Intercomparison results between AMSR2 and TMI/AMSR-E/GMI
(AMSR2 Version 2.0)

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Japan Aerospace Exploration Agency

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Intercomparison Summary

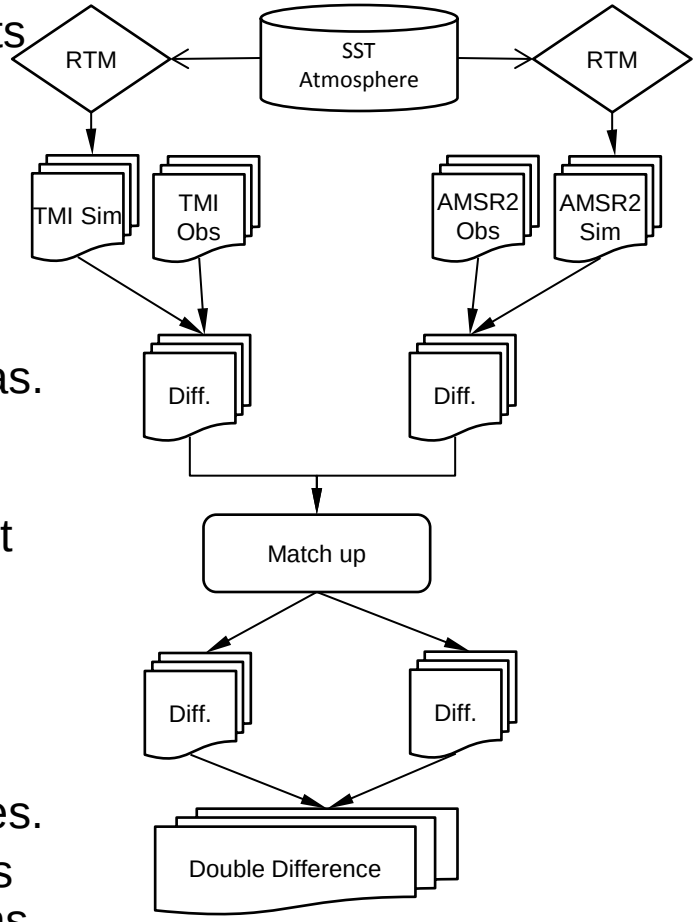
- This material provides intercomparison results for the AMSR2 calibration (Version 2.0) with those of TMI, GMI, and AMSR-E (slow rotation mode).
- Because of the no fundamental changes of calibration procedures between Version 1.1 and Version 2.0, the essential features of calibration differences are almost the same.
- The interconversion coefficients (slope and intercept) were derived and shown for users. Characteristics of the differences sometimes differ for ocean/land and ascending/descending. In this material, the coefficients were determined by linear approximation with all data values. Calibration differences at typical brightness temperatures (Tbs) are also shown based on the results.
- Note that these coefficients are just to cancel out the calibration differences. Tb differences originated from instrument's characteristics (e.g., center frequency and incidence angle) should be handled by users.

Data and Models

- Tb products for intercalibration
  - AMSR2: Level-1B (Version 2.0) and AMSR-E: Level-1B (Version7.0)
    - AMSR2 and AMSR-E Level-1B products are available from GCOM-W1 Data Providing Service at https://gcom-w1.jaxa.jp
  - AMSR-E: Level-1S
    - Research product observed by slow rotation mode (2 rpm).
    - Available at http://sharaku.eorc.jaxa.jp/AMSR/products/amsre_slowdata.html
  - TMI: 1B11 (Version 7)
  - GMI: Level-1B (Version 03B)
- Radiative transfer model (RTM)
  - RTTOV 10.2 distributed by NWP SAF.
  - Used surface emissivity model/atlas built-in RTTOV 10.2: FASTEM 5 for ocean and TELSEM for land surface emissivity.
- Global analysis data
  - Japan Meteorological Agency (JMA)'s global analysis data and merged satellite SST (MGDSST) were used as atmospheric profile and SST, respectively.
  - ECMWF ERA-Interim product was used for consistency check.

