Initial results from using ATMS and CrIS data at ECMWF

Niels Bormann[1], William Bell[1], Anne Fouilloux[1], Tony McNally[1], Ioannis Mallas[1], Nigel Atkinson[2], Steve Swadley[3]

[1] ECMWF, [2] Met Office, [3] NRL

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Initial results from using ATMS ~~and CrIS~~ data at ECMWF

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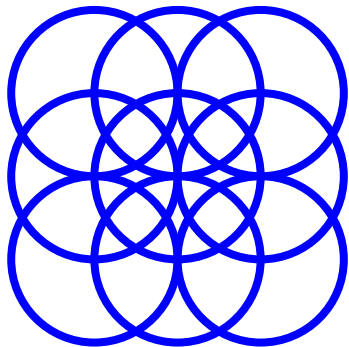**[1] ECMWF, [2] Met Office, [3] NRL**

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ATMS

- Microwave sounder combining AMSU-A and MHS heritage channels, with 3 new channels.

- Temperature sounding channels compared to AMSU-A:
  - ➢ Higher noise
  - ➢ Smaller footprint
  - ➢ Oversampled
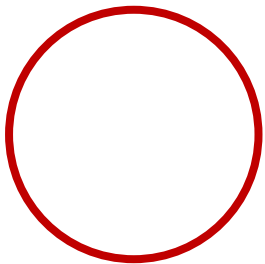
AMSU-A   ATMS

| Channel number	Frequency [GHz]	Polarisation
1	23.8	QV
2	31.4	QV
3	50.3	QH
4	51.76	QH
5	52.8	QH
6	53.596 ± 0.115	QH
7	54.4	QH
8	54.94	QH
9	55.5	QH
10	57.29	QH
11	57.29±0.3222±0.217	QH
12	57.29±0.3222±0.048	QH
13	57.29±0.3222±0.022	QH
14	57.29±0.3222±0.010	QH
15	57.29±0.3222±0.0045	QH
16	88.2	QV
17	165.5	QH
18	183.31±7	QH
19	183.31±4.5	QH
20	183.31±3	QH
21	183.31±1.8	QH
22	183.31±1	QH

AMSU-A

MHS

Outline

1) **Analysis of departure statistics**

2) Preliminary assimilation experiments

3) Conclusions

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ATMS data: First impression
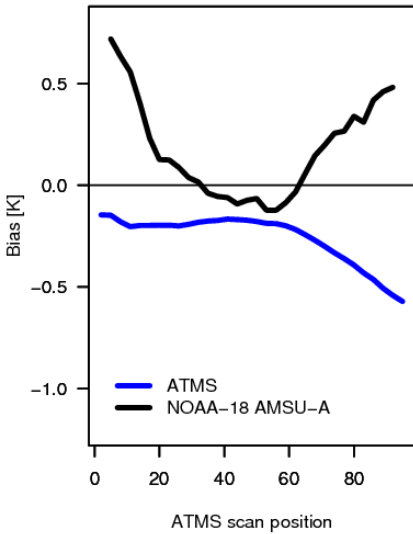

ATMS obs-FG, channel 10, 3x3 averaged

- Assessments based on ATMS data before antenna pattern correction.

- Mostly based on 3x3 averaged data for channels 3-22.

- Larger swath for ATMS = better spatial coverage.
- Better scanbiases than AMSU-A.
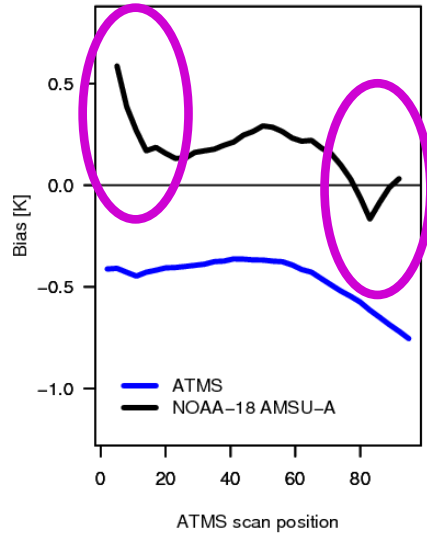- ATMS data look generally ok.

