

# **An update on the use of ATMS data at ECMWF**

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# Operational use of ATMS

- **ATMS has been assimilated operationally at ECMWF since 26 September 2012.**
  - 3x3 averaging for channels 3-22
  - Assimilate channels 6-15, 18-22; 6-8 and 18-22 over sea only
  - Assimilation in clear-sky
- **Neutral to slightly positive forecast impact when used in addition to the full observing system.**
- **Striping remains the only small issue identified.**
- **See also Bormann et al 2014, JGR NPP Special Issue**

# ATMS: Forecast impact

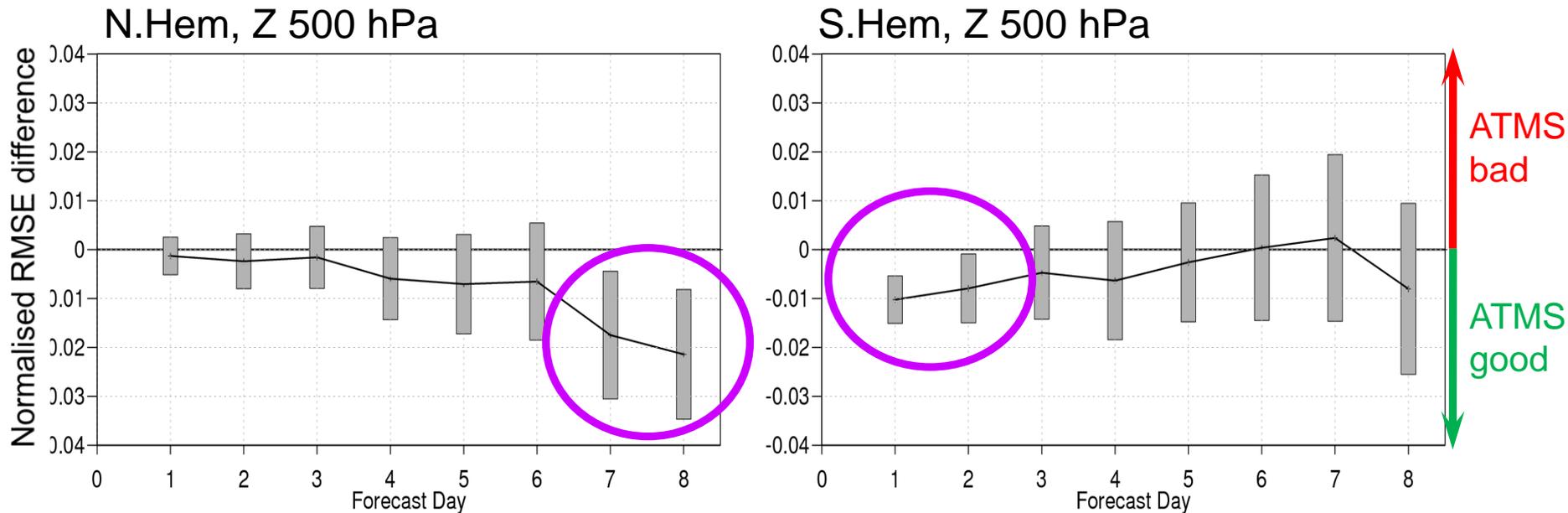
Assimilation experiments over two seasons:

15 Dec 2011 – 6 Feb 2012

28 June 2012 – 31 August 2012

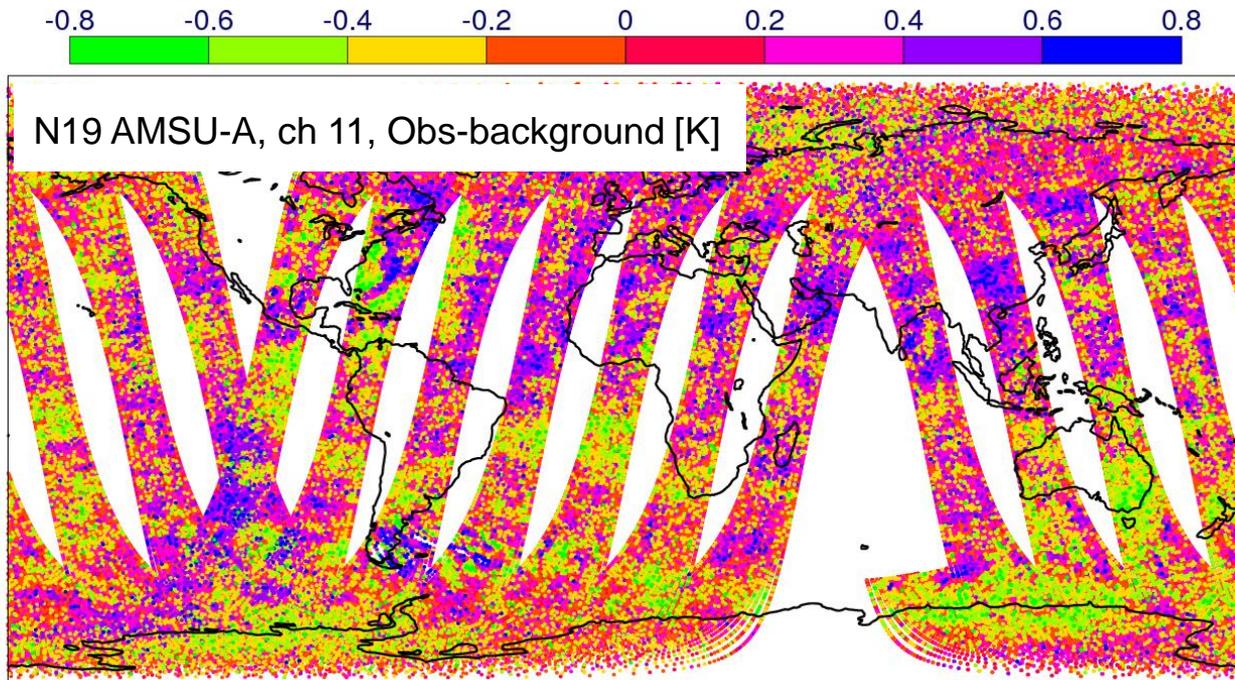
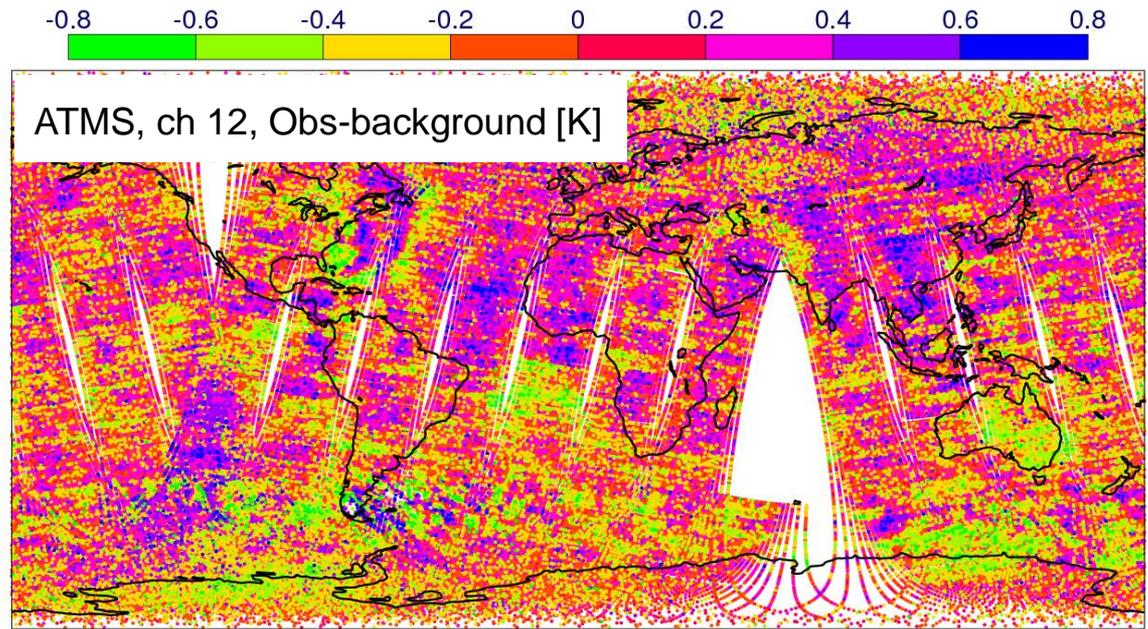
Use temperature and humidity channels (6-15; 18-22); surface-sensitive channels over sea only.

Combined scores over two seasons (102 cases):



# ATMS: Striping

Weak cross-track striping effect, especially for stratospheric temperature-sounding channels.



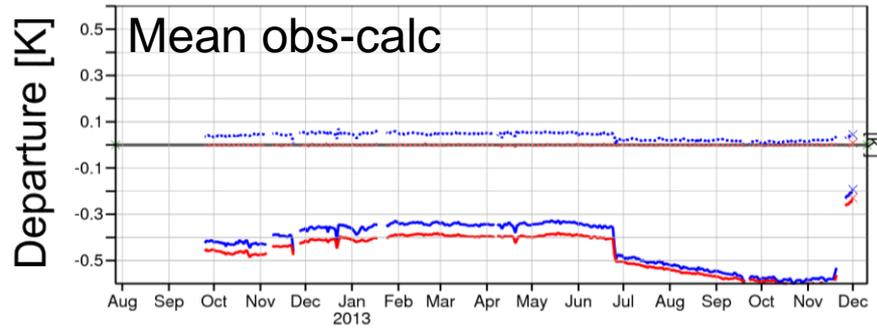
# Outline

- 1) Looking back over 15 months of assimilation of ATMS
  - **Stability**
  - **Lunar intrusions**
  - **Introduction of antenna pattern correction**
- 2) **ATMS vs AMSU-A/MHS impact in an observation-depleted system**

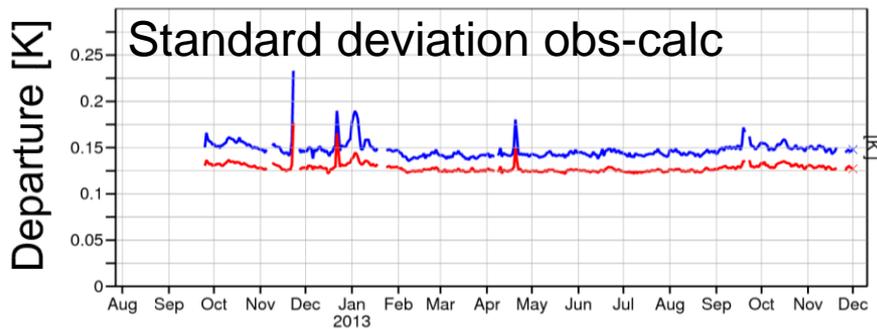
# 15 months of assimilating ATMS

## ATMS, channel 9

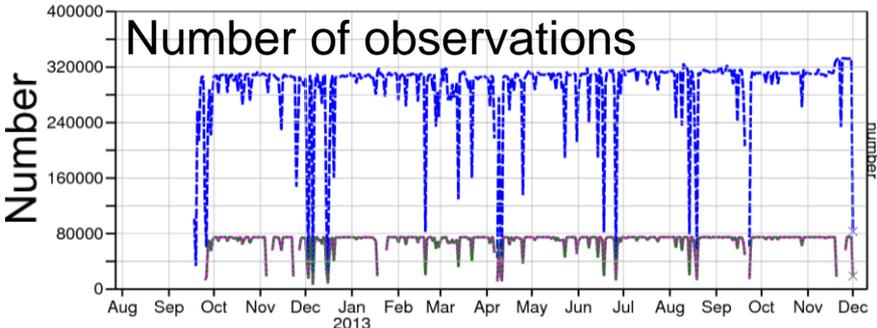
— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)