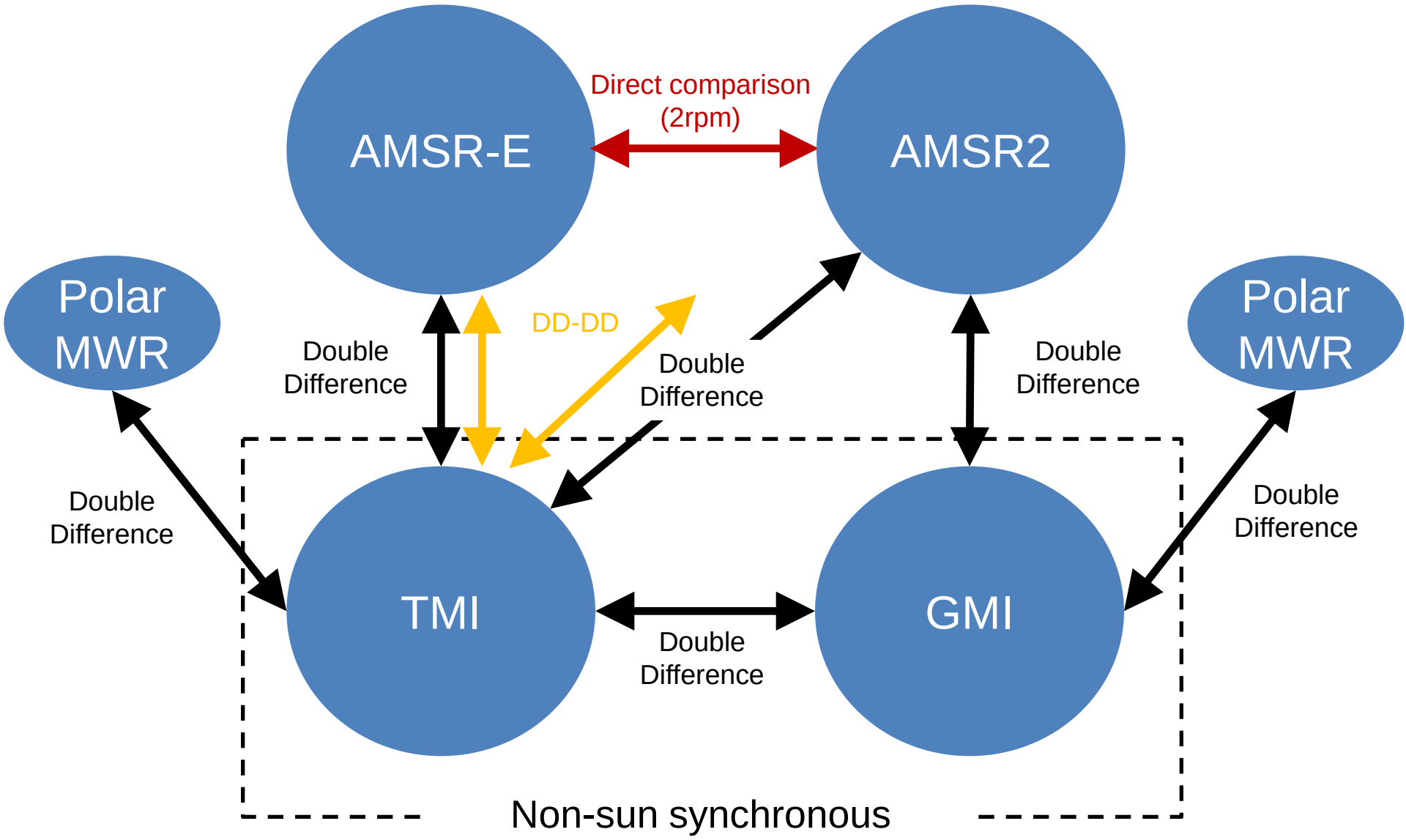
Methodology

- Double difference approach
  - Create collocation dataset from two instruments to be intercompared.
    - Temporal difference: 30 minutes over ocean and 15 minutes over rainforest.
    - Grid size: 0.5 by 0.5 degrees
  - Compute differences between observed- and calculated-Tb (O-C) for both two instruments, over rainforest and cloud-free/calm ocean areas. Global analysis data and RTM are used to derive calculated-Tbs.
  - Further create “double difference” to cancel out the differences in frequency and incidence angle: e.g., Sensor-1 (O-C) – Sensor-2 (O-C).
- Direct comparison with AMSR-E L1S
  - Create grid data (0.5 degree grid) for AMSR-E L1B and L1S products and calculate differences.
  - This enables simple and accurate comparisons in the wide range of Tbs without any corrections.