NOAA-19 AMSU-A obs -FG, channel 9
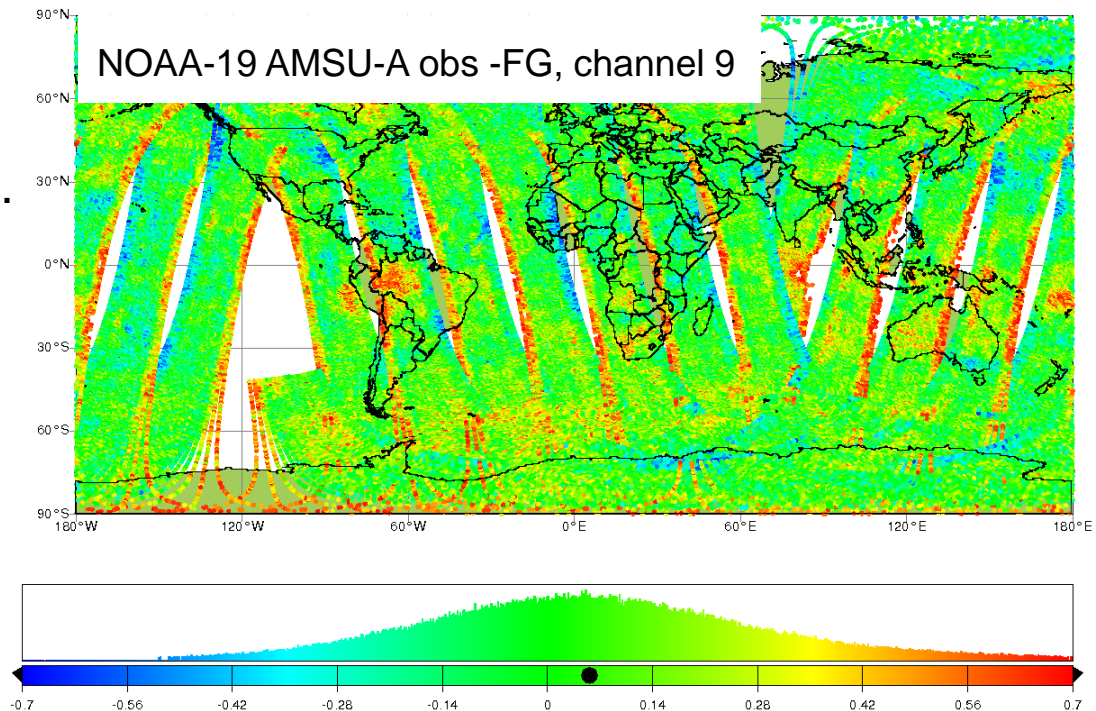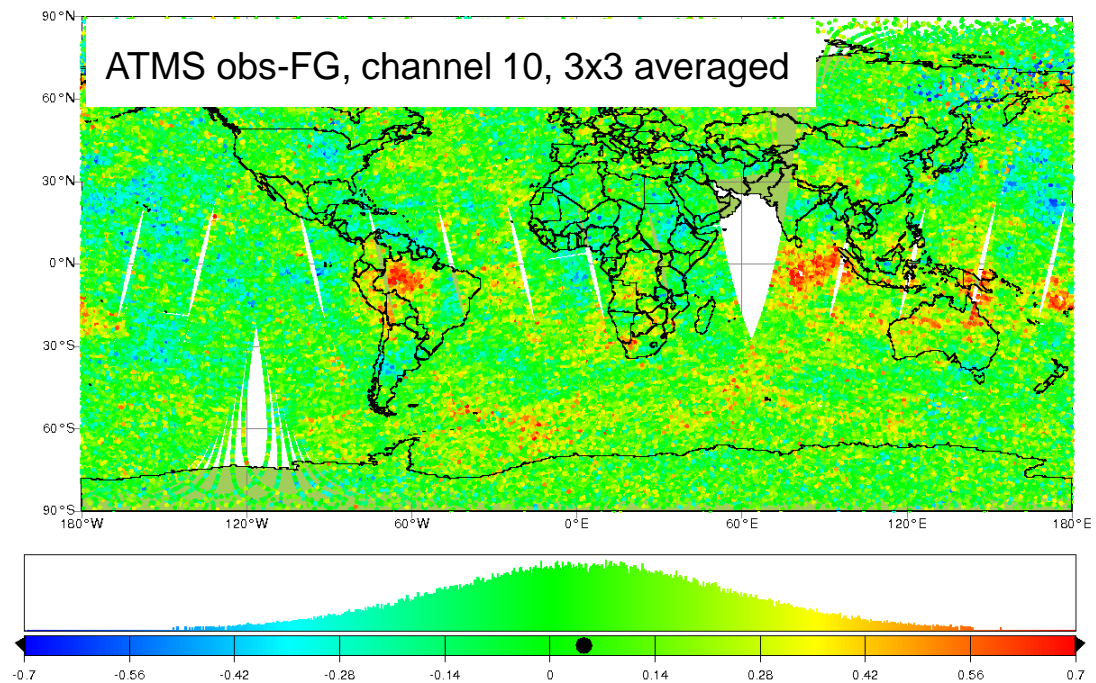
Scan bias: Comparison to NOAA-18
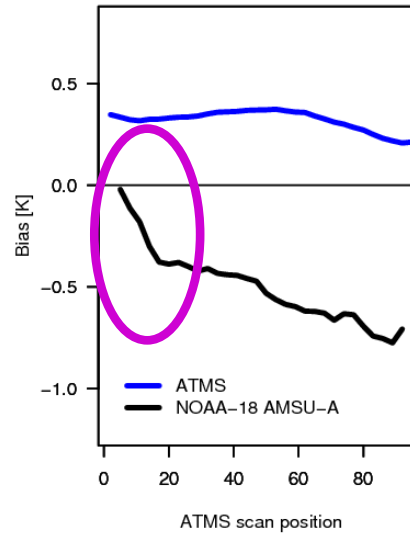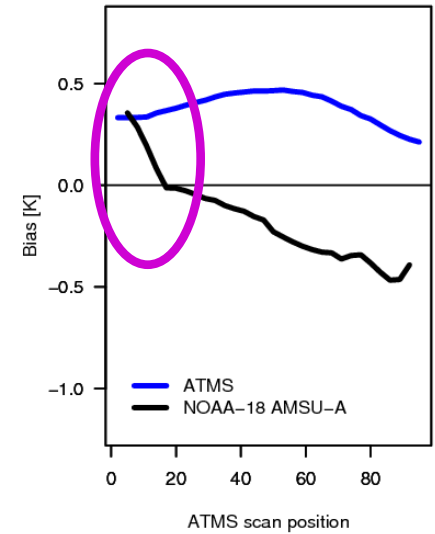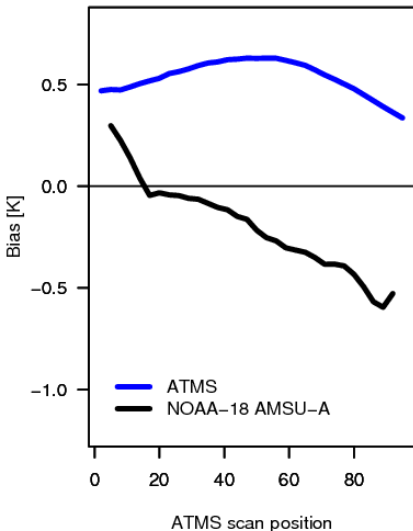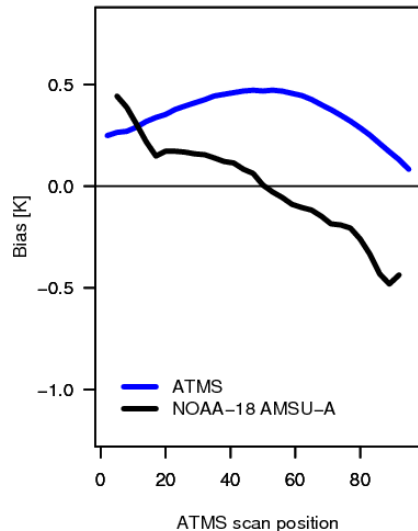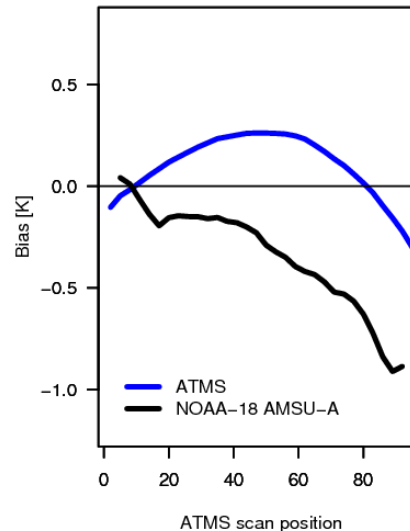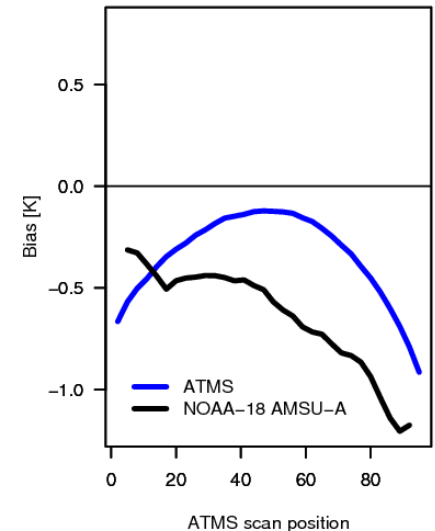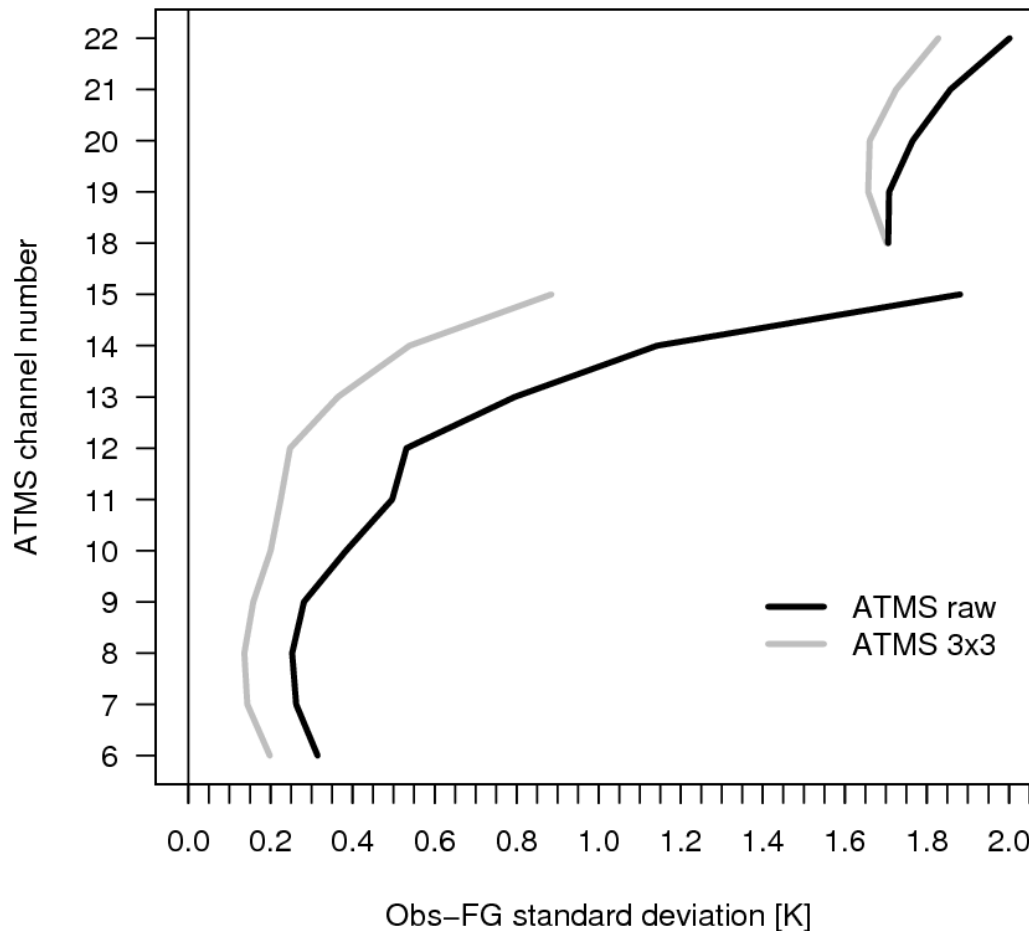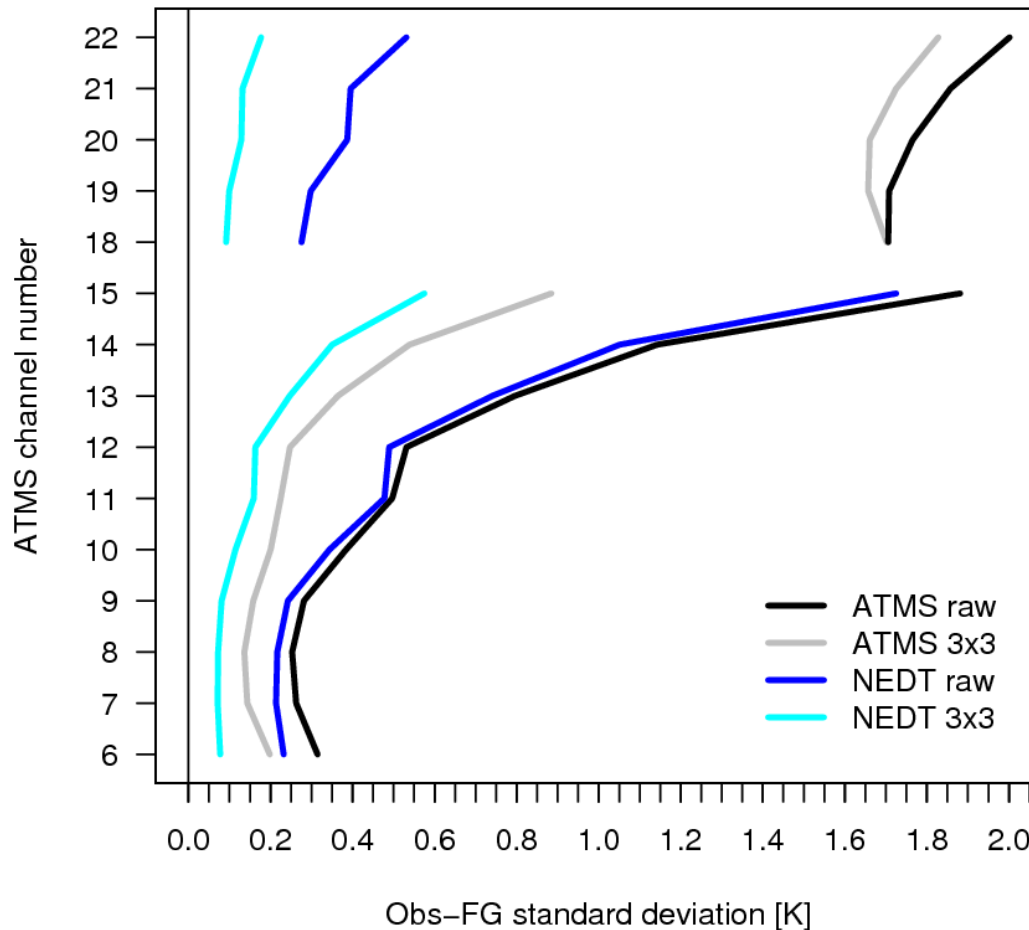
Standard deviations and averaging...

