On-Board Calibration Efforts for MWR of SAC-D/Aquarius mission

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Summary

- X-calibration between MWR (**V5**) and Windsat over selected targets.
  - Intercalibration coefficients (slope & intercept) were derived by linear regression to compensate the calibration differences.
- MWR Data (**Version 6 Beta 2**) & AMSR-2
- Vicarious cold for drift monitoring

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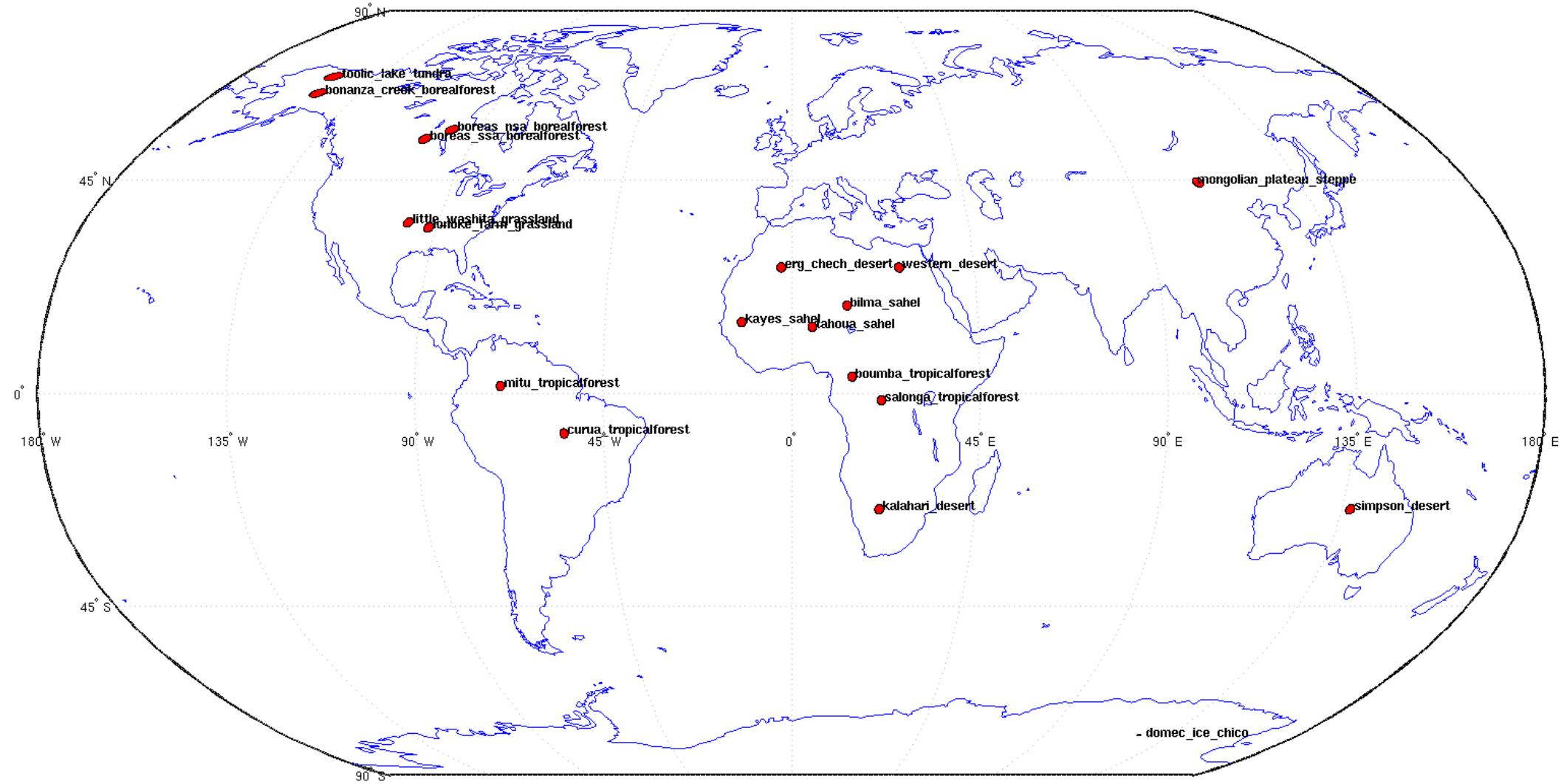
MWR & Windsat characteristics

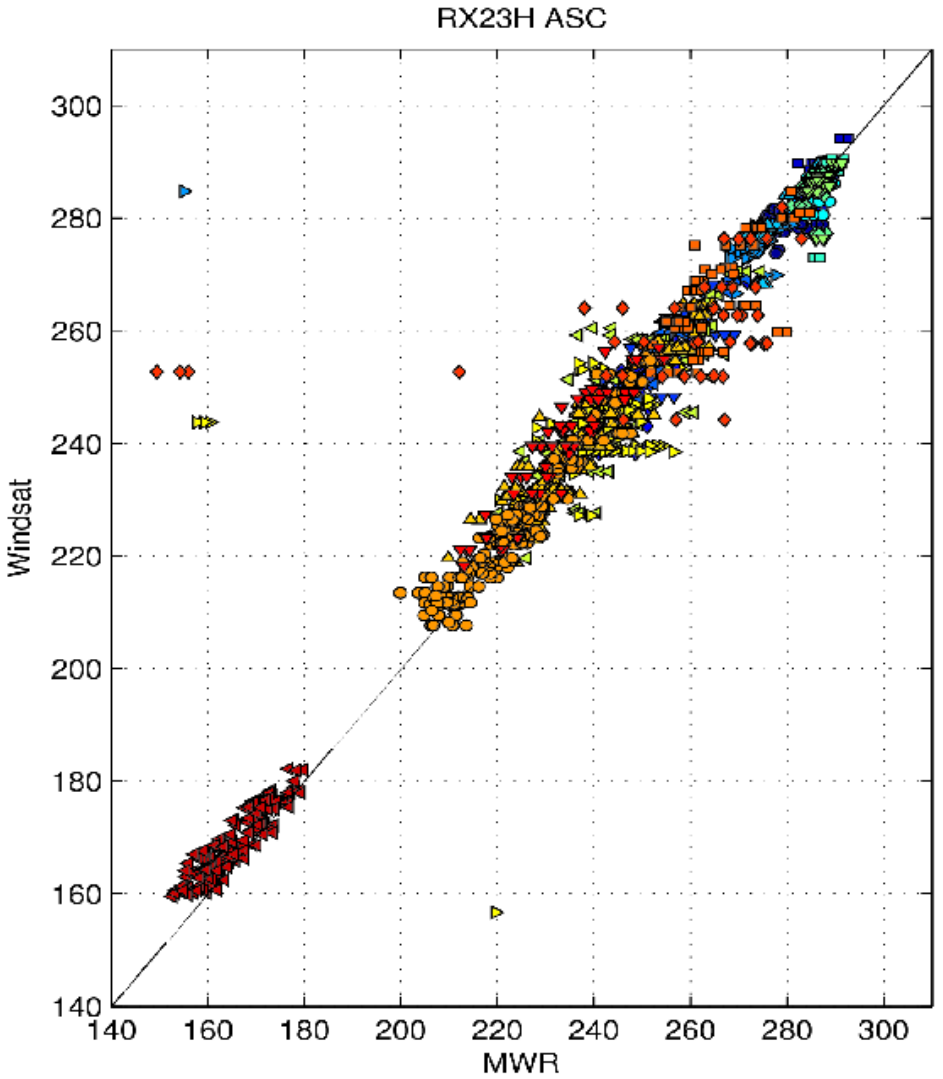
	Windsat	MWR
Frequency	6.8, 23.8 GHz (VH) 10.7, 18.7, y 37.0 GHz (Full Polarimetric)	23.8 GHz (H) 36.5 GHz (VH3)
Incidence angle	53°	52° & 58°
Orbit	Sun-synchronous Height: 840 km Ascending time: 6 pm Inclination angle: 98.7° Eccentricity: 0.00134	Sun-synchronous Height: 657 km Ascending time: 6 pm Inclination angle: 98.01° Eccentricity: 0.0012

