Cal/Val and Assimilation of satellite data at ECMWF

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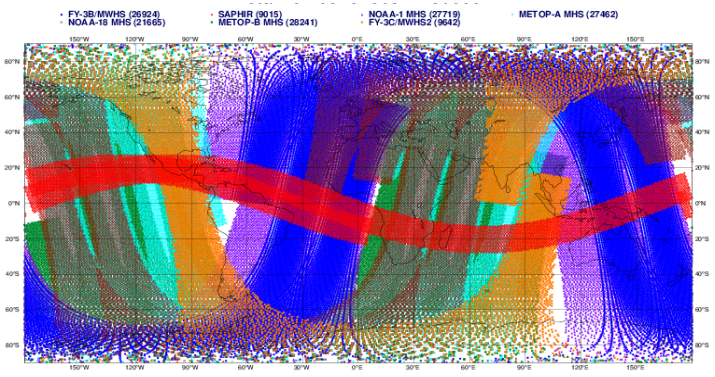
Thanks to: Fabien Carminati, Bill Bell, Stuart Newman

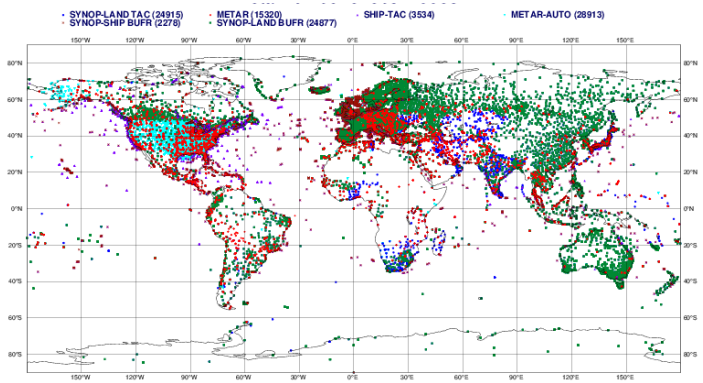
UK Met Office

Using NWP short-range forecasts to evaluate satellite data

MHS/MWHS-2/SAPHIR/MWHS



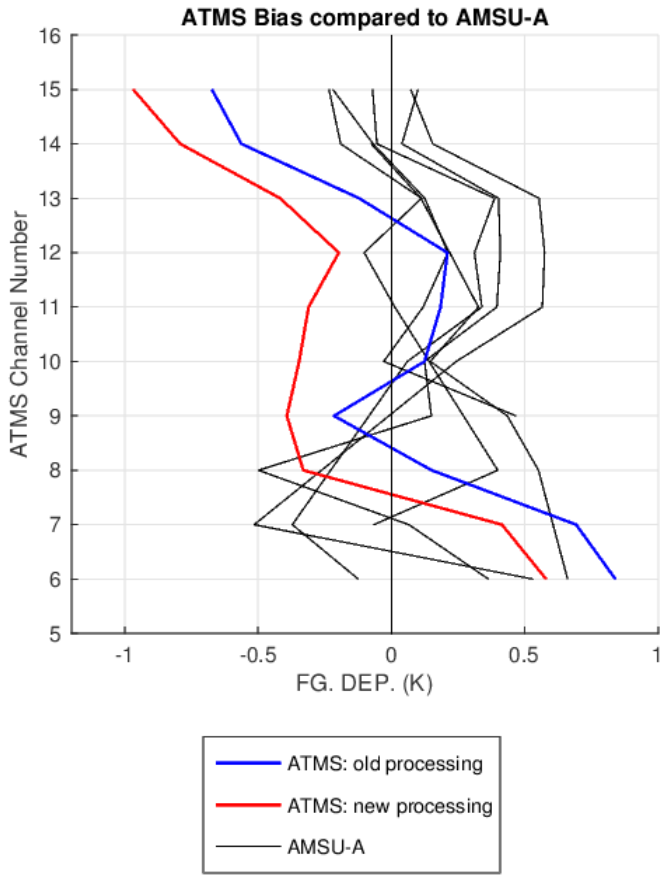
SYNOP



NWP Data Assimilation:

- Optimal combination of many observations past and present
- High accuracy temperature and humidity analyses