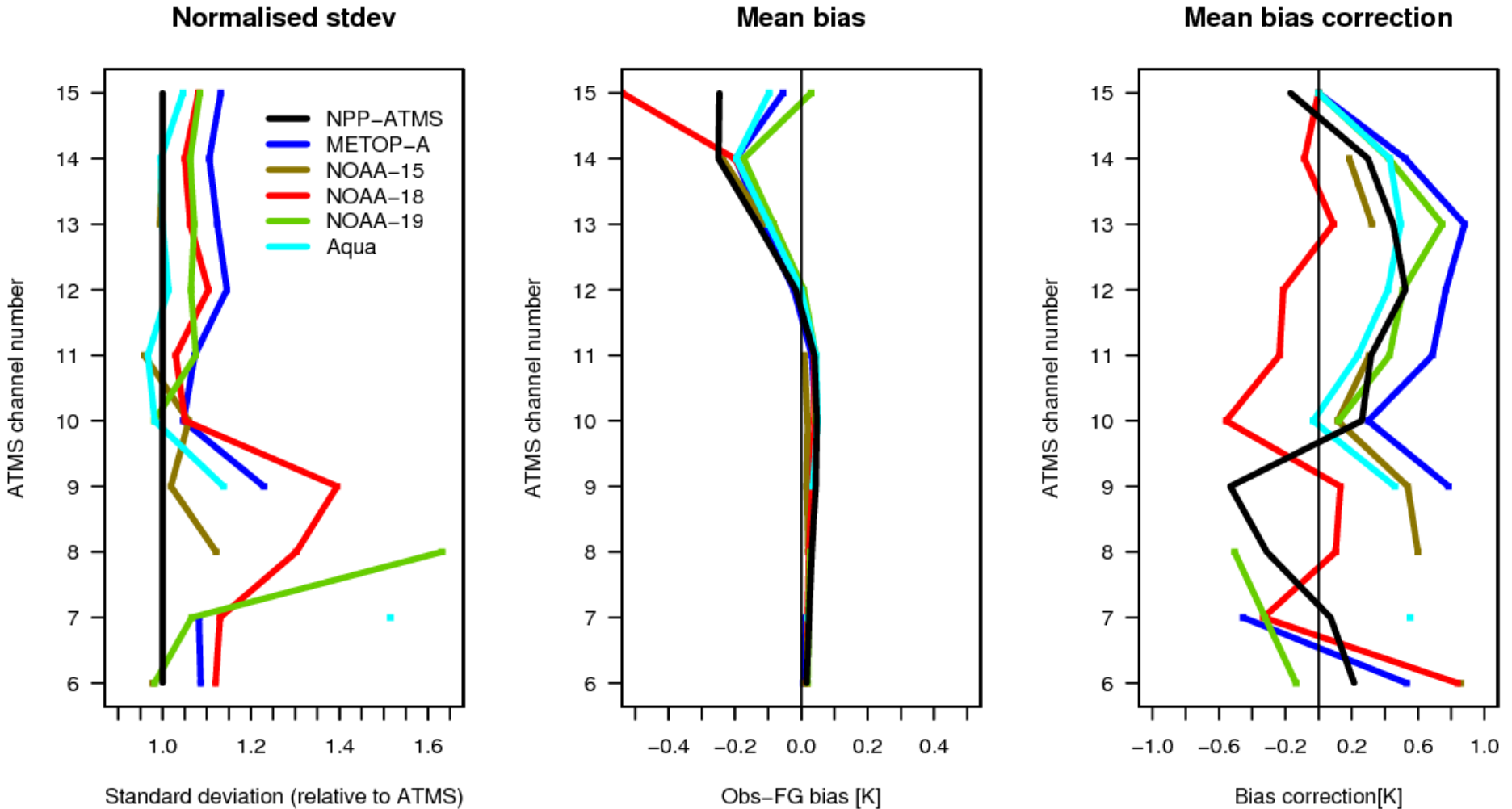Data for 20-29 Dec 2011, over sea, after QC and bias correction

Standard deviations and averaging...

