

An assessment of Meteor-M N2 MTVZA imager/sounder data at the Met Office and ECMWF for GAIA-CLIM

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Meteor-M N2 spacecraft

MTVZA-GY instrument



Credit: Roscosmos



Credit: Roscosmos,
Roshydromet/Planeta

Channel No	Centre Frequency (GHz)	Polarisation	Effective FOV (km x km)	Approx. peak sensitivity altitude (km)
1, 2	10.6	V, H	89 x 198	-
3, 4	18.7	V, H	52 x 16	-
5, 6	23.8	V, H	42 x 94	-
7, 8	31.5	V, H	35 x 76	-
9, 10	36.5	V, H	30 x 67	-
11, 12	42	V, H	26 x 60	-
13, 14	48	V, H	24 x 43	-
15	52.80	V	21 x 48	2
16	53.30	V	21 x 48	4
17	53.80	V	21 x 48	6
18	54.64	V	21 x 48	10
19	55.63	V	21 x 48	14
20	57.290344±0.3222±0.1	H	21 x 48	20
21	57.290344±0.3222±0.05	H	21 x 48	25
22	57.290344±0.3222±0.025	H	21 x 48	29
23	57.290344±0.3222±0.01	H	21 x 48	35
24	57.290344±0.3222±0.005	H	21 x 48	42
25, 26	91.65	V, H	14 x 30	Surface
27	183.31±7.0	V	9 x 21	1.5
28	183.31±3.0	V	9 x 21	2.9
29	183.31±1.4	V	9 x 21	5.3

- 2nd flight of Meteor-M series
- Conical scanning instrument: view angle 53.3°, incidence angle 65°, swath width 1500 km
- 29 Channels (24 operational)
- 11 imager channels
- 10 temperature sounding channels
- 3 water vapour sounding channels

MTVZA-GY data quality assessment

- Study as part of 3-year European GAIA-CLIM project
- Data in HDF format received via Eumetcast
- At ECMWF: MTVZA observations ingested and processed within ECMWF DA system
- At the Met Office: offline study using NWP-SAF radiance simulator and archived model fields
- Compute observed minus NWP background (O-B) departures for common period starting February 2017



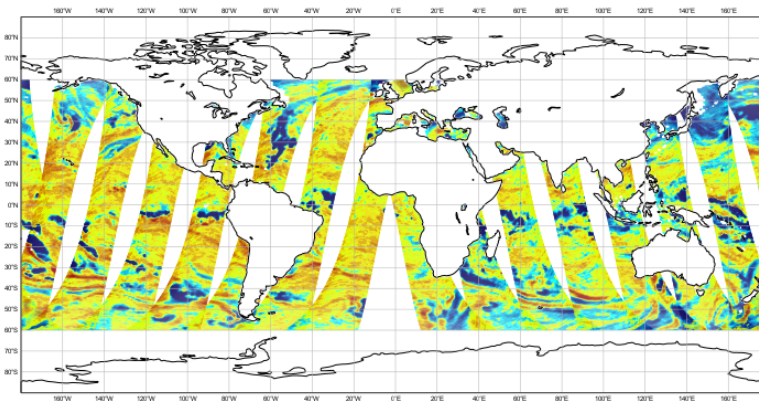
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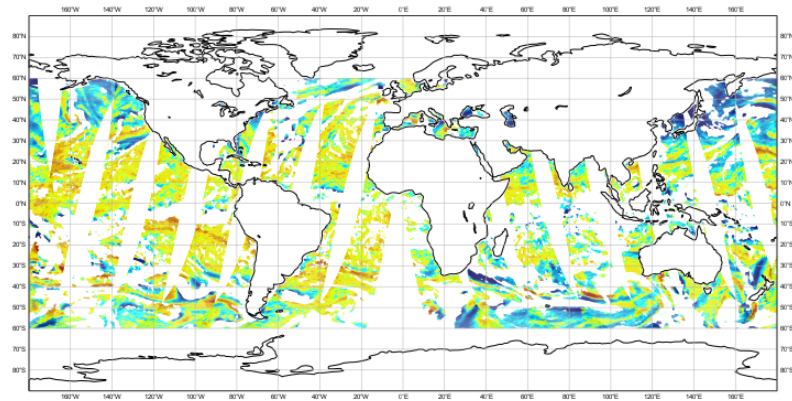
Cloud screening (37 GHz depolarization signal)

183±3 GHz
(MHS-4)