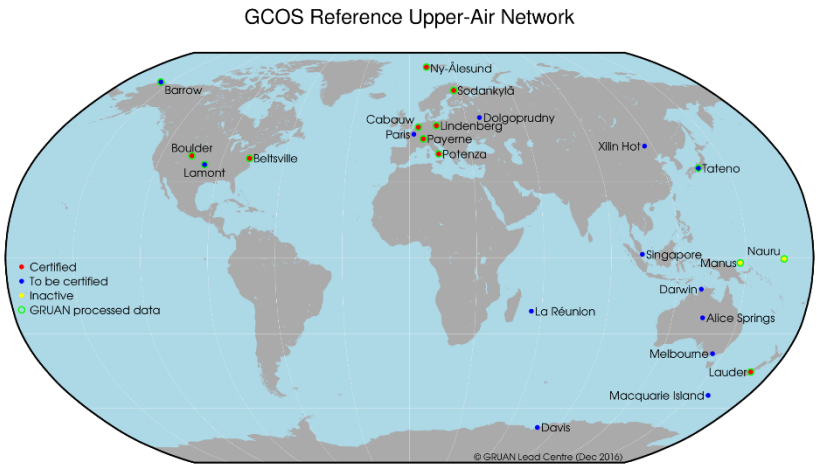
ATMS operational change – March 2017

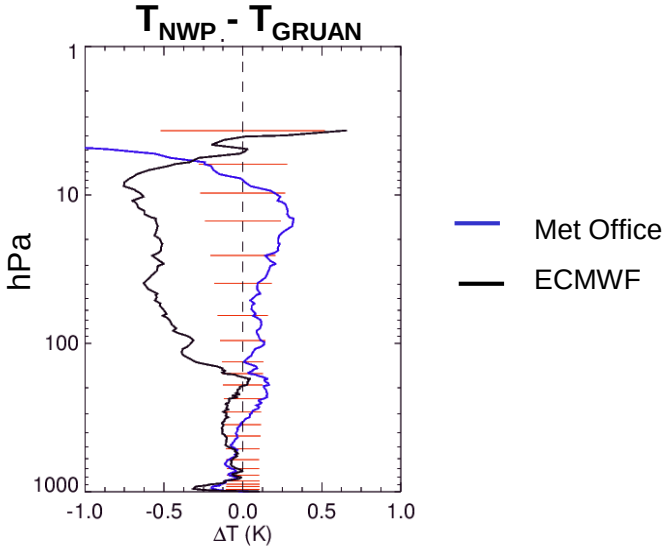


- Biases are now more different to AMSU-A
- But magnitude still similar

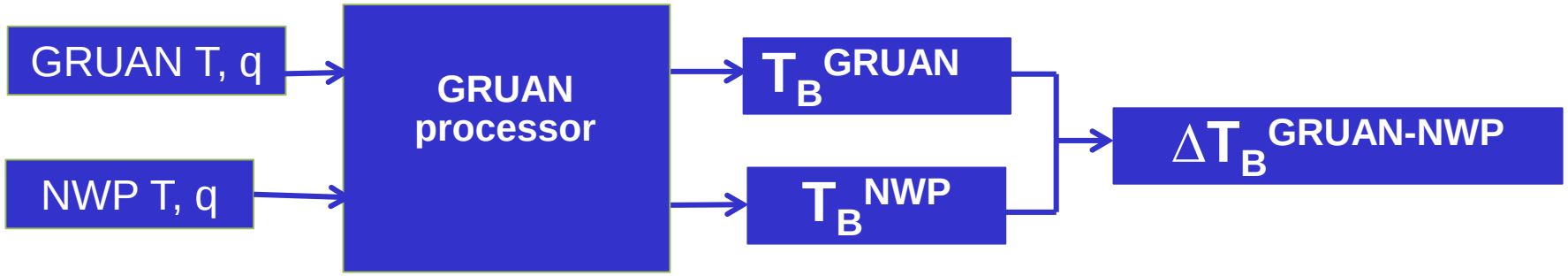
What are the forecast biases?

