

Supplementary Materials for

New generation of U.S. satellite microwave sounder achieves high radiometric stability performance for reliable climate change detection

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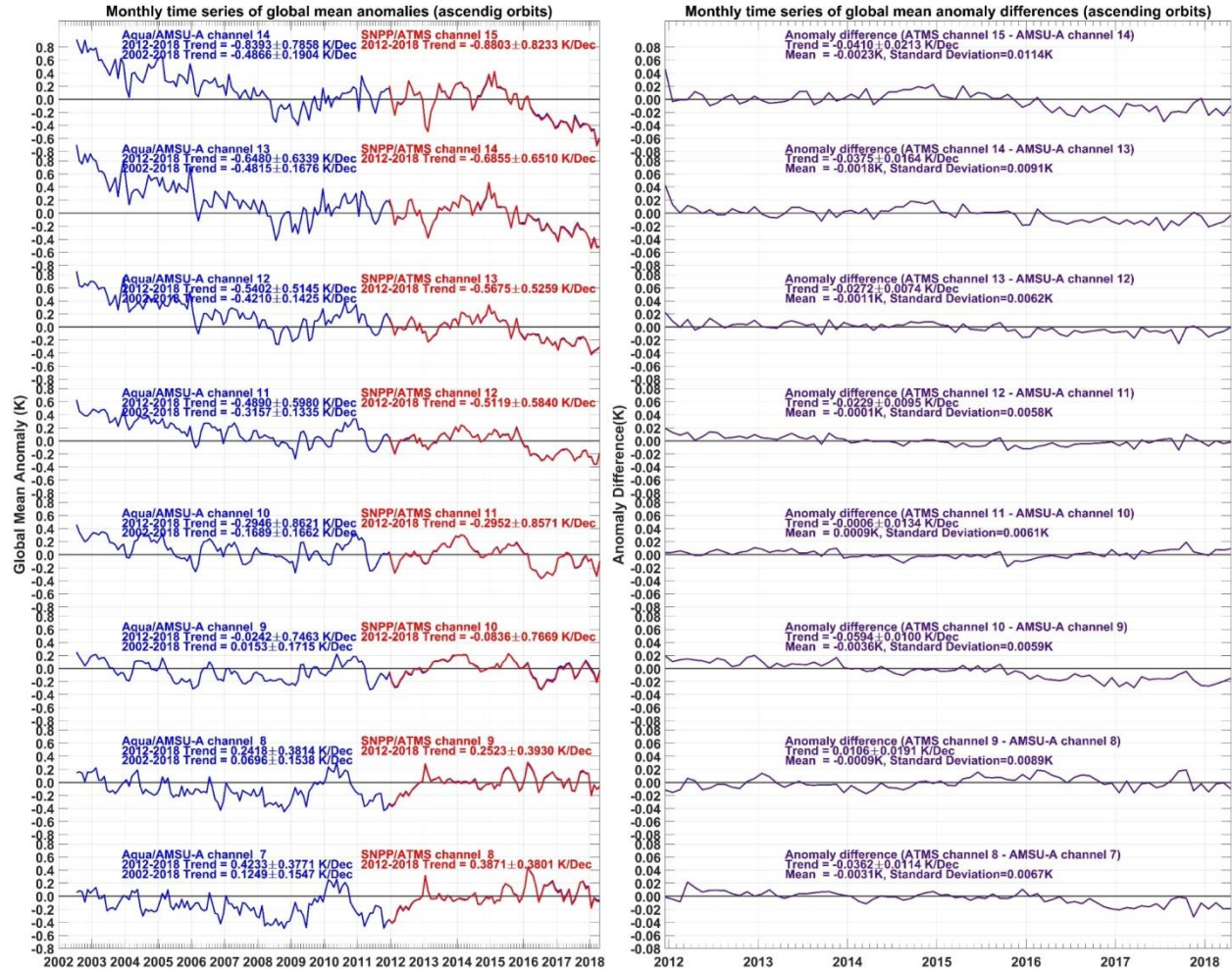


