

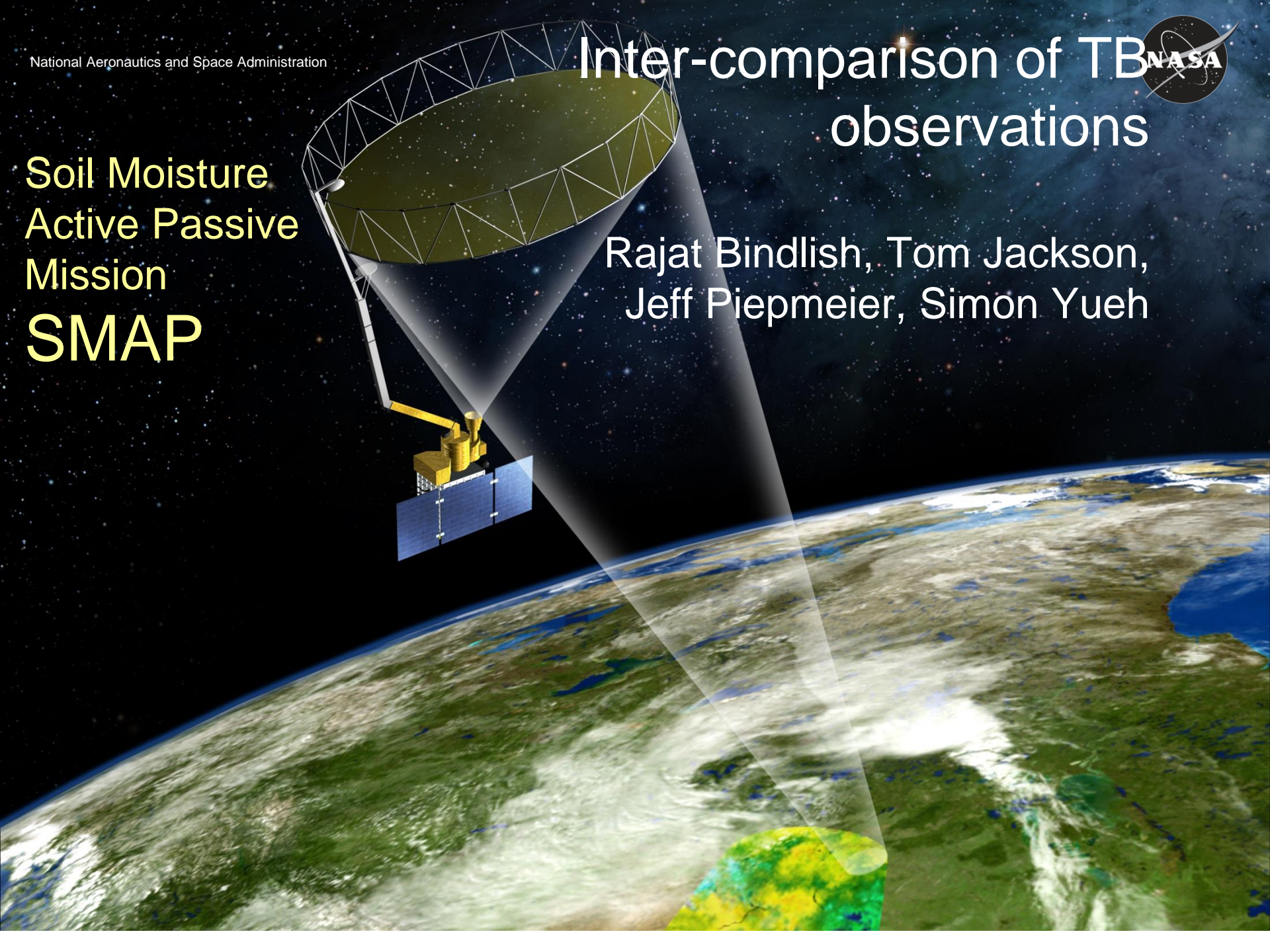
National Aeronautics and Space Administration

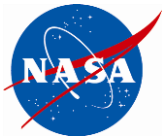
Inter-comparison of TB observations



Soil Moisture
Active Passive
Mission
SMAP

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Introduction

- On orbit inter-comparison of multiple L-band radiometers
 - Need for consistent TB observations:
 - SMAP, SMOS and Aquarius provide an opportunity to check each others calibration
 - Critical to develop a long-term climatic data record of L-band brightness temperature observations
 - A physical algorithm for development of a long term environmental data record that spans multiple L-band missions requires consistent input observations
 - It is prudent that all L-band radiometers (SMAP, SMOS and Aquarius) have a consistent calibration
 - Consistent soil moisture retrievals are not sufficient
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SMAP, SMOS and Aquarius