MTVZA chan 27 183.31 +/- 3.0V (MHS 4) O - B - mean (K), me=-4.47, st=5.481

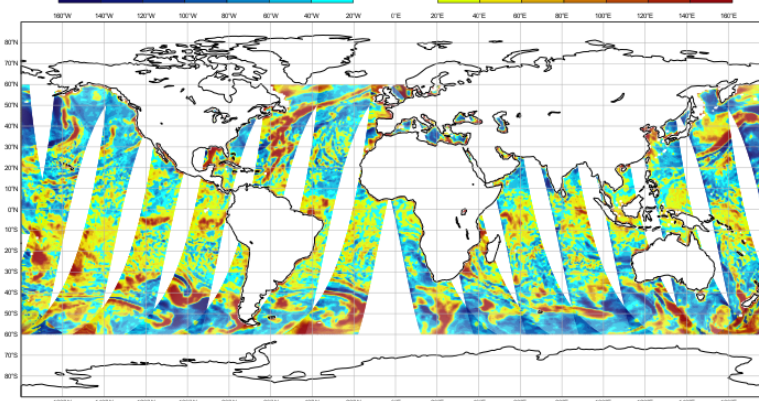


MTVZA chan 27 183.31 +/- 3.0V (MHS 4) O - B - mean (K), me=-4.47, st=5.481



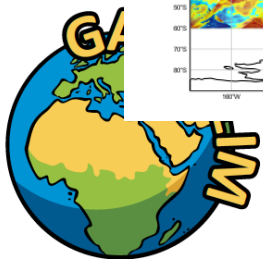
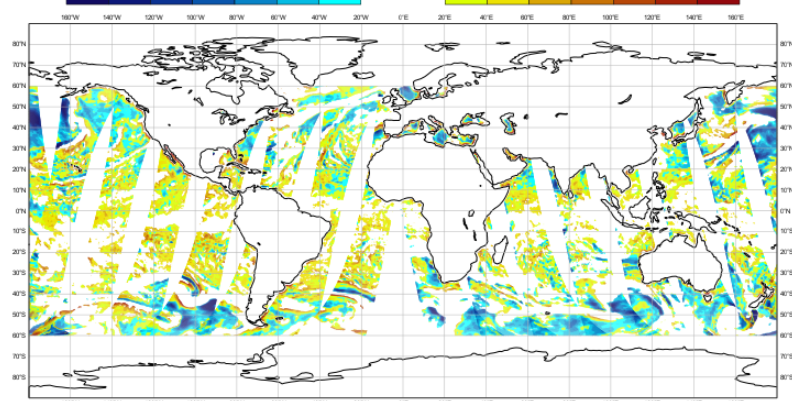
23 GHz
H-pol

