Evaluation and assimilation of MW sensors on NOAA-20 and Metop-C

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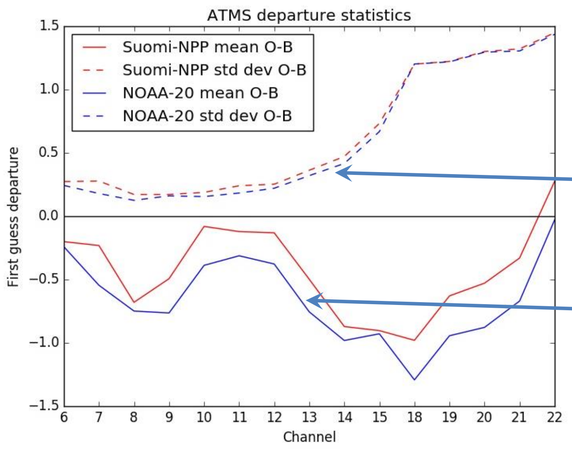
NOAA-20 ATMS

Launched: 18 Nov 2017 +++ **First routine data received:** 25 Feb 2018 +++ **Operationally assimilated:** 22 May 2018

Data evaluation

NOAA-20 ATMS data were first evaluated passively against the model background, and statistics compared to S-NPP ATMS. 3x3 averaging is applied to all data.

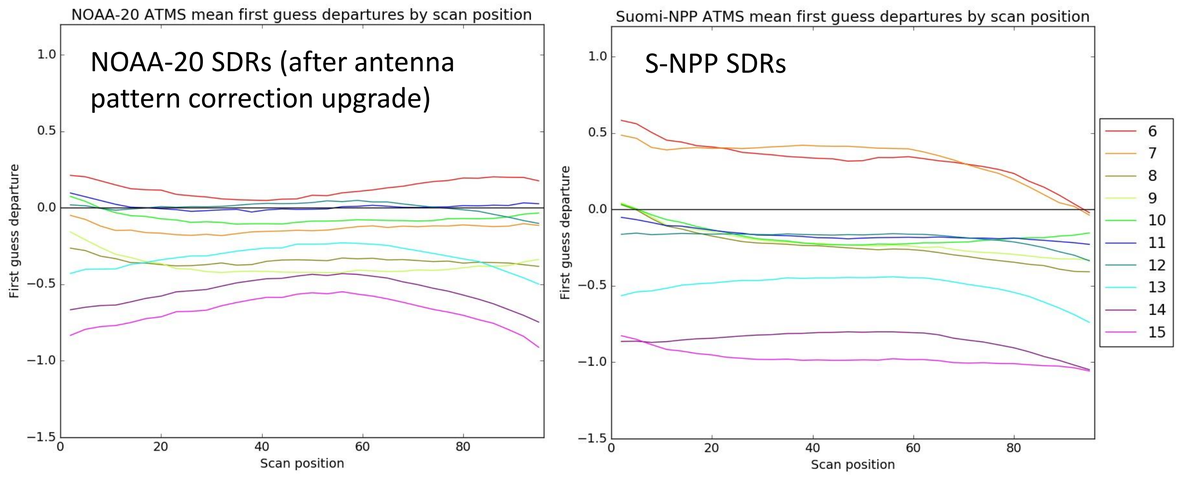


ATMS departure statistics for TDRs, before bias correction, after cloud screening.

Significantly lower standard deviations of o-b for ATMS on NOAA-20 (blue) than on S-NPP, linked to less striping noise.

Bias against the background is similar for both instruments, within variations seen in the past for similar instruments.

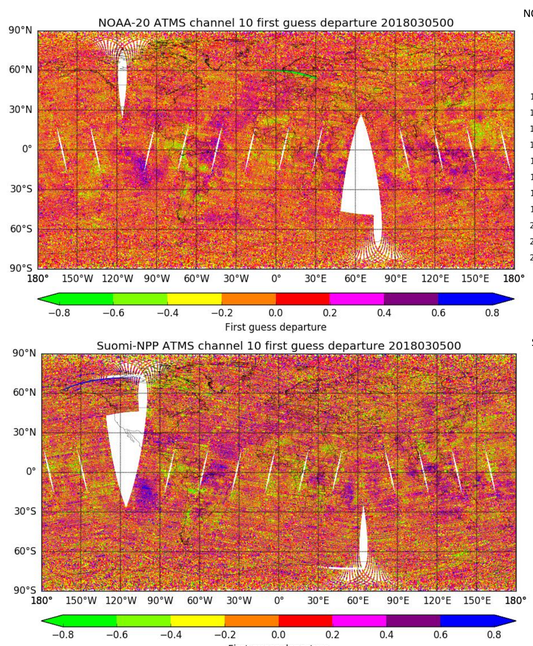
Scan-biases of the SDRs (brightness temperatures) vs the model background are smaller for NOAA-20, and have similar variations across the scan as for S-NPP (note: the upgrade on 15 Oct 2019 made S-NPP SDRs more similar to NOAA-20 SDRs):



Less striping

NOAA-20 ATMS shows less striping in maps of unveraged o-b than the S-NPP ATMS, though some striping remains.