Inter-comparison methodology

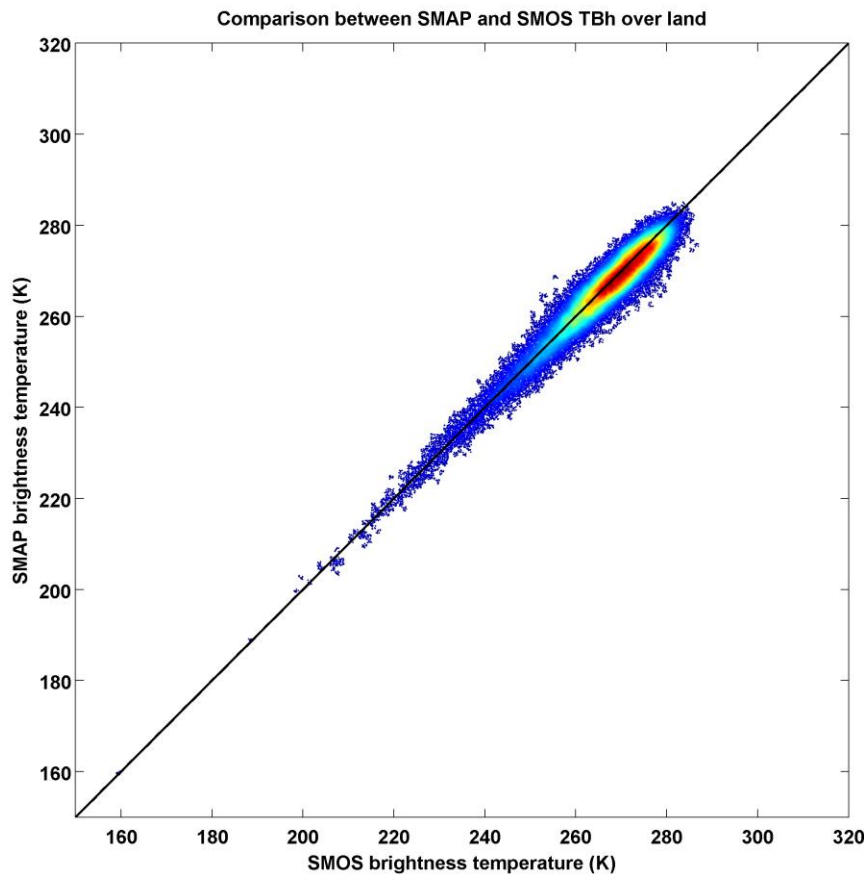


- Approach: Inter-compare the TOA TB observed by L-band radiometers
- Concurrent observations in both time (within 30 min → eliminates effect of change in physical temperature) and space (same location)
- SMAP, Aquarius and SMOS inter-comparison notes
 - SMAP Version T11750 (April-July 2015)
 - SMOS Version 620
 - Aquarius Version 4.0
 - Same incidence angle (after re-processing SMOS data)
 - Only alias free portions of SMOS observations
 - Differences in azimuth angle and orientation of the footprints ignored

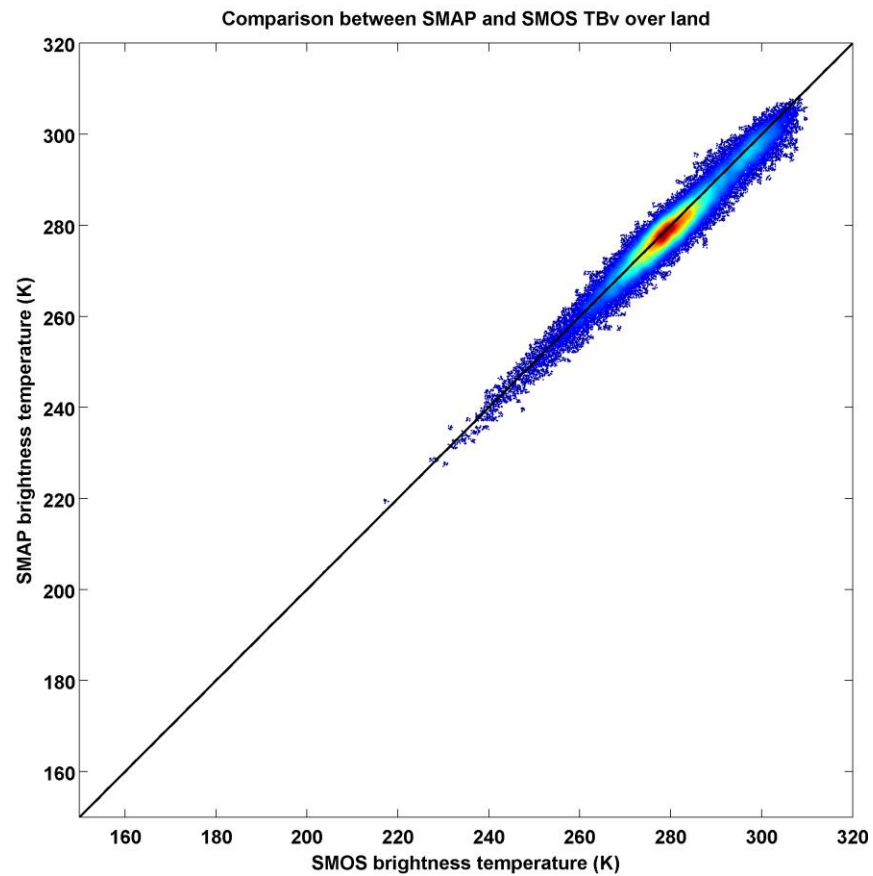
Comparison between SMAP and SMOS (land)



