



NOAA Satellite Microwave Sounder FCDR: Version 2

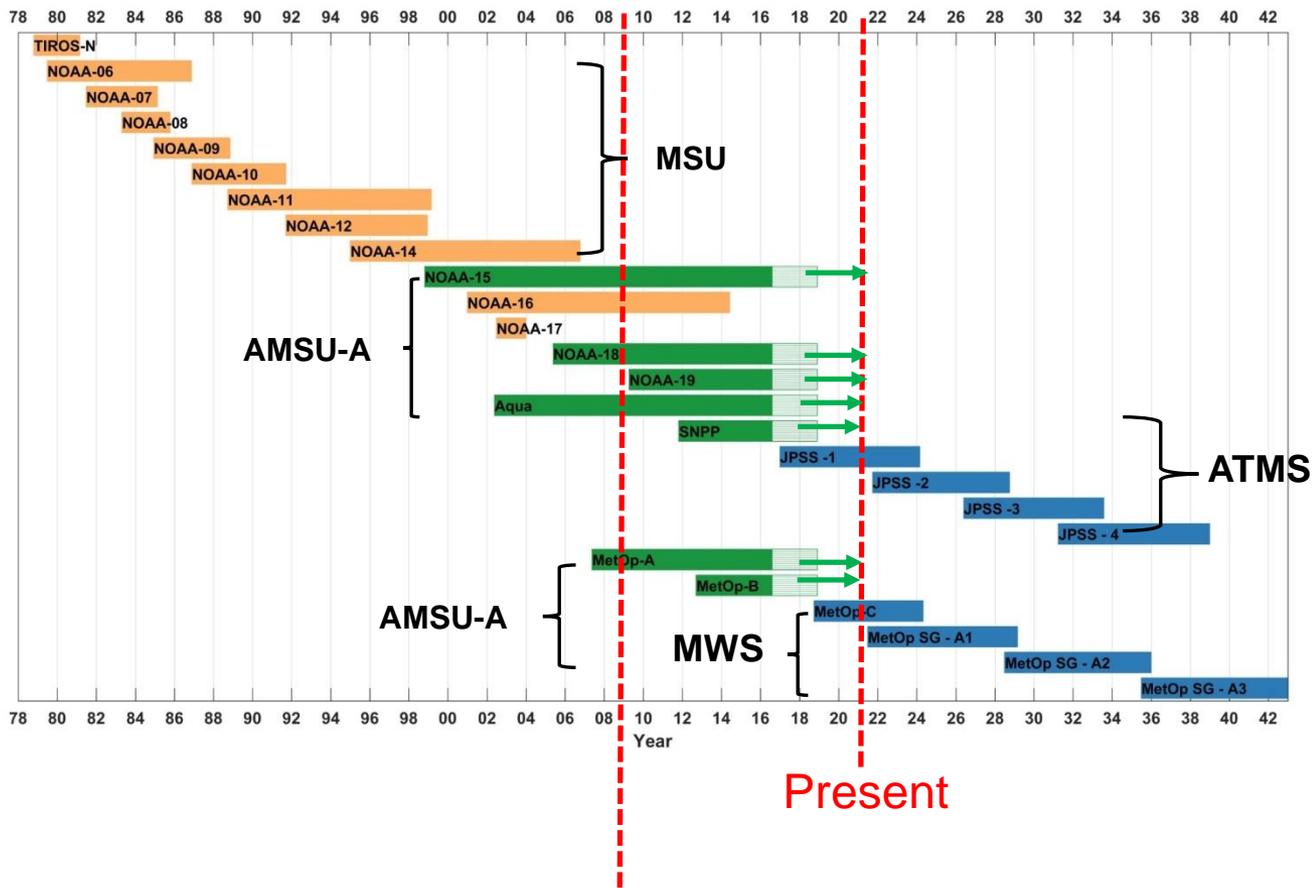
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Overview of NOAA Satellite Microwave Sounder FCDR

- Involve satellite microwave sounders on NOAA/NASA/MetOp series from 1978 to present and onward to the future
- Version 1 FCDR was developed around 2005-2009 (Zou et al. 2006, 2009, Zou and Wang 2011)
- MSU FCDR is archived in the NOAA/NCEI data center
- AMSU-A FCDR is still routinely delivered from STAR to NOAA/NCEI for archiving and distribution to users
- All MSU and most AMSU-A satellites had orbital drifts at that time