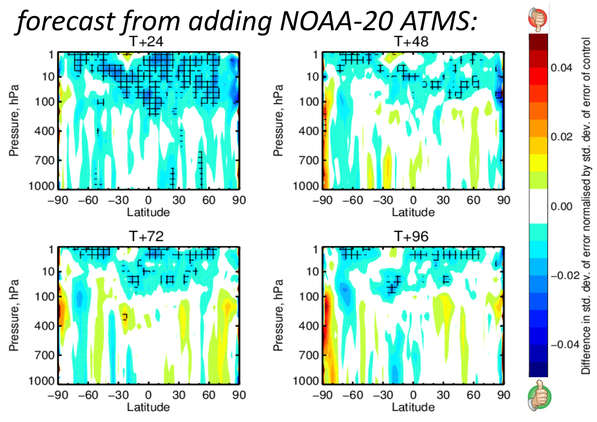
Desroziers-diagnosed inter-channel observation error correlations (right) are also significantly smaller for NOAA-20 (top) than for S-NPP ATMS for the temperature-sounding channels. They are similar for the humidity channels, where representativeness errors dominate.

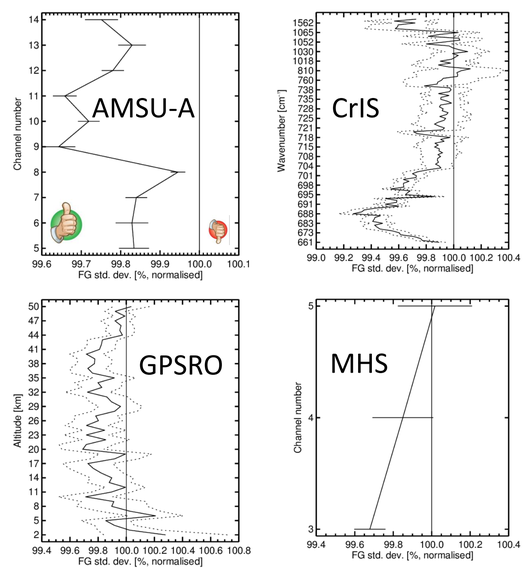


Forecast impact

Added as 8th MW temperature sounder and 12th MW humidity sounder, NOAA-20 ATMS gives slight positive forecast impact, mostly in the short-range and in the stratosphere. Trials were run over 4 months (1 March – 30 June 2018). Channels assimilated: 6-15; 18-22, subject to channel-dependent cloud and geographical screening.

Normalised difference in Stdev of geopotential forecast from adding NOAA-20 ATMS:





Reduced normalised standard deviations of background departures for other observations indicate improved short-range forecasts (global statistics; 95% confidence intervals).

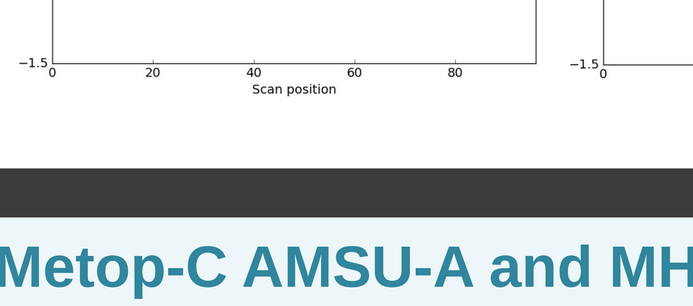
Metop-C AMSU-A and MHS

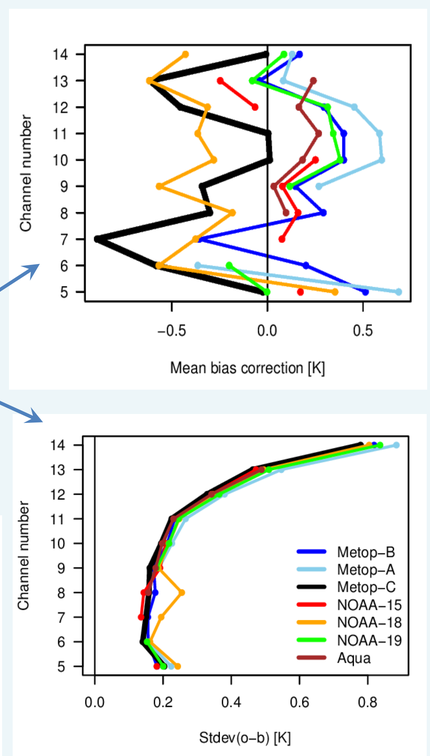
Launched: 7 Nov 2018 +++ **First routine data received:** 21 Nov 2018 +++ **Operationally assimilated:** 14 March 2019