— stdv(OBS-FG)    — stdv(OBS-AN)

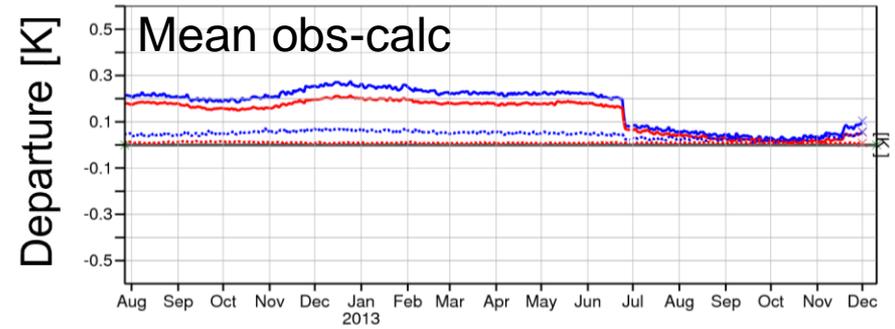


— n\_displayed    - - - n\_all    ..... n\_used

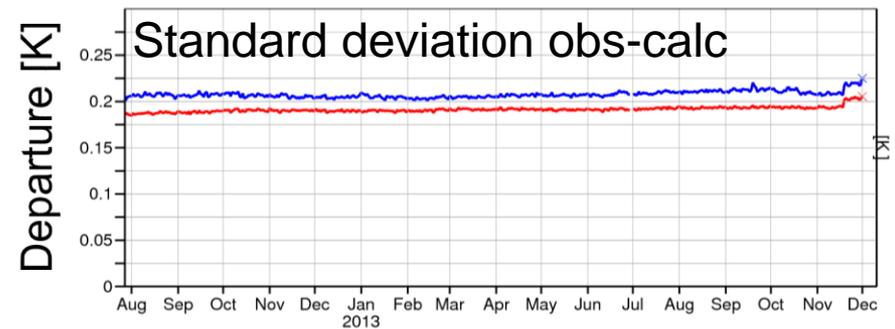


## NOAA-18, AMSU-A, channel 8

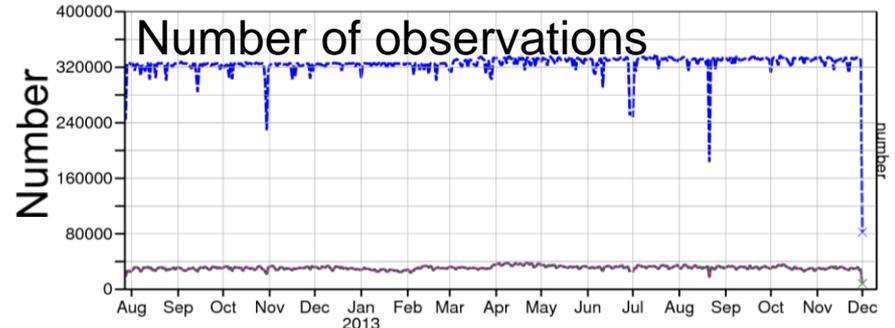
— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)



— stdv(OBS-FG)    — stdv(OBS-AN)



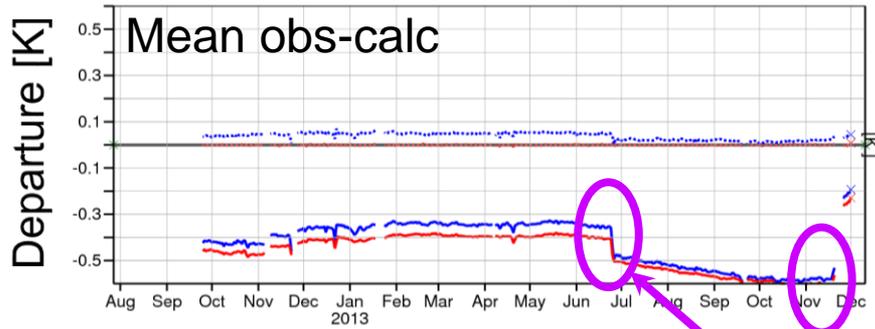
— n\_displayed    - - - n\_all    ..... n\_used



# 15 months of assimilating ATMS

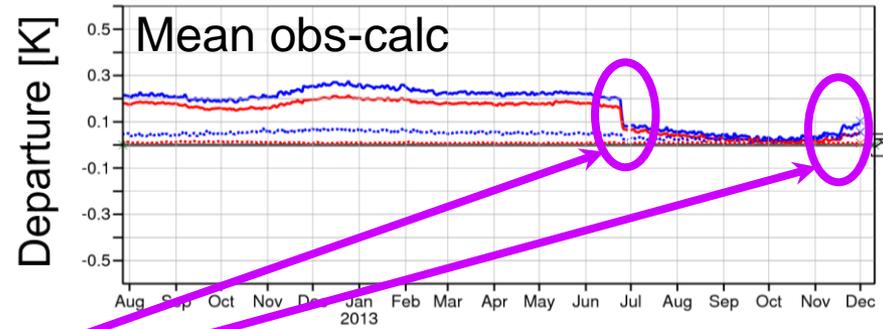
## ATMS, channel 9

— OBS-FG — OBS-AN ..... OBS-FG(bcor) ..... OBS-AN(bcor)

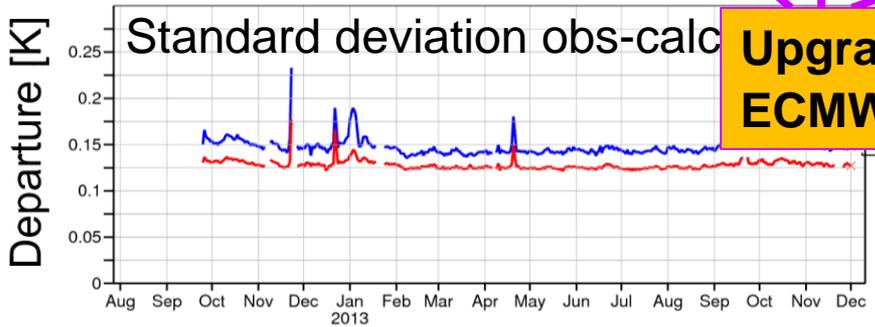


## NOAA-18, AMSU-A, channel 8

— OBS-FG — OBS-AN ..... OBS-FG(bcor) ..... OBS-AN(bcor)

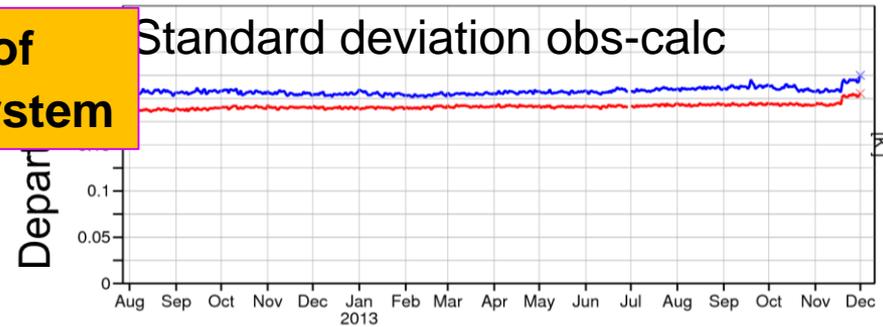


— stdv(OBS-FG) — stdv(OBS-AN)

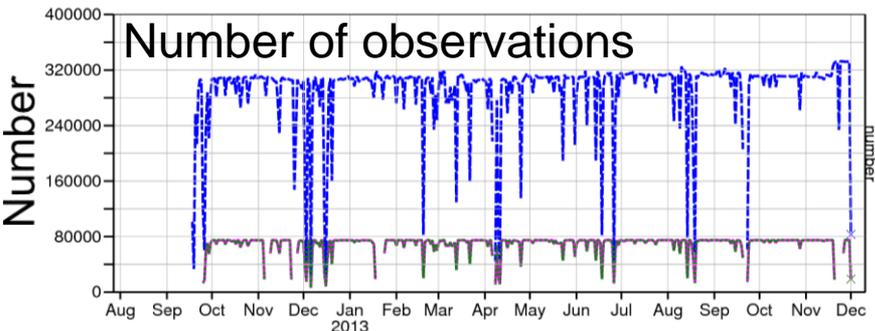


**Upgrades of  
ECMWF system**

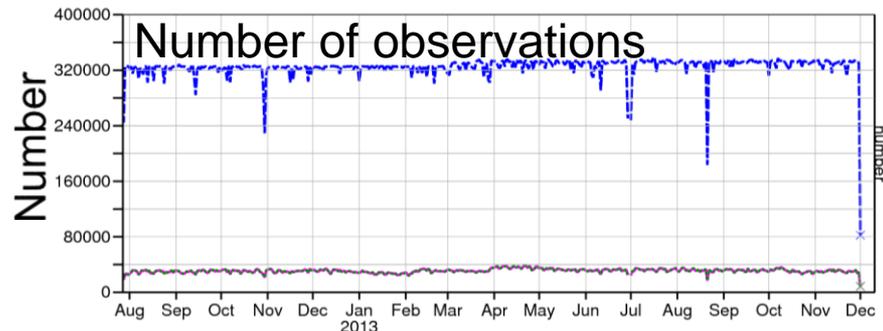
— stdv(OBS-FG) — stdv(OBS-AN)



— n\_displayed - - - n\_all ..... n\_used



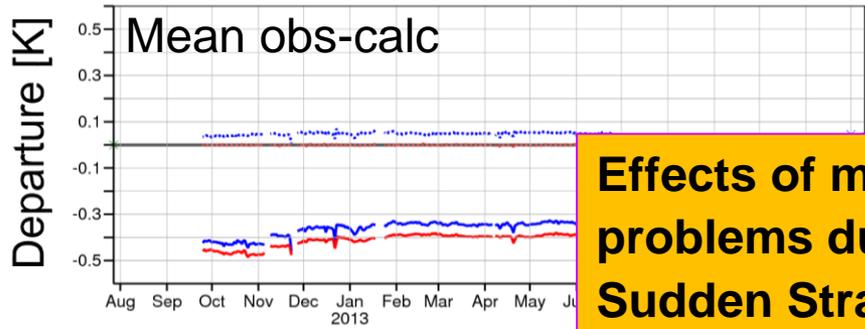
— n\_displayed - - - n\_all ..... n\_used