MTVZA chan 6 23.8H O - B - mean (K), me=-8.49, st=7.879



MTVZA chan 6 23.8H O - B - mean (K), me=-8.49, st=7.879

MTVZA chan 6 23.8H O - B - mean (K), me=-8.49, st=7.879

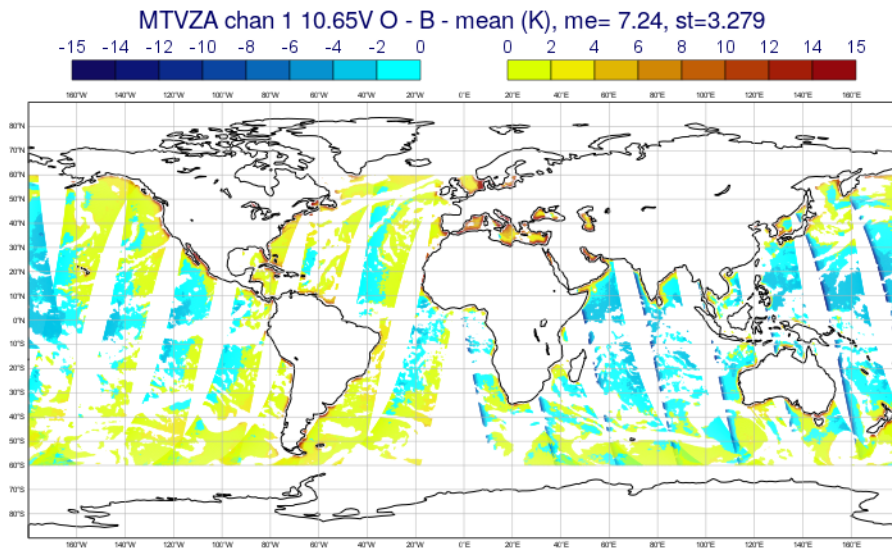


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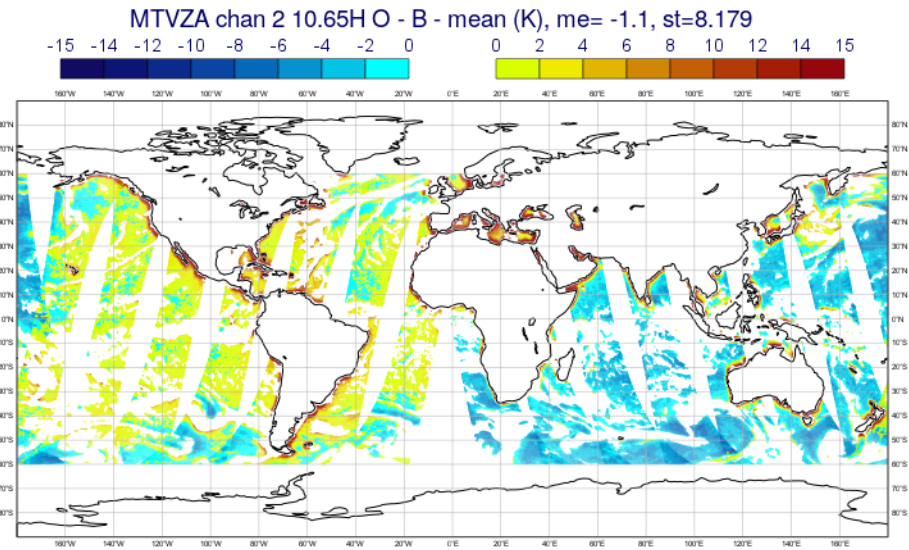
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MTVZA-GY 10 GHz channels

10.65 GHz V-pol



10.65 GHz H-pol



- Ascending/descending biases
- Scan angle bias

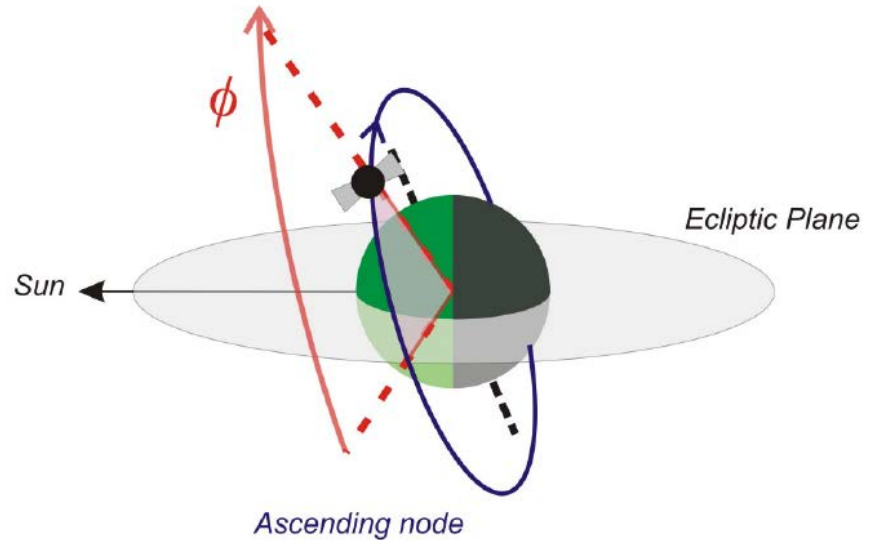


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Biases around spacecraft orbit

- Conical scanners have been known to exhibit biases that vary around the spacecraft orbit
- Anomalies can arise due to reflector emissions and solar intrusions affecting the calibration
- The Met Office employs a Fourier series bias correction scheme for SSMIS (Anna Booton) and is implementing similarly for MWRI (Brett Candy)