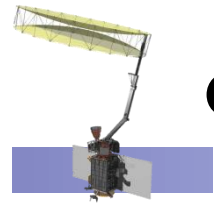
H



V



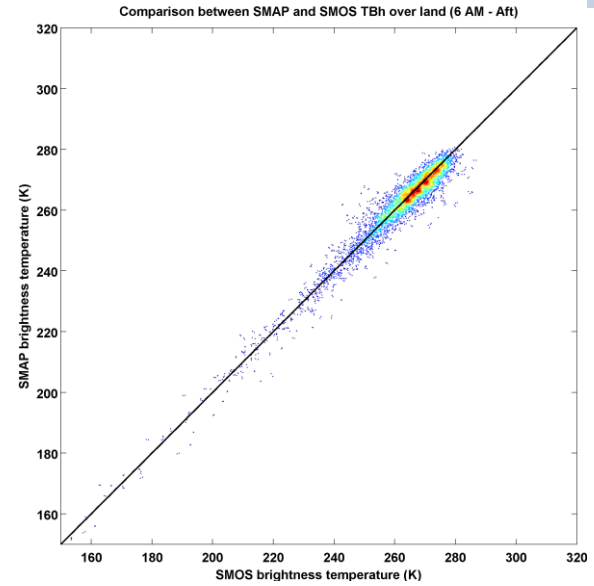
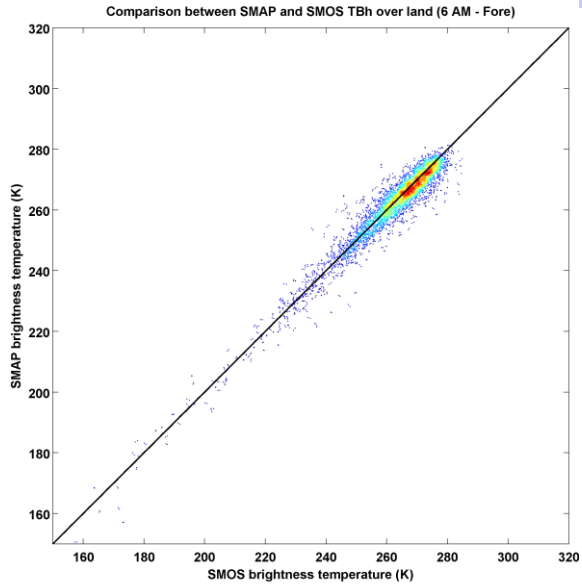
SMAP (T11750), SMOS - Version 620



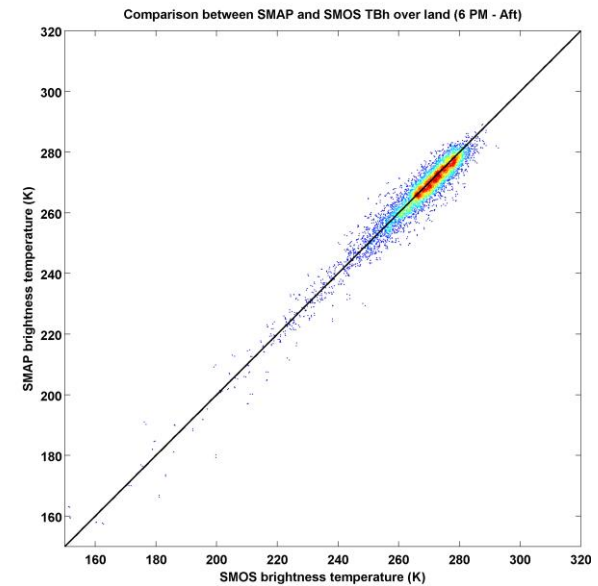
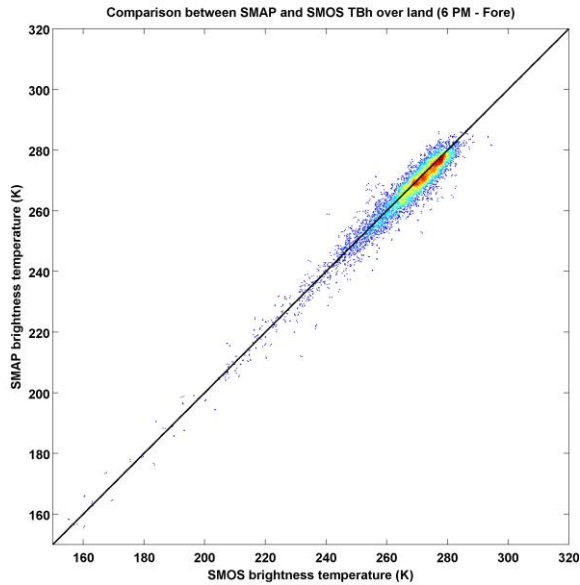
Comparison between SMAP and SMOS (h-pol) (land)



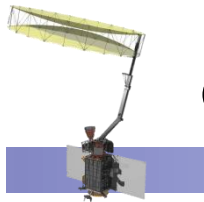
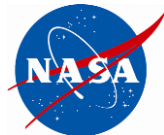
6 AM