GRUAN processor from the GAIA-CLIM project



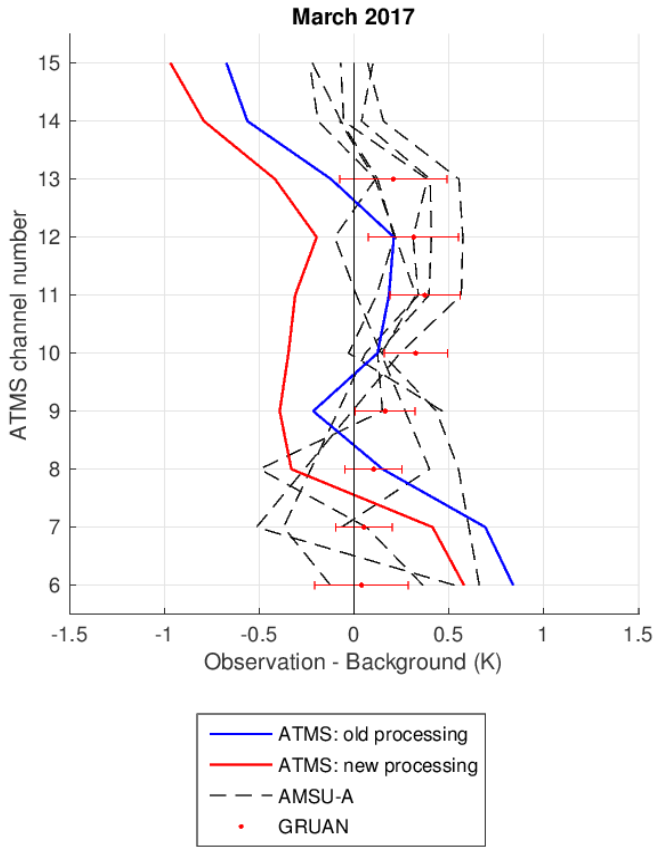


Met Office GRUAN Processor (F. Carminati):



Evaluating ATMS bias change

ATMS calibration change



But….

Error bars should be increased for:

- Radiative transfer uncertainty
- Representivity
- Vertical interpolation uncertainty…
- Correlations?

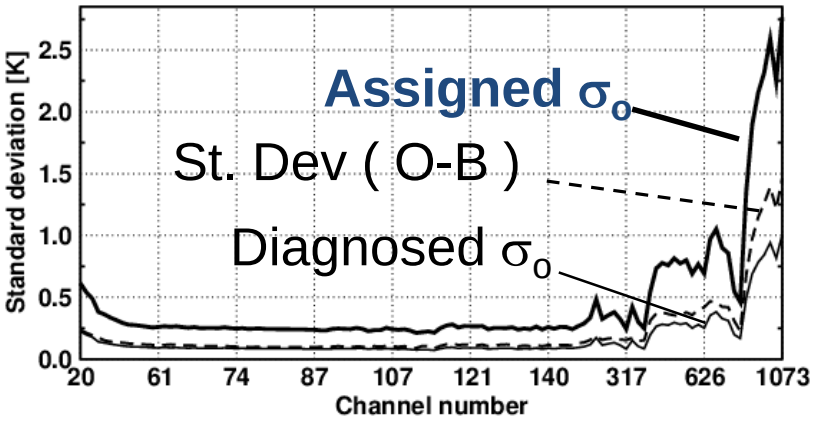
Are the number of GRUAN sites enough?