Analysis flow of Double Difference approach for the case of AMSR2 and TMI.

Methodology



Intercomparison Results
AMSR2 vs AMSR-E (2rpm)

Cal Difference (AMSR2-AMSR-E) [K]

+10K

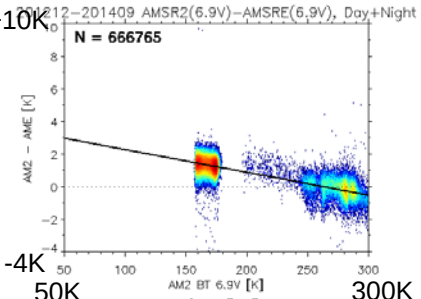
-4K

50K

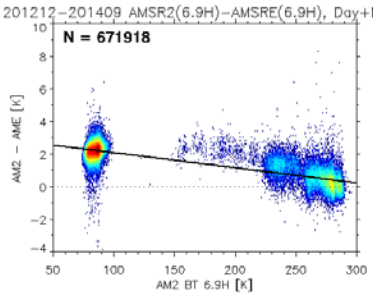
300K

Tbs [K]

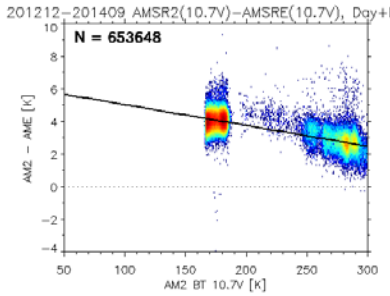
06V



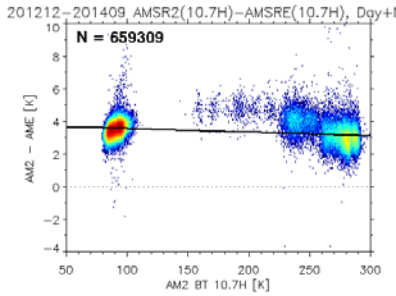
06H



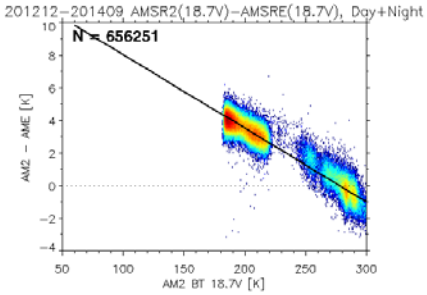
10V



10H



18V



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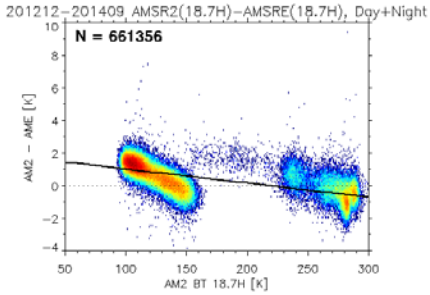
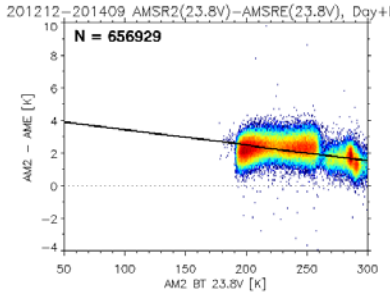
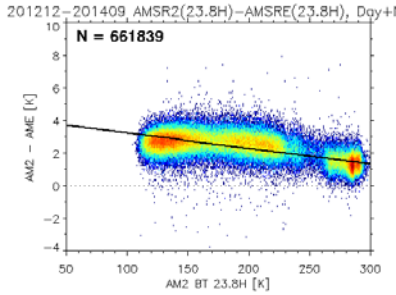