# 15 months of assimilating ATMS

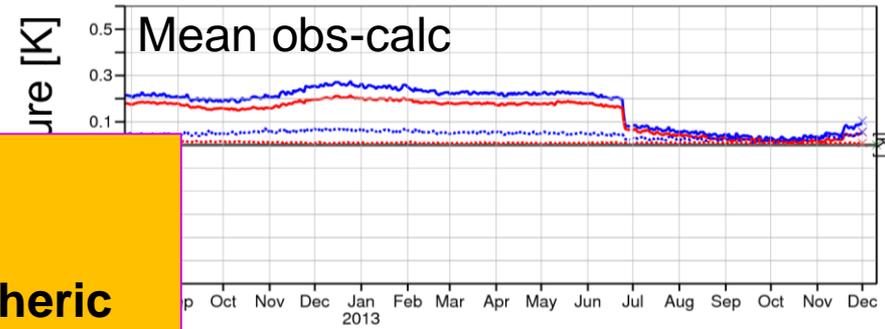
## ATMS, channel 9

— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)



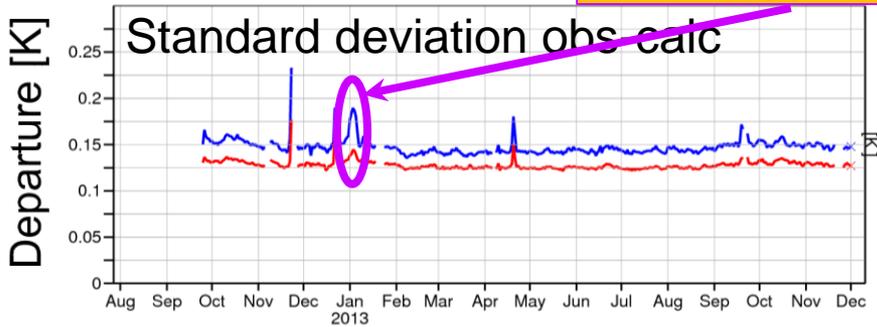
## NOAA-18, AMSU-A, channel 8

— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)

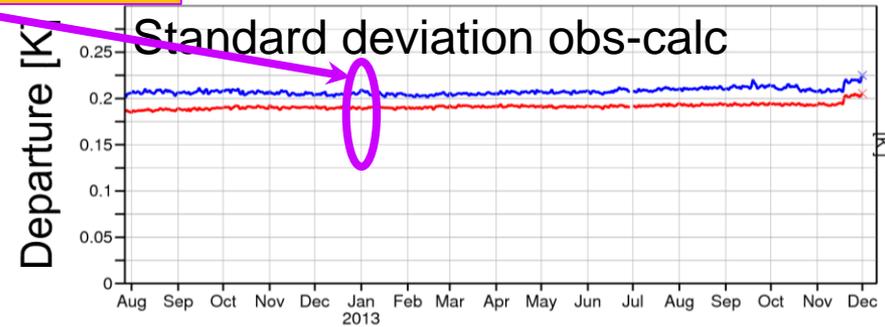


**Effects of model problems due to Sudden Stratospheric Warming**

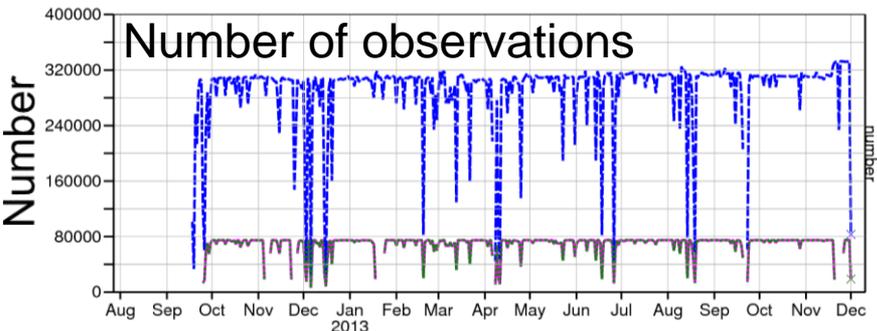
— stdv(OBS-FG)    — stdv(OBS-AN)



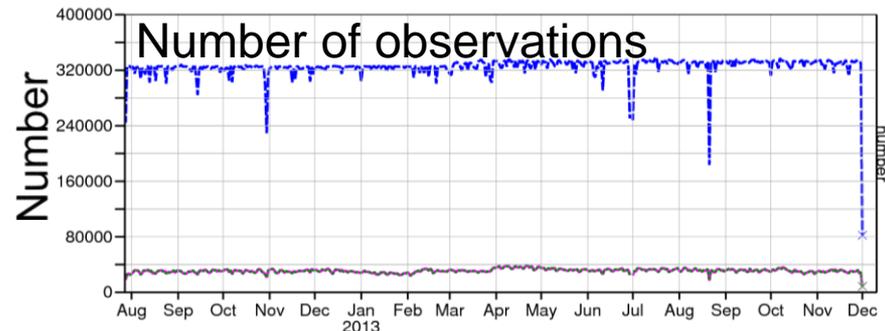
— stdv(OBS-FG)    — stdv(OBS-AN)



— n\_displayed    - - - n\_all    ..... n\_used



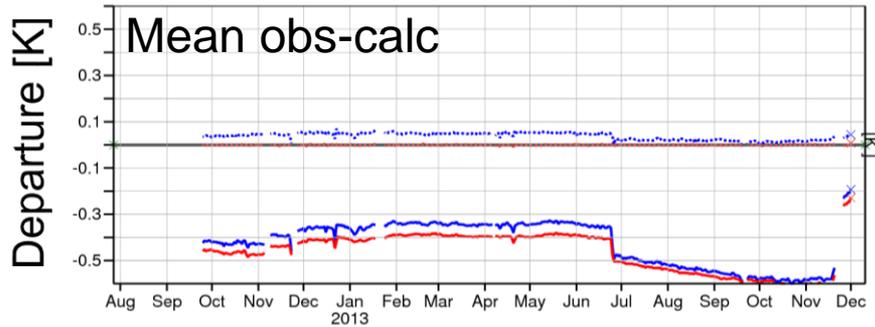
— n\_displayed    - - - n\_all    ..... n\_used



# 15 months of assimilating ATMS

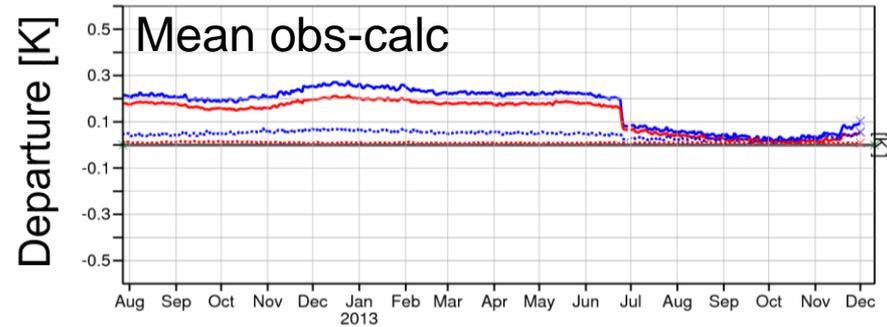
## ATMS, channel 9

— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)

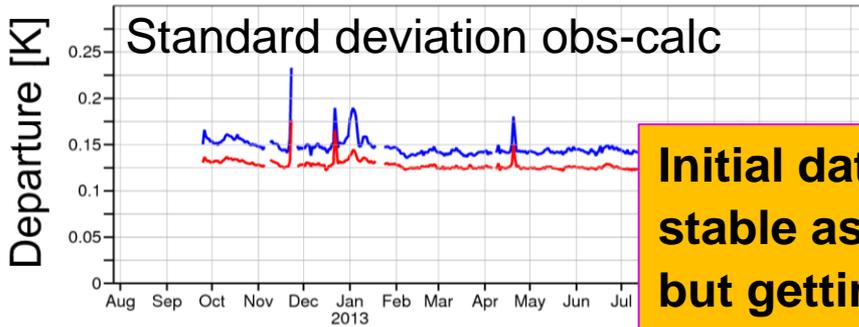


## NOAA-18, AMSU-A, channel 8

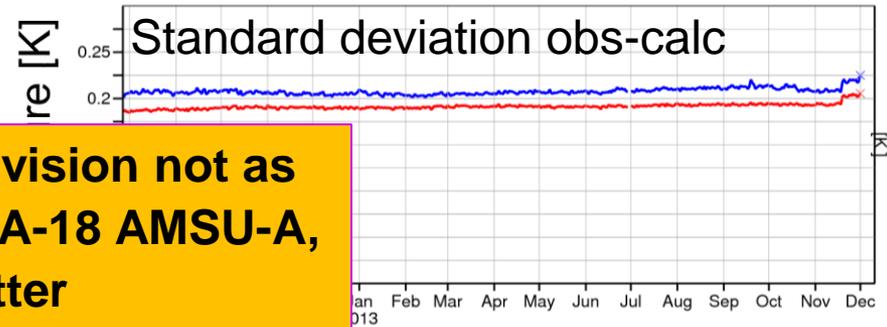
— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)



— stdv(OBS-FG)    — stdv(OBS-AN)

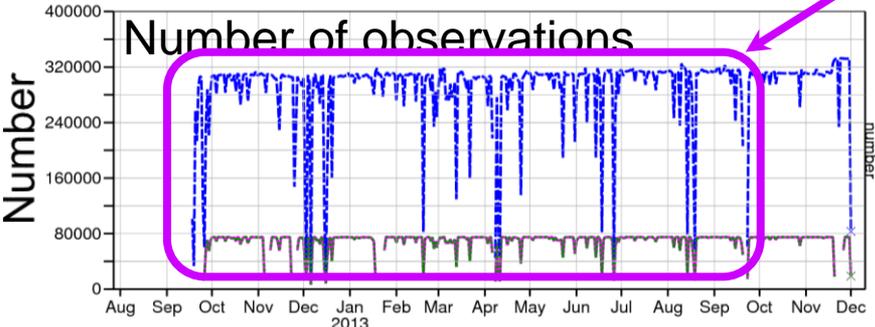


— stdv(OBS-FG)    — stdv(OBS-AN)