fig. S1A

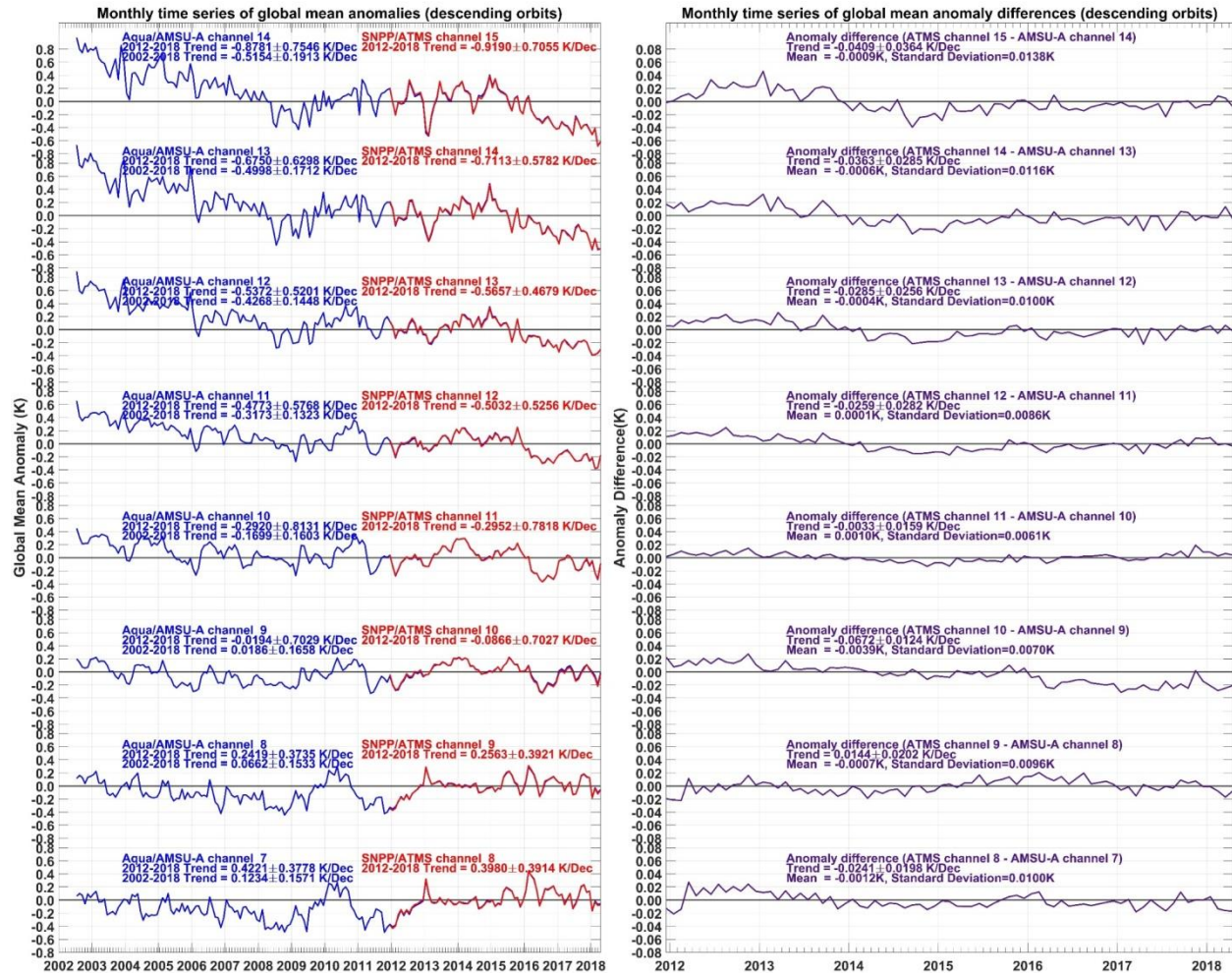


fig. S1B

Fig. S1. Anomaly time series for assessment of radiometric stability for all analyzed SNPP/ATMS and Aqua/AMSU-A channels. Monthly global mean anomaly time series of brightness temperatures for AMSU-A channels 7 through 14 onboard Aqua (blue, left panel) versus ATMS channels 8 through 15 onboard SNPP (red, left panel) and their differences (right panel) for ascending (A) and descending (B) orbits, respectively. The AMSU-A and ATMS data are respectively from June 2002 and December 2011 to April 2018. The AMSU-A time series are overlaid by ATMS during their overlapping period from 2012 to 2018. Both ATMS and AMSU-A data are from limb-adjusted views. Uncertainties in trends represent 95% confidence intervals with autocorrelation adjustment.