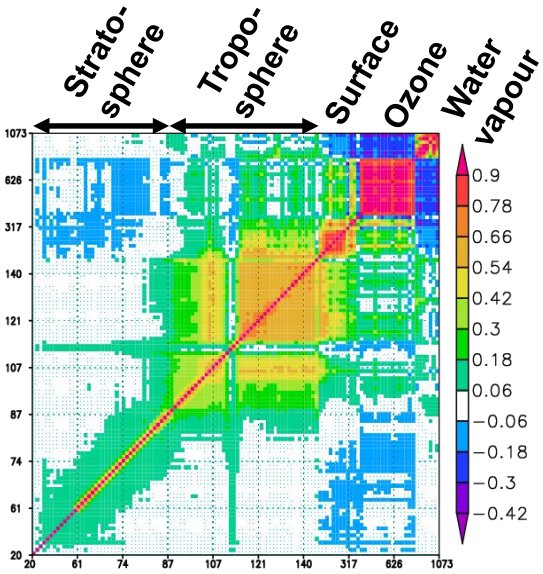
Ongoing work…

Assimilation of CrIS and ATMS

Assimilating CrIS: Reima Eresmaa

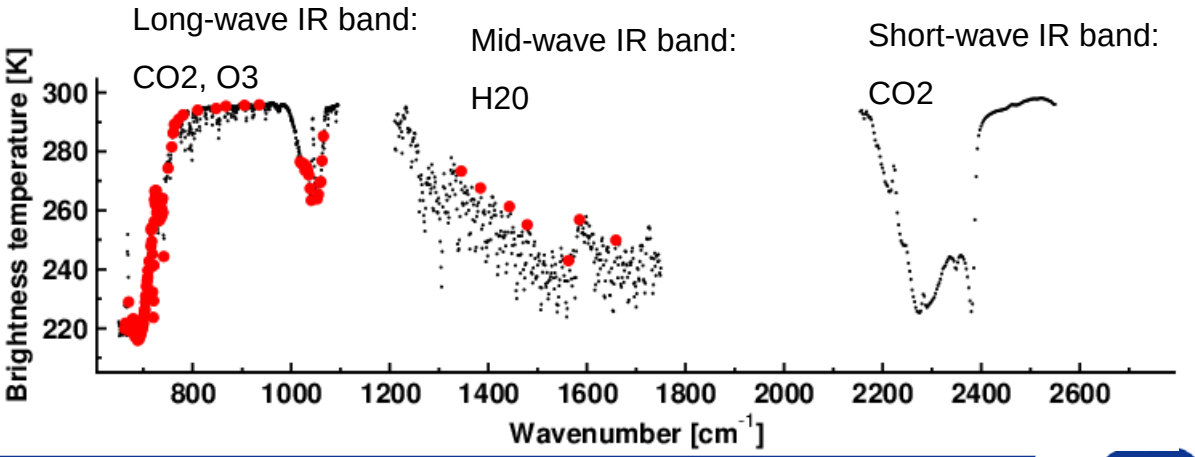
1. New Observation Errors





Error correlation

2. Increased number of channels used (118 channels):

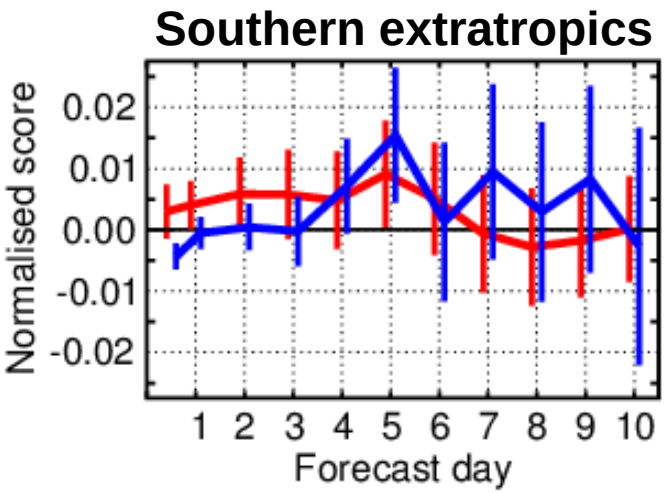


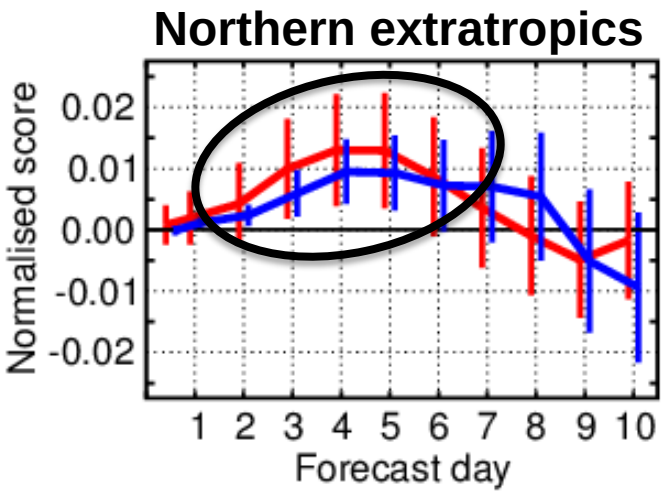
ECMWF

Assimilating CrIS: Reima Eresmaa

Z500

RMSE





Own analysis verification

Radiosonde verification

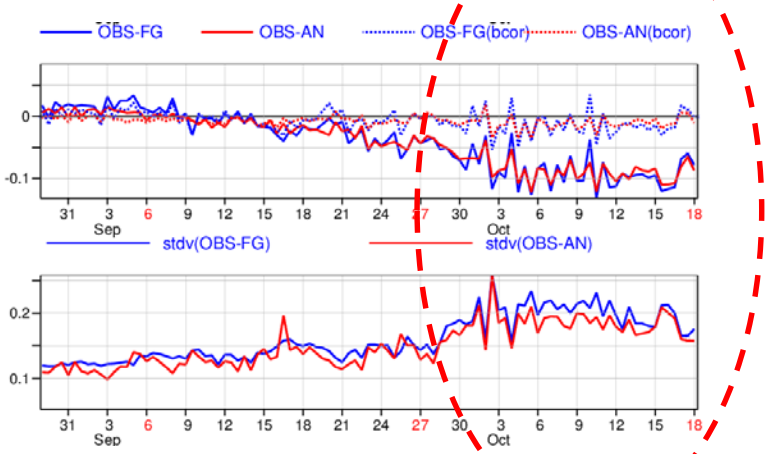
Future Plans:

- Start using a large number of tropospheric channels over land (to become operational in 2018 Q1)
- Assimilation of JPSS-1 CrIS
- Working on making the observation error situation-dependent e.g. intersatellite differences

ECMWF

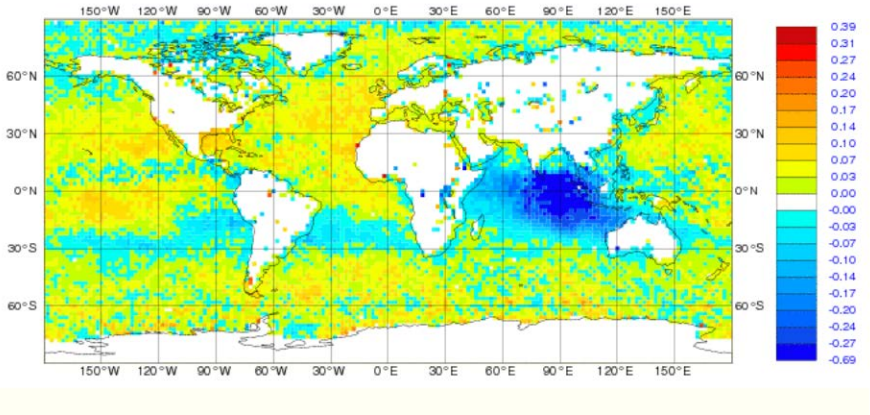
CrIS monitoring: HCN event identified

CrIS channel 101



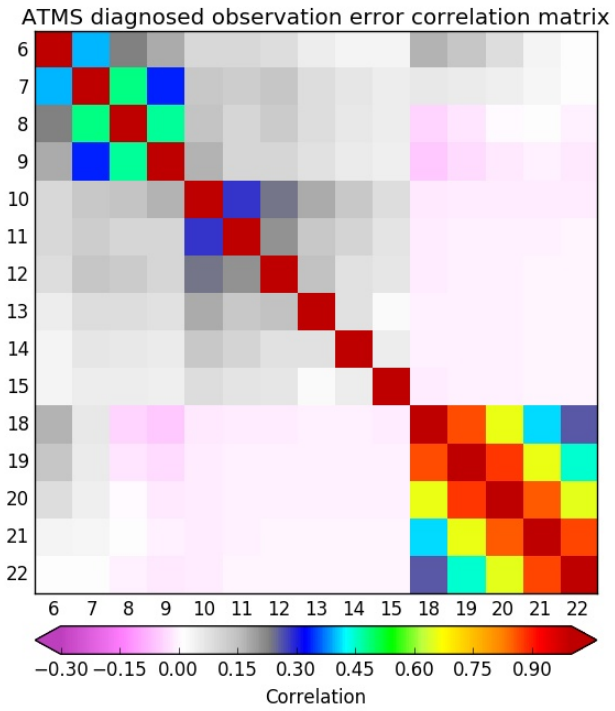
50 mK – 0.1 K

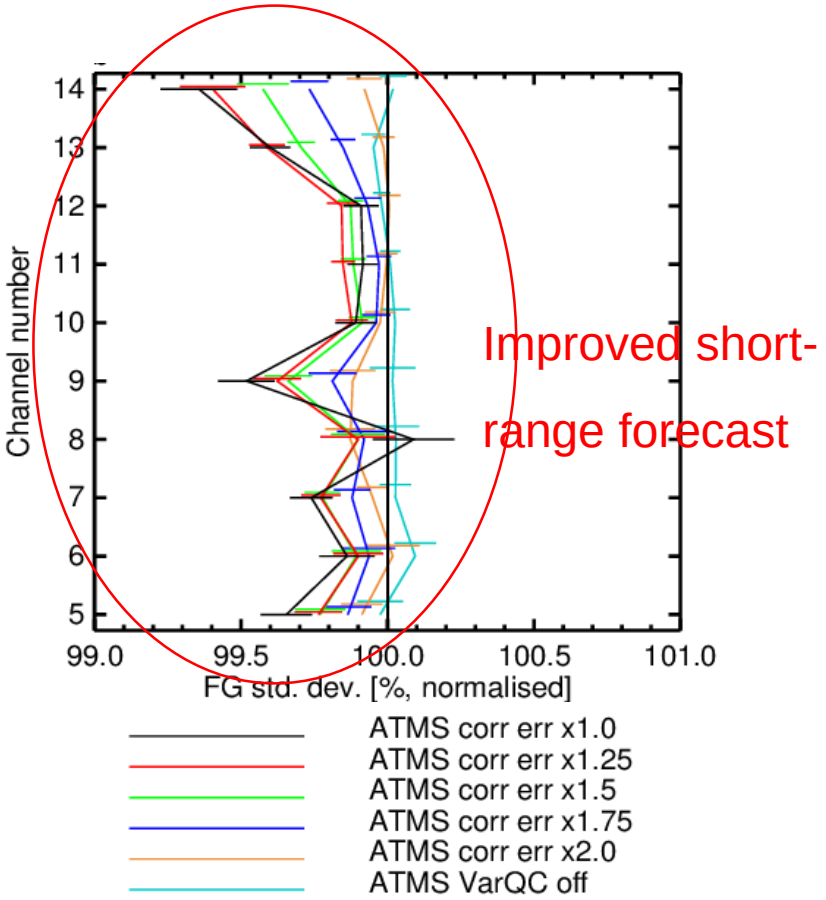
change identified