Anna Booton, Bill Bell and Nigel Atkinson

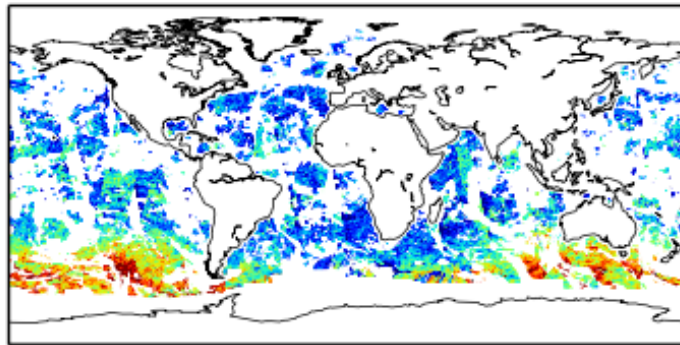


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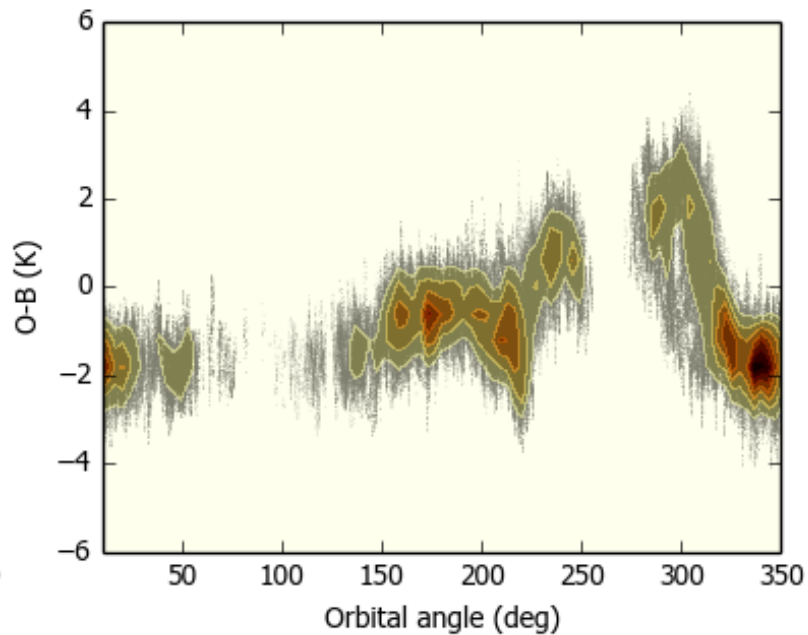
Biases around spacecraft orbit

RTTOV ch 20: m_m2_16_57_0.32_0.1H

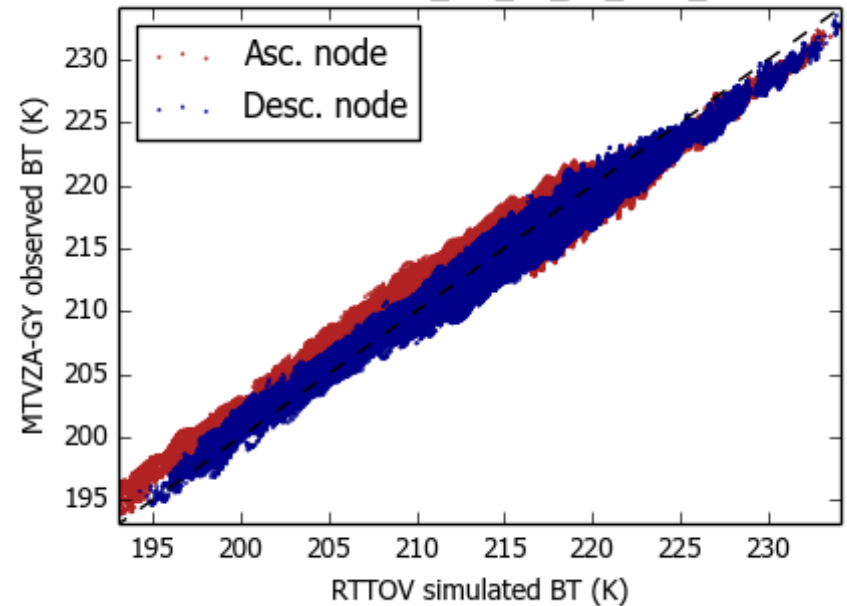


-2.4 -1.8 -1.2 -0.6 0.0 0.6 1.2 1.8 2.4

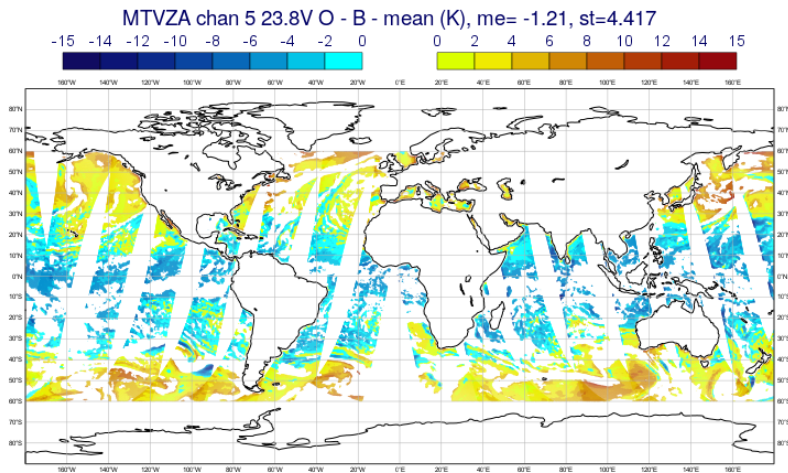
O-B (K)