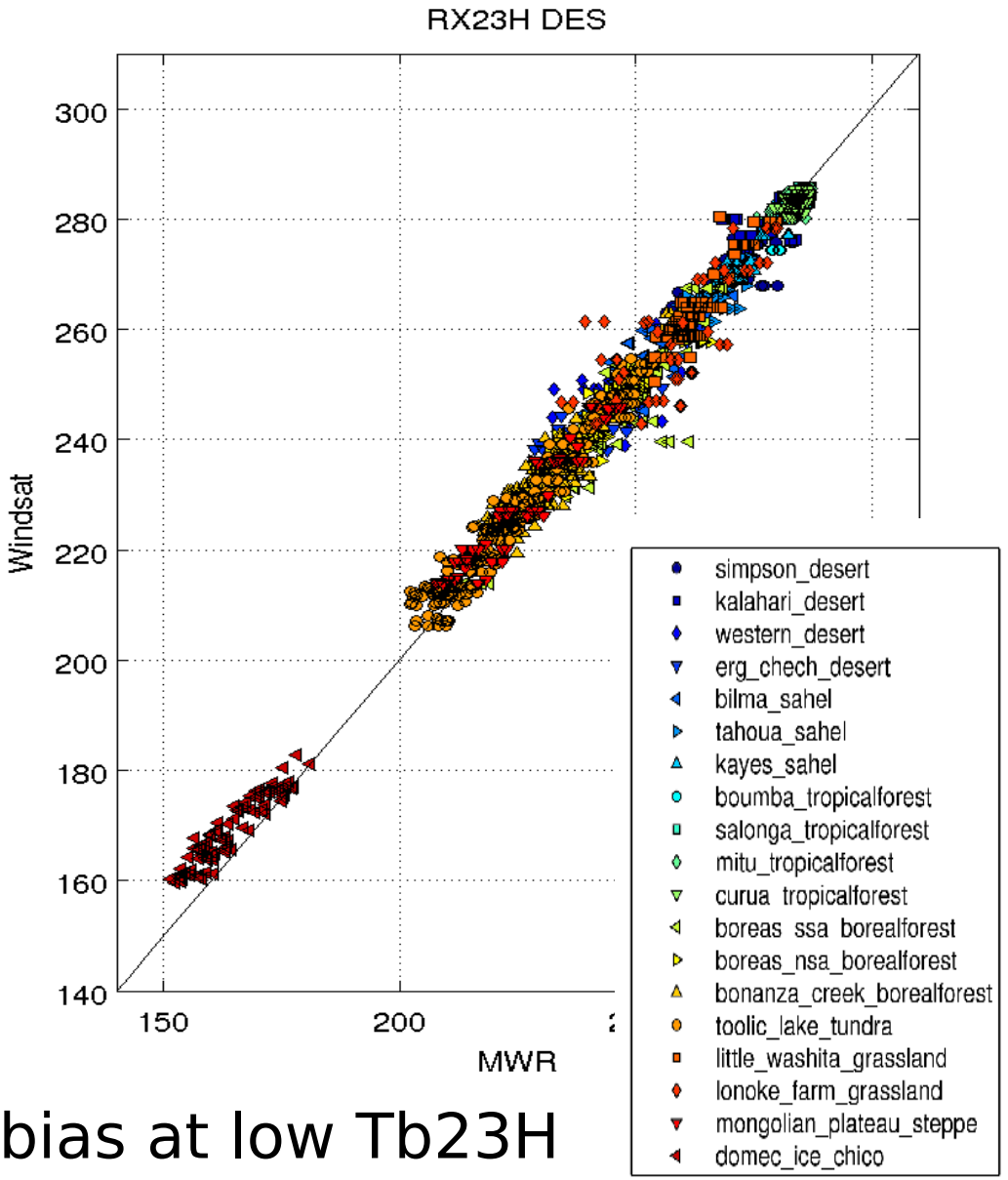


Selected targets for X-calibration MWR vs Windsat

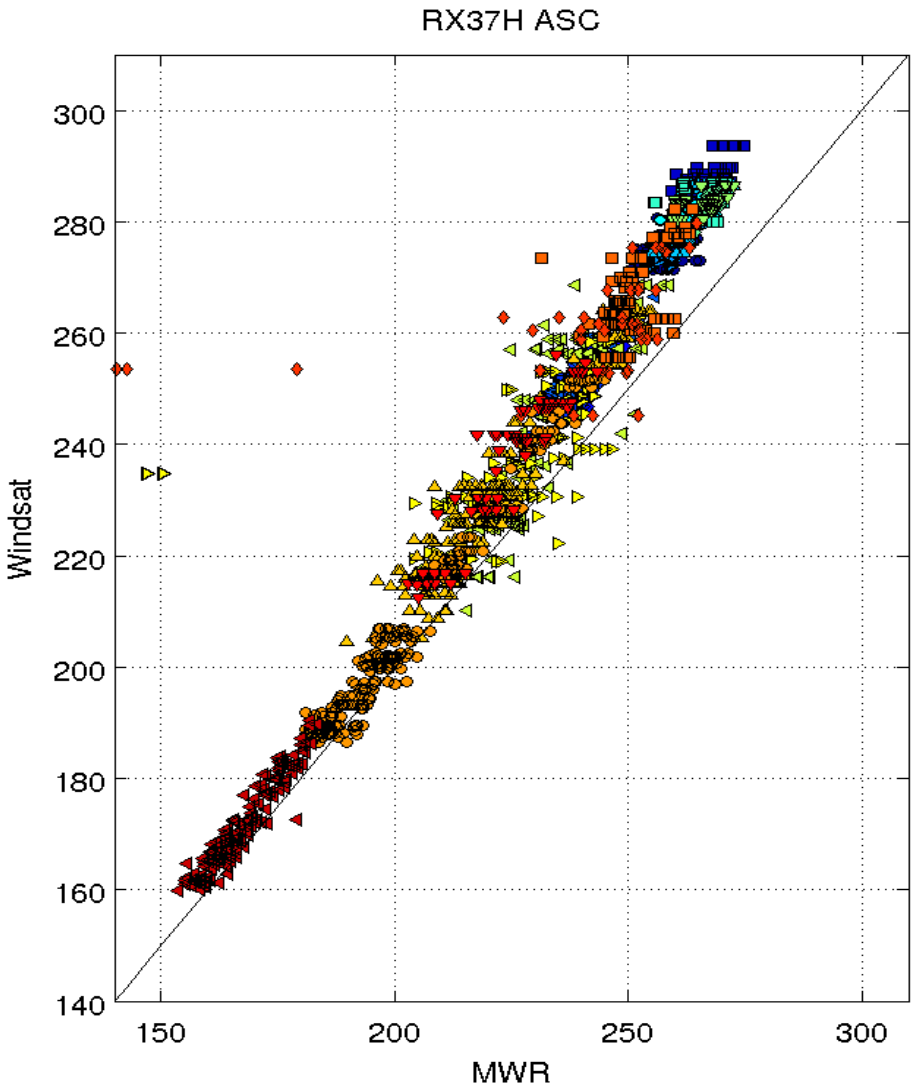
- Homogeneous and stable targets were selected: forest, deserts, Dome C, grassland, tundra, sahel [1].
- Daily temporal window, over 30.000 km^2 areas
- Mean and Std Tb were computed for each channel and asc/desc passes, and compared to Windsat. No angle correction was applied.

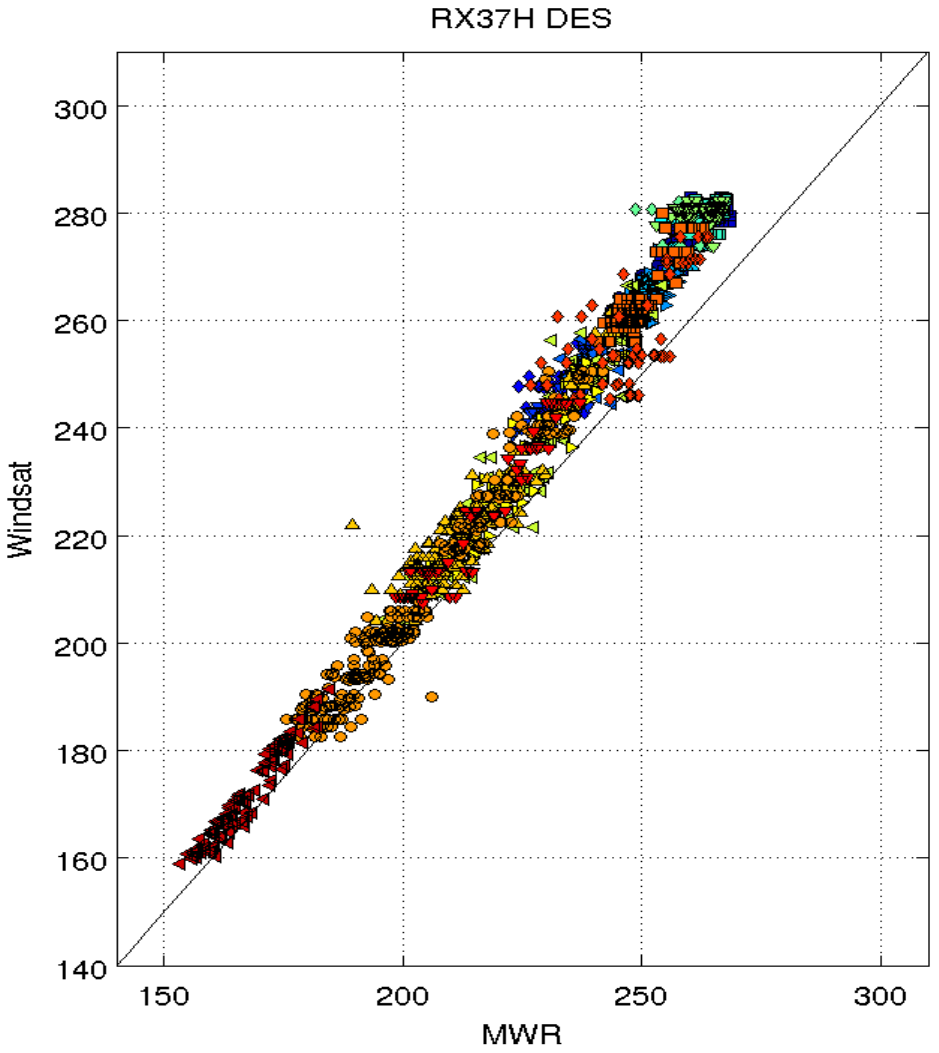
[1] Njoku, E. G., Chan, T., Crosson, W., and Limaye, A.: ”Evaluation of the AMSR-E Data Calibration Over Land”, Ital. J. Remote Sens., 30/31, 19–37, 2004.