Assimilating ATMS: Peter Weston

Improve the use of ATMS with Correlated observation errors:





Improved short-range forecast

Summary

- NWP forecasts are very powerful for assessing new satellite data

- There is ongoing work to assess the uncertainties of NWP in the GAIA-CLIM project

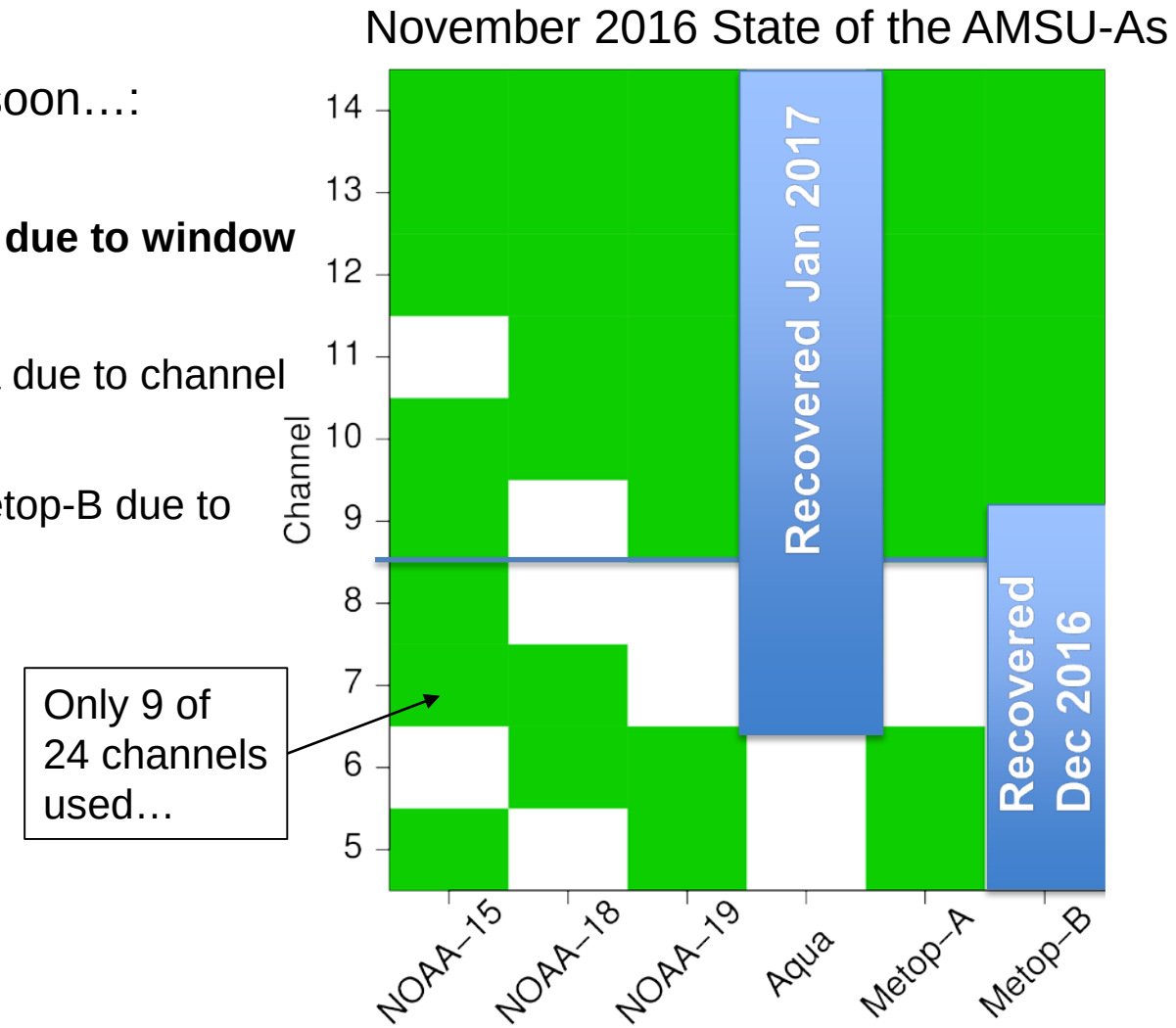
- Improved use of CrIS and ATMS at ECMWF, especially accounting for observation error correlation