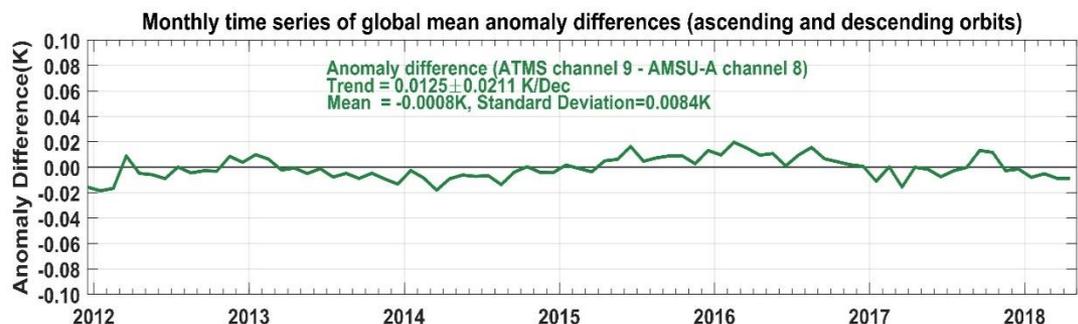
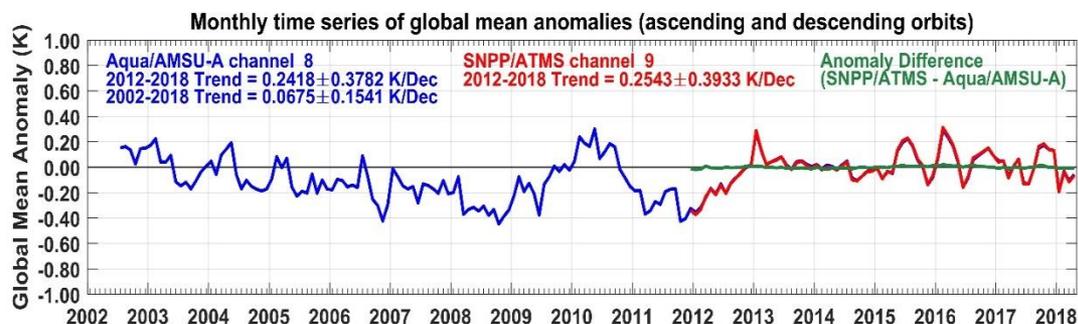
Time when Version 1 FCDR was developed



SNPP ATMS and Aqua/MetOp-A AMSU-A Achieve High Radiometric Stability

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- Diurnal sampling difference is absent
 - diurnal sampling biases are naturally removed by satellites with stable orbits of the same overpass time
- Time series from different satellites match with each other nearly perfectly without applying any diurnal drift corrections or time-dependent inter-calibration
- Calibration drifts could be estimated quite accurately
- Small trend differences suggest high radiometric stability for both instruments
- Radiometric stability within 0.004K/Year for SNPP/ATMS and Aqua/AMSU-A for all analyzed channels

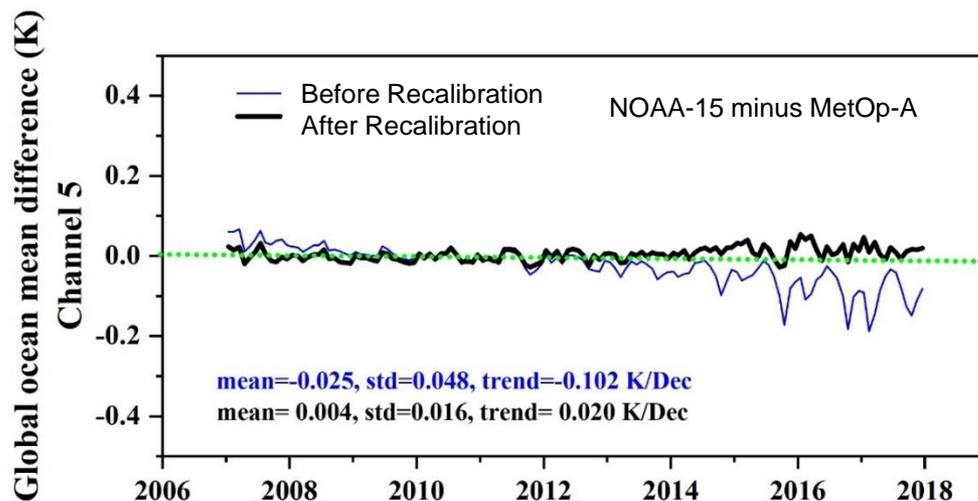
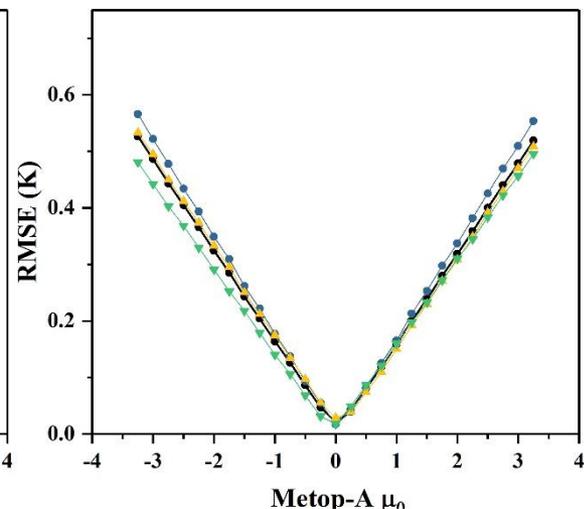
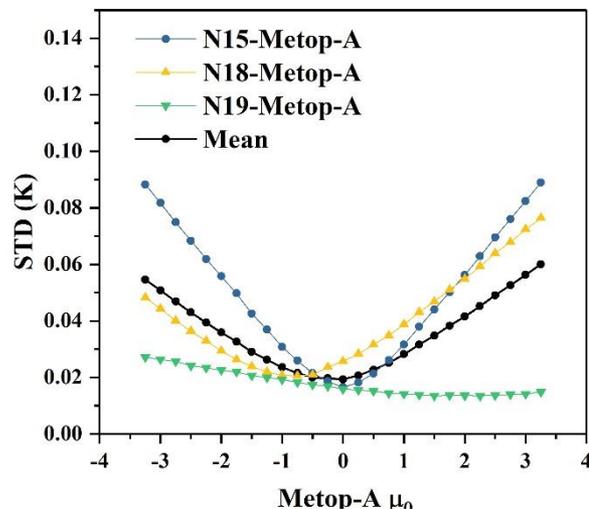