Data for 20-29 Dec 2011, over sea, after QC and bias correction

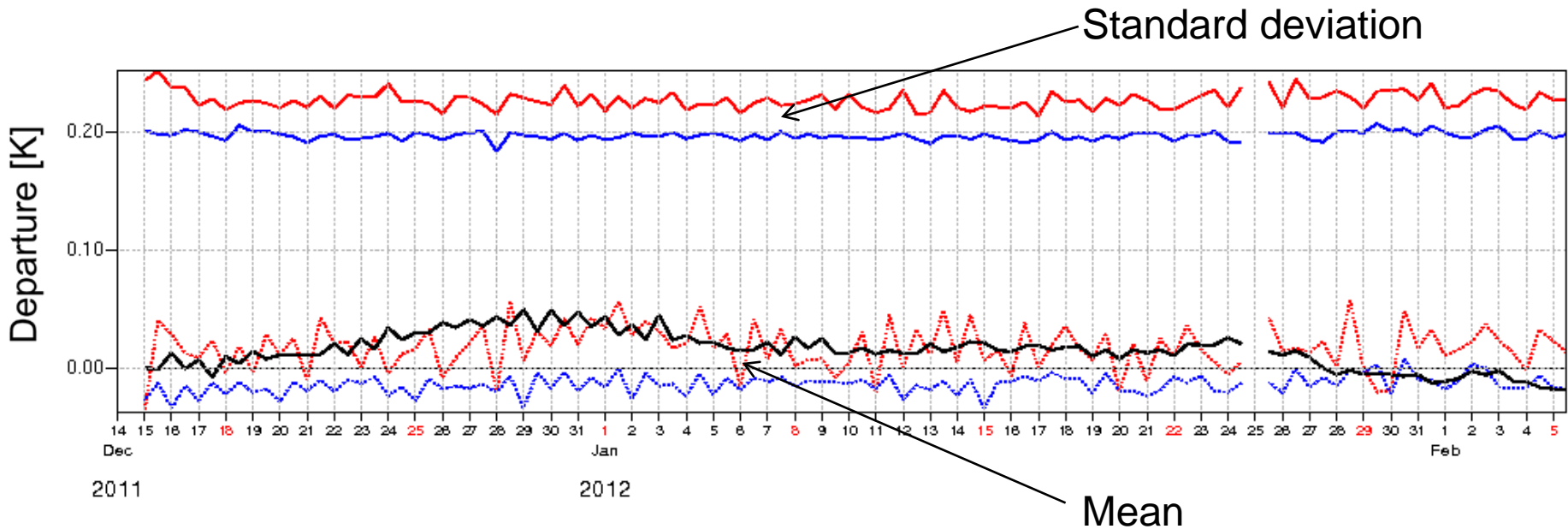# Comparison to AMSU-As (for ATMS 3x3)

(Departure statistics for data after QC, 20-29 Dec 2011; global over sea)

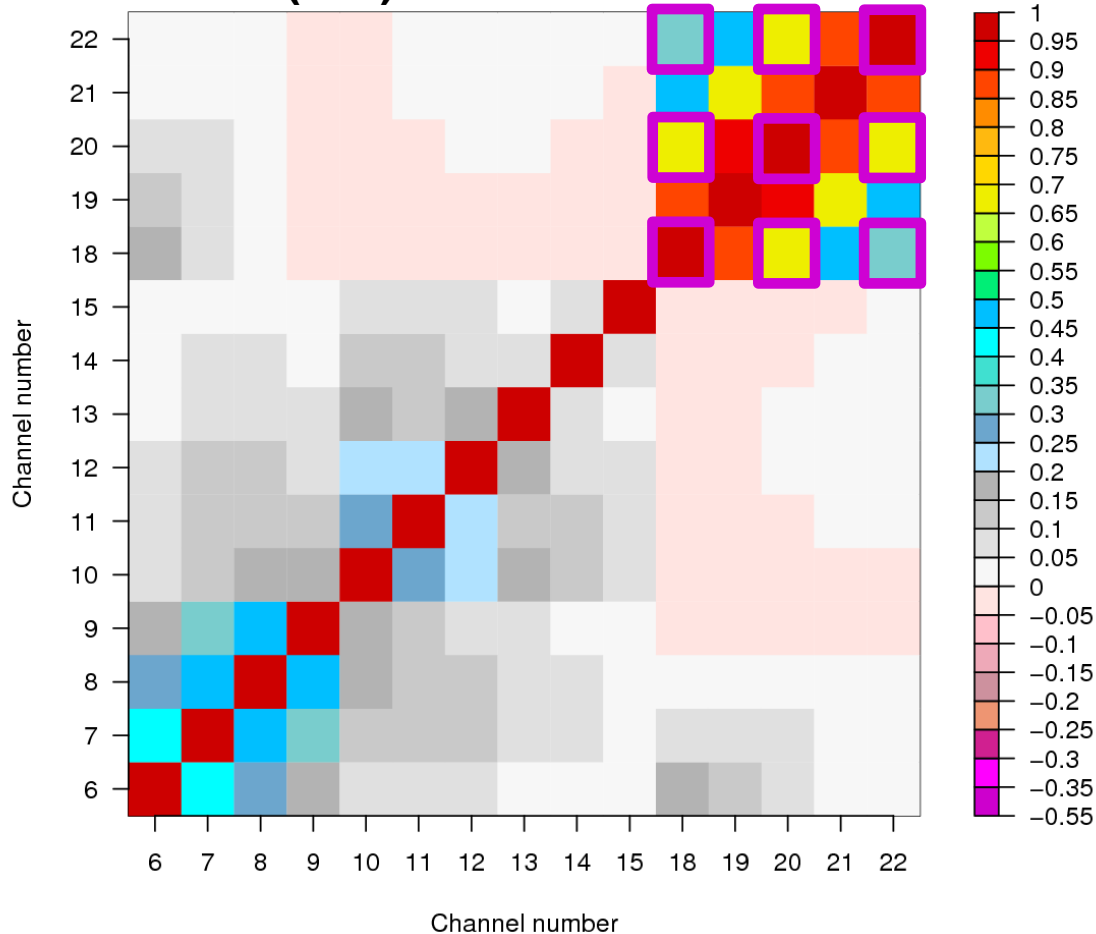ECMWF

Day-to-day stability

Channel 11, tropics:

Standard deviation

Mean

Obs - FG

Obs – Analysis

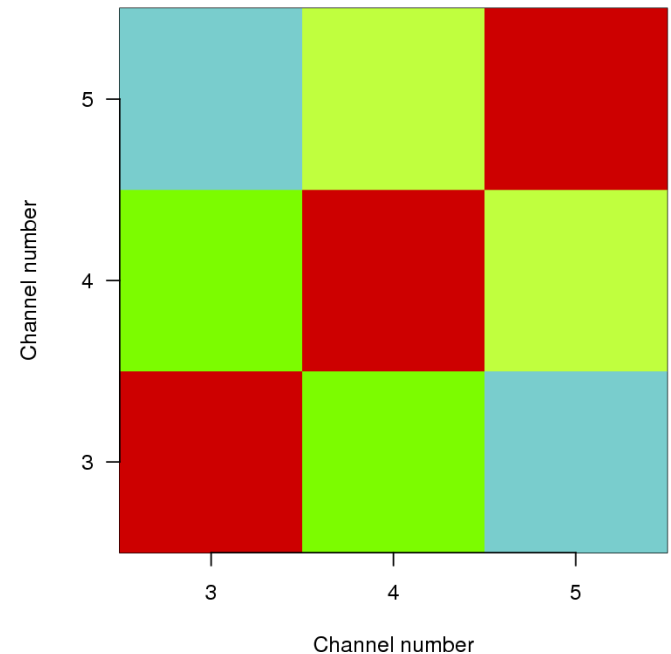Bias correction – 0.29 K

ECMWF

Inter-channel error correlation diagnostics

(based on Desroziers et al. 2005)
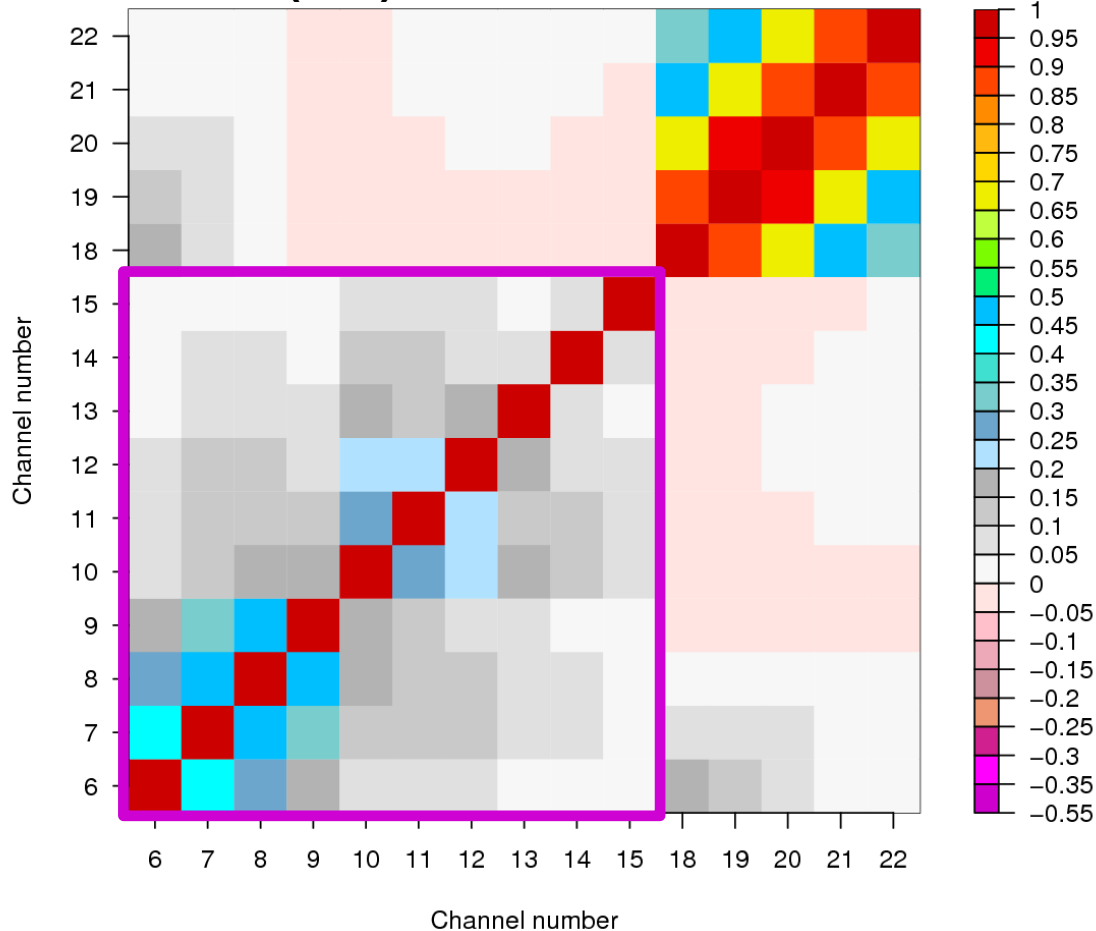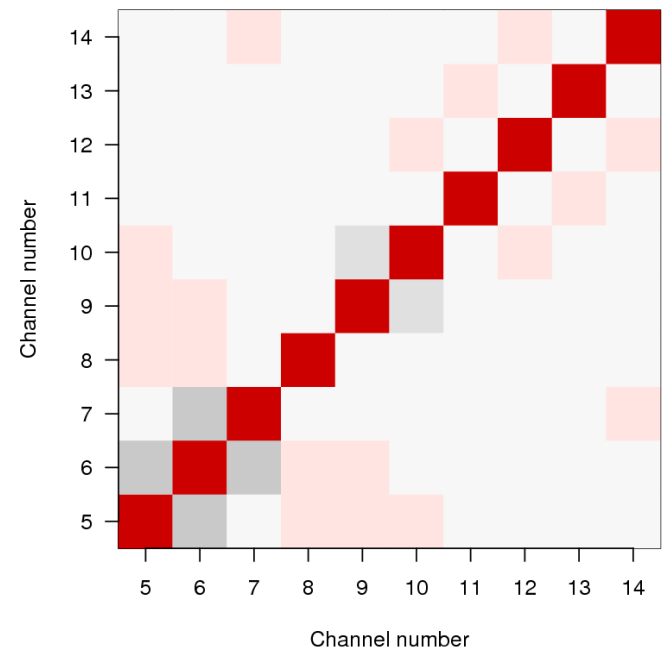

ATMS (3x3):

NOAA-18 MHS:

Inter-channel error correlation diagnostics

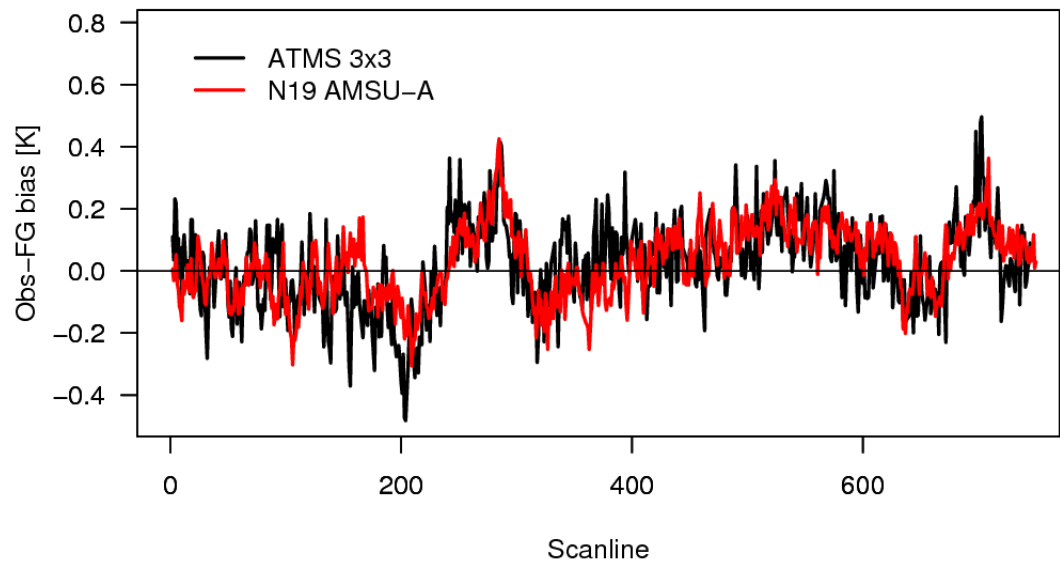(based on Desroziers et al. 2005)