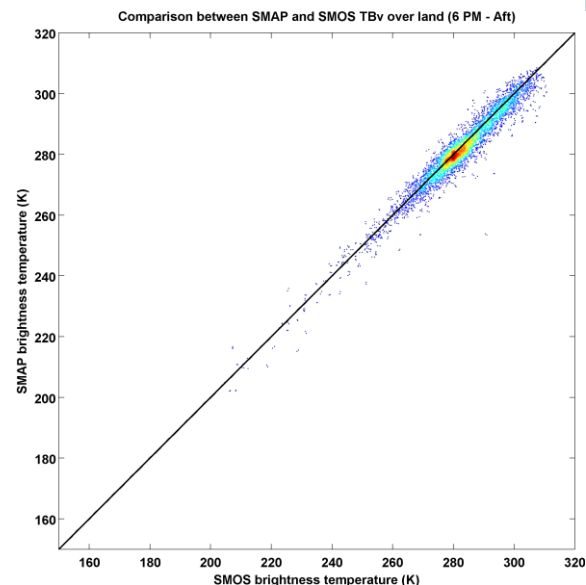
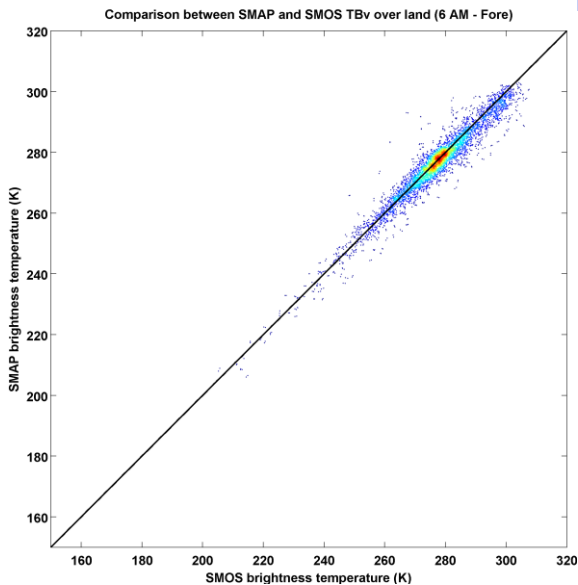
6 PM



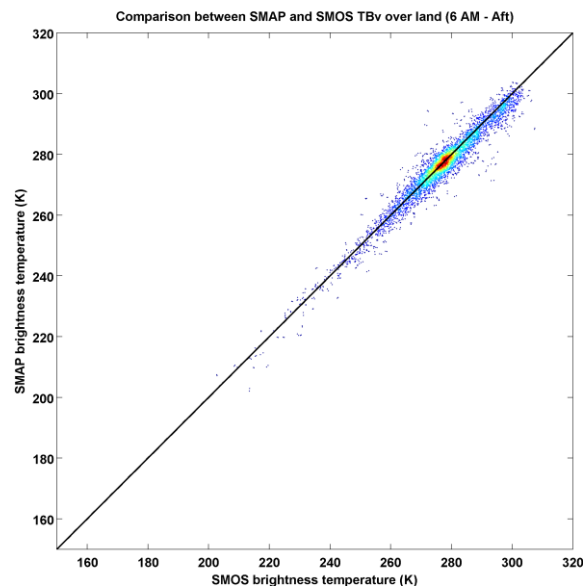
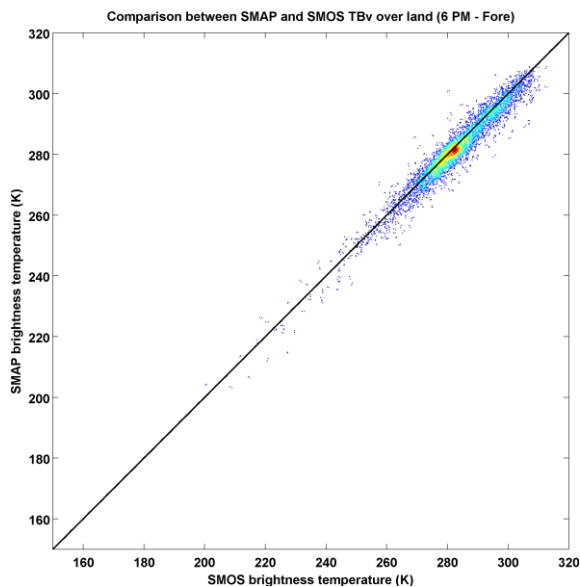
Comparison between SMAP and SMOS (v-pol) (land)