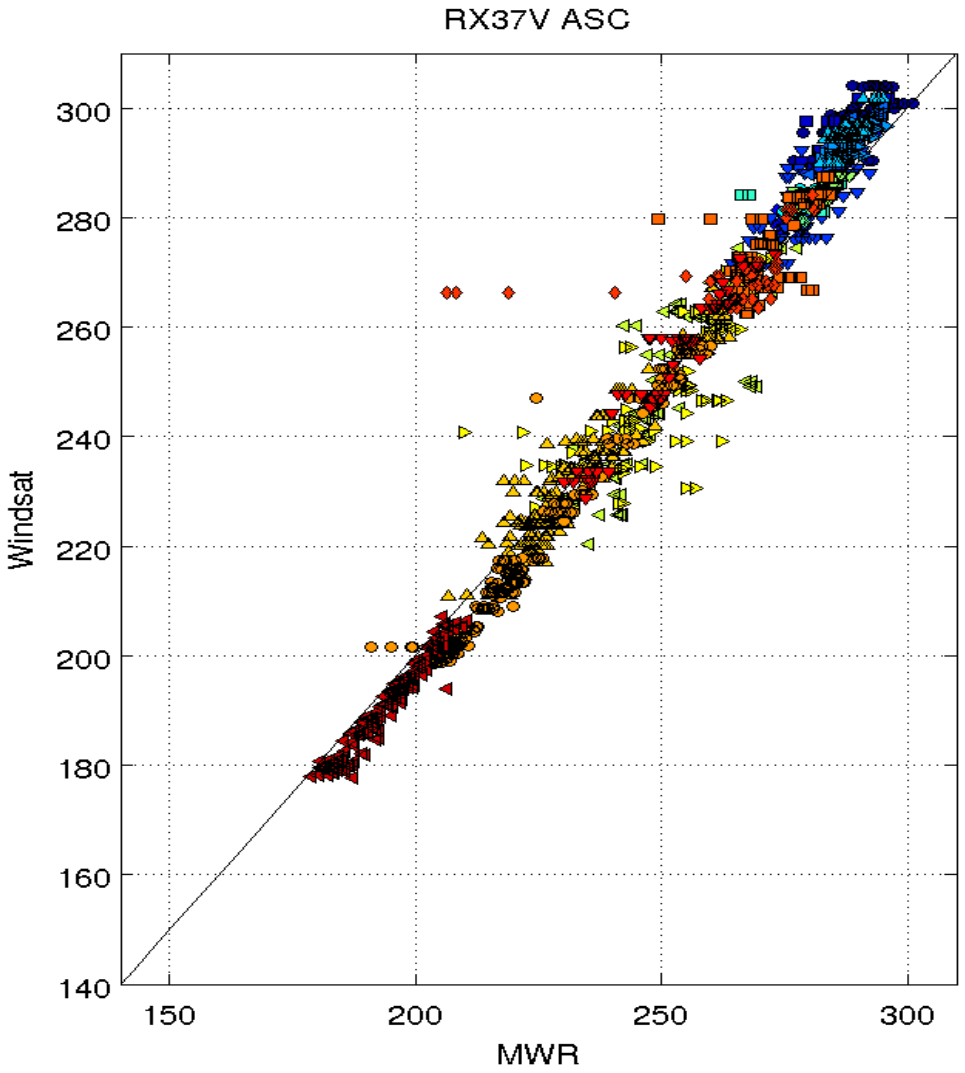


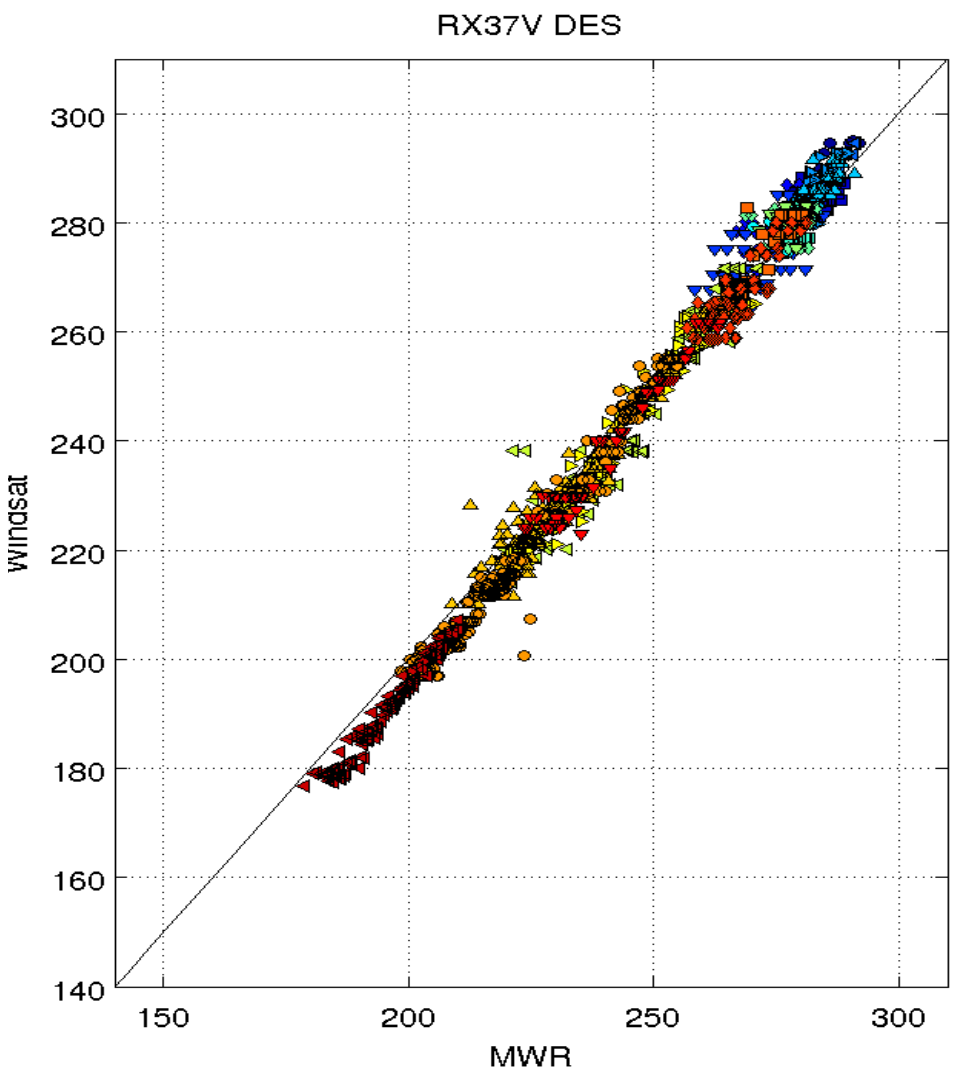
Existence of a slight negative bias at low Tb23H values.





Existence of significant negative bias through all Tb37H dynamic range.





Existence of a slight bias in Tb37V, positive at lower values and negative at high ones.

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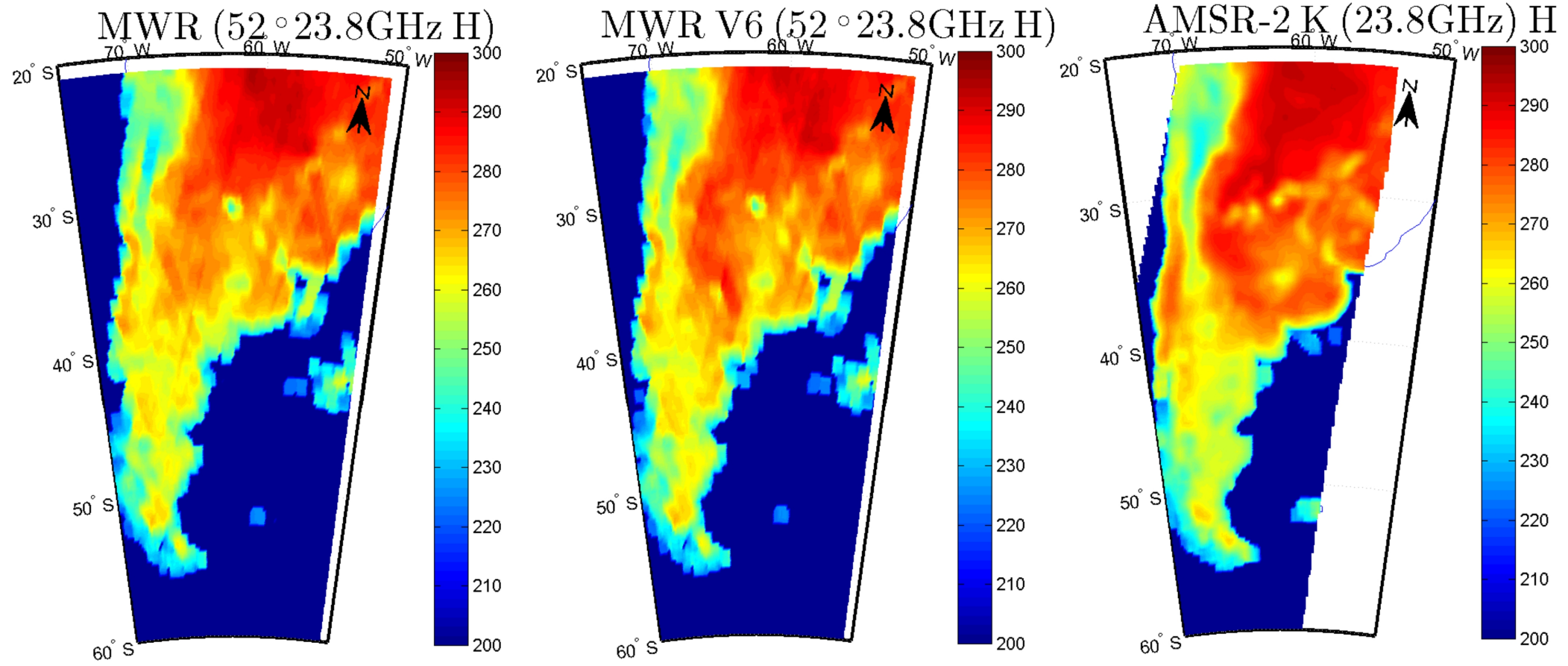
Composite

- *0.25°x0.25° grid*
- distance-weighted averaged
- 1° bandwidth

- *MWR*
  - *Weekly* composite of MWR data for V5 & V6beta2
    -Dates: 1/3/13 to 7/3/13
- *AMSR-2*
  - *Daily* composite of AMSR-2 data
    -Date: 3/3/13

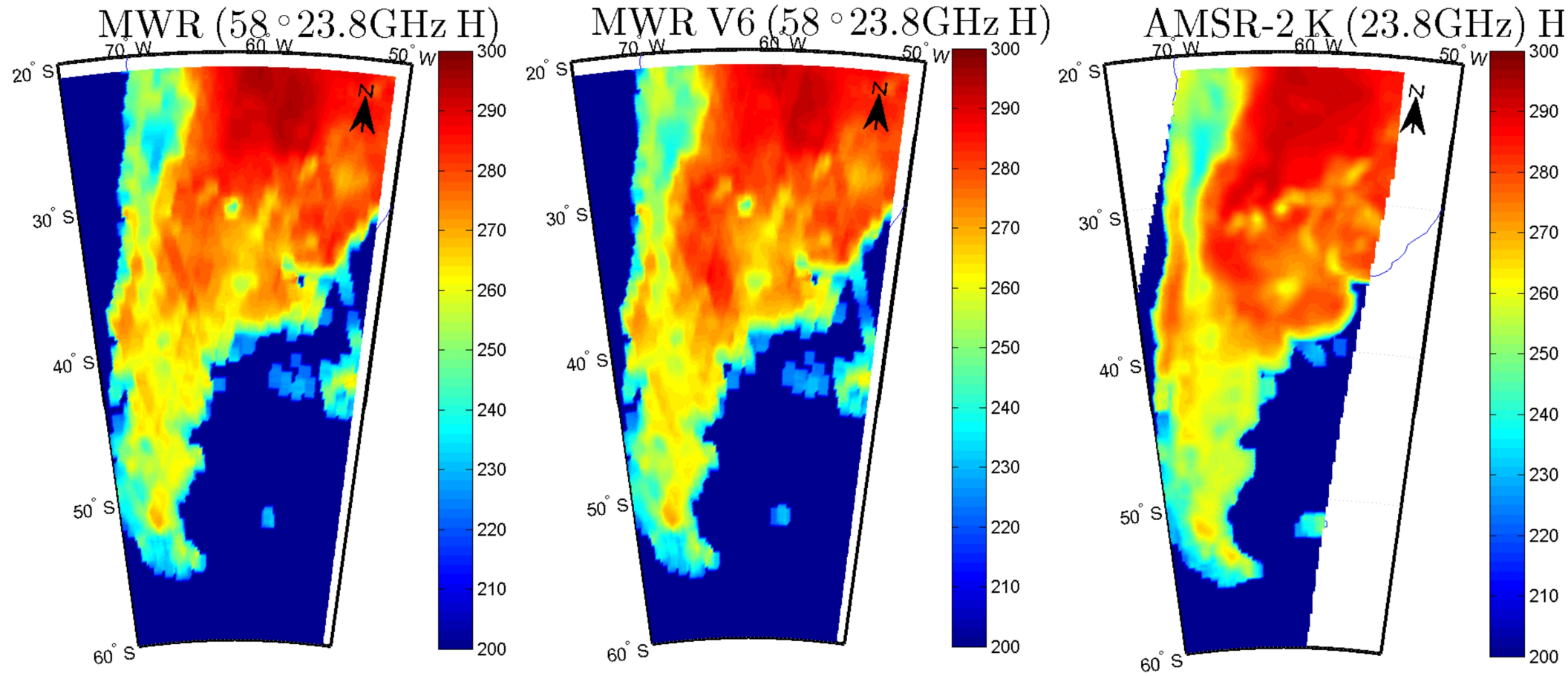
	AMSR-2	MWR
Frequency	6.9, 10.65, 18.7, 23.8, 36.5, 89 GHz (VH)	23.8 GHz (H) 36.5 GHz (VH3)
Incidence angle	55°	52° & 58°
Orbit	Ascending time: 13:30 pm	Ascending time: 6 pm

AMSR-2 & MWR characteristics



MWR V5: Existence of a slight negative bias at low (<200K) Tb23H values.

MWRV6 should be slightly warmer at low temperatures.



