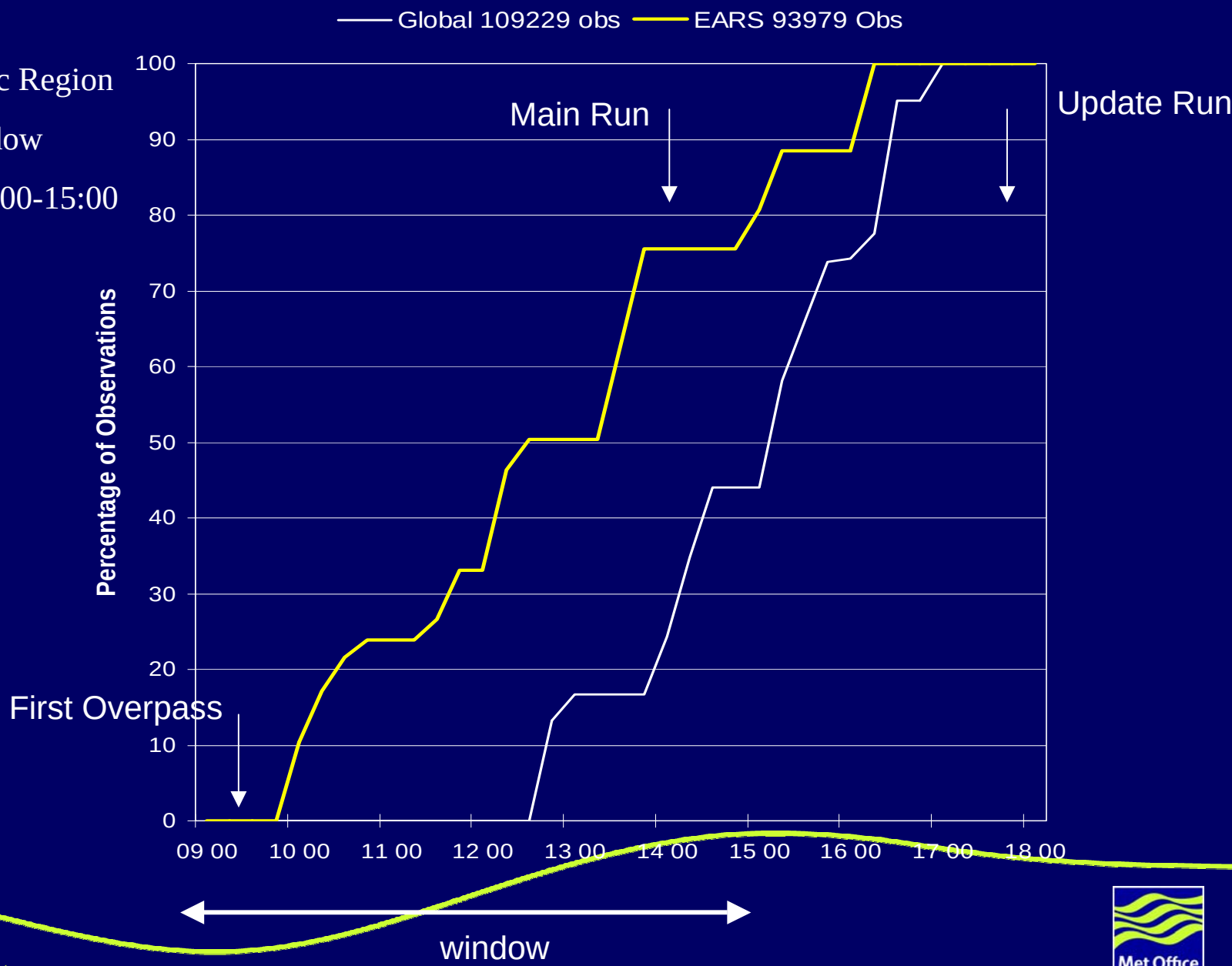
# Arrival Times of Data

- North Atlantic Region
- six-hour window

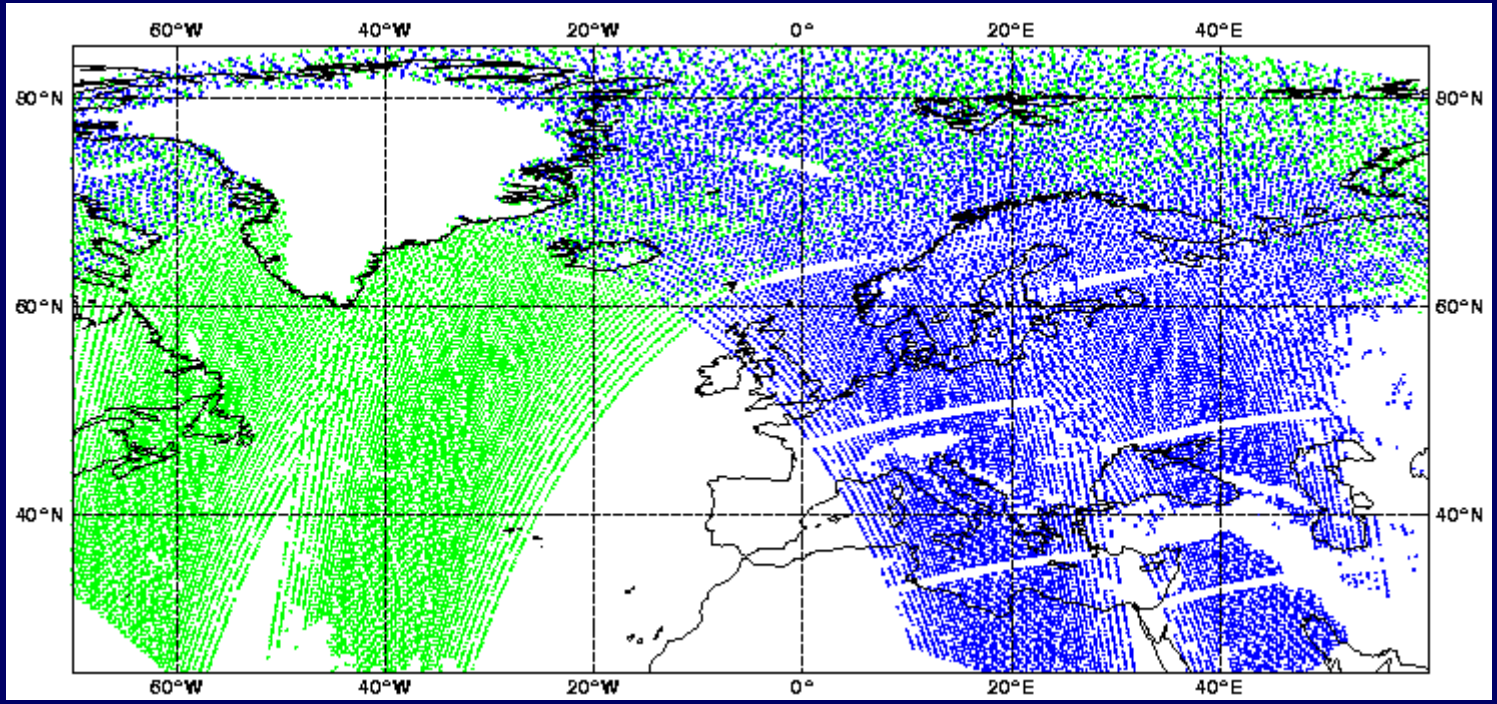
09/09/2003 09:00-15:00



# Global AMSU Data Used in the Main Run

six-hour window 09/09/2003 09:00-15:00




Green: NOAA 15 Blue: NOAA 16 Red: NOAA 17

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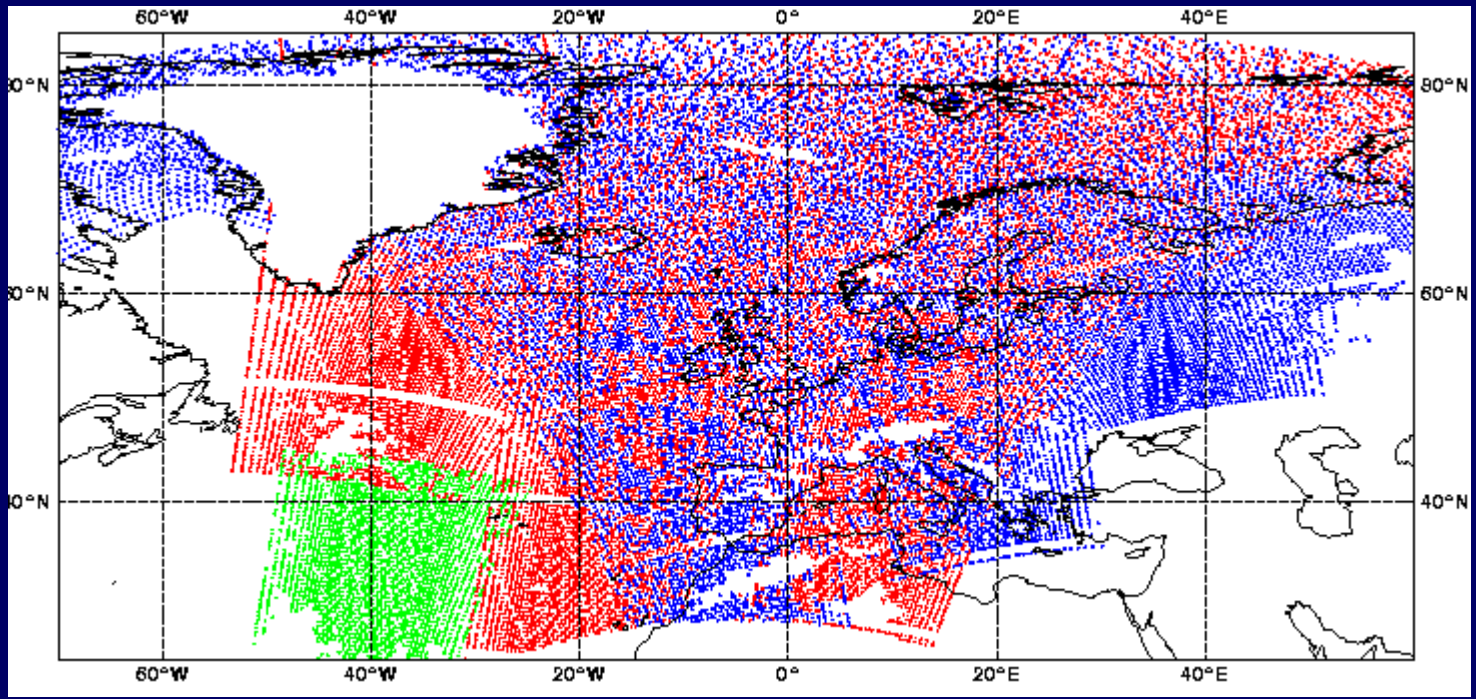
# Available EARS AMSU Data

six-hour window 09/09/2003 09:00-15:00




Green: NOAA 15 Blue: NOAA 16 Red: NOAA 17

- Assimilation trials using EARS to commence in autumn 2003

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# Conclusions

- AAPP v4 released
- Work underway for NOAA-N and METOP
- EARS comparisons with NESDIS data performed routinely
- Monitoring in the operational system suggests good quality for assimilation & ability to fill in ‘blind orbits’

# Acknowledgements


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