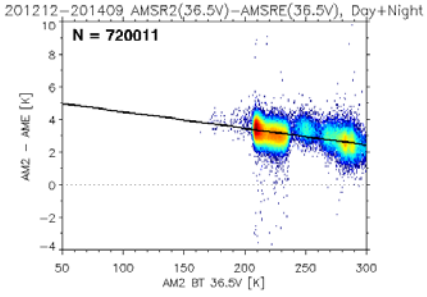
23V



23H



36V



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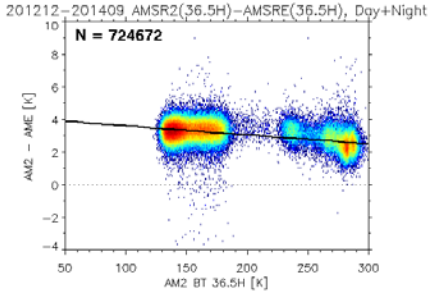
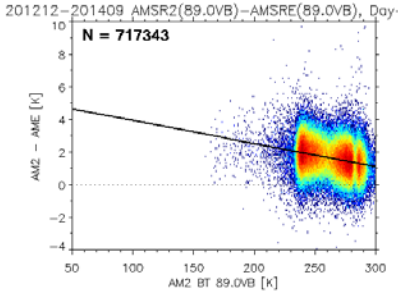


89VB



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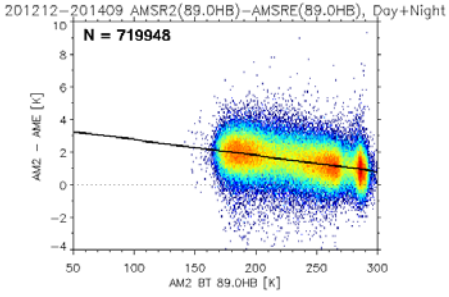
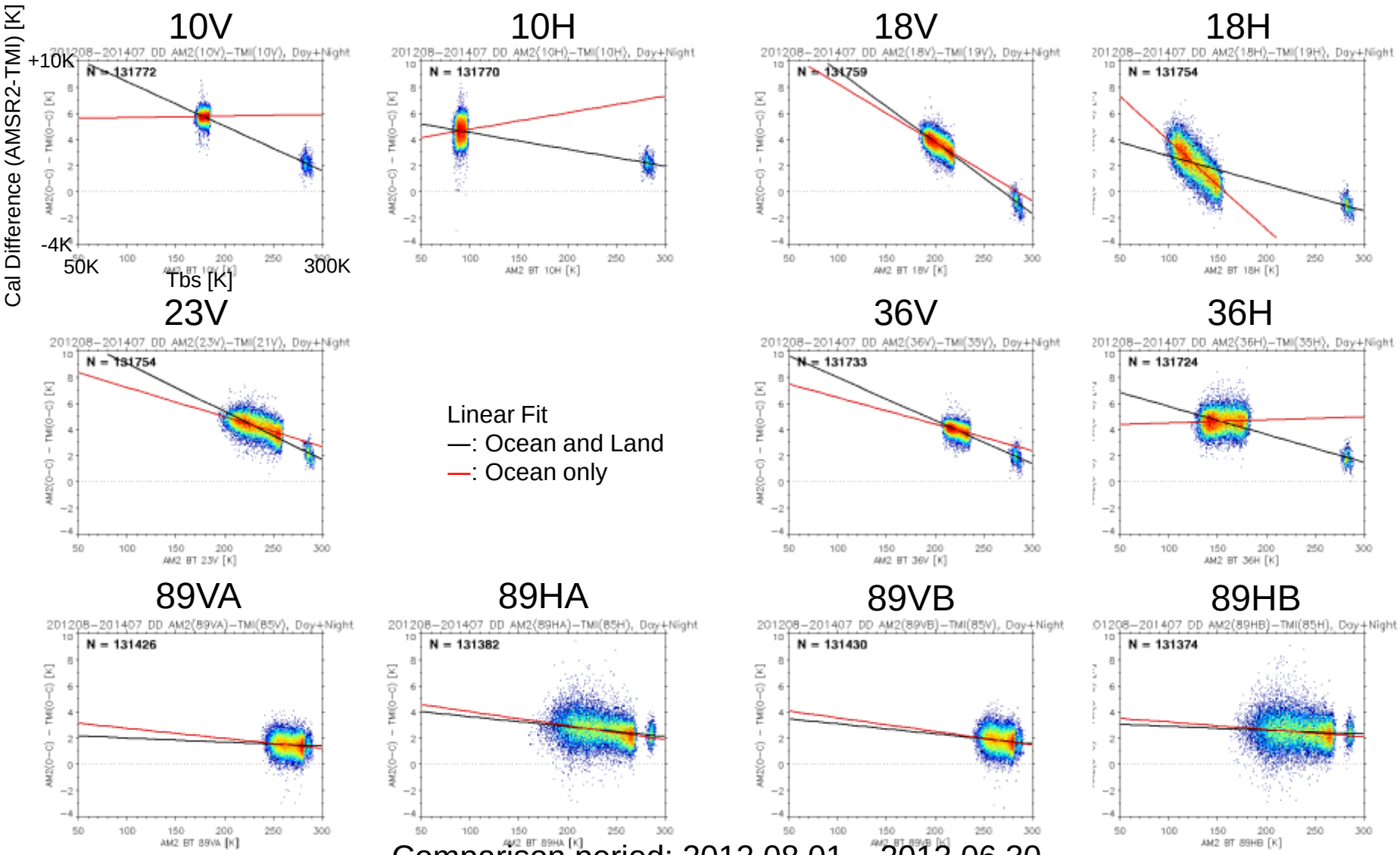