Eresmaa, R., Letertre-Danczak, J., Lupu, C., Bormann, N. and McNally, A., 2017: *The assimilation of Cross-track Infrared Sounder radiances at ECMWF*, submitted to QJRMS

Future work: New data from JPSS-1

Keen for new data soon…:

- **2016 AMSU-A losses due to window channel failures:**
  - 24 September: Aqua due to channel 1 & 2 failure
  - 17 Oct – 29 Nov: Metop-B due to channel 15 failure



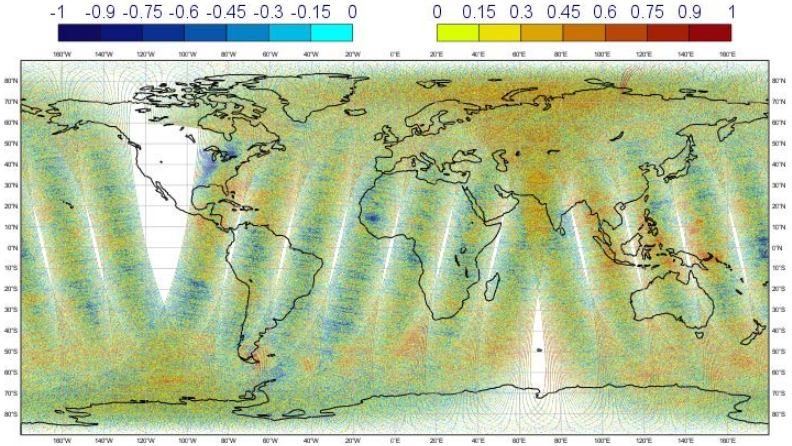
Thank you for listening..

Extra slides

Evaluating biases in satellite data

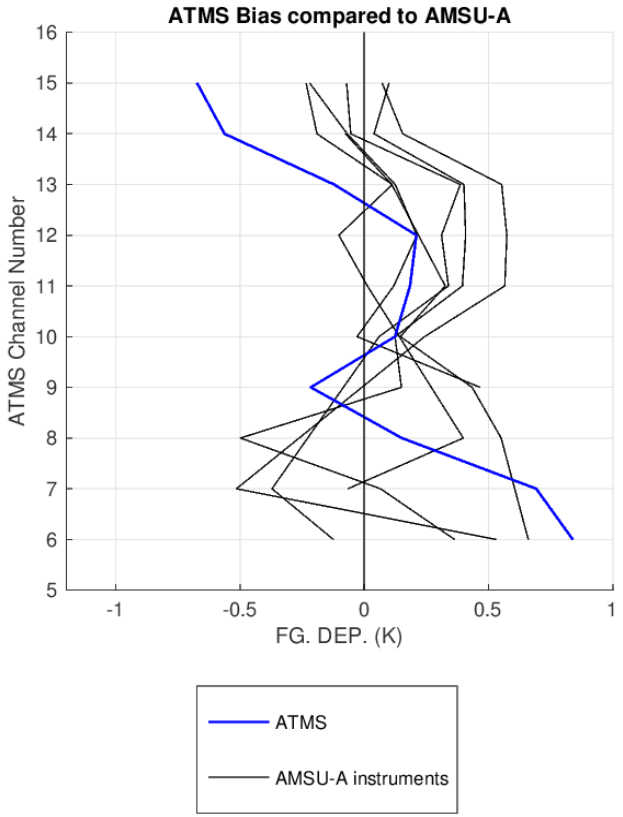
Striping noise:

ATMS channel 10

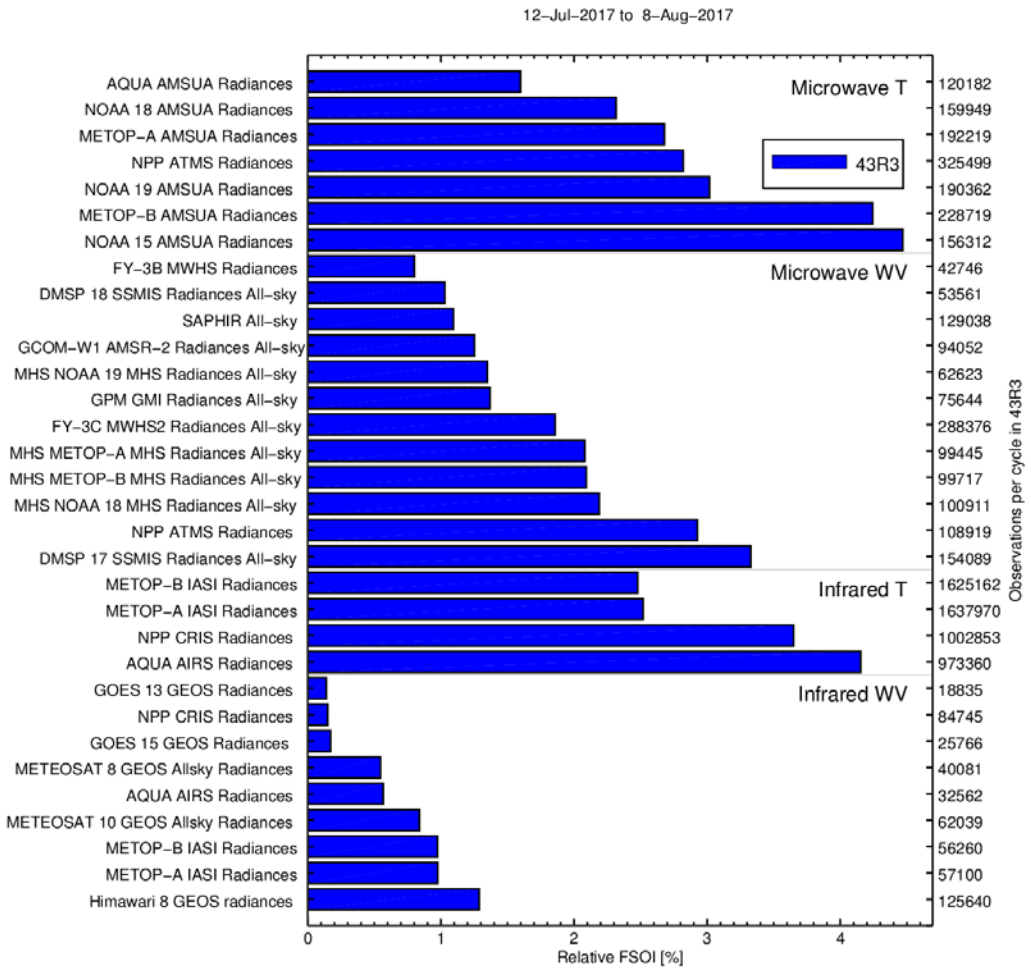


(Data are successfully assimilated despite the striping)

Global biases per channel:



43R3 FSOI


12–Jul–2017 to 8–Aug–2017
AQUA AMSUA Radiances
NOAA 18 AMSUA Radiances
METOP–A AMSUA Radiances
NPP ATMS Radiances
NOAA 19 AMSUA Radiances
METOP–B AMSUA Radiances
NOAA 15 AMSUA Radiances
FY–3B MWHS Radiances
DMSP 18 SSMIS Radiances All–sky
SAPHIR All–sky
GCOM–W1 AMSR–2 Radiances All–sky
MHS NOAA 19 MHS Radiances All–sky
GPM GMI Radiances All–sky
FY–3C MWHS2 Radiances All–sky
MHS METOP–A MHS Radiances All–sky
MHS METOP–B MHS Radiances All–sky
MHS NOAA 18 MHS Radiances All–sky
NPP ATMS Radiances
DMSP 17 SSMIS Radiances All–sky
METOP–B IASI Radiances
METOP–A IASI Radiances
NPP CRIS Radiances
AQUA AIRS Radiances
GOES 13 GEOS Radiances
NPP CRIS Radiances
GOES 15 GEOS Radiances
METEOSAT 8 GEOS Allsky Radiances
AQUA AIRS Radiances
METEOSAT 10 GEOS Allsky Radiances
METOP–B IASI Radiances
METOP–A IASI Radiances
Himawari 8 GEOS radiances
Microwave T
43R3
Microwave WV
Infrared T
Infrared WV
120182
159949
192219
325499
190362
228719
156312
42746
53561
129038
94052
62623
75644
288376
99445
99717
100911
108919
154089
1625162
1637970
1002853
973360
18835
84745
25766
40081
32562
62039
56260
57100
125640
Observations per cycle in 43R3
0
1
2
3
4
Relative FSOI [%]