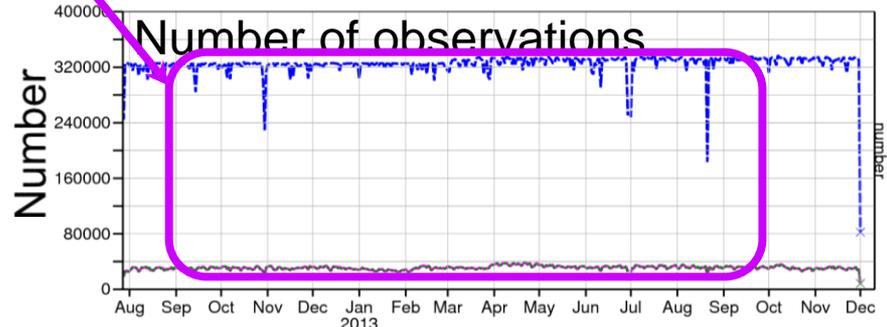


**Initial data provision not as stable as NOAA-18 AMSU-A, but getting better**

— n\_displayed    - - - n\_all    ..... n\_used



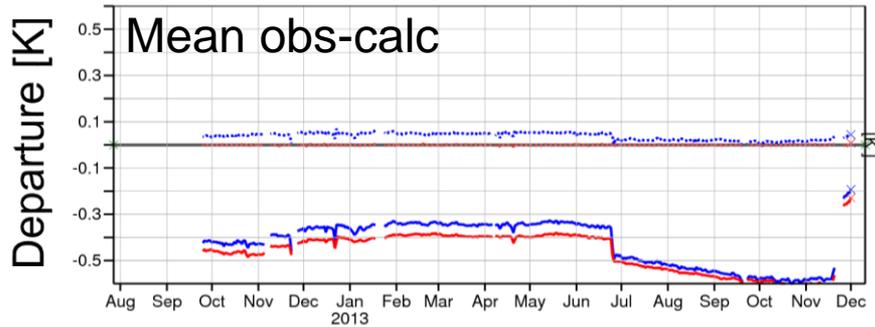
— n\_displayed    - - - n\_all    ..... n\_used



# 15 months of assimilating ATMS

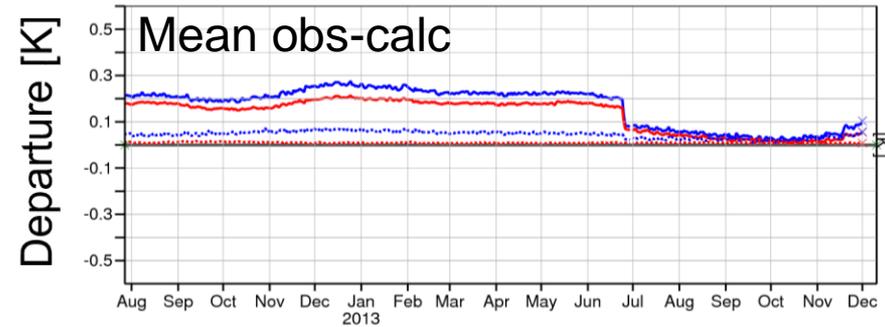
## ATMS, channel 9

— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)

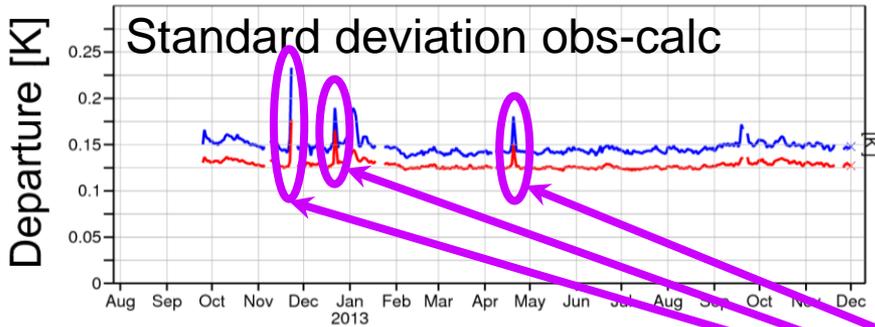


## NOAA-18, AMSU-A, channel 8

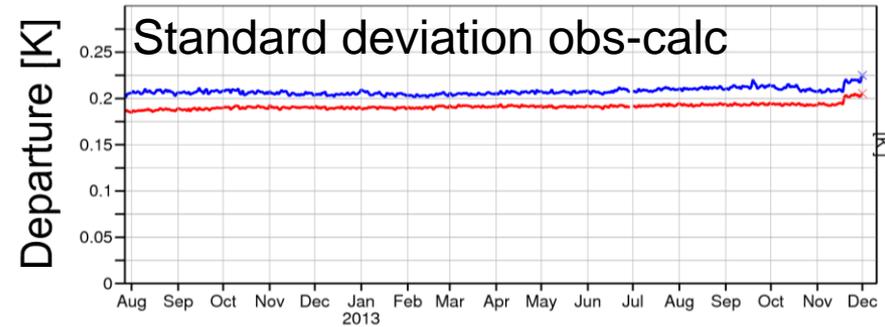
— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)



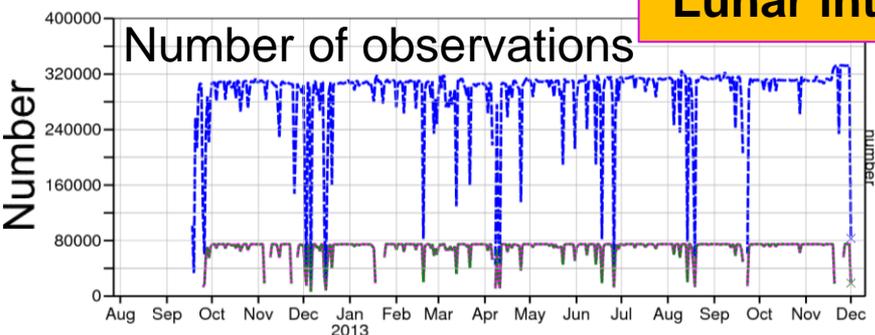
— stdv(OBS-FG)    — stdv(OBS-AN)



— stdv(OBS-FG)    — stdv(OBS-AN)

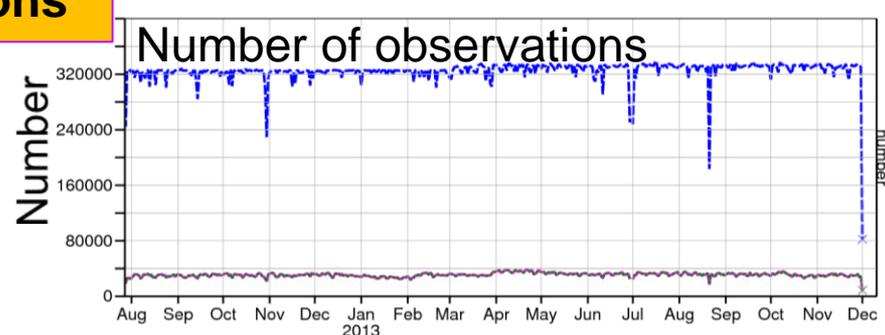


— n\_displayed    - - - n\_all    ..... n\_used



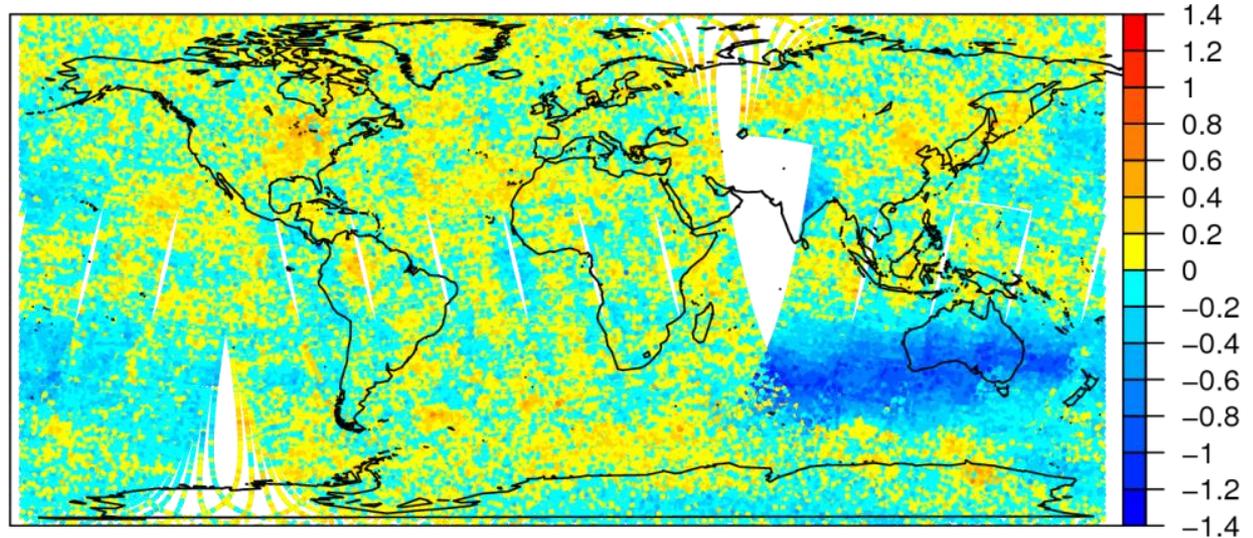
**Lunar intrusions**

— n\_displayed    - - - n\_all    ..... n\_used

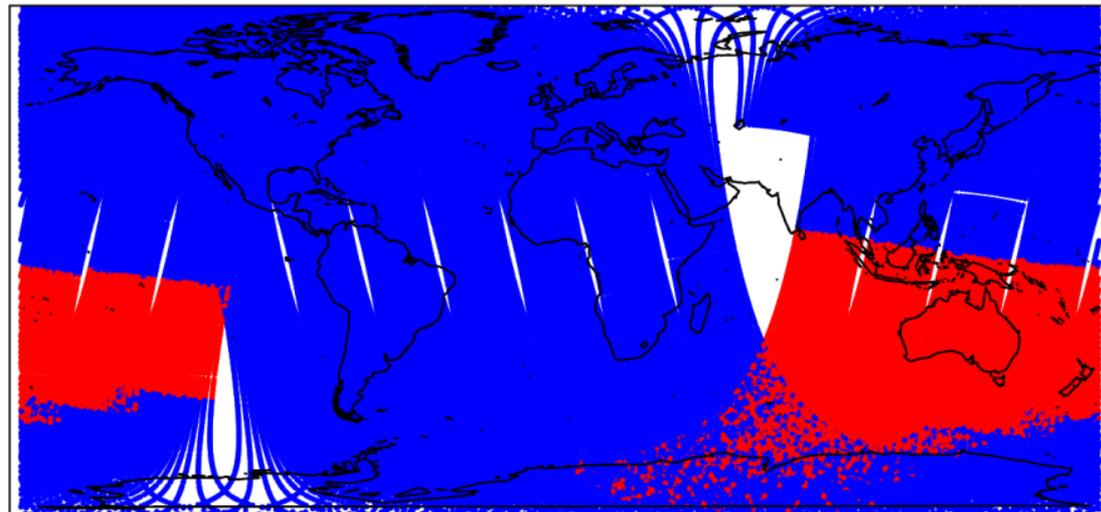


# Lunar intrusions

**Obs – FG [K],**  
ATMS channel 9,  
19 April 2013, 9-21 UTC



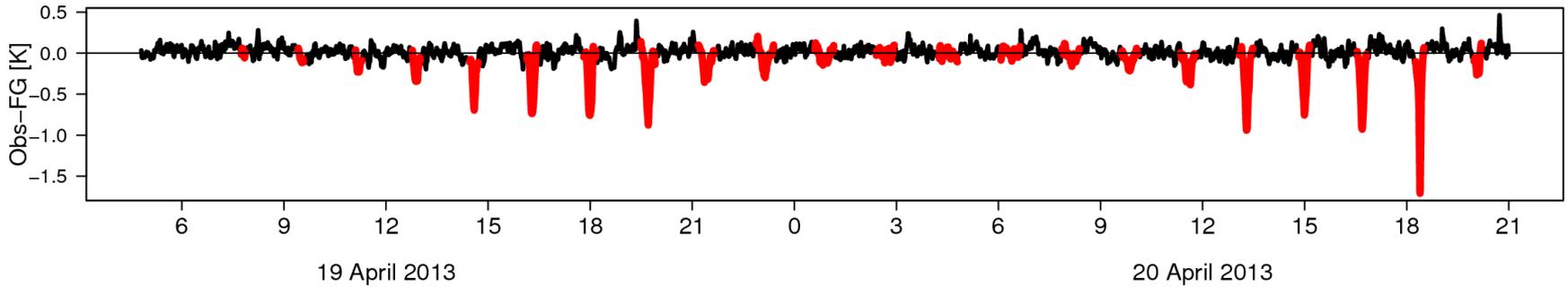
**Lunar intrusion flag,**  
ATMS channel 9,  
19 April 2013, 9-21 UTC