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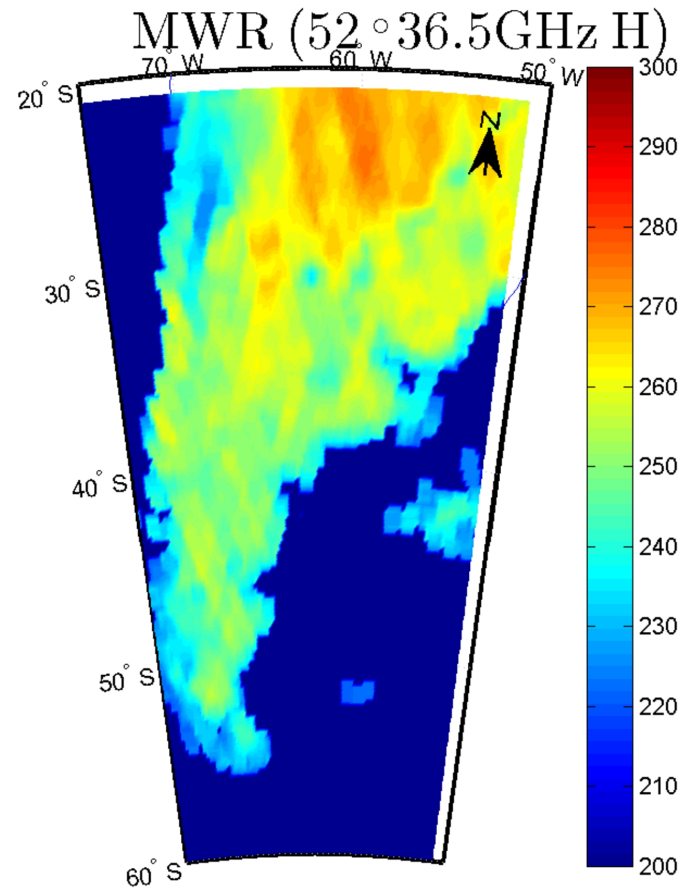
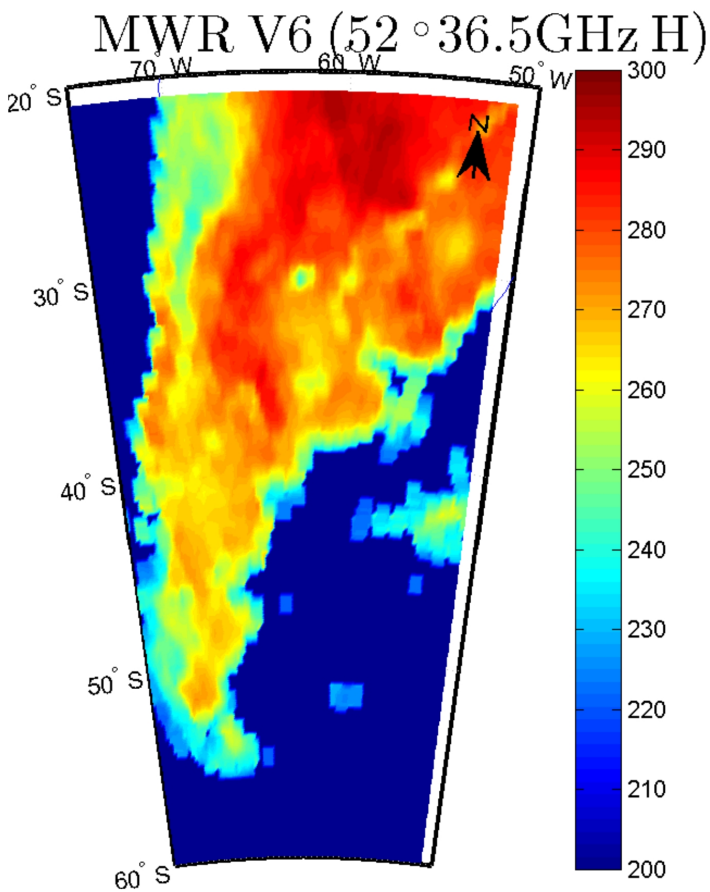
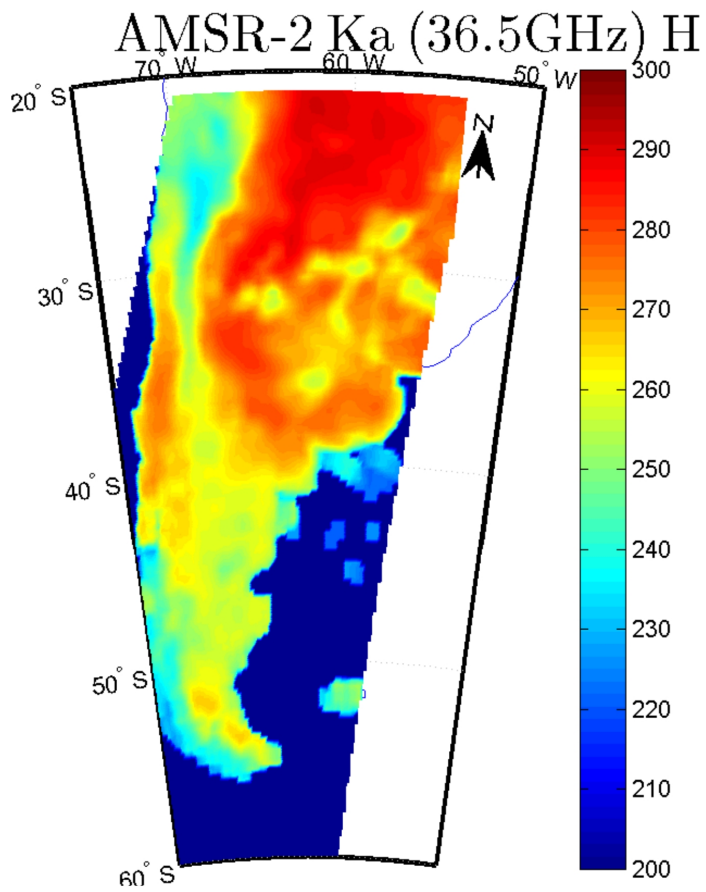
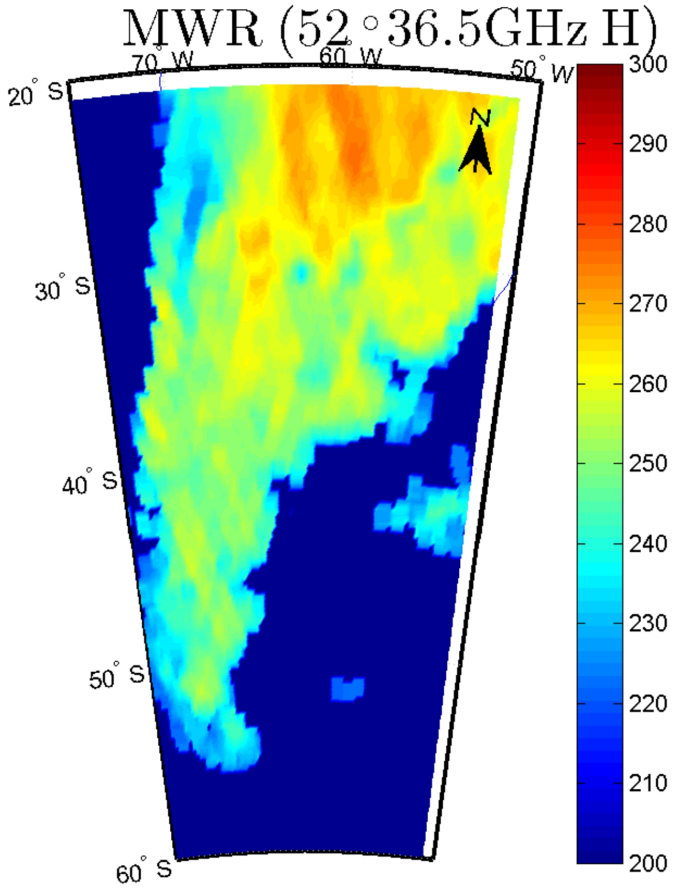


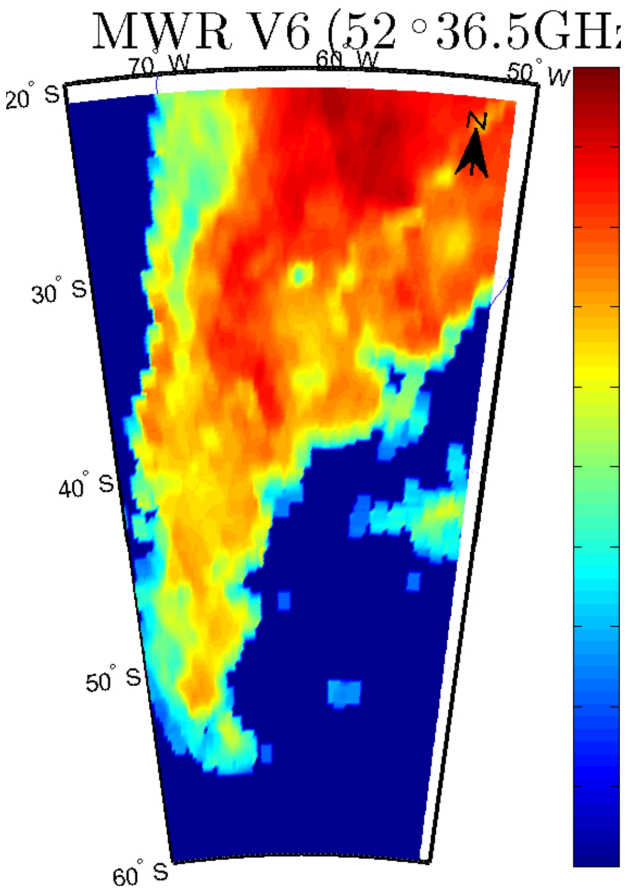


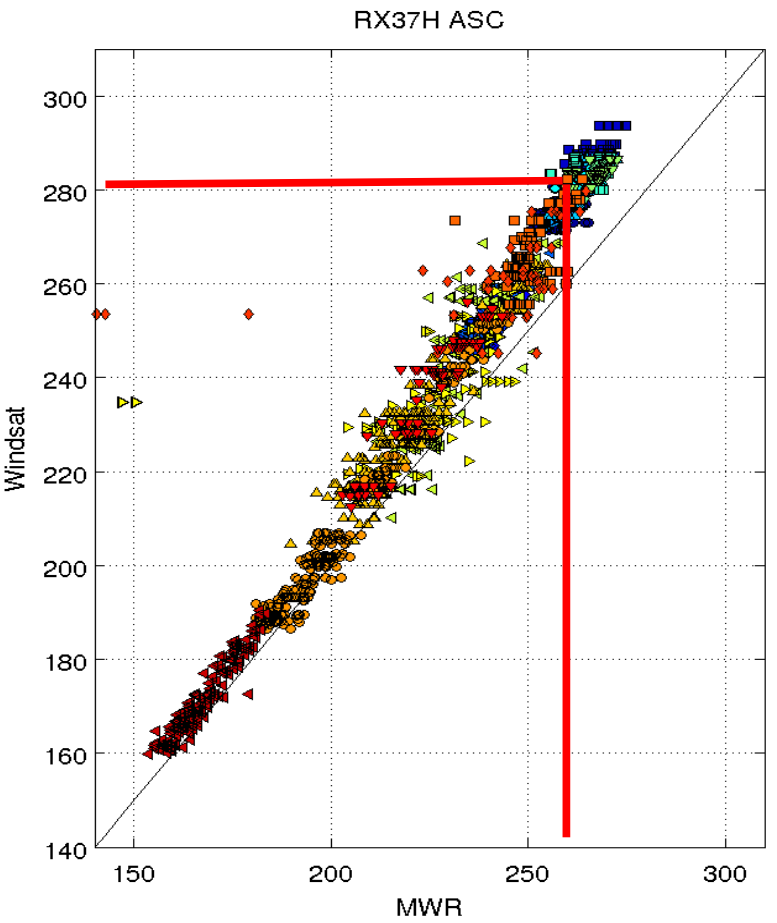


MWR V5: Existence of significant negative bias through all Tb37H dynamic range.

MWRV6 should be significantly warmer.