6 AM



6 PM





Comparison between SMAP and SMOS over Land

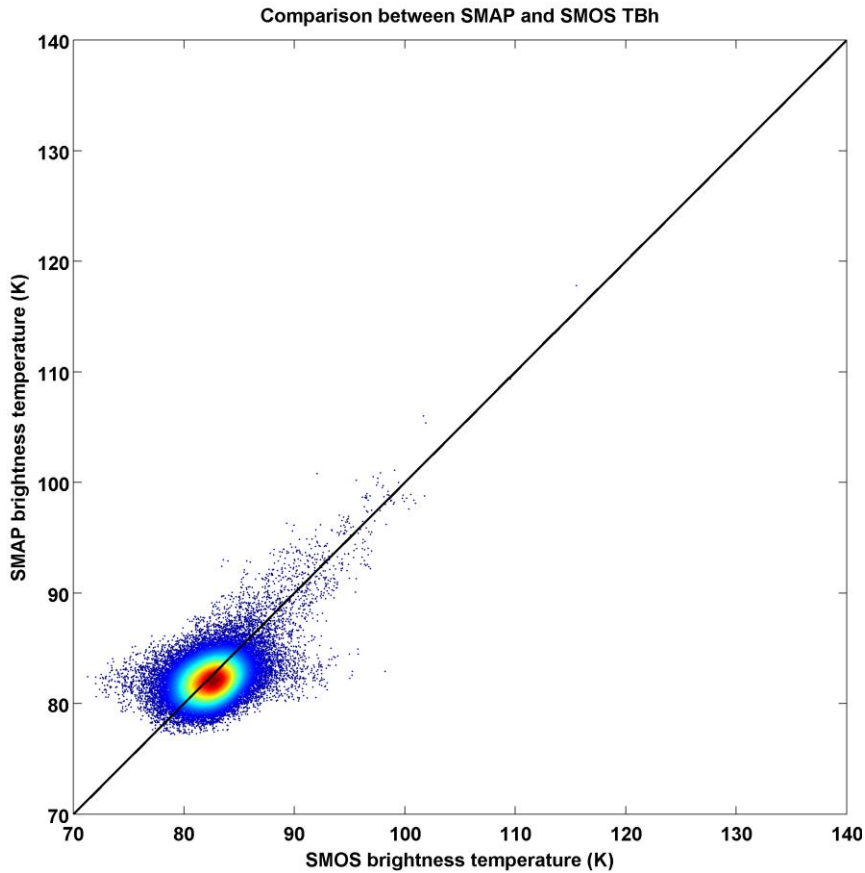
Summary Statistics (May 2015)

		RMSD (K)	R	Bias [SMAP-SMOS] (K)
H pol	Fore (AM)	3.90	0.9683	-0.60
	Fore (PM)	3.52	0.9752	-0.79
	Aft (AM)	3.79	0.9742	-0.49
	Aft (PM)	3.60	0.9722	-0.64
	Overall	3.34	0.9660	-0.59
V pol	Fore (AM)	3.50	0.9673	-0.71
	Fore (PM)	3.55	0.9696	-1.08
	Aft (AM)	3.37	0.9723	-0.67
	Aft (PM)	3.44	0.9704	-0.96
	Overall	3.07	0.9731	-0.84

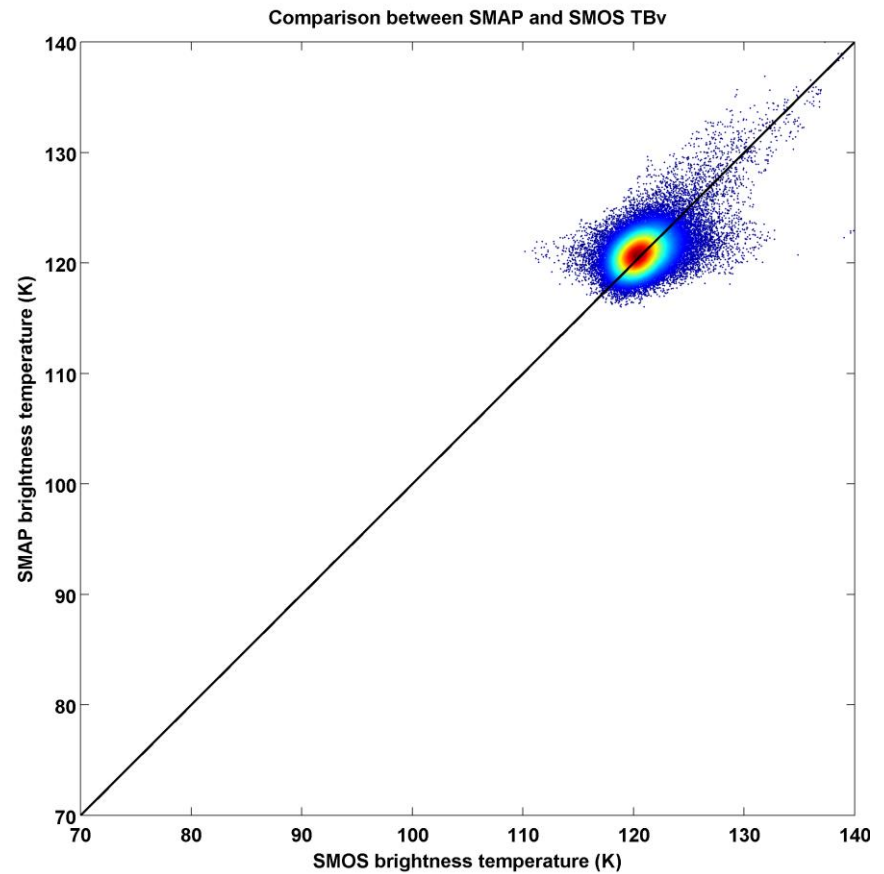


Comparison between SMAP and SMOS (ocean)