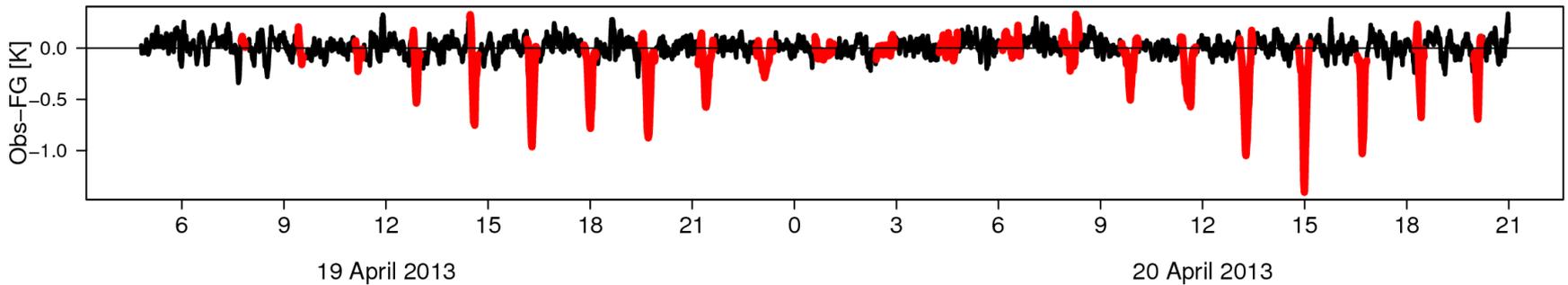
# Mean(Obs-FG) during lunar intrusion

(Red – lunar intrusion flagged)

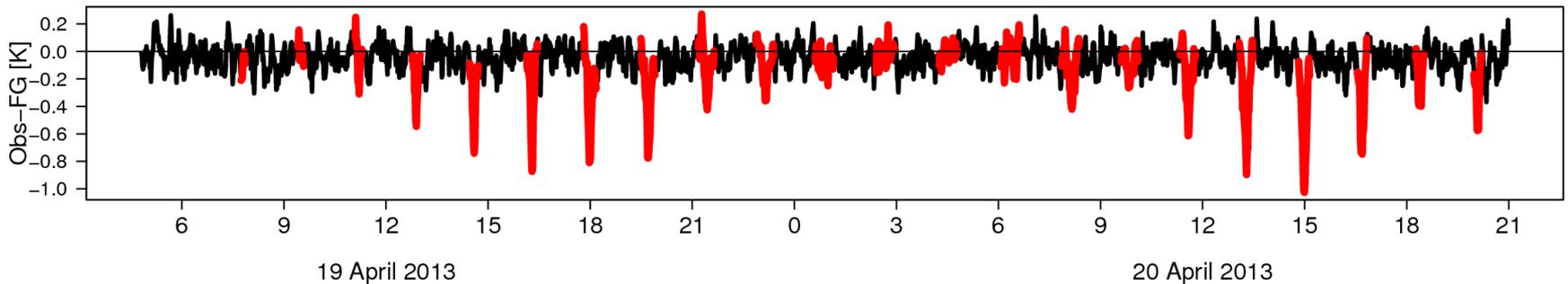
Channel 8



Channel 10



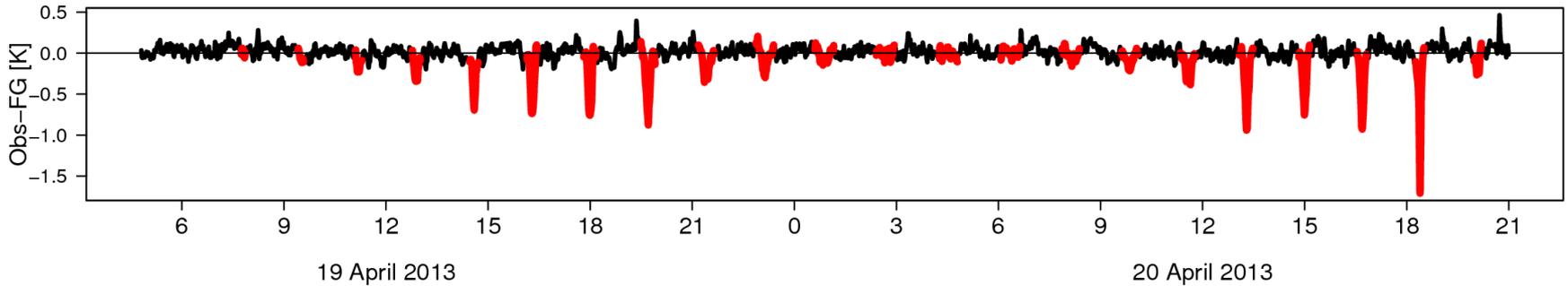
Channel 12



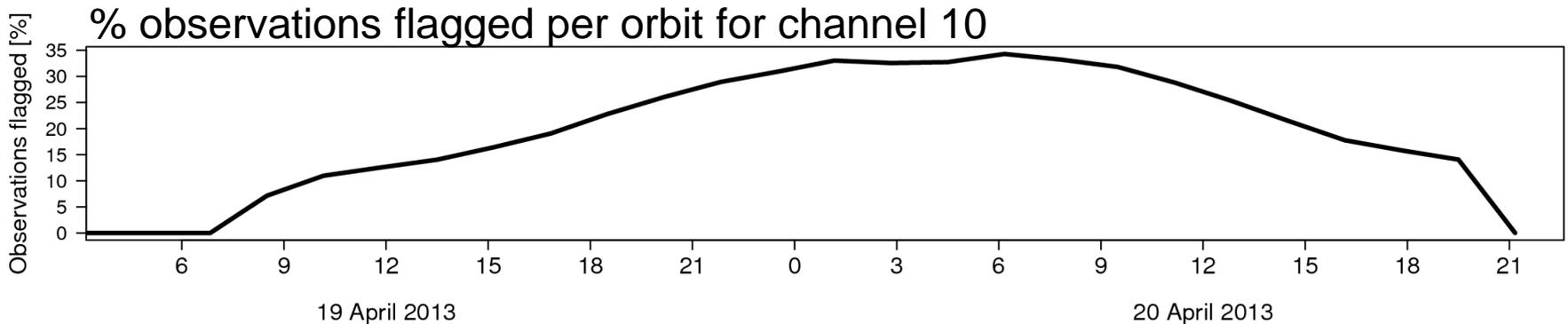
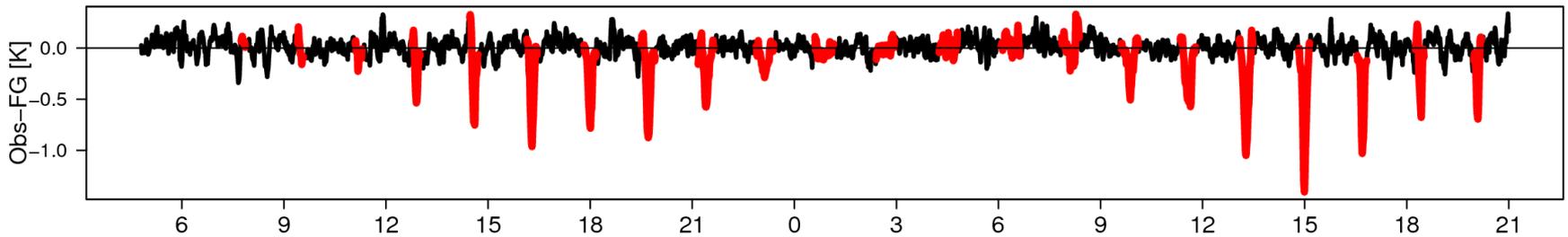
# Mean(Obs-FG) during lunar intrusion

(Red – data is flagged)