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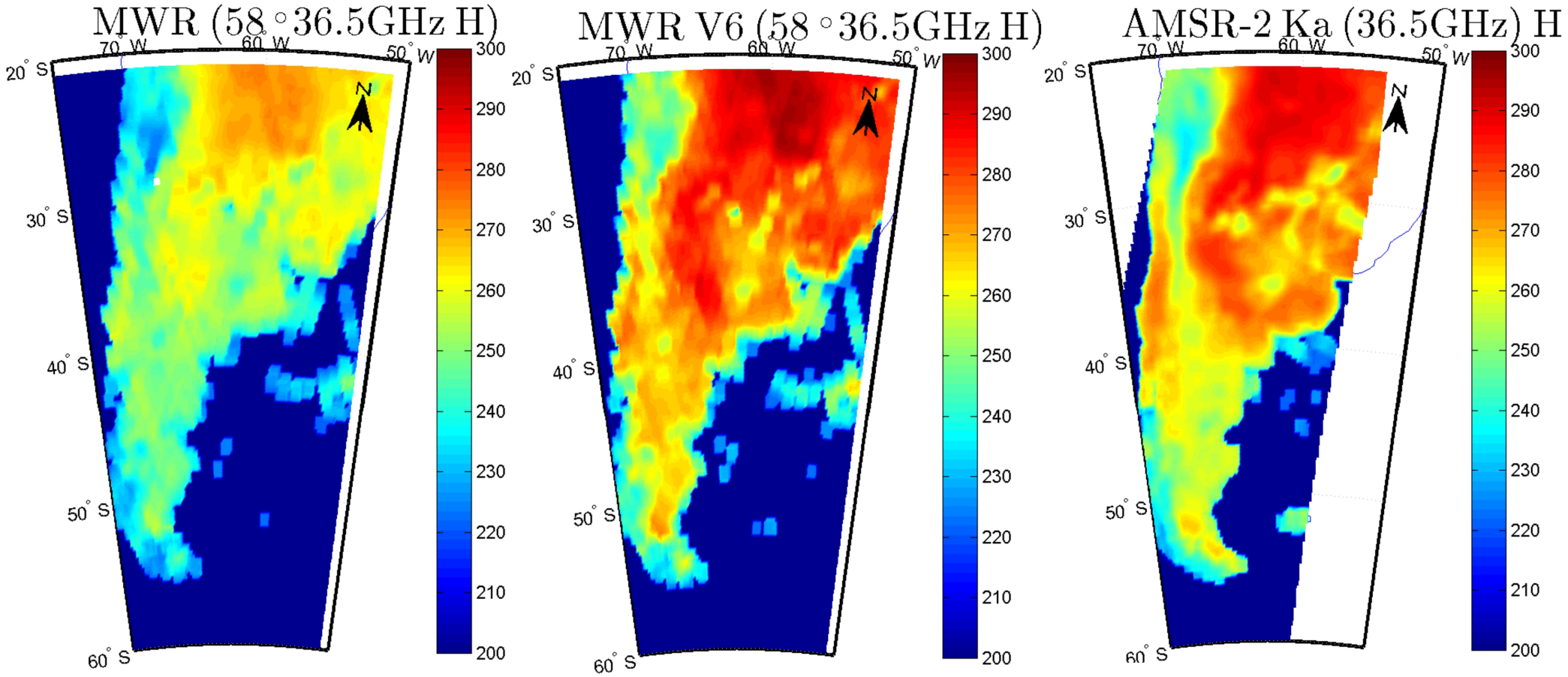

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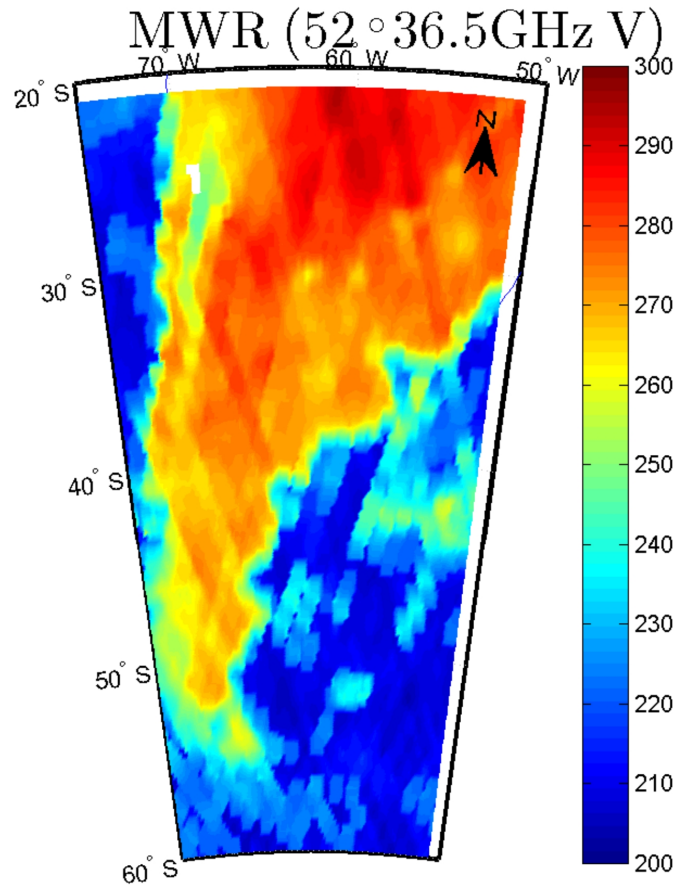
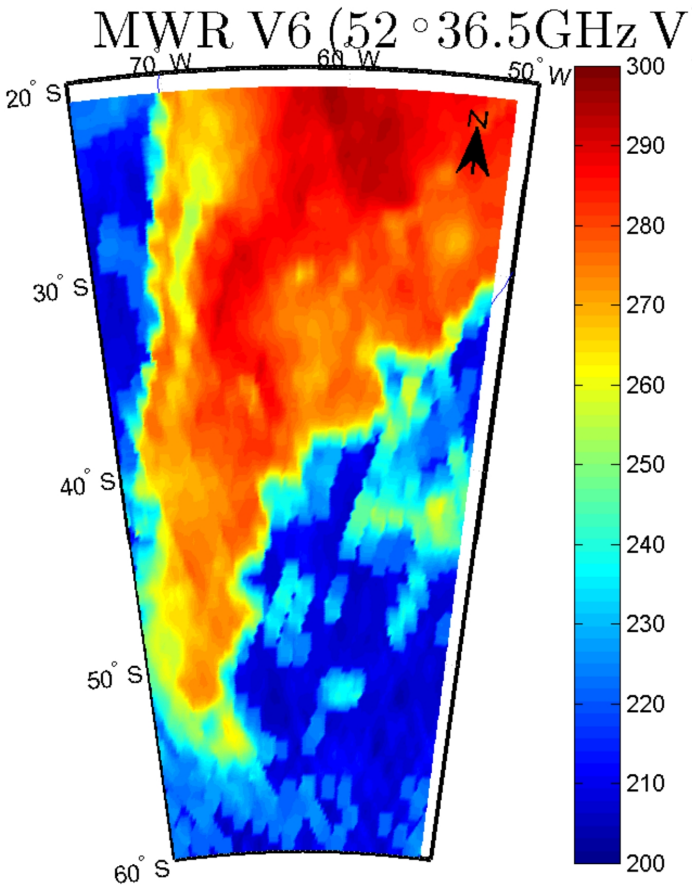
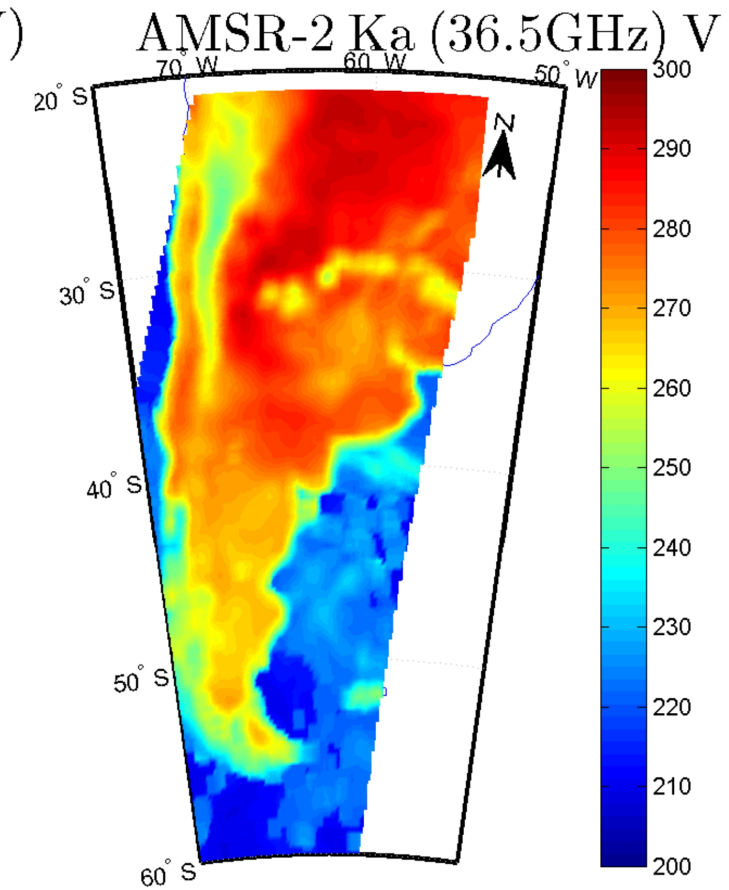
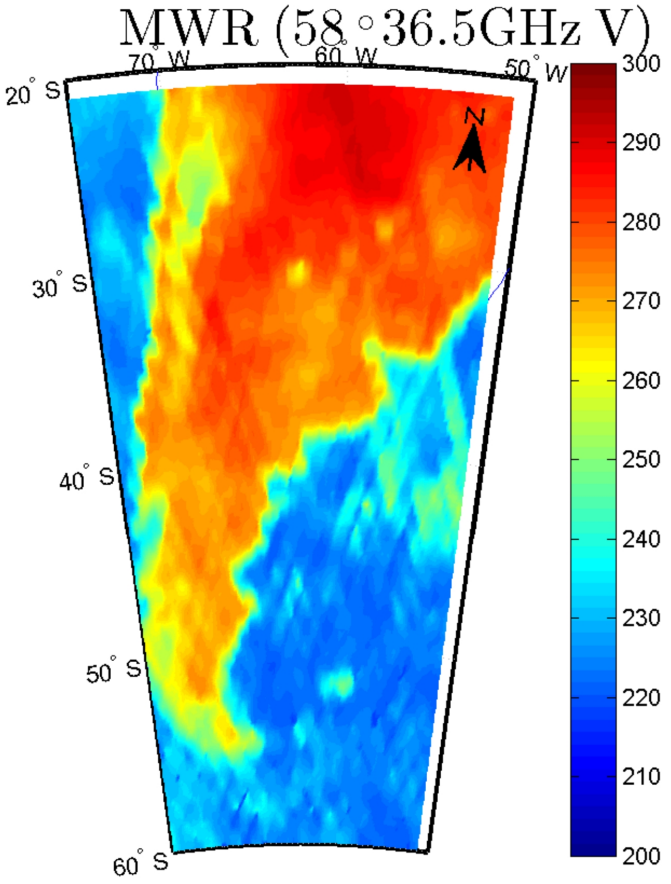