H



V



SMAP (T11750), SMOS - Version 620

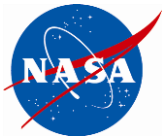


Comparison between SMAP and SMOS

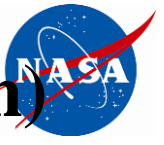
Summary Statistics (May-July 2015)

		RMSD (K)	R	Bias [SMAP-SMOS] (K)
H pol	Land	3.34	0.9660	-0.59
	Ocean	2.51	0.3408	-1.33
	Overall	2.63	0.9995	-1.22
V pol	Land	3.07	0.9731	-0.84
	Ocean	1.93	0.4096	0.06
	Overall	2.10	0.9994	-0.07

Comparison between SMAP, SMOS and Aquarius observations



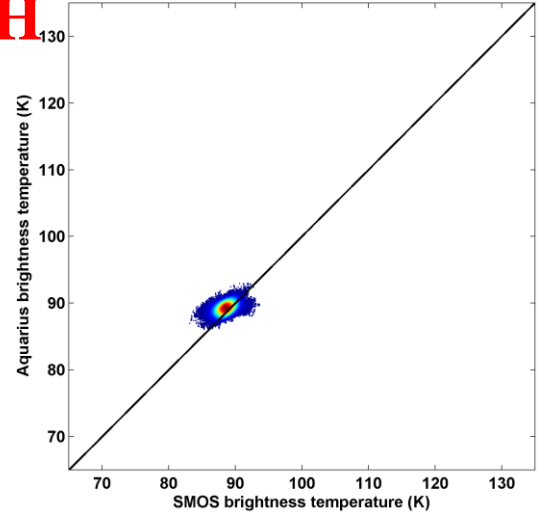
- Scatter possibly due to:
 - RFI (possible RFI in SMOS/SMAP)
 - Heterogeneous footprint
 - Different azimuth angles
 - Noise in SMAP/SMOS data
 - SMAP, SMOS and Aquarius use different land and ocean models for L1 calibration which could lead to some discrepancy
 - The impact of these TB differences on soil moisture retrievals is unknown – though it might not be significant – difference in soil moisture algorithms and ancillary parameters have a bigger impact
 - SMAP and SMOS TB observations are within the noise levels of the radiometer
-



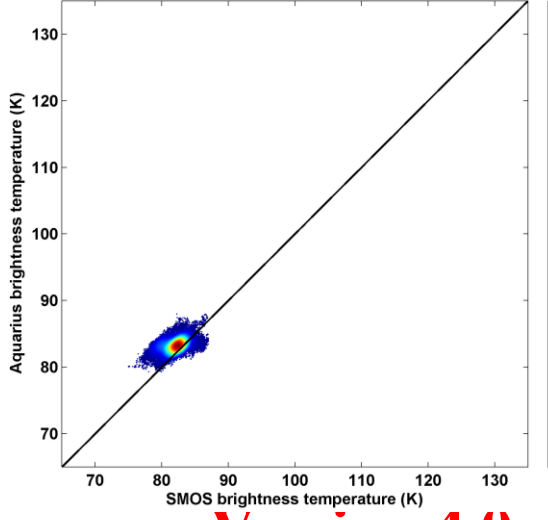
Comparison between Aquarius and SMOS (ocean)

H

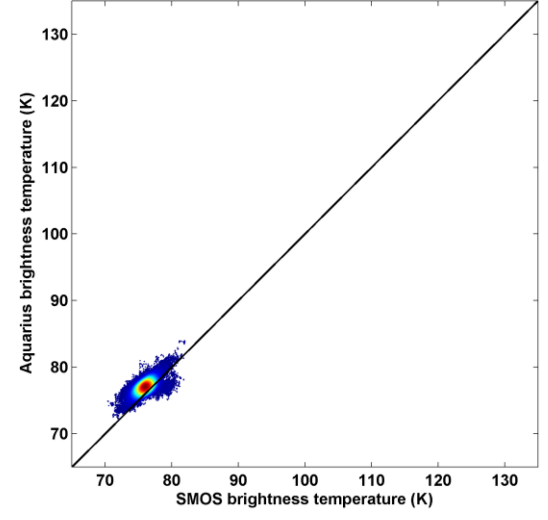
Comparison between Aquarius and SMOS TB_H (Inner Beam)



Comparison between Aquarius and SMOS TB_H (Middle Beam)



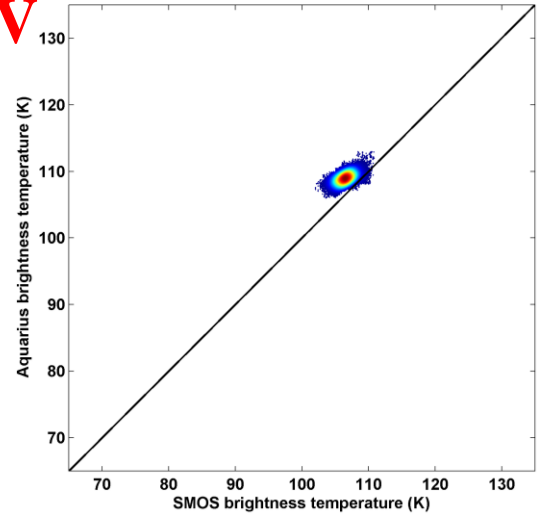
Comparison between Aquarius and SMOS TB_H (Outer Beam)