Channel 8



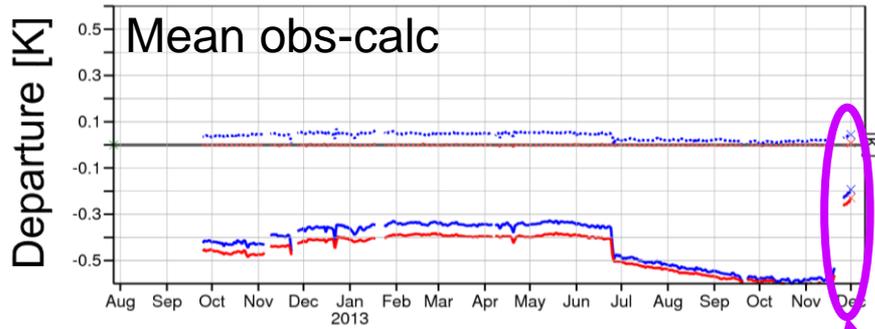
Channel 10



# 15 months of assimilating ATMS

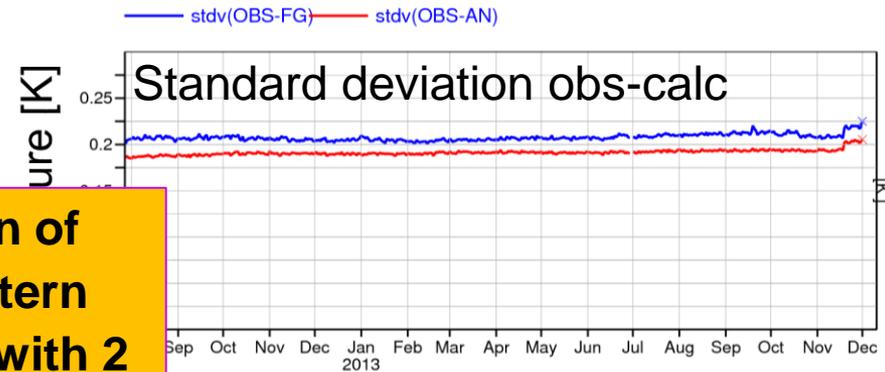
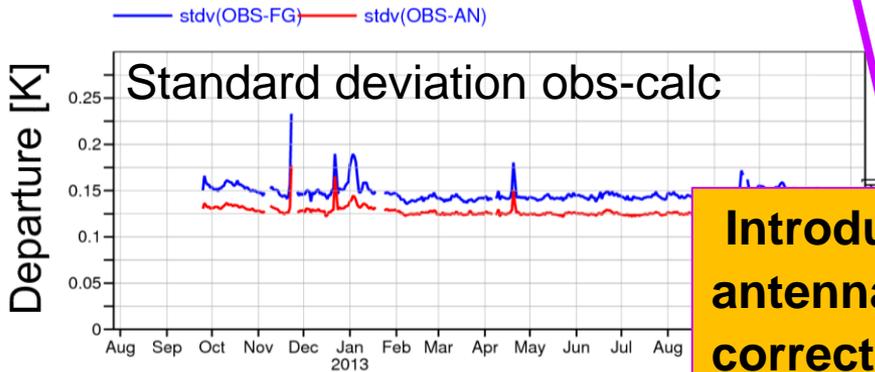
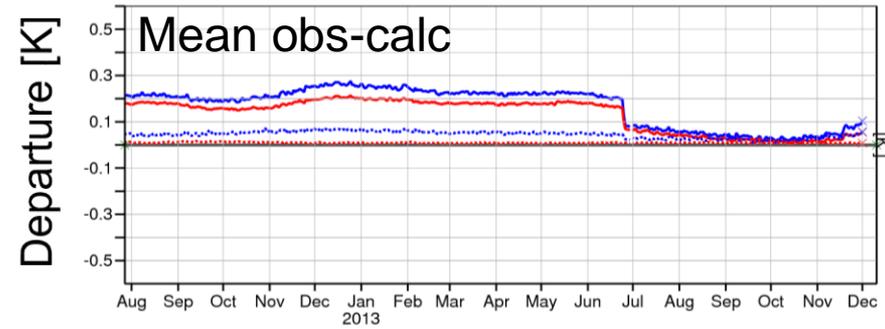
## ATMS, channel 9

— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)

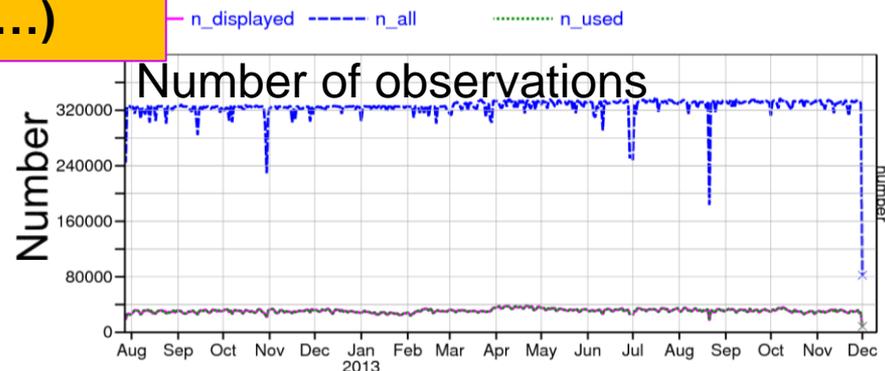
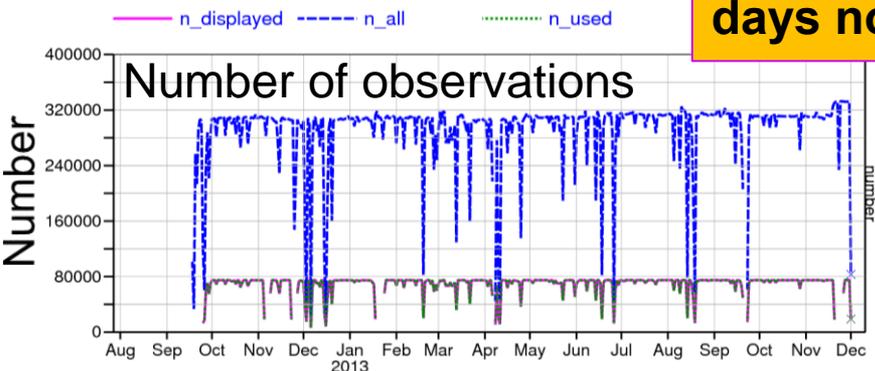


## NOAA-18, AMSU-A, channel 8

— OBS-FG    — OBS-AN    ..... OBS-FG(bcor)    ..... OBS-AN(bcor)