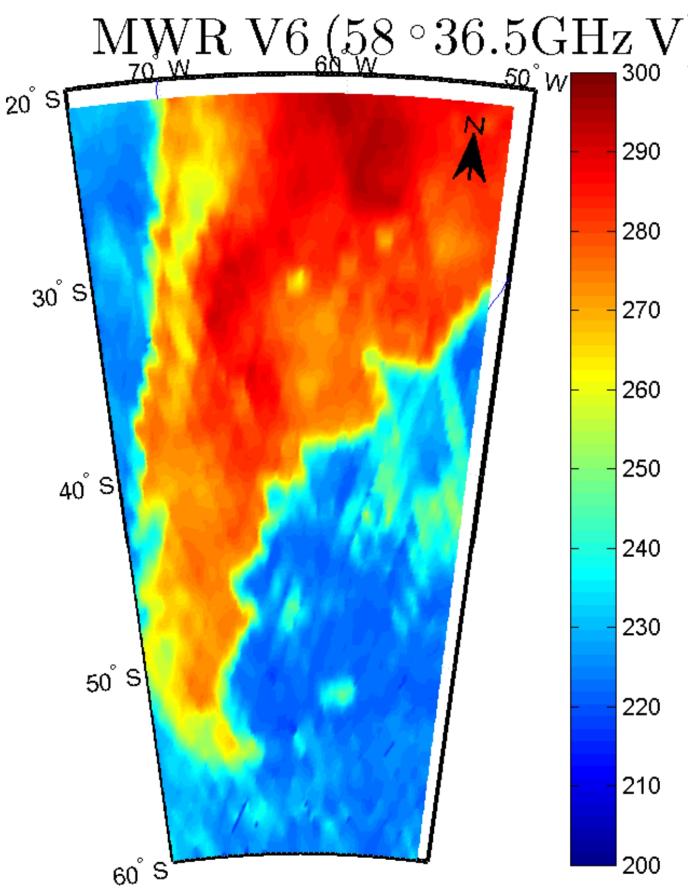


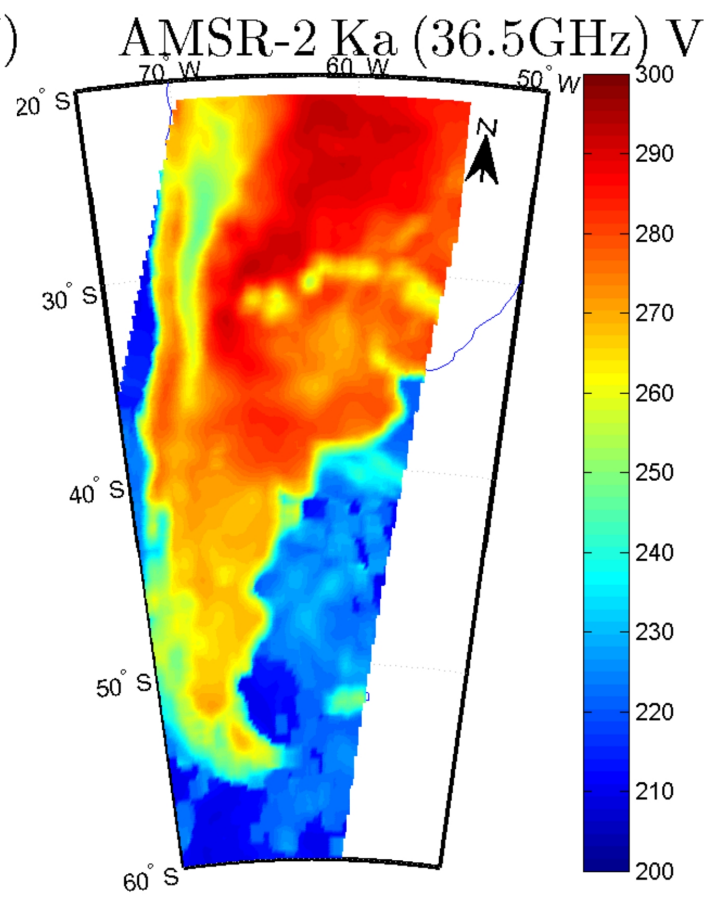


MWR V5: Existence of a slight bias in Tb37V, positive at lower values and negative at high ones.

MWRV6 should be slightly warmer at high temperatures and little colder at low temperatures.







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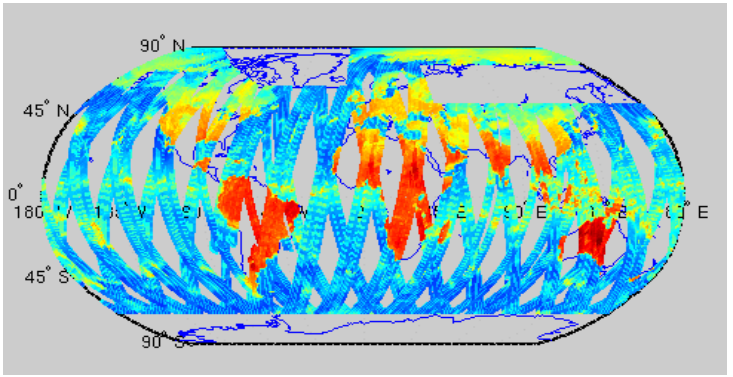
Vicarious Cold Method

Goal: tracking significant (>1ºK) drifts and ascending/descending bias.

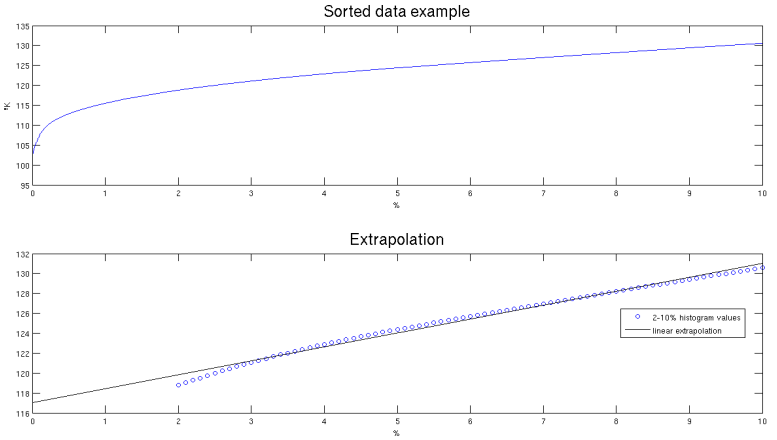
→ No data requirements from other instruments

→ Requires a long period of consistently calibrated data. The only available to us is 2011-2012 V5.0S

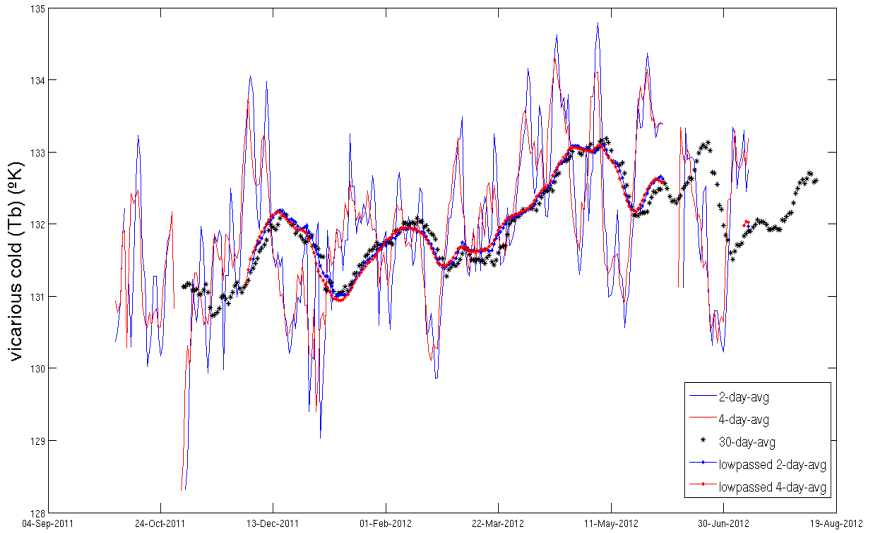
Manual remotion of areas with continental ice