Data evaluation

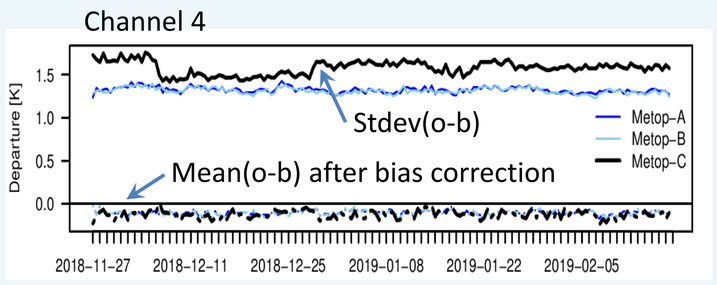
Metop-C AMSU-A and MHS data were first evaluated passively against the model background (clear data over sea), and statistics compared to similar instruments.

- **AMSU-A** shows biases within usual variations (somewhat colder than other Metops).
- Noise performance is mostly good compared to other AMSU-As.
- There are occasional instabilities in channels 7 and 8.





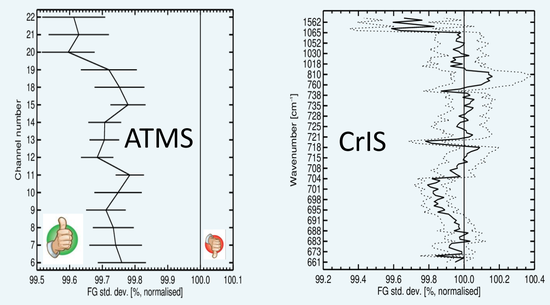
- **MHS** biases are similar to those of other MHSs.
- Channels 3 and 4 show a poorer noise performance, with some variation over time. Striping is visible in maps of o-b during episodes with higher noise (not shown).



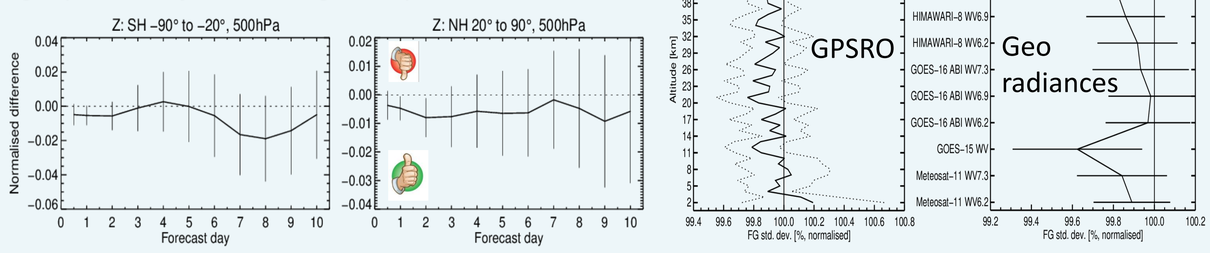
Forecast impact

Added as 9th MW temperature sounder and 11th MW humidity sounder, Metop-C AMSU-A and MHS give slight positive forecast impact. Trials were run over 3 months (12 Dec 2018 – 13 March 2019). Channels assimilated: AMSU-A 5-14, subject to channel-dependent cloud and geographical screening; MHS 3-5 in all-sky, subject to channel-dependent geographical screening.

Reduced normalised standard deviations of background departures for other observations indicate improved short-range forecasts (global statistics; 95% confidence intervals):



Normalised difference in RMSE for 500 hPa geopotential from adding Metop-C AMSU-A & MHS:



Conclusions

NOAA-20 ATMS and Metop-C AMSU-A and MHS are the latest additions of MW instruments to the ECMWF system. Even when added to a full system with 7-8 MW temperature and 10-11 MW humidity sounders already assimilated, they still bring small, but statistically significant forecast benefits. This suggests the benefits obtainable from the assimilation of further MW sounding instruments are not yet saturated.

Acknowledgements

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