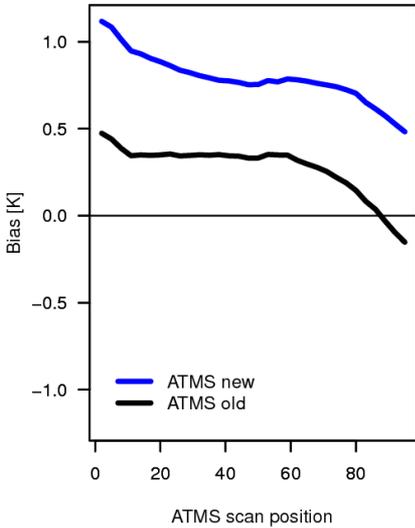


**Introduction of antenna pattern correction (with 2 days notice...)**

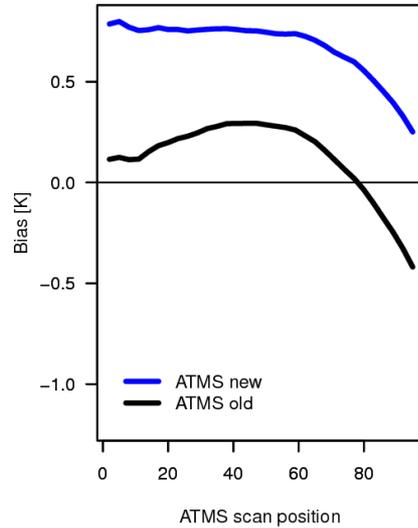


# Introduction of antenna pattern correction

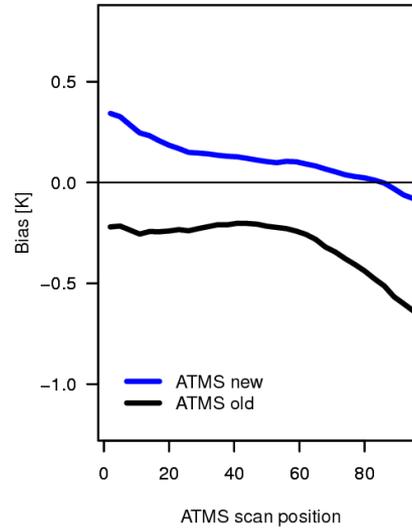
Obs-FG bias, channel 6



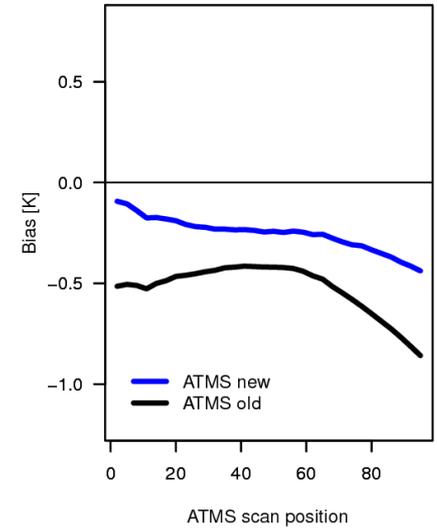
Obs-FG bias, channel 7



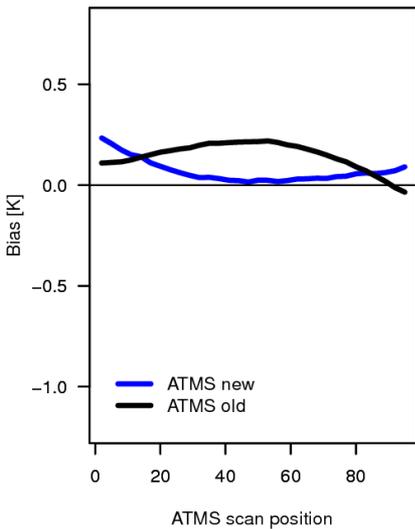
Obs-FG bias, channel 8



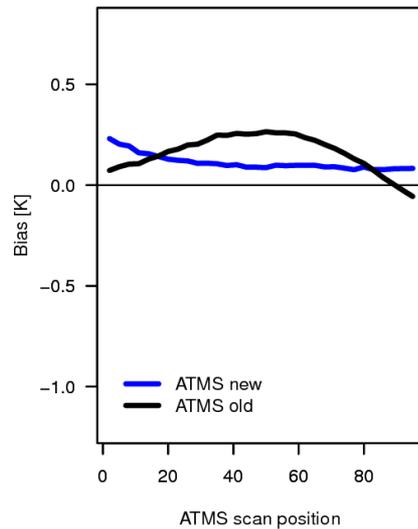
Obs-FG bias, channel 9



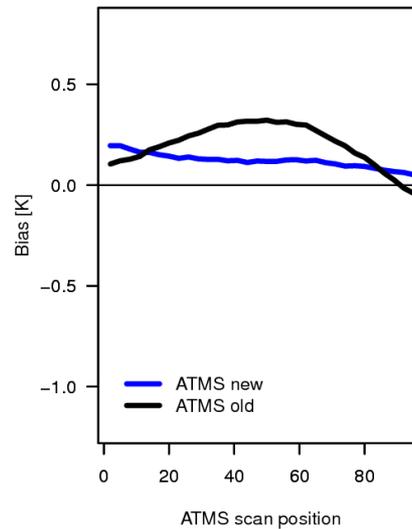
Obs-FG bias, channel 10



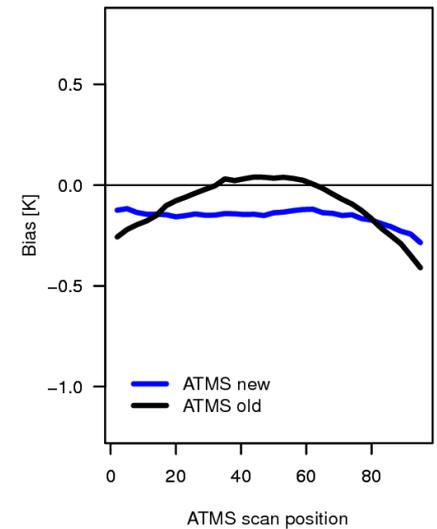
Obs-FG bias, channel 11



Obs-FG bias, channel 12

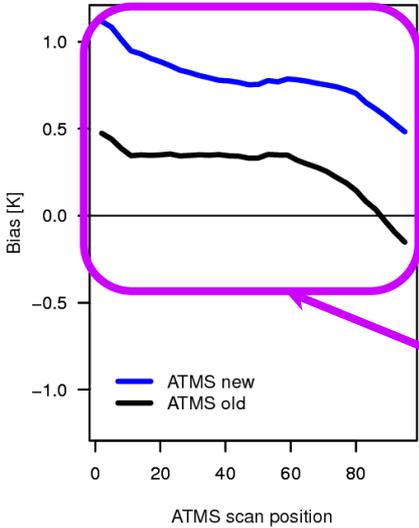


Obs-FG bias, channel 13

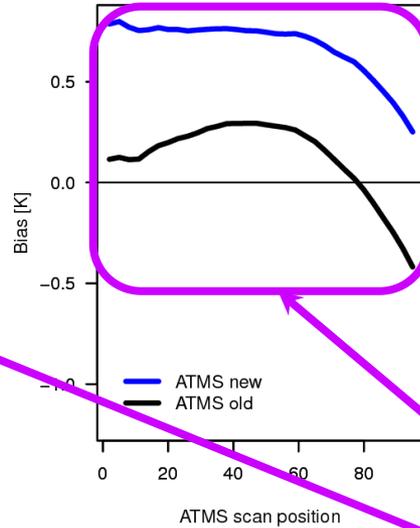


# Introduction of antenna pattern correction

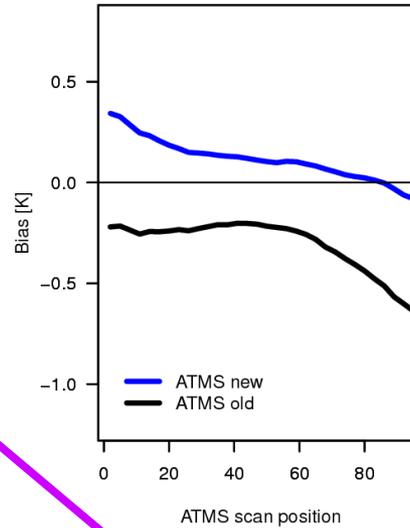
Obs-FG bias, channel 6



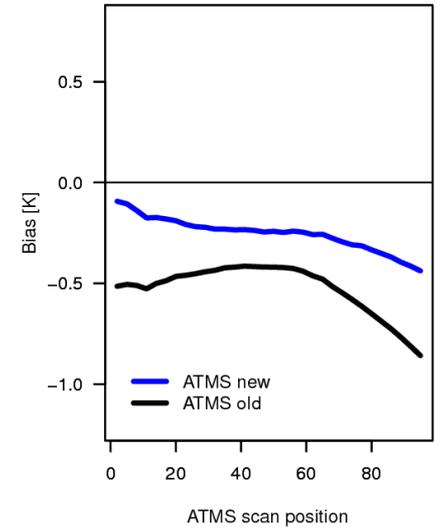
Obs-FG bias, channel 7



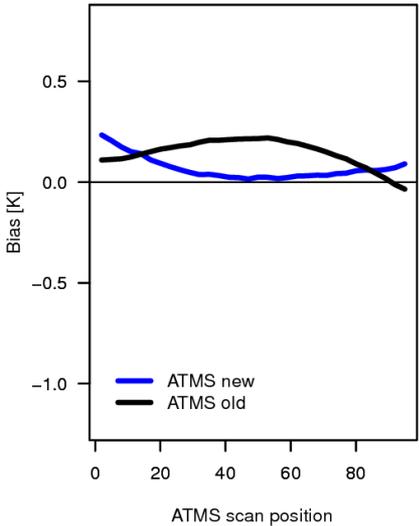
Obs-FG bias, channel 8



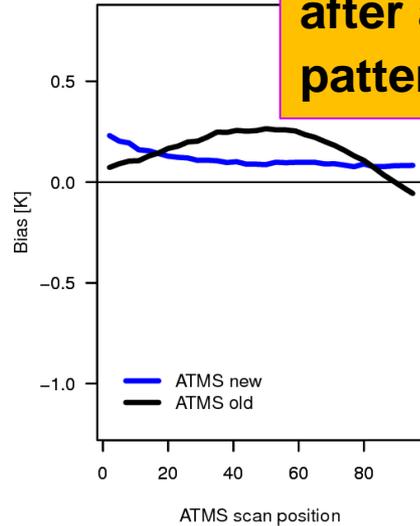
Obs-FG bias, channel 9



Obs-FG bias, channel 10

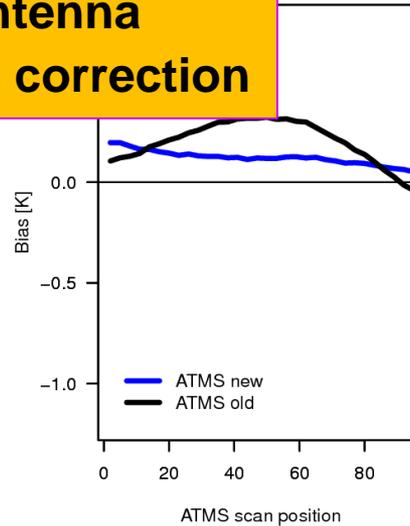


Obs-FG bias,

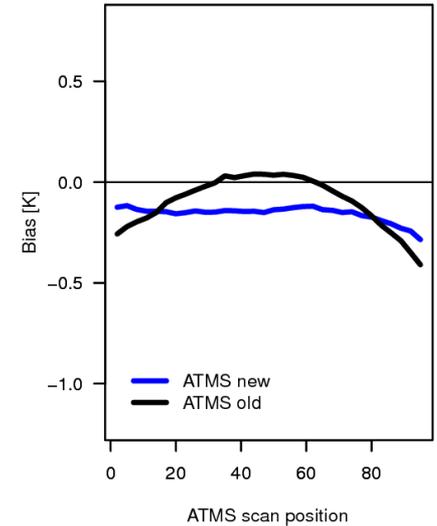


**Increased biases  
after antenna  
pattern correction**

channel 12

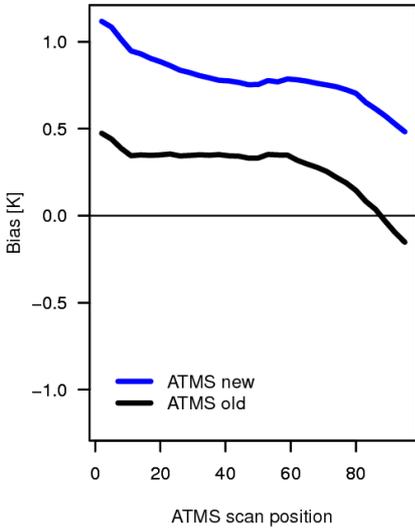


Obs-FG bias, channel 13

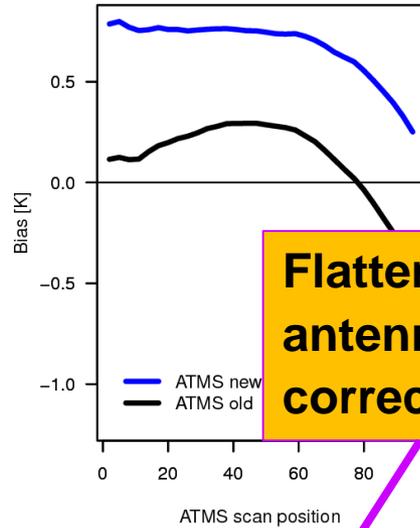


# Introduction of antenna pattern correction

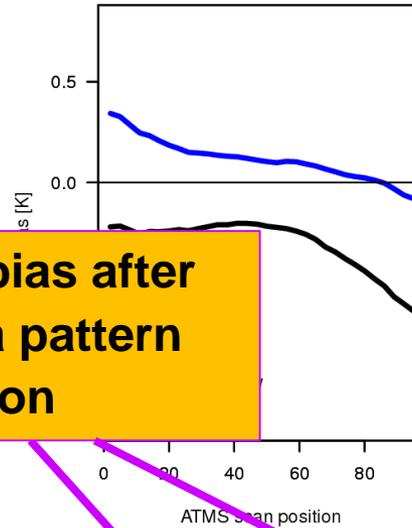
Obs-FG bias, channel 6



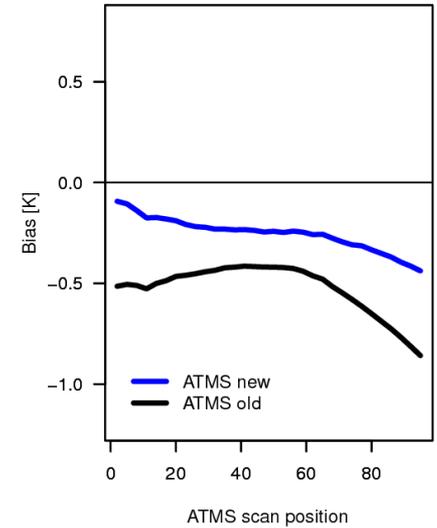
Obs-FG bias, channel 7



Obs-FG bias, channel 8

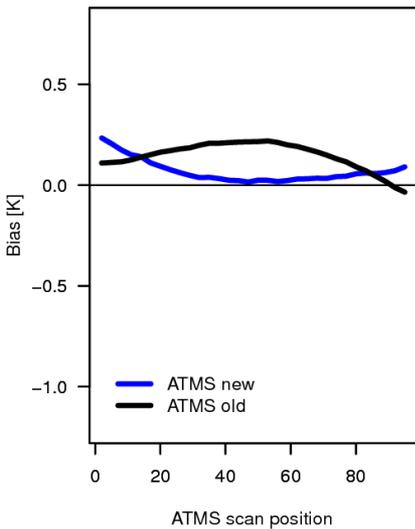


Obs-FG bias, channel 9

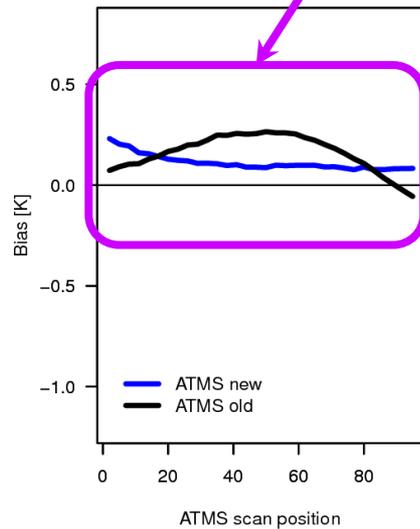


**Flatter bias after antenna pattern correction**

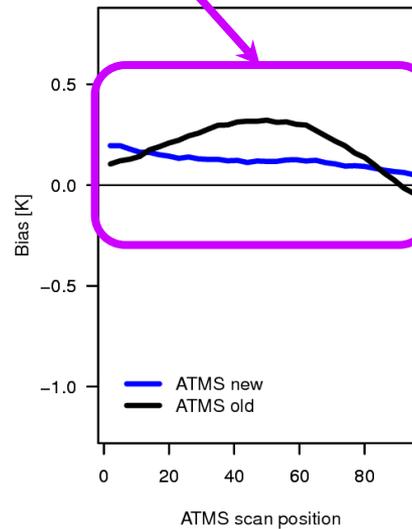
Obs-FG bias, channel 10



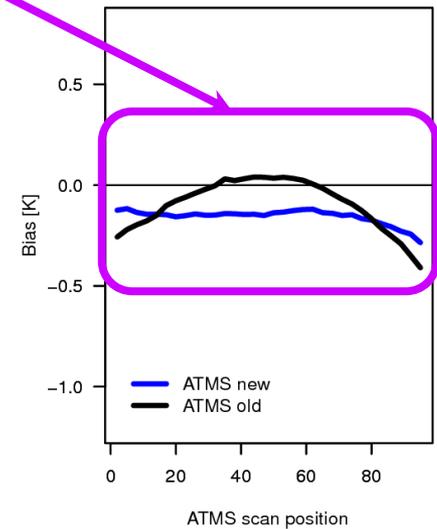
Obs-FG bias, channel 11



Obs-FG bias, channel 12

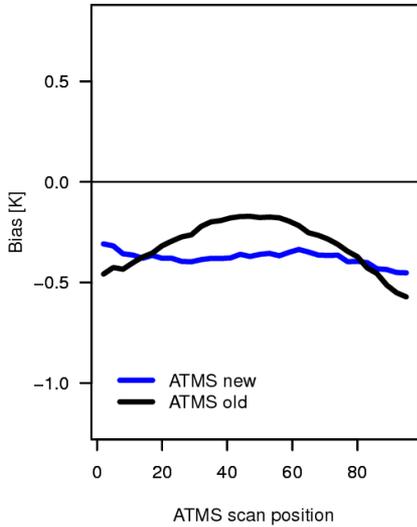


Obs-FG bias, channel 13