Comparison period: 2012.12.05 – 2014.09.30

Intercomparison Results
AMSR2 vs TMI



Comparison period: 2012.08.01 – 2013.06.30

Intercomparison Results
AMSR2 vs GMI

Cal Difference (AMSR2-GMI) [K]

+6K

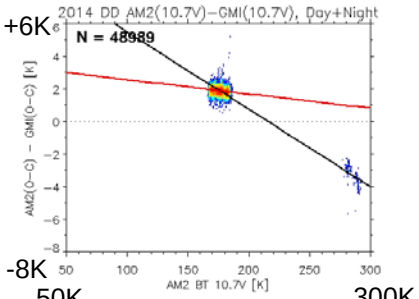
-8K

50K

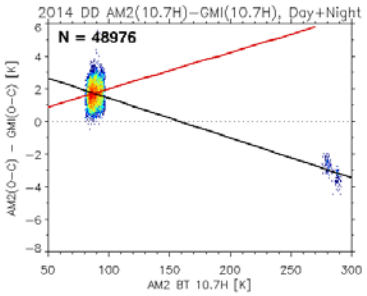
300K

Tbs [K]

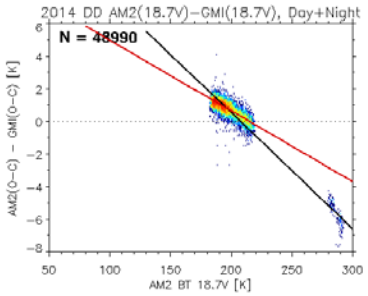
10V



10H



18V



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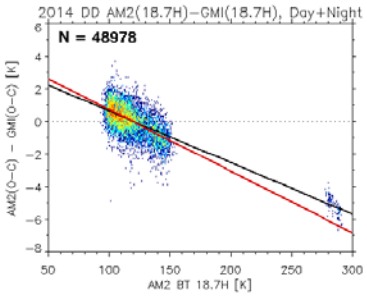
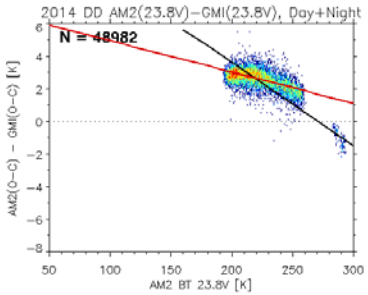