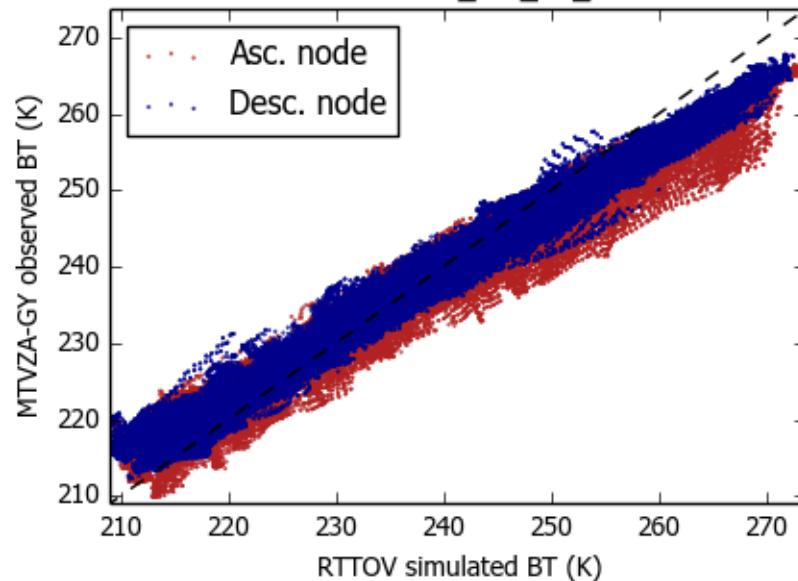
RTTOV ch 20: m_m2_16_57_0.32_0.1H



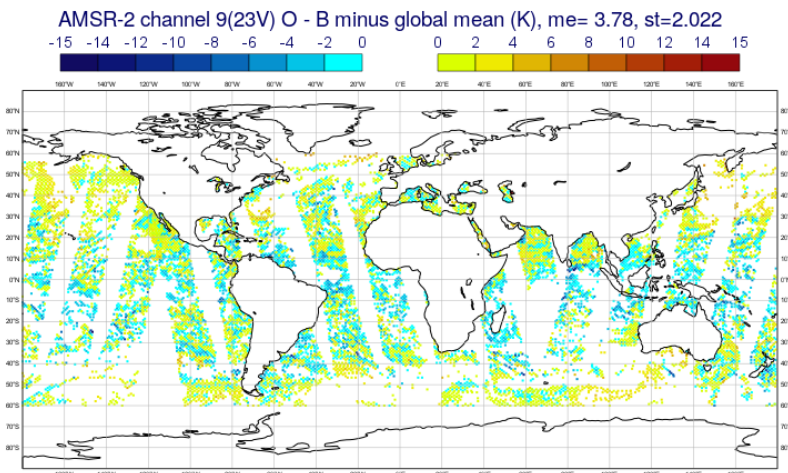
MTVZA-GY 23.8 GHz V-pol



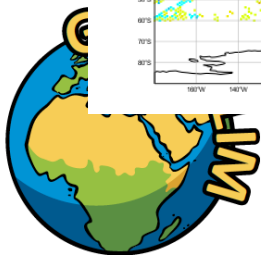
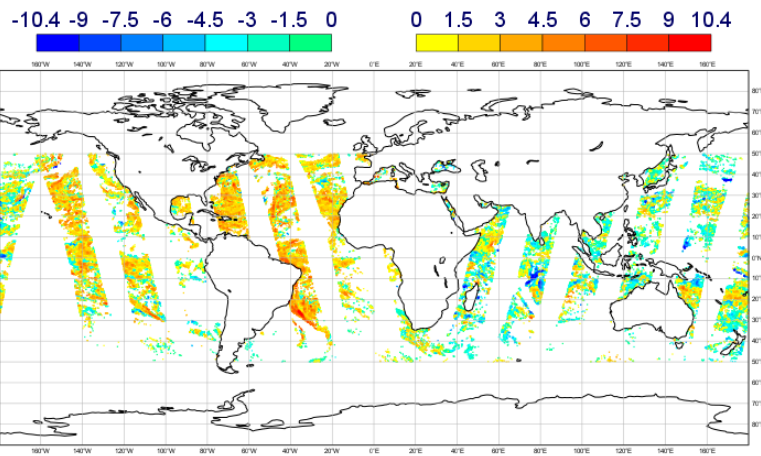
RTTOV ch 5: m_m2_05_23.8V