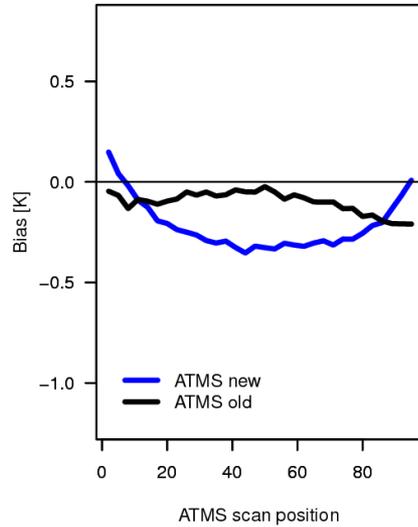


# Introduction of antenna pattern correction

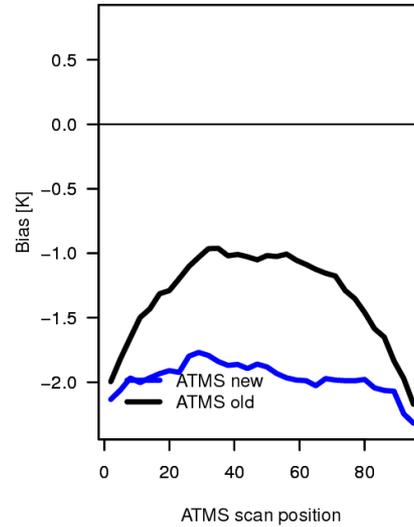
Obs-FG bias, channel 14



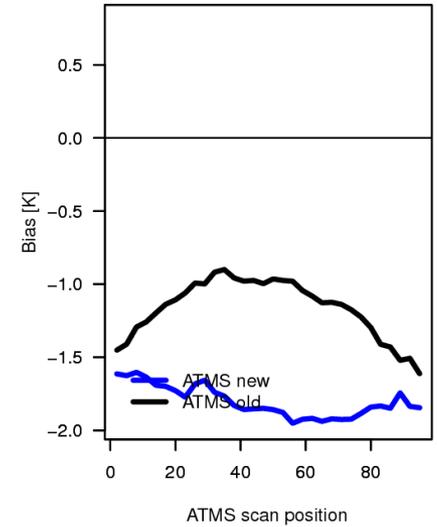
Obs-FG bias, channel 15



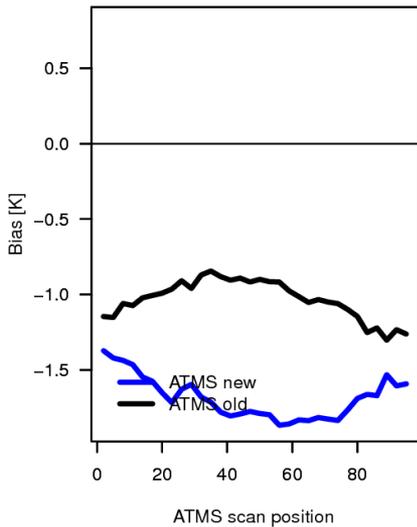
Obs-FG bias, channel 18



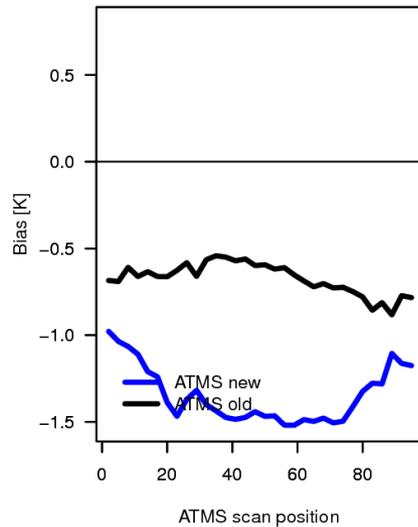
Obs-FG bias, channel 19



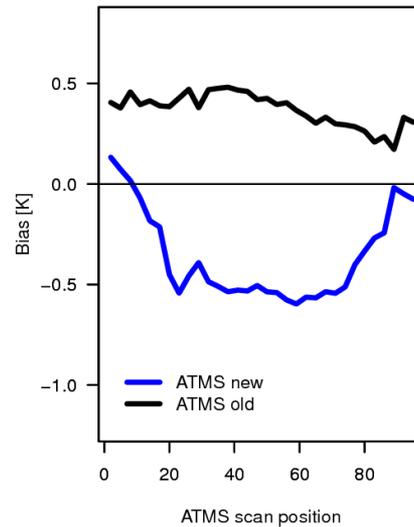
Obs-FG bias, channel 20



Obs-FG bias, channel 21



Obs-FG bias, channel 22



# Outline

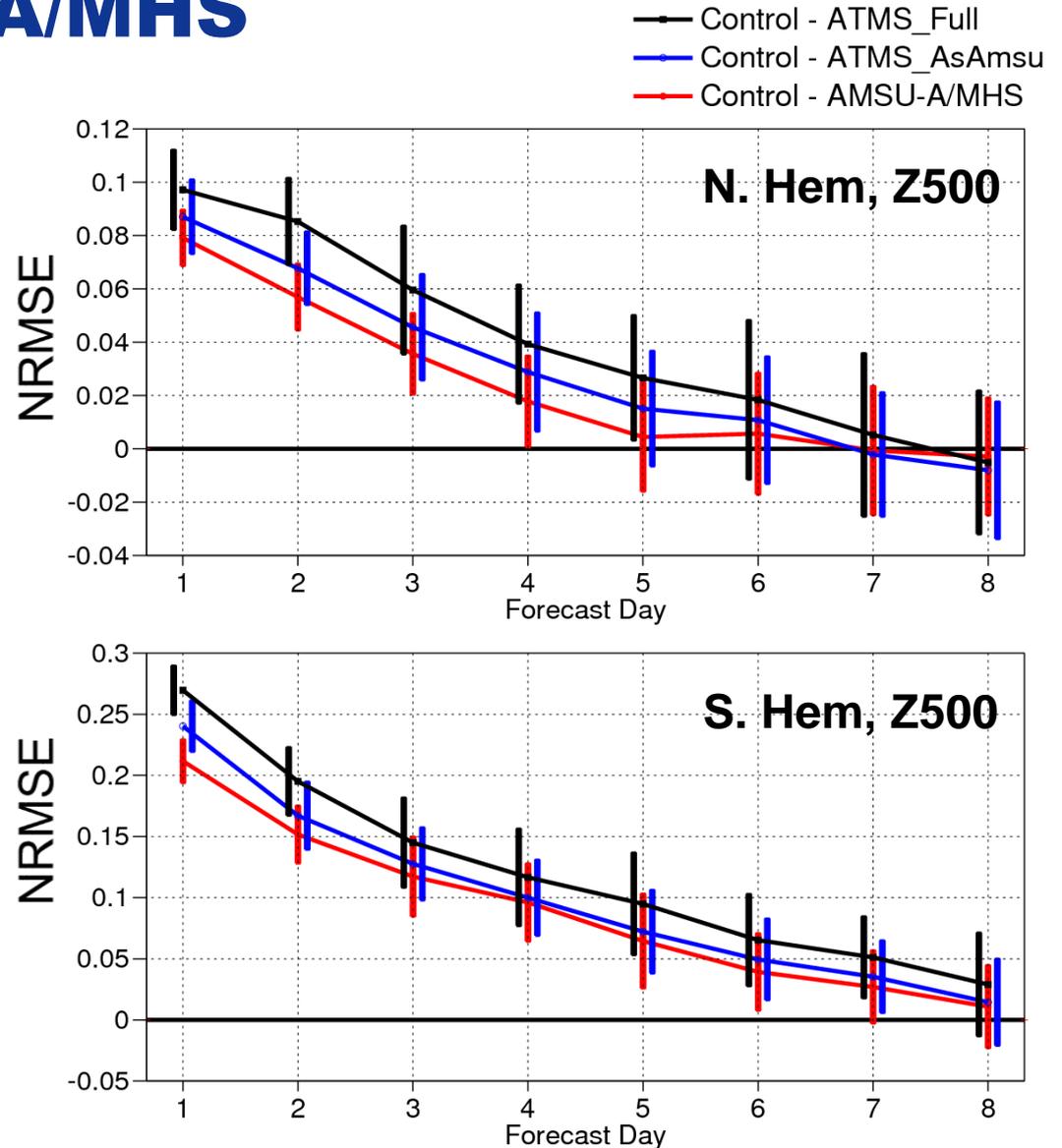
- 1) Looking back over 15 months of assimilation of ATMS
  - Stability
  - Lunar intrusions
  - Introduction of antenna pattern correction
- 2) **ATMS vs AMSU-A/MHS impact in an observation-depleted system**

# ATMS vs AMSU-A/MHS

- Experiments with depleted observing system, 1 July-31 Aug 2012:
  - Control: No polar satellite data
  - ATMS Full: Control + ATMS
  - ATMS AsAmsu: As ATMS\_Full, but blacklist outer-most 4 scan-positions and two additional humidity channels
  - AMSU-A/MHS: Control + NOAA-18 AMSU-A and MHS
  
- Note:
  - All **scan-positions** used for ATMS; outermost 3 on either side are blacklisted for AMSU-A, 9 for MHS (scan-biases).
  - ATMS experiments use 5 **humidity channels**; only 3 available from MHS.
  - MHS humidity channels **unaveraged**, ATMS 3x3.

# ATMS vs AMSU-A/MHS

- Comparable impact from ATMS and AMSU-A/MHS
- Benefits from using the outer-most fields of view



# Summary

- **ATMS performance has been stable over the last 15 months:**
  - **Noise performance and forecast impact comparable to AMSU-A/MHS (or a little better).**
  - **Striping remains the only issue.**
  - **Lunar intrusions are flagged successfully.**
- **Outlook:**
  - **Assimilation of surface-sensitive channels over land and sea-ice**
  - **Tuning of observation errors**

# Backup slides

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

→ After averaging, ATMS noise performance at least as good as AMSU-A.