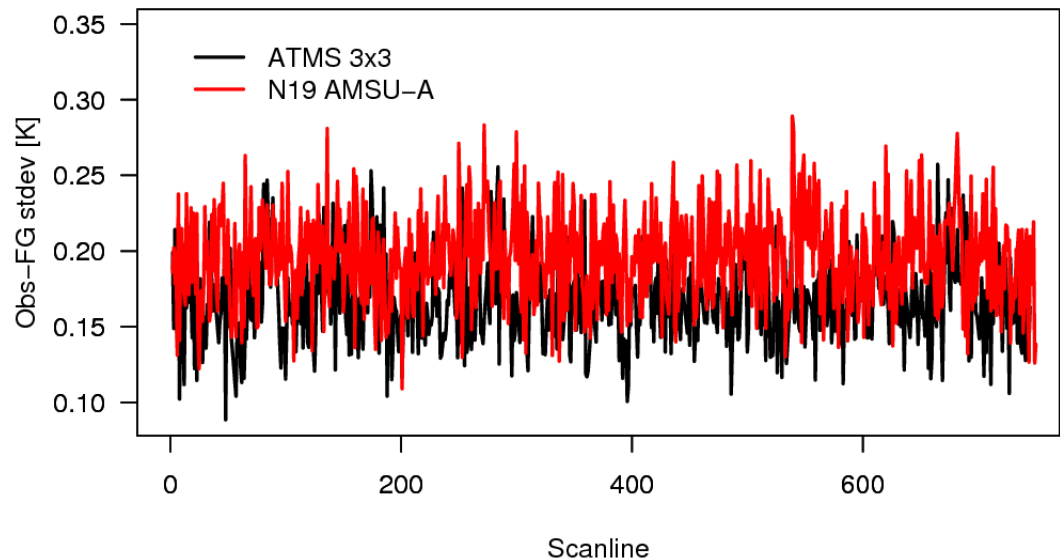ATMS (3x3):

NOAA-18 AMSU-A:

Variability by scanline

- Variability of biases by scanline appear higher for ATMS than for AMSU-A.
- Room for improvement in calibration for ATMS?

ATMS channel 11, bias

ATMS channel 11, standard deviation

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1) Analysis of departure statistics

2) Preliminary assimilation experiments

3) Conclusions

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Preliminary assimilation experiments

- **Period: 15 Dec 2011 – 6 Feb 2012**

- **Resolution: T319 (~60 km)**

- **ATMS data: 3x3 averaged for channels 3-22**

- **Quality control for ATMS:**

  - **Use data only over open sea**

  - **Use all scan positions**

  - **Use channels 6-15 & 18-22**

  - **Screening for cloud/rain:**

    - **| (Obs-FG)$_{ch3}$| > 5 K for ch 6-8; 18-22**

    - **LWP > 0.12 kg/m^2 for ch 6, 7, 18; > 0.15 kg/m^2 for ch 8**

    - **Scatter index (89/165 GHz) > 10 for channels 18-22**

  - **Observation error for channels 7-11: 0.35 K**
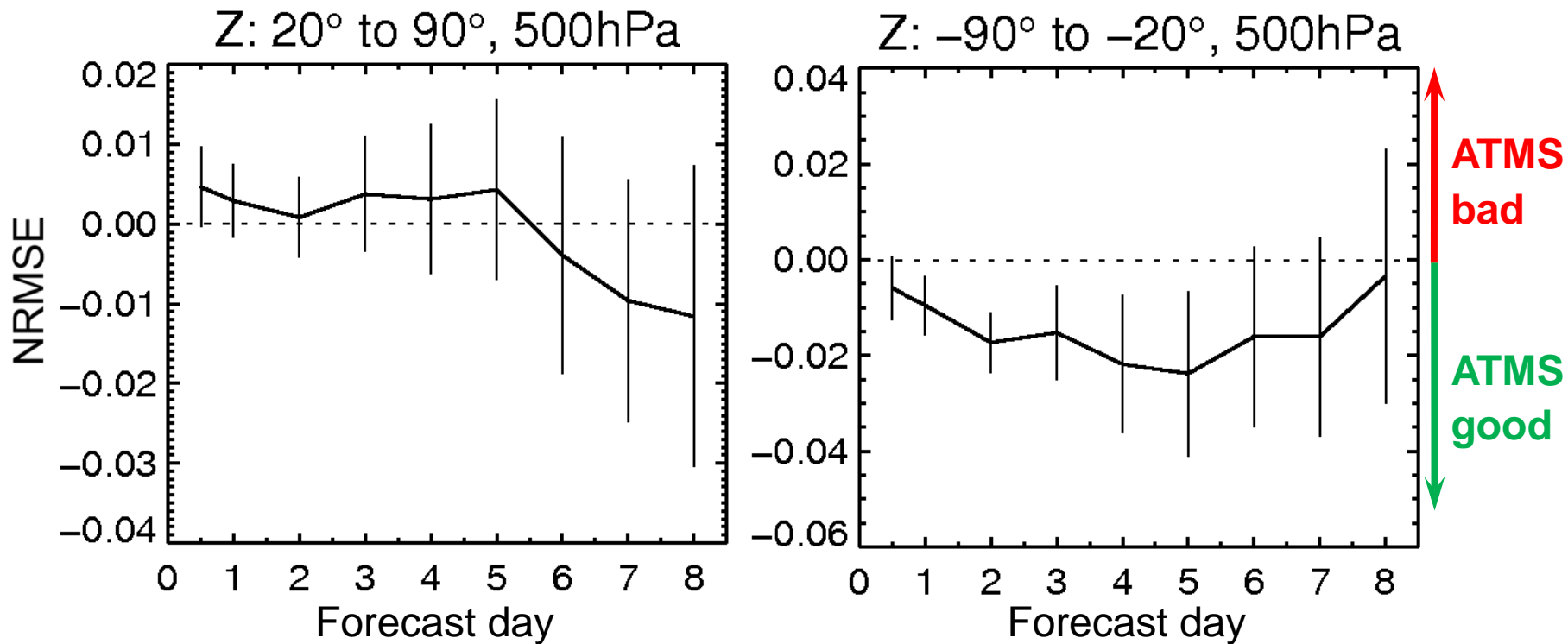
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Improvements for short-term humidity forecasts