Monthly global mean anomaly time series of brightness temperatures for AMSU-A channel 8 onboard Aqua (blue, top panel) versus ATMS channel 9 onboard SNPP (red, top panel) and their difference time series (green, top and lower panels). The AMSU-A and ATMS data are respectively from June 2002 and December 2011 to April 2018. The AMSU-A anomaly time series are overlaid by ATMS during their overlapping period with their differences shown as nearly a constant zero line in the same temperature scale. Amplified scale of temperature is used in the bottom panel to show detailed features in the anomaly difference time series. Both ATMS and AMSU-A data are from limb-adjusted views and averaged over ascending and descending orbits (plot from Zou et al. 2018).



Recalibration of AMSU-A/MSU Using MetOp-A as a Reference

- Use the same L1 calibration equation as in Version 1 to convert counts to radiances in the recalibration
- Use Integrated Microwave Inter-calibration Approach (IMICA) to obtain optimal calibration nonlinearity and offsets that minimized inter-satellite differences
- Use MetOp-A as a reference in the recalibration since it overlaps with most NOAA AMSU-A satellites
- Both trend and variability in inter-satellite difference time times were greatly reduced





Recalibration of Satellites and Channels of Interest— With MetOp-A As a Reference

	Satellite	δR_0	k	μ_0	λ
Channel 4	Metop-A	0.0	0.0	0.0	0.0
	NOAA-15	-0.043	1.000e-7	-1.088	0.026
	NOAA-18	0.178	0.0	0.426	0.0
	NOAA-19	0.456	0.0	0.750	0.0
Channel 5	Metop-A	0.0	0.0	0.0	0.0
	NOAA-15	-0.442	1.120e-6	-1.253	0.126
	NOAA-18	1.056	-7.100e-7	3.083	-0.150
	NOAA-19	0.617	0.0	0.752	0.0
Channel 6	Metop-A	0.0	0.0	0.0	0.0
	NOAA-15	1.646	-8.100e-7	1.089	-0.18
	NOAA-18	-0.274	0.0	0.120	0.0
	NOAA-19	-0.024	0.0	0.056	0.0
Channel 9	Metop-A	0.0	0.0	0.0	0.0
	NOAA-15	-0.390	1.100e-7	-0.657	-0.006
	NOAA-18	1.347	-1.050e-6	1.446	-0.091
	NOAA-19	0.555	-5.900e-7	0.837	-0.046
Channel 10	Metop-A	0.0	0.0	-0.25	0.0
	NOAA-15	0.519	0.0	-0.571	0.0
	NOAA-18	1.272	-1.080e-6	1.632	-0.089
	NOAA-19	-0.228	0.0	-0.297	0.0

MetOp-A offset was set to be zero; nonlinear coefficient were obtained by IMICA method, but turned out to be zero for most channels



Dataset Information

➤ URL address for FCDR Version 1

- <https://www.ncdc.noaa.gov/cdr/fundamental/amsu-brightness-temperature-noaa>

➤ URL address for IMICA Approach

- <https://www.star.nesdis.noaa.gov/smcd/emb/mscat/algorithm.php>

Thank you!