AMSR2 23.8 GHz V-pol



MWRI 23.8 GHz V-pol

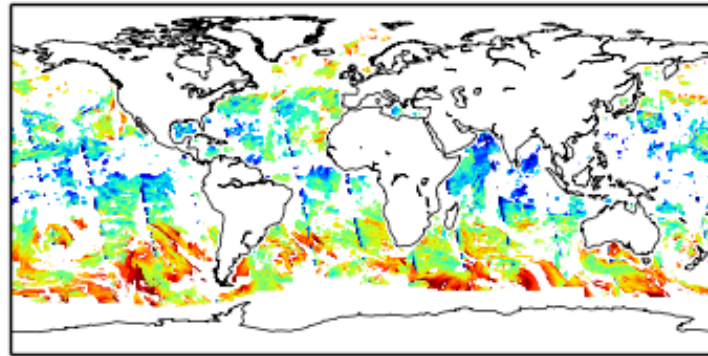


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Scan position biases

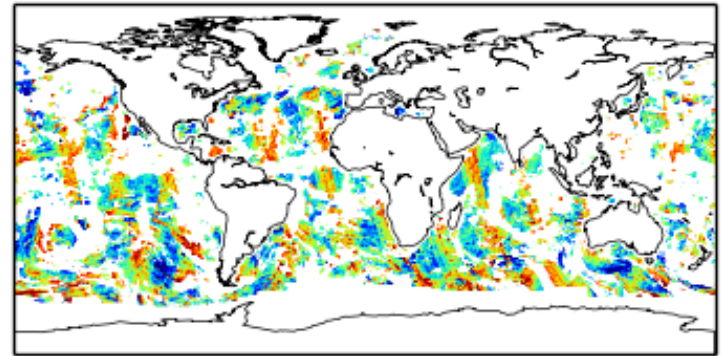
RTTOV ch 3: m_m2_03_18.7V



-1.5 0.0 1.5 3.0 4.5 6.0 7.5

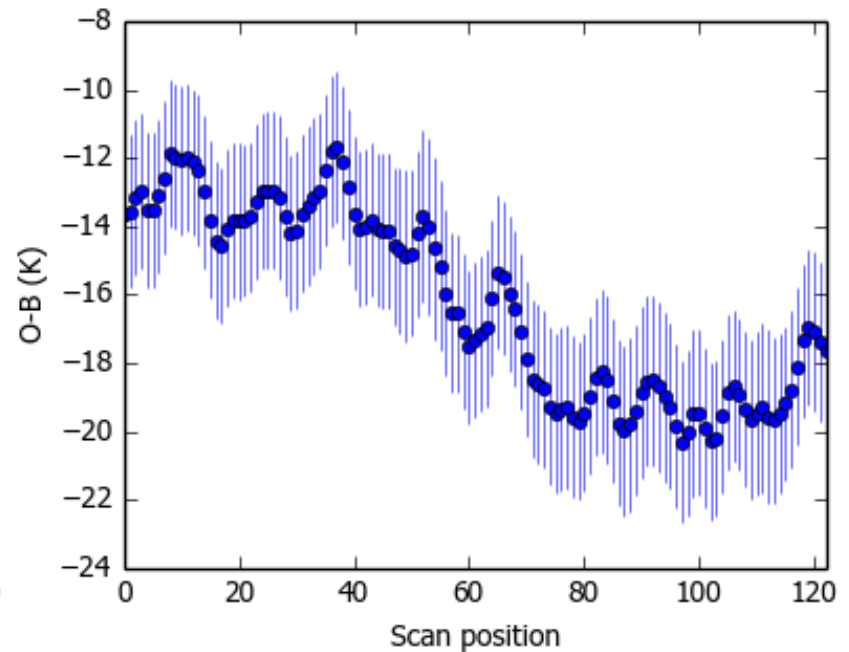
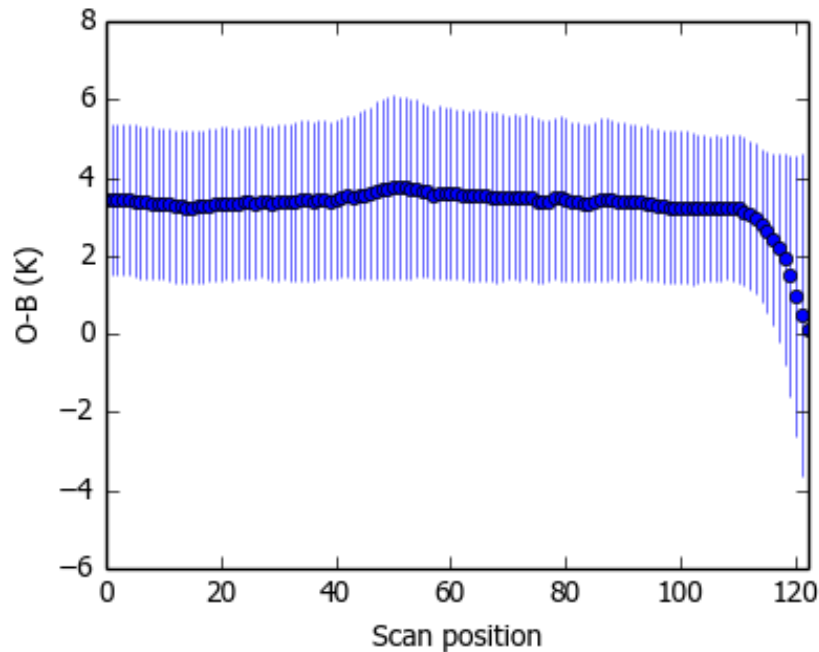
O-B (K)