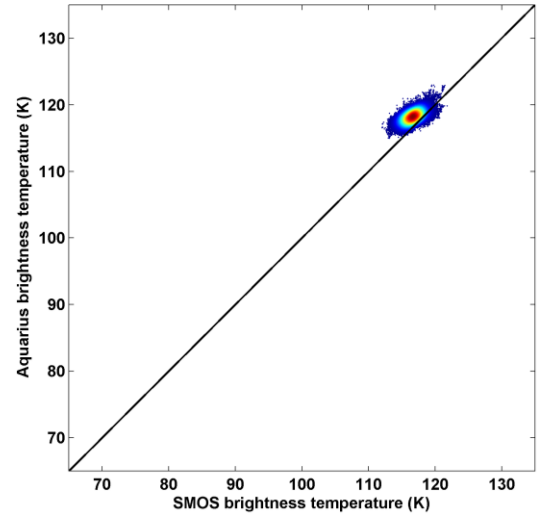
Version 4.0

V

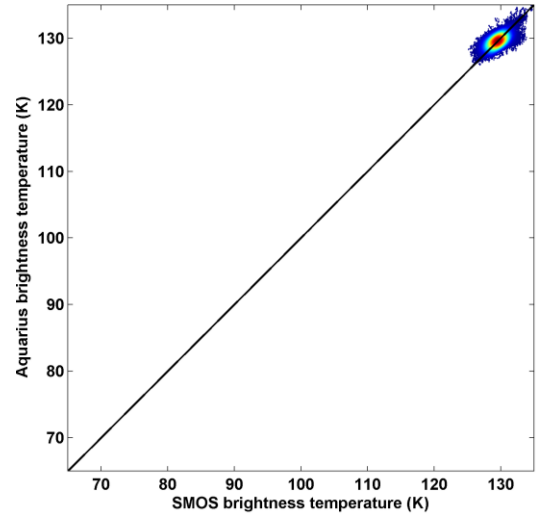
Comparison between Aquarius and SMOS TB_V (Inner Beam)

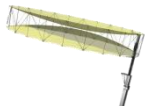


Comparison between Aquarius and SMOS TB_V (Middle Beam)



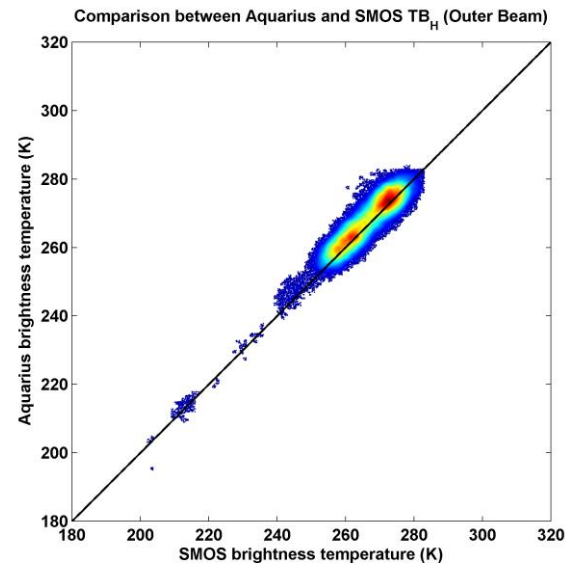
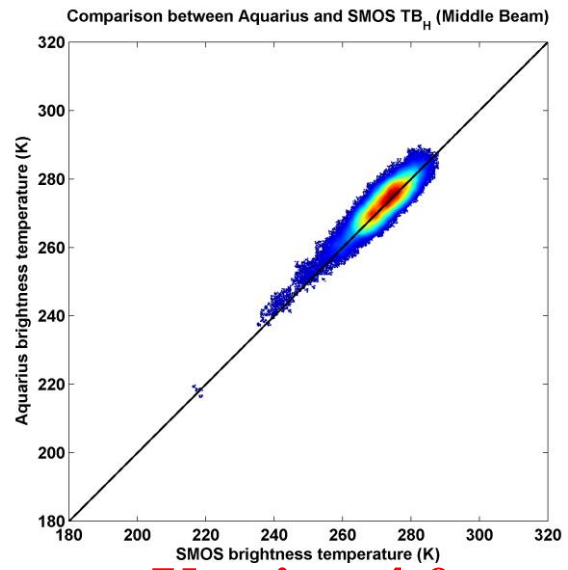
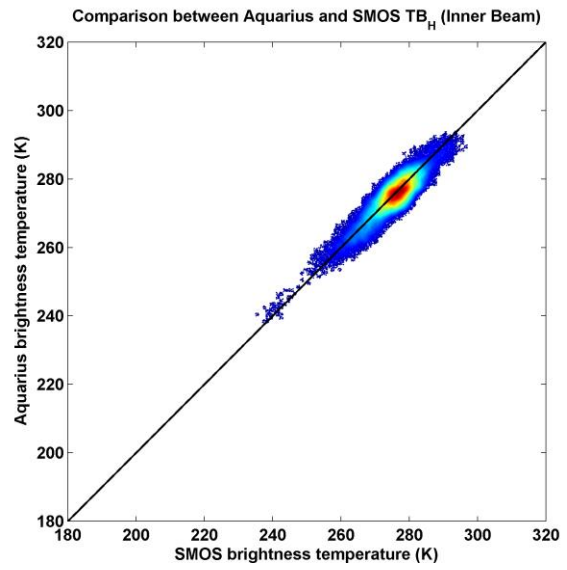
Comparison between Aquarius and SMOS TB_V (Outer Beam)