Standard deviation of FG departures for all used MHS data combined:
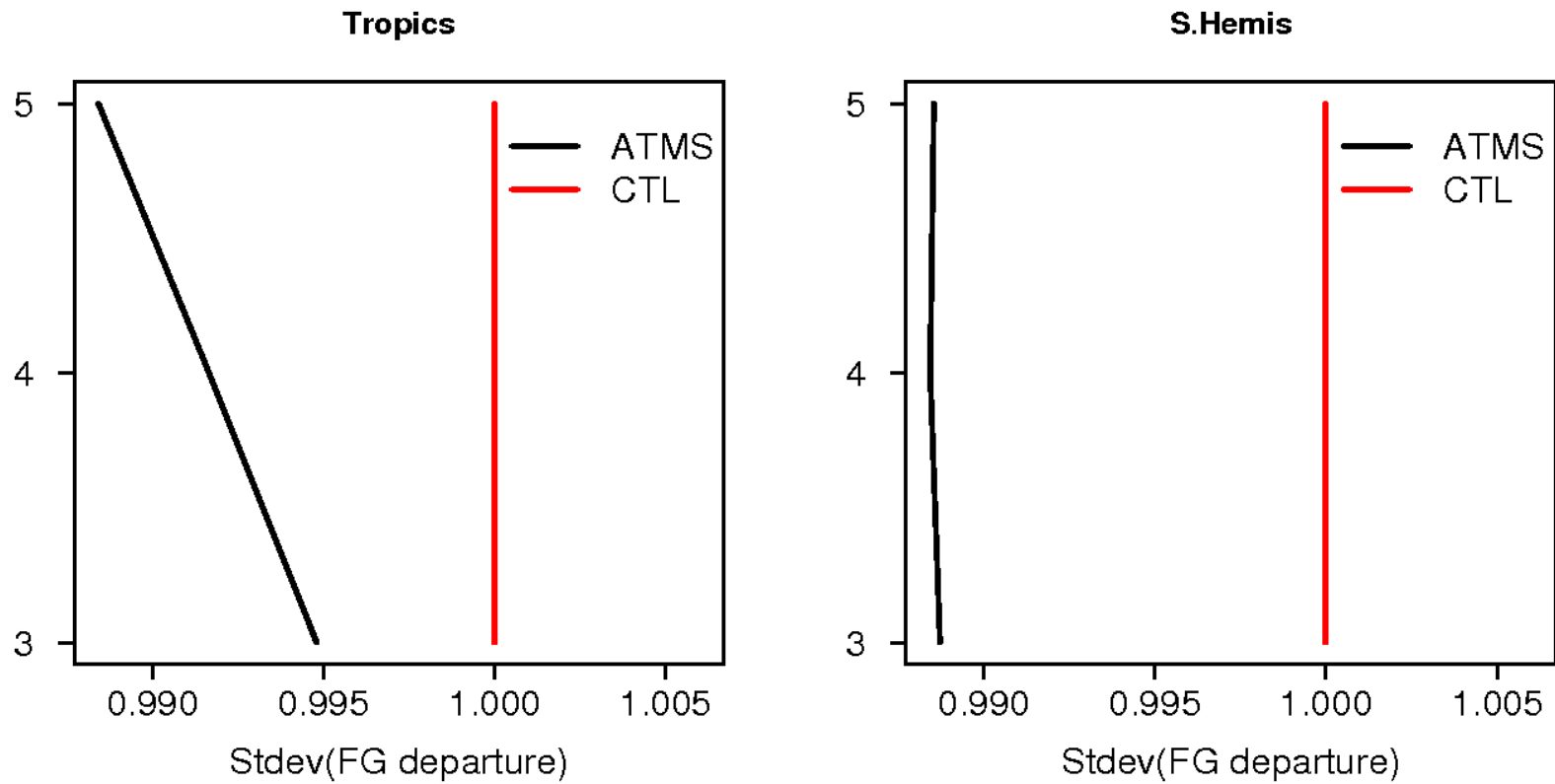
Similar improvements for humidity channels from HIRS, AIRS, IASI.
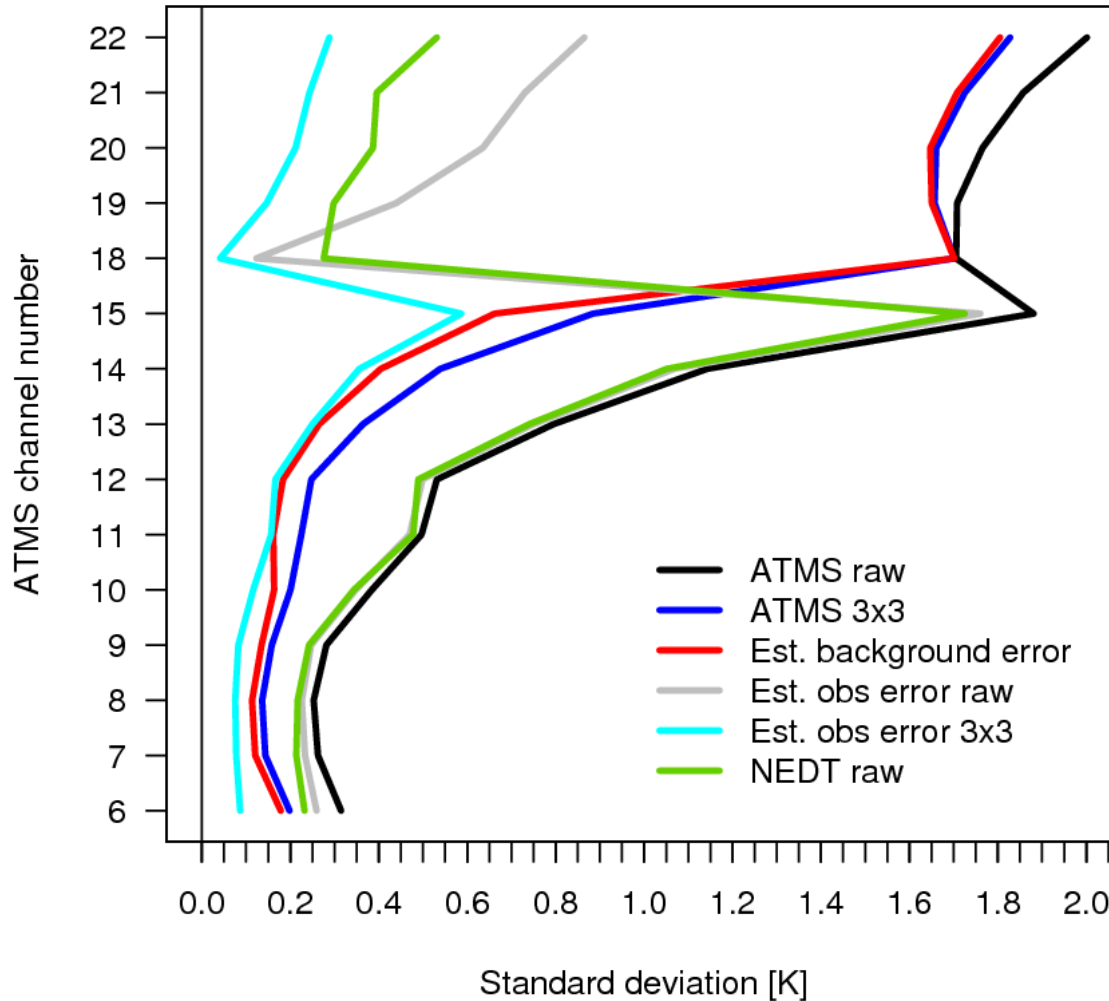
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Forecast impact

Normalised difference in RMSE for 500 hPa geopotential, verified against own analysis (46-54 cases), with 95 % confidence intervals :
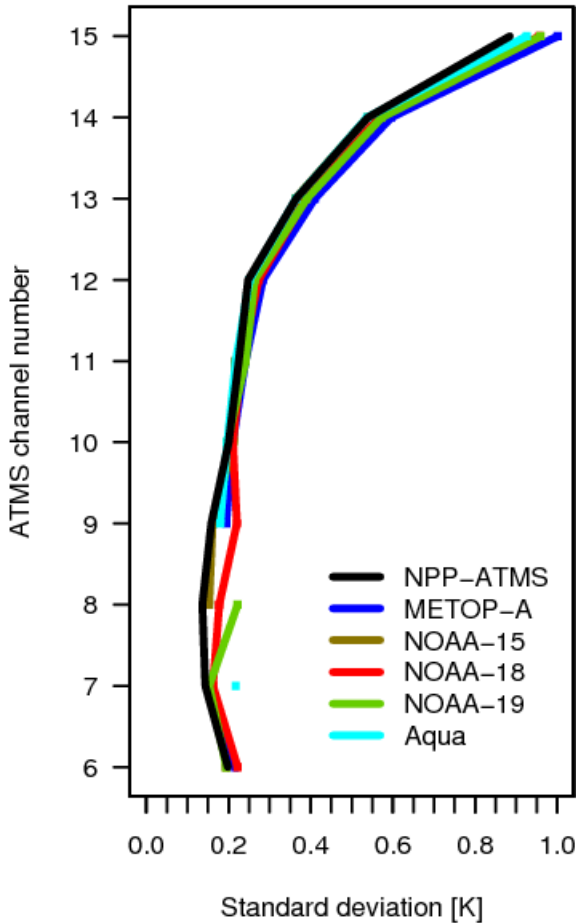
Preliminary conclusions

- **Scan-biases for ATMS look smoother than for AMSU-A even without an antenna pattern correction applied to ATMS data.**

- **Noise performance of temperature sounding channels against short-term forecasts looks good:**

  - **(At least) comparable to AMSU-A after 3x3 averaging.**

  - **However, some errors appear correlated; possibly room for improvement for calibration?**