23V

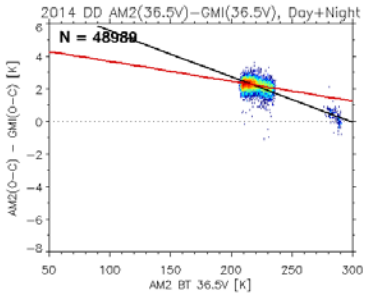


Linear Fit

—: Ocean and Land

—: Ocean only

36V



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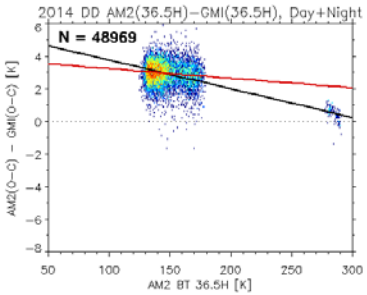

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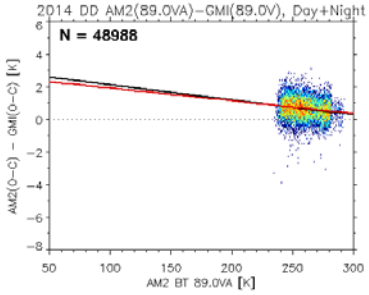

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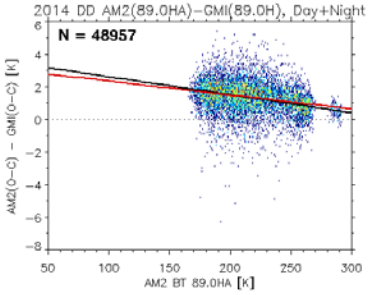

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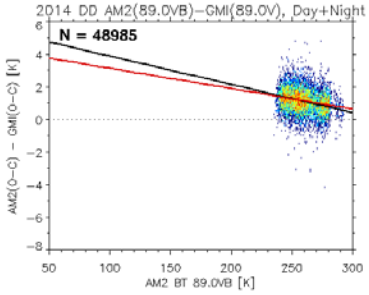

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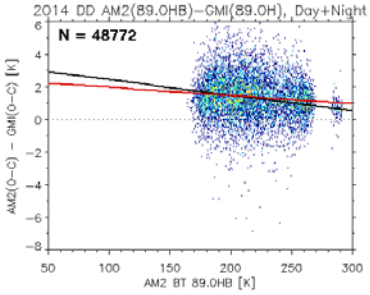


Comparison period: 2014.03.04 – 2014.11.30

Intercomparison Results AMSR-E (40rpm) vs TMI

Cal Difference (AMSR2-TMI) [K]

+10K

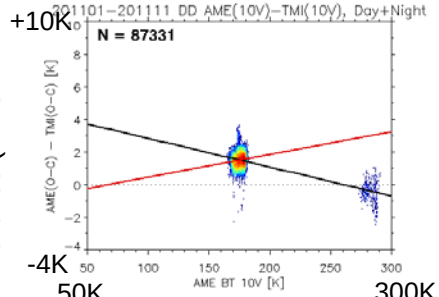
-4K

50K

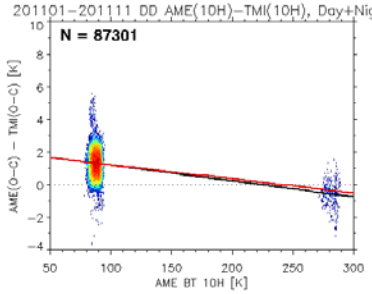
300K

Tbs [K]