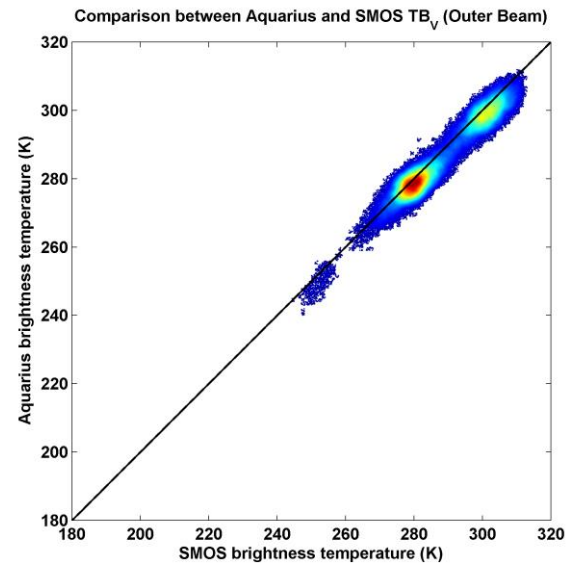
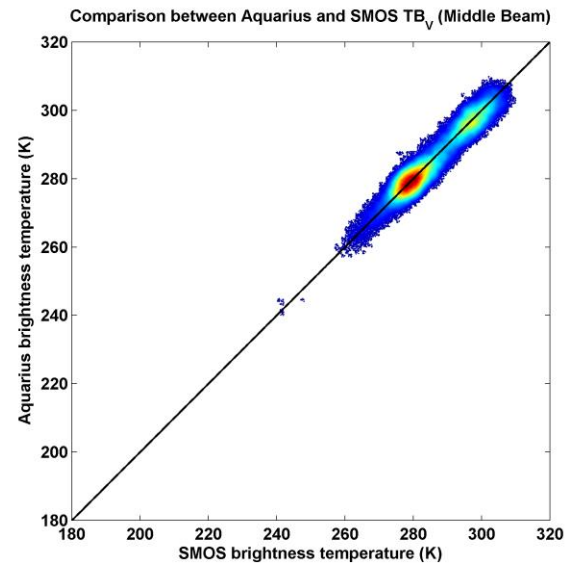
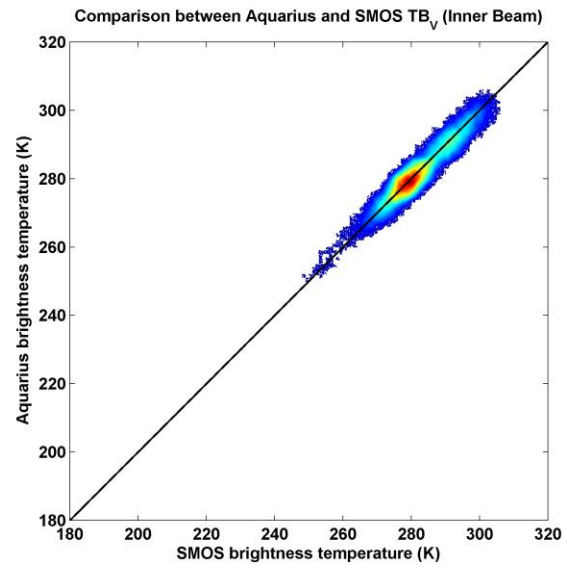
Comparison between Aquarius and SMOS (land)

H



Version 4.0

V





Aquarius and SMOS (Summary Statistics)

		Land			Ocean		
		RMSD (K)	R	Bias [Aq-SMOS] (K)	RMSD (K)	R	Bias [Aq-SMOS] (K)
H pol	Inner (29.36°)	3.35	0.9201	-0.43	0.94	0.5552	-0.03
	Middle (38.49°)	3.39	0.9139	0.93	1.28	0.4830	0.44
	Outer (46.29°)	3.87	0.9262	1.47	0.83	0.7417	0.28
V pol	Inner (29.36°)	3.16	0.9459	-0.20	1.15	0.5725	0.71
	Middle (38.49°)	3.33	0.9506	-0.17	0.90	0.6206	-0.19
	Outer (46.29°)	3.87	0.9623	-1.81	1.04	0.6951	-0.71