- **Preliminary assimilation experiments suggest:**

  - **Positive impact on humidity analyses.**

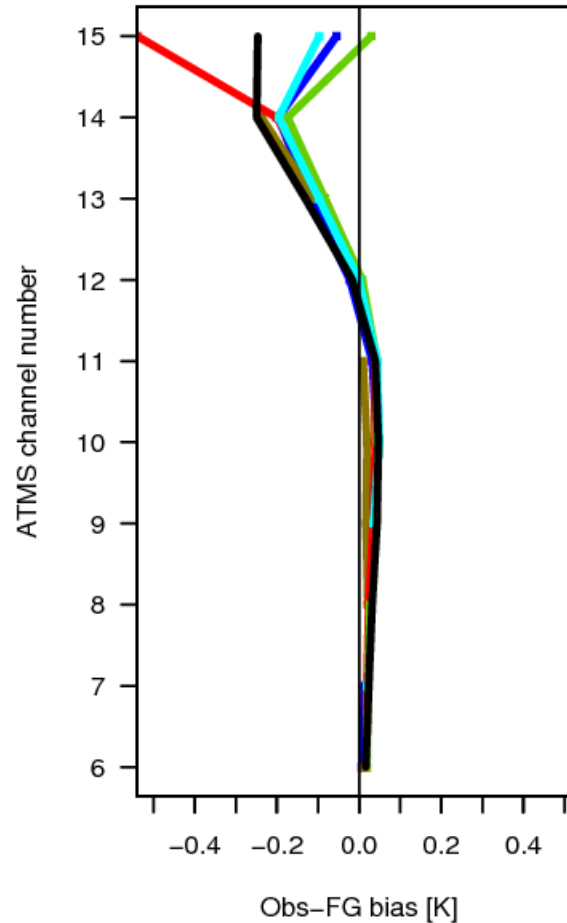 - **Positive forecast impact over the Southern Hemisphere.**

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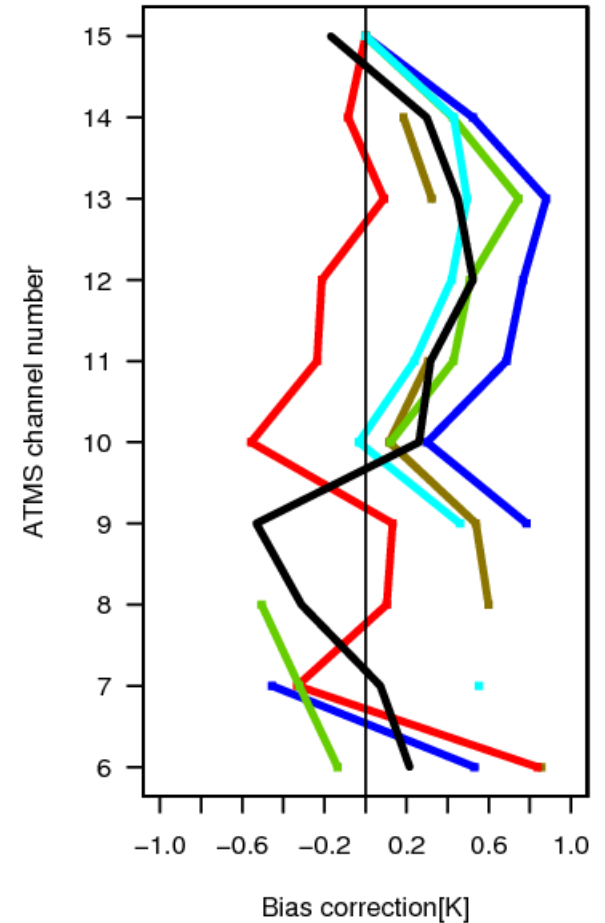# Averaging…

Comparison to AMSU-As

Standard deviation

Mean bias

Mean bias correction

Legend:
- NPP-ATMS (black)
- METOP-A (blue)
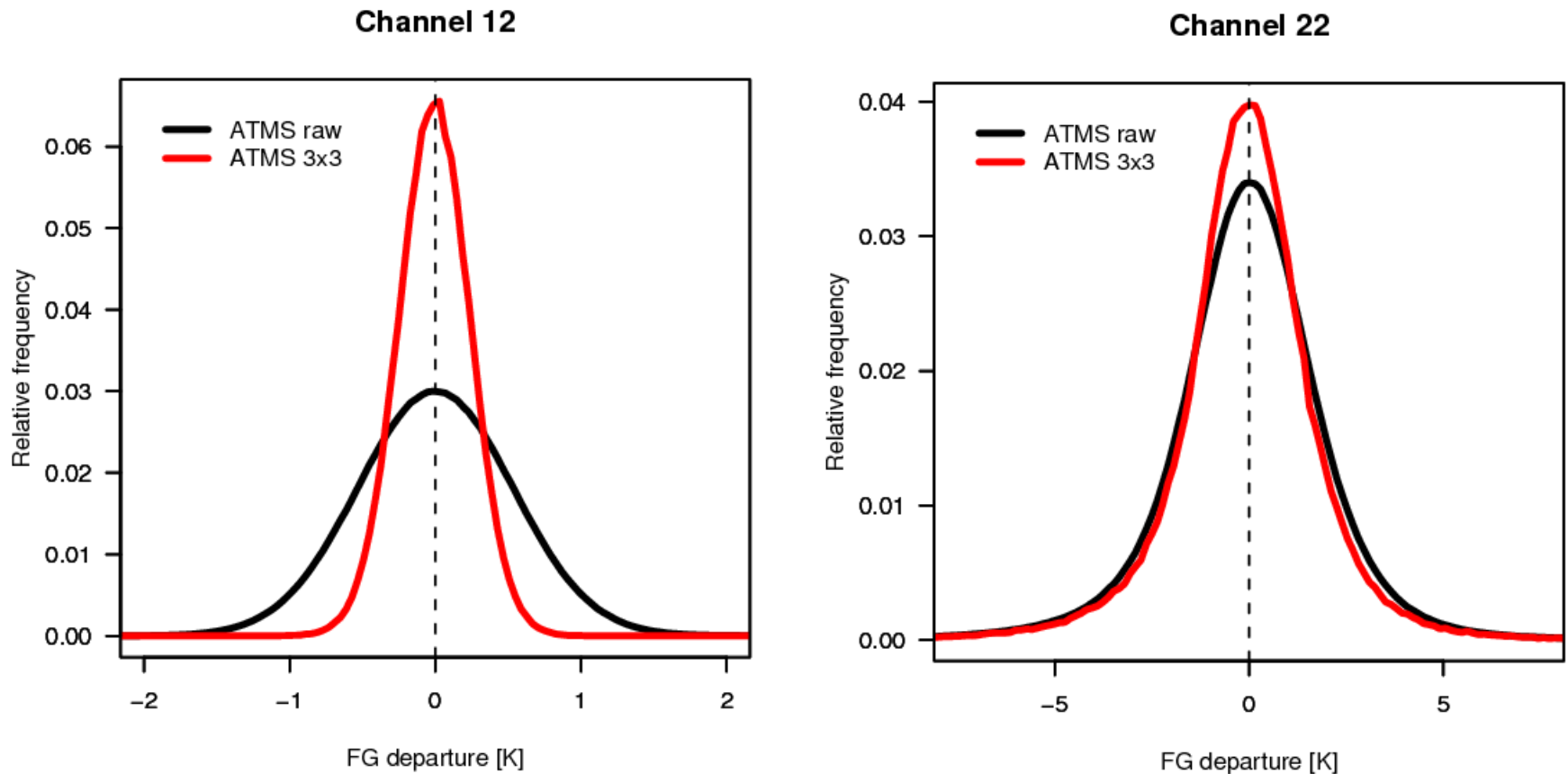- NOAA-15 (dark yellow)
- NOAA-18 (red)
- NOAA-19 (green)
- Aqua (cyan)

(Departure statistics for used data, 20-29 Dec 2011; global over sea)

ECMWF

Histograms of Obs-FG: Effect of averaging

(Statistics for used data, 20-29 Dec 2011; global over sea, after bias correction)

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