Linear Extrapolation of histogram values

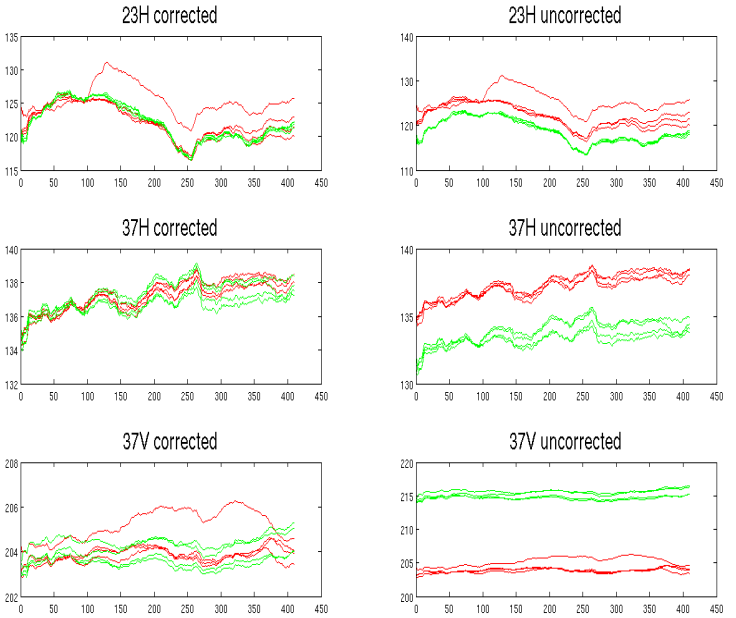


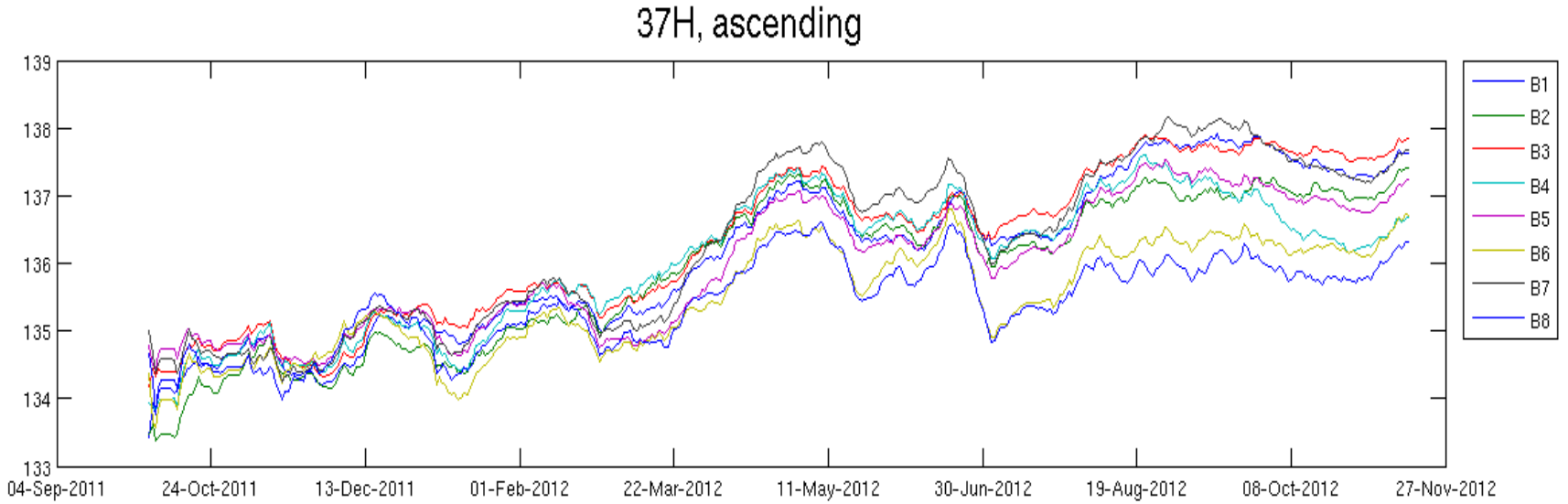
Time Window

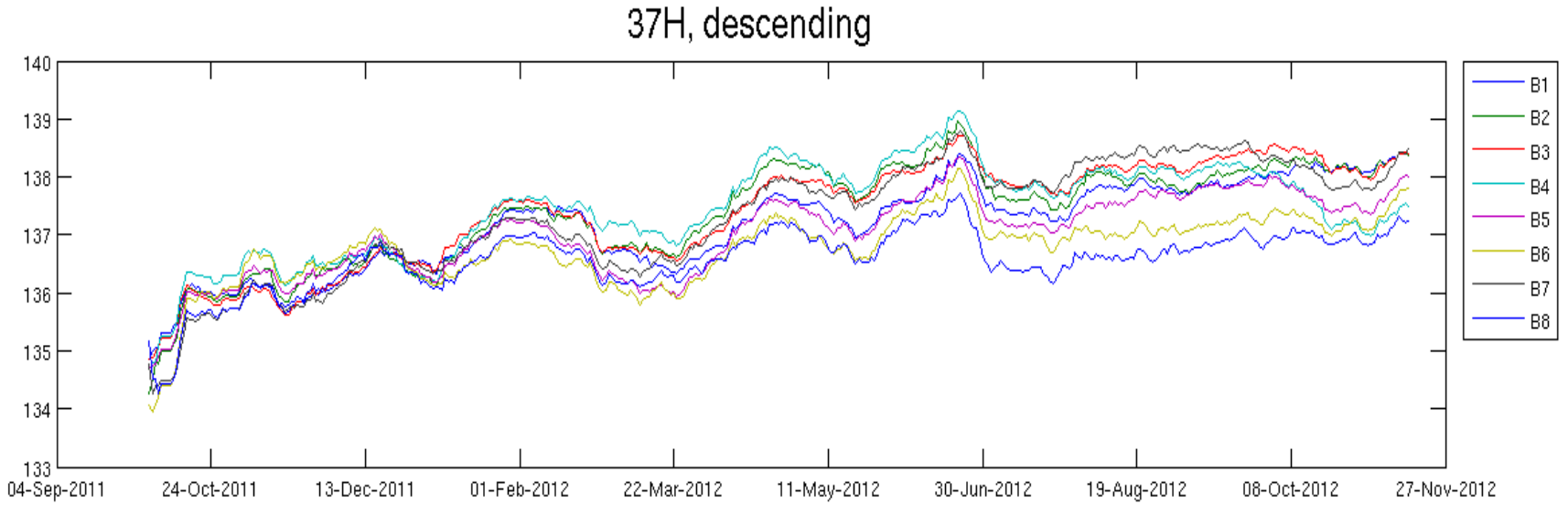


30-day histogram ~ moving average of 2-day histogram

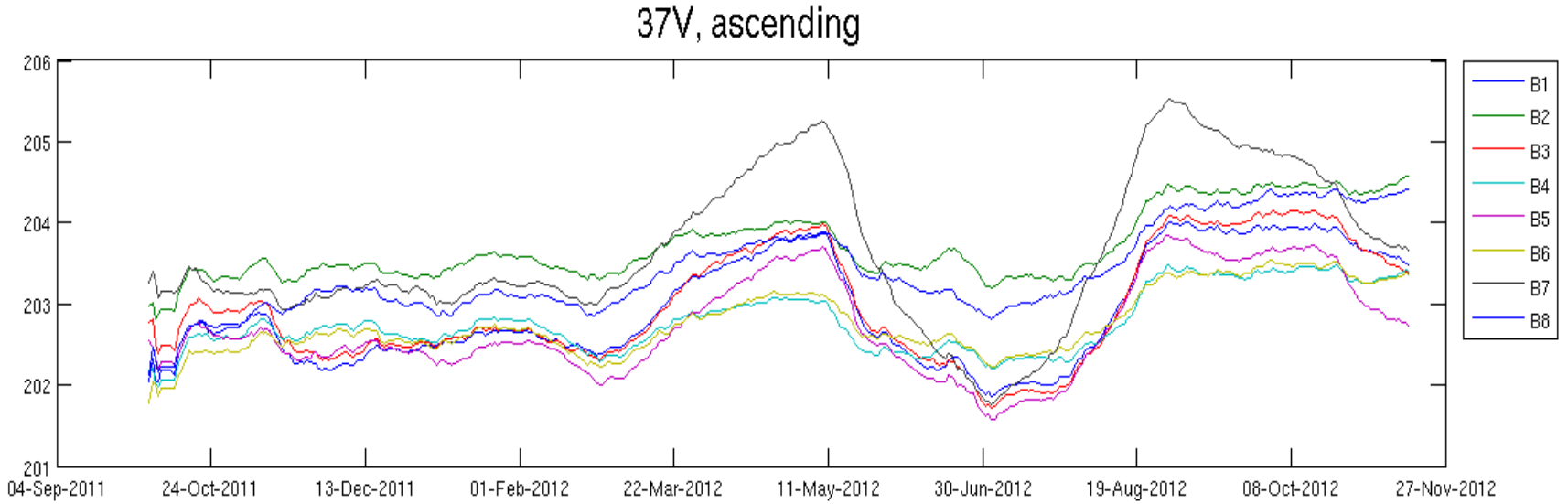
Incidence angle normalization

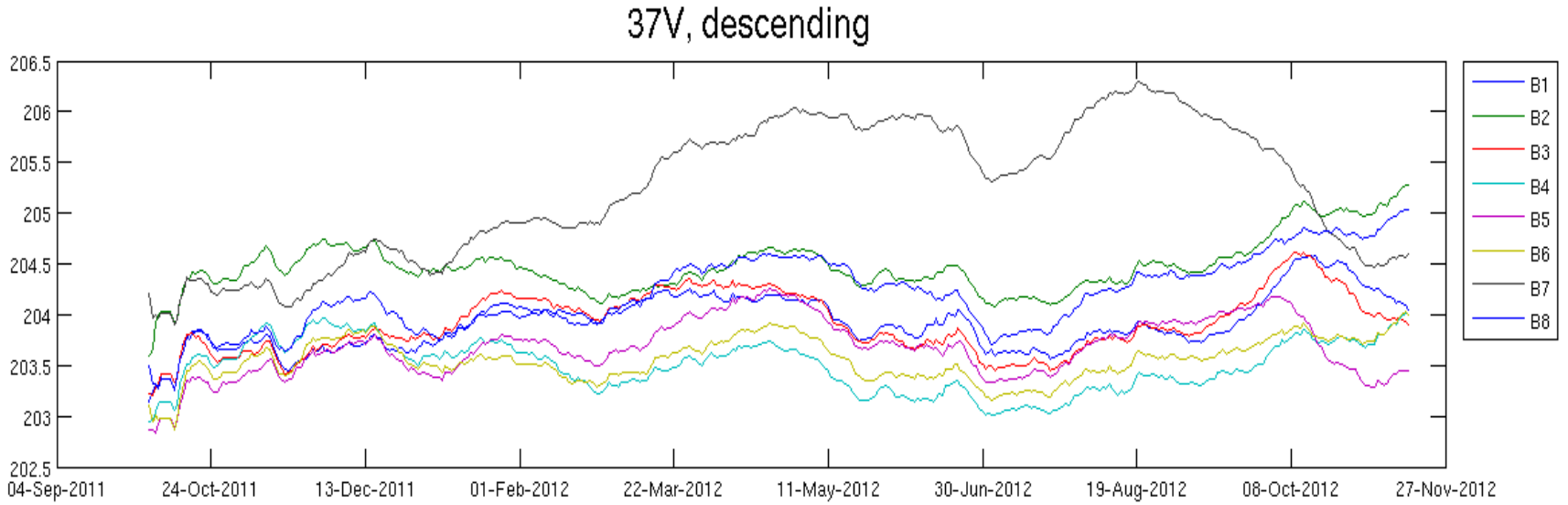




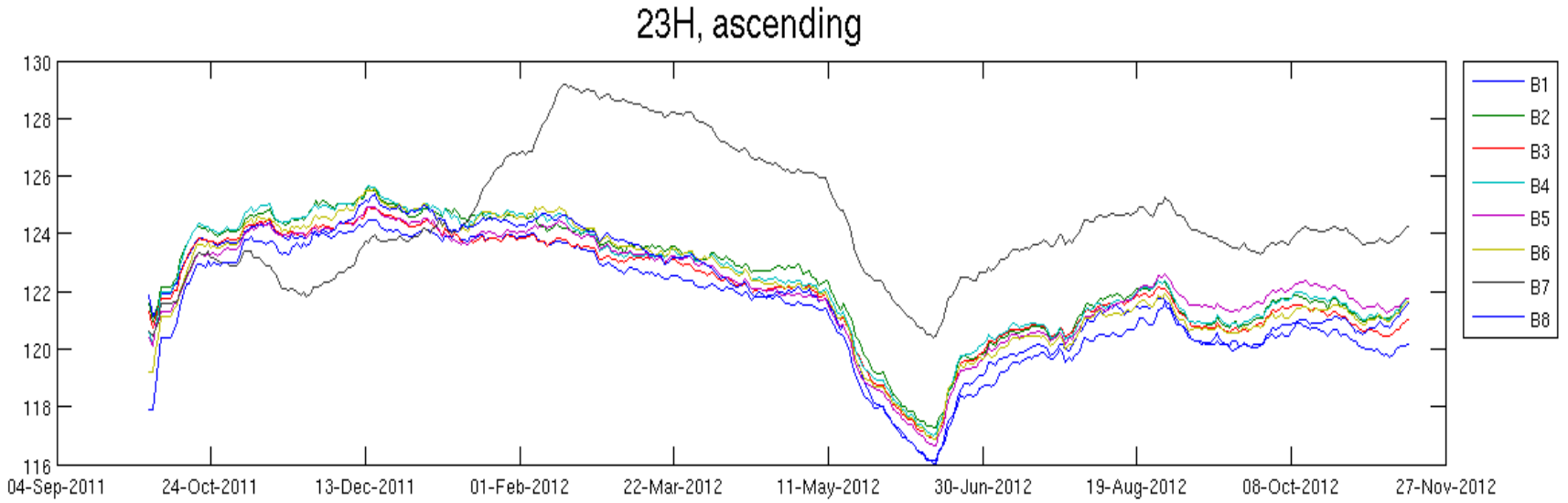


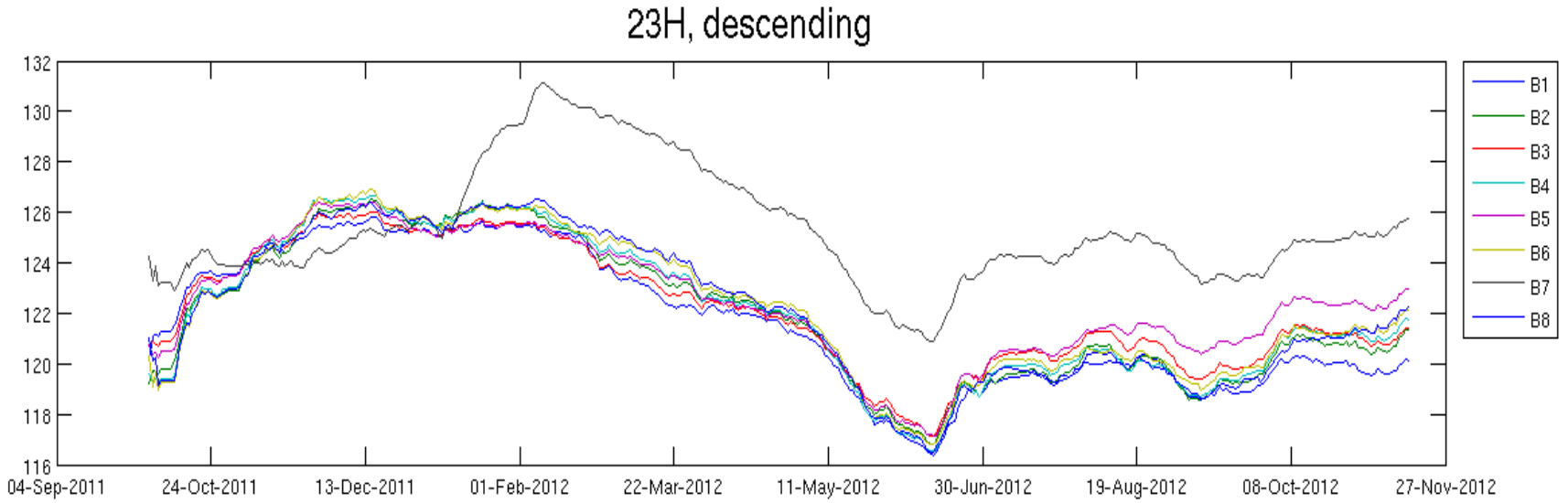
Stability of < 1ºK after July 2012



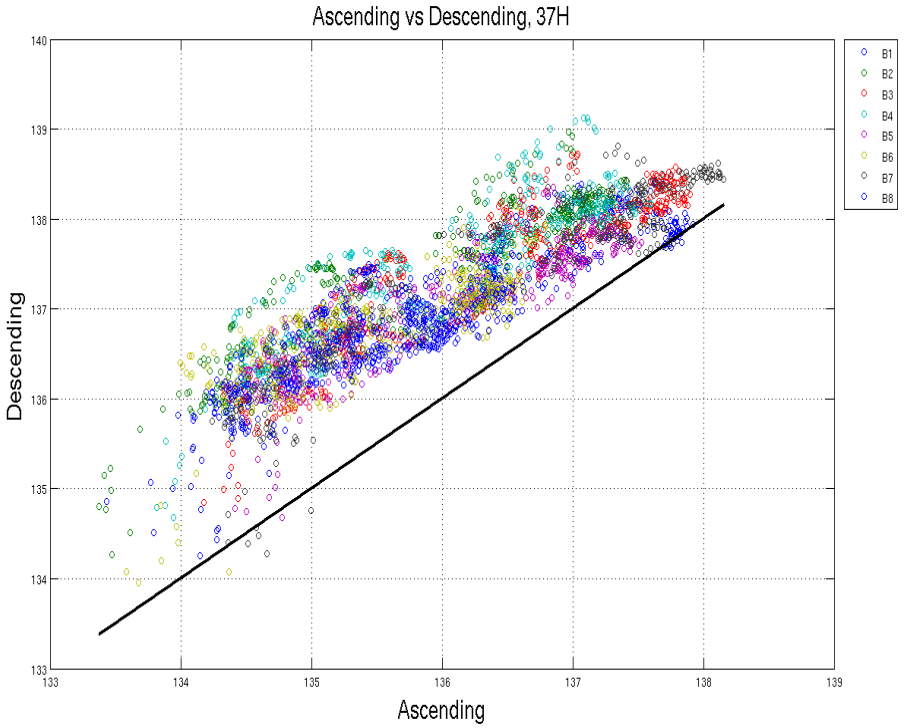


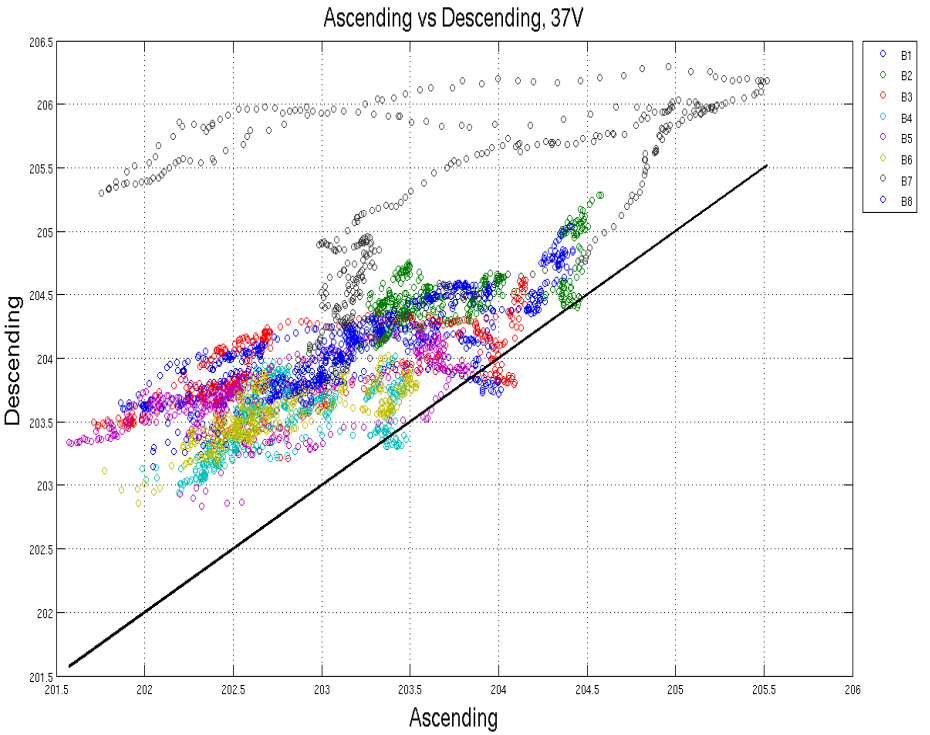
Overall stability of < 1.5ºK, possible issue in beam #7



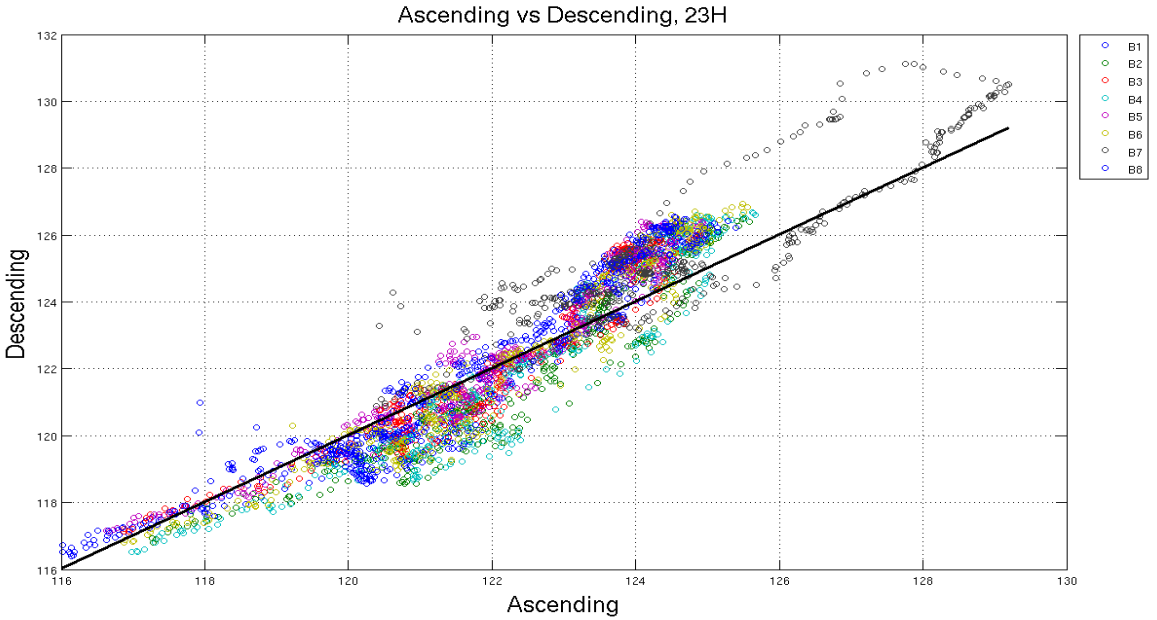


Much better stability after July 2012 (even beam #7)





In 37 (H&V): descending is ~ 1,5ºK warmer than ascending.



No significant difference in 23H

Appendix

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  - Intercalibration coefficients (slope & intercept) were derived by linear regression to compensate the calibration differences.
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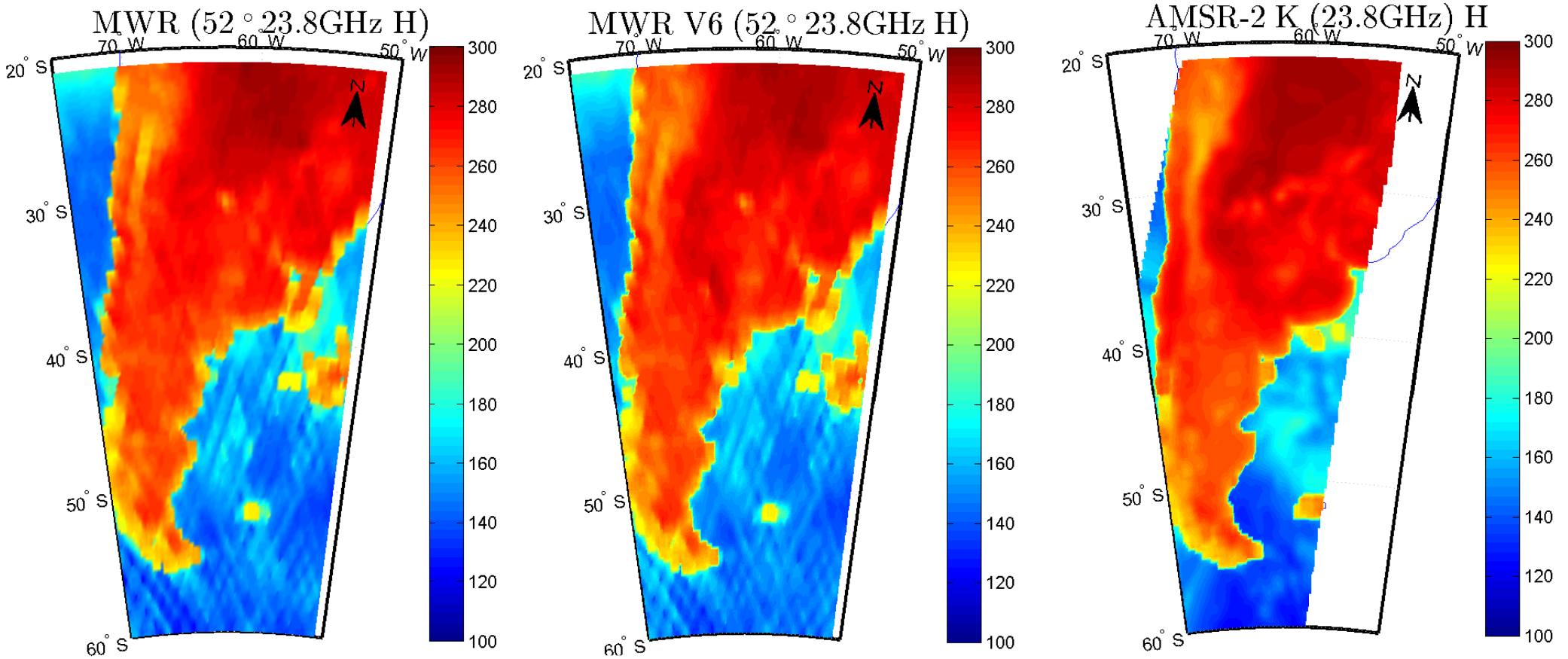