RTTOV ch 25: m_m2_09_91.65V



-24 -22 -20 -18 -16 -14 -12 -10

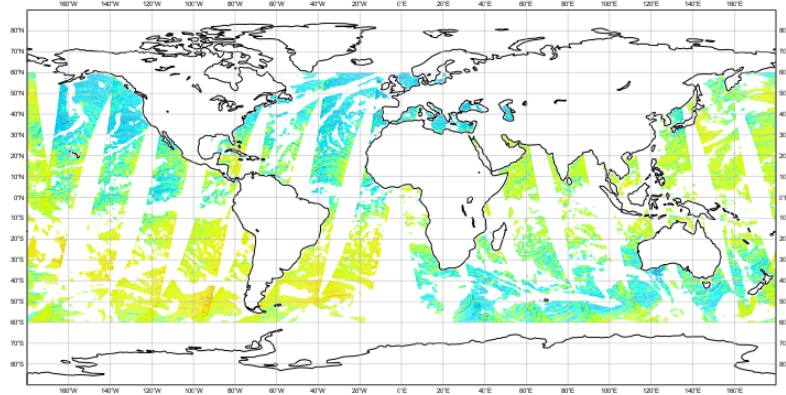
O-B (K)



Temperature sounding channels

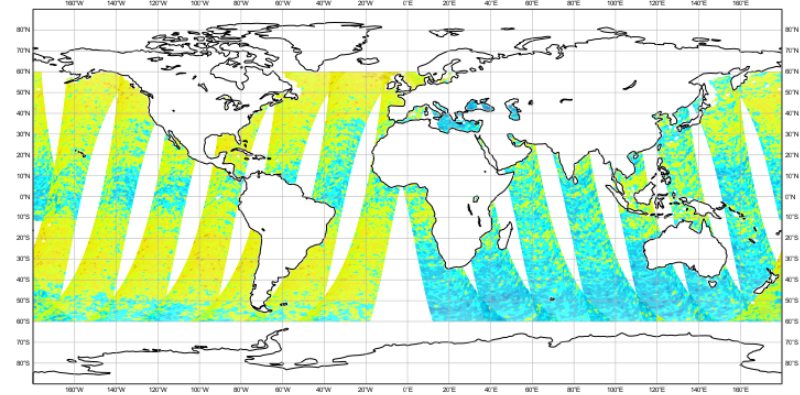
55.63V (AMSU-A 7)

MTVZA chan 19 55.63V (AMSUA 7) O - B - mean (K), me= 0.89, st=0.738



57.29±0.32±0.1H (AMSU-A 9/10)

MTVZA chan 20 57.29 +/-0.32 +/- 0.1 H (AMSUA 9/10) O - B - mean (K), me= 0.46, st=0.82

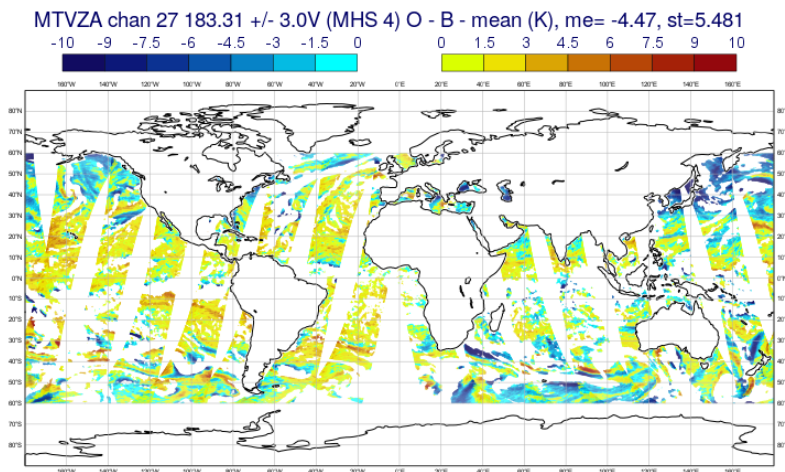


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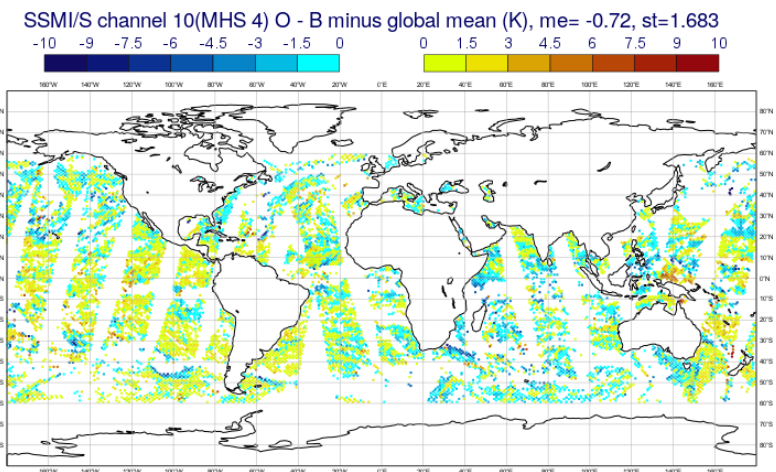
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Humidity sounding channels

183.31±3.0V (MHS 4)