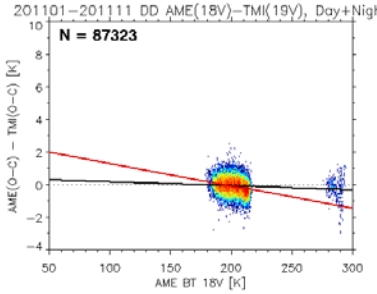
10V



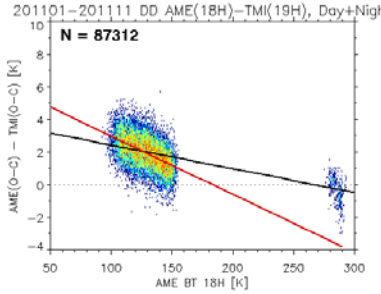
10H



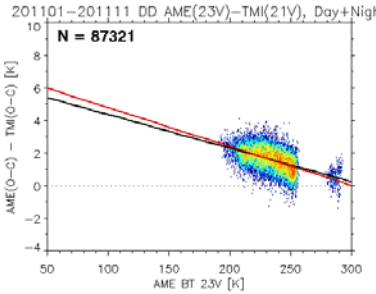
18V



18H



23V

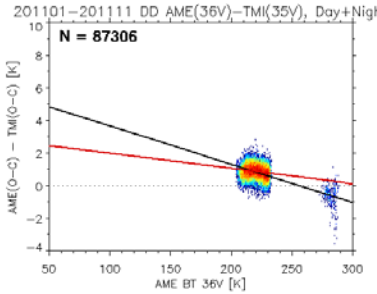


Linear Fit

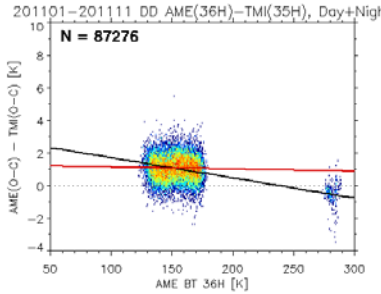
—: Ocean and Land

—: Ocean only

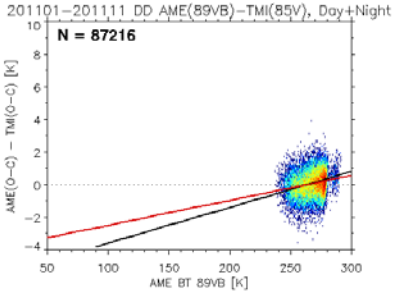
36V



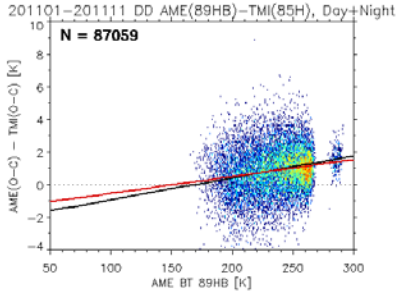
36H



89VB



89HB



Comparison period: 2011.01.26 – 2011.10.04

Interconversion Coefficients AMSR2 vs AMSR-E (2rpm)

Channel	Interconversion Coefficients		Ocean		Land	
	Slope	Intercept	Typical Tb [K]	Calibration Difference [K]	Typical Tb [K]	Calibration Difference [K]
06V	-0.01390	3.67421	170.2	1.3	279.4	-0.2
06H	-0.00940	3.03663	88.3	2.2	269.6	0.5
10V	-0.01289	6.34775	177.5	4.1	281.1	2.7
10H	-0.00221	3.79624	94.7	3.6	272.4	3.2
18V	-0.04524	12.57562	198.9	3.6	281.7	-0.2
18H	-0.00858	1.89574	123.9	0.8	274.0	-0.5
23V	-0.00957	4.40435	222.5	2.3	283.1	1.7
23H	-0.00947	4.18710	167.8	2.6	277.2	1.6
36V	-0.01019	5.49799	218.6	3.3	280.5	2.6
36H	-0.00561	4.19181	153.9	3.3	274.6	2.7
89VB	-0.01403	5.32379	256.7	1.7	281.4	1.4
89HB	-0.00980	3.75174	218.2	1.6	277.9	1.0