Canal	Beam	Ascendente		Descendente	
		a	b	a	b
23H	1	0.98694	3.9108	0.97297	7.8392
	2	0.8565	39.4745	0.89511	27.123
	3	0.96909	8.2212	0.954	10.5932
	4	0.89756	27.5456	0.92963	19.1245
	5	0.90868	23.2777	1.0008	-0.82069
	6	0.86298	36.4253	0.91648	22.6145
	7	0.93469	16.1957	0.96616	8.1175
	8	0.91447	23.7059	0.93869	16.7805
37H	1	1.1219	-19.1177	1.1383	-24.0788
	2	1.1509	-22.7353	1.1039	-13.6748
	3	1.1286	-21.2954	1.1085	-18.5082
	4	1.0671	-1.9863	1.1053	-13.3515
	5	1.1095	-12.191	1.2475	-45.5736
	6	1.0265	6.0777	1.1215	-16.8013
	7	1.1037	-9.9243	1.1743	-26.4572
	8	1.1038	-11.9025	1.1104	-14.2161
37V	1	1.0591	-14.4051	1.0837	-21.1007
	2	1.1021	-26.5787	1.0795	-21.3856
	3	1.1316	-32.0848	1.0935	-23.8659
	4	1.1007	-24.8229	1.0558	-15.4049
	5	1.1273	-28.7053	1.1553	-37.8758
	6	1.0738	-17.9359	1.0727	-19.2004
	7	1.0318	-8.5096	1.0824	-21.367
	8	1.0638	-16.5852	1.0959	-25.1562

Slope & intercept obtained through Windsat-MWR(V5) X-calibration


MWR (52 ◦ 23.8GHz H)
MWR V6 (52 ◦ 23.8GHz H)
AMSR-2 K (23.8GHz) H
70 W
60 W
50 W
20 S
30 S
40 S
50 S
60 S
N
300
280
260
240
220
200
180
160
140
120
100