F-17 SSMI/S: 183.31±3.0H

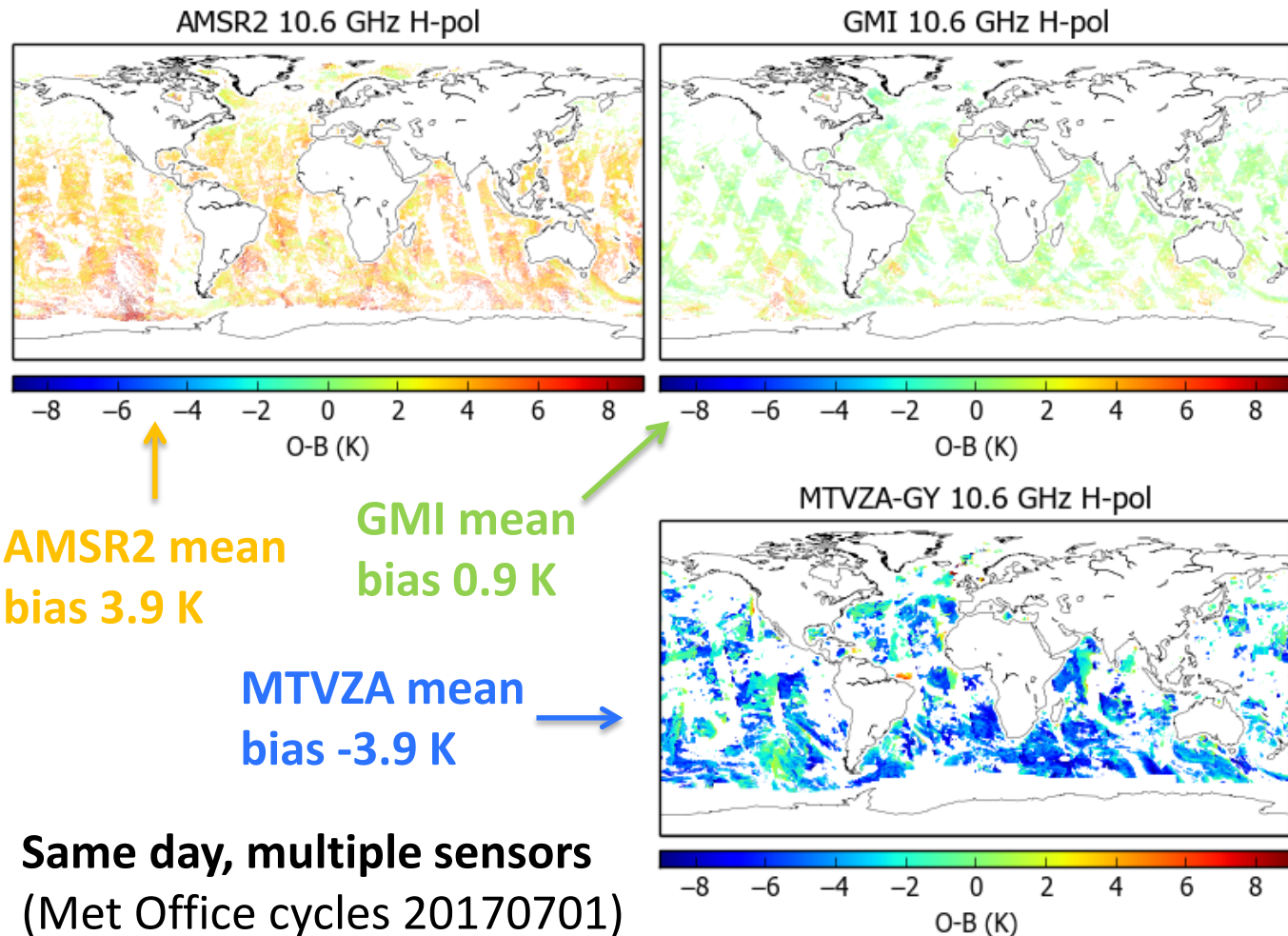


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Gap Analysis for Integrated Atmospheric ECV CLimate Monitoring (GAIA-CLIM)

Demonstrating the value of NWP for EO validation



GAIA-CLIM Workshop @ ITSC-21

- Workshop to explore role of NWP in assessing Earth observations for monitoring essential climate variables
- Short talks and practical demonstration of GRUAN processor
- Hopefully lots of discussion
- Come along at 18.45 on Thursday (room Neon)
- There will be light refreshments for attendees



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Summary

- Meteor-M N2 MTVZA-GY observations have been assessed at the Met Office and ECMWF for GAIA-CLIM
- O-B departures reveal presence of channel biases, including scan dependent and as a function of orbital angle
- DA bias correction schemes (VarBC) can handle limited biases of this type...
- ...but we would like to understand the physical cause of these biases for the benefit of future missions



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