$$\Delta Cal_{AMSR2-AMSR-E}[K] = Tb_{AMSR2}[K] * slope + intercept$$

$$\Delta Cal_{\mathrm{AMSR-E}-AMSR2}[K] = -(Tb_{AMSR2}[K] * slope + intercept)$$

Interconversion Coefficients AMSR2 vs TMI

Channel	Interconversion Coefficients		Ocean		Land	
	Slope	Intercept	Typical Tb [K]	Calibration Difference [K]	Typical Tb [K]	Calibration Difference [K]
10V	-0.03403	11.83131	178.7	5.8	284.1	2.2
10H	-0.01287	5.82429	90.1	4.7	282.7	2.2
18V	-0.05466	14.73634	203.2	3.6	284.5	-0.8
18H	-0.02093	4.83390	126.1	2.2	283.3	-1.1
23V	-0.03673	12.72337	232.9	4.2	286.7	2.2
36V	-0.03299	11.28616	221.9	4.0	283.3	1.9
36H	-0.02141	7.90630	154.5	4.6	282.8	1.9
89VA	-0.00317	2.32472	267.1	1.5	285.9	1.4
89HA	-0.00759	4.40487	233.8	2.6	285.8	2.2
89VB	-0.00761	3.85692	266.8	1.8	286.2	1.7
89HB	-0.00298	3.19680	233.3	2.5	285.9	2.4

$$\Delta Cal_{AMSR2-TMI}[K] = Tb_{AMSR2}[K] * slope + intercept$$
$$\Delta Cal_{TMI-AMSR2}[K] = -(Tb_{AMSR2}[K] * slope + intercept)$$

Interconversion Coefficients AMSR2 vs GMI

Channel	Interconversion Coefficients		Ocean		Land	
	Slope	Intercept	Typical Tb [K]	Calibration Difference [K]	Typical Tb [K]	Calibration Difference [K]
10V	-0.04754	10.25830	175.6	1.9	286.0	-3.3
10H	-0.02443	3.87692	87.6	1.7	284.5	-3.1
18V	-0.07129	14.80677	196.9	0.8	286.4	-5.6
18H	-0.03166	3.81397	116.7	0.1	285.1	-5.2
23V	-0.05107	13.82238	222.0	2.5	288.4	-0.9
36V	-0.02810	8.36832	217.5	2.3	285.2	0.4
36H	-0.01759	5.53122	145.8	3.0	284.6	0.5
89VA	-0.00922	3.07087	259.3	0.7	287.5	0.4
89HA	-0.01101	3.72802	216.3	1.4	287.2	0.6
89VB	-0.01734	5.62692	259.1	1.1	287.7	0.6
89HB	-0.00949	3.39669	216.1	1.4	287.4	0.7

$$\Delta Cal_{AMSR2-GMI}[K] = Tb_{AMSR2}[K] * slope + intercept$$
$$\Delta Cal_{GMI-AMSR2}[K] = -(Tb_{AMSR2}[K] * slope + intercept)$$

Interconversion Coefficients AMSR-E (40rpm) vs TMI

Channel	Interconversion Coefficients		Ocean		Land	
	Slope	Intercept	Typical Tb [K]	Calibration Difference [K]	Typical Tb [K]	Calibration Difference [K]
10V	-0.01767	4.61166	175.2	1.5	282.8	-0.4
10H	-0.00972	2.17930	87.0	1.3	281.2	-0.6
18V	-0.00238	0.40797	200.9	-0.1	286.3	-0.3
18H	-0.01454	3.88875	127.5	2.0	285.2	-0.3
23V	-0.02063	6.43209	232.8	1.6	286.0	0.5
36V	-0.02337	5.99709	220.0	0.9	281.9	-0.6
36H	-0.01236	2.95514	152.5	1.1	281.4	-0.5
89VB	0.02200	-5.78705	266.9	0.1	285.9	0.5
89HB	0.01348	-2.26939	235.5	0.9	285.9	1.6

$$\Delta Cal_{AMSR-E-TMI}[K] = Tb_{AMSR-E}[K] * slope + intercept$$
$$\Delta Cal_{TMI-AMSR-E}[K] = -(Tb_{AMSR-E}[K] * slope + intercept)$$