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):

- N.Hem, Z 500 hPa
- S.Hem, Z 500 hPa
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

Mean obs - calc

Standard deviation obs - calc

Number of observations

NOAA-18, AMSU-A, channel 8

Mean obs - calc

Standard deviation obs - calc

Number of observations
15 months of assimilating ATMS

ATMS, channel 9

Mean obs-calc

Standard deviation obs-calc

Number of observations

NOAA-18, AMSU-A, channel 8

Mean obs-calc

Standard deviation obs-calc

Number of observations

Upgrades of ECMWF system
15 months of assimilating ATMS

ATMS, channel 9

NOAA-18, AMSU-A, channel 8

Effects of model problems due to Sudden Stratospheric Warming
15 months of assimilating ATMS

ATMS, channel 9

NOAA-18, AMSU-A, channel 8

Initial data provision not as stable as NOAA-18 AMSU-A, but getting better
15 months of assimilating ATMS

ATMS, channel 9

Mean obs-calc

Standard deviation obs-calc

Number of observations

NOAA-18, AMSU-A, channel 8

Mean obs-calc

Standard deviation obs-calc

Number of observations

Lunar intrusions
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

Suomi NPP SDR product review, 18 Dec 2013
Mean(Obs-FG) during lunar intrusion

(Red – data is flagged)

Channel 8

Channel 10

% observations flagged per orbit for channel 10

Suomi NPP SDR product review, 18 Dec 2013
15 months of assimilating ATMS

ATMS, channel 9

NOAA-18, AMSU-A, channel 8

Mean $\text{obs-calc}$

Standard deviation $\text{obs-calc}$

Number of observations

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

Increased biases after antenna pattern correction
Introduction of antenna pattern correction

Flatter bias after antenna pattern correction
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
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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.