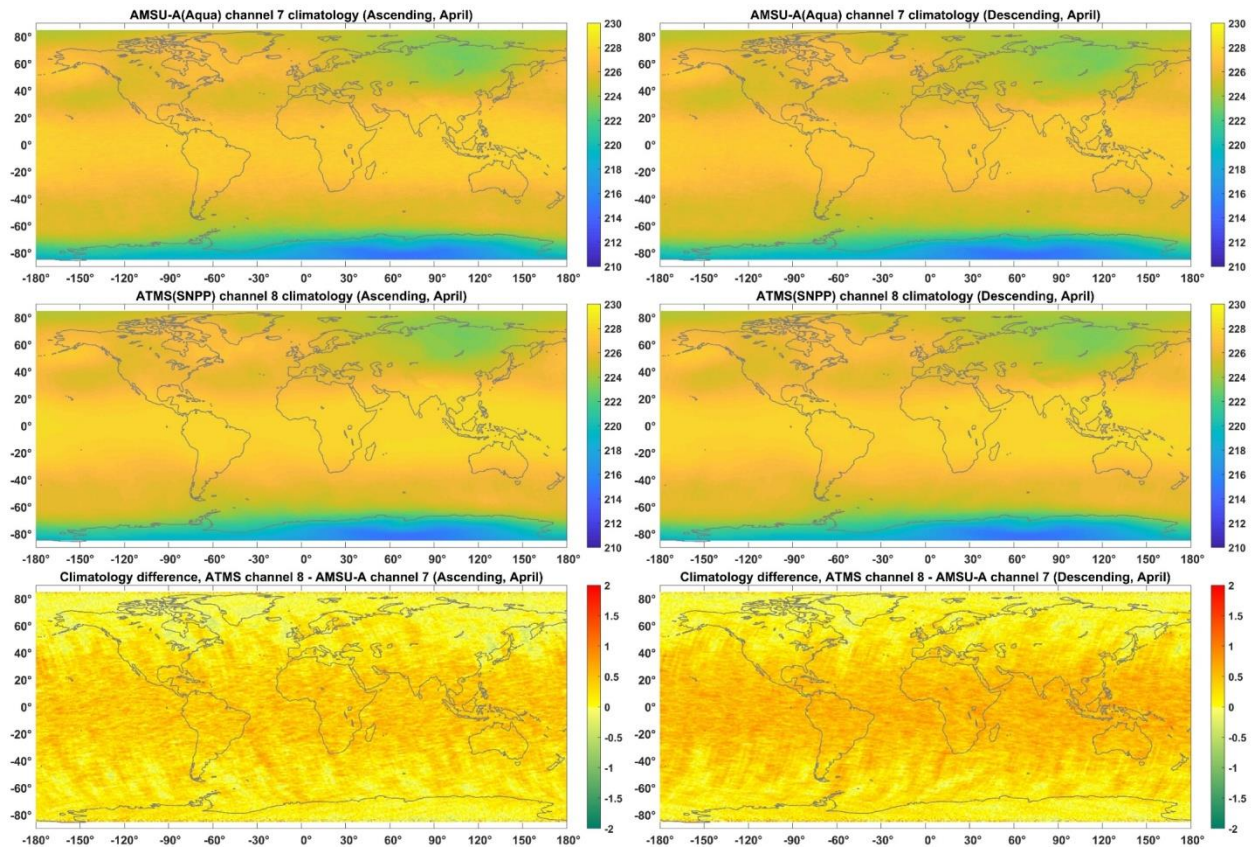


fig. S2

Fig. S2. Climatology of upper-tropospheric temperature in April. Climatology of April for Aqua/AMSU-A channel 7 (top panels) versus its ATMS counterpart channel 8 (middle panels) and their differences (ATMS minus AMSU-A, bottom panels) for ascending (left panels) and descending (right panels) orbits, respectively. The constant offset for their differences represents a time-invariant calibration bias in either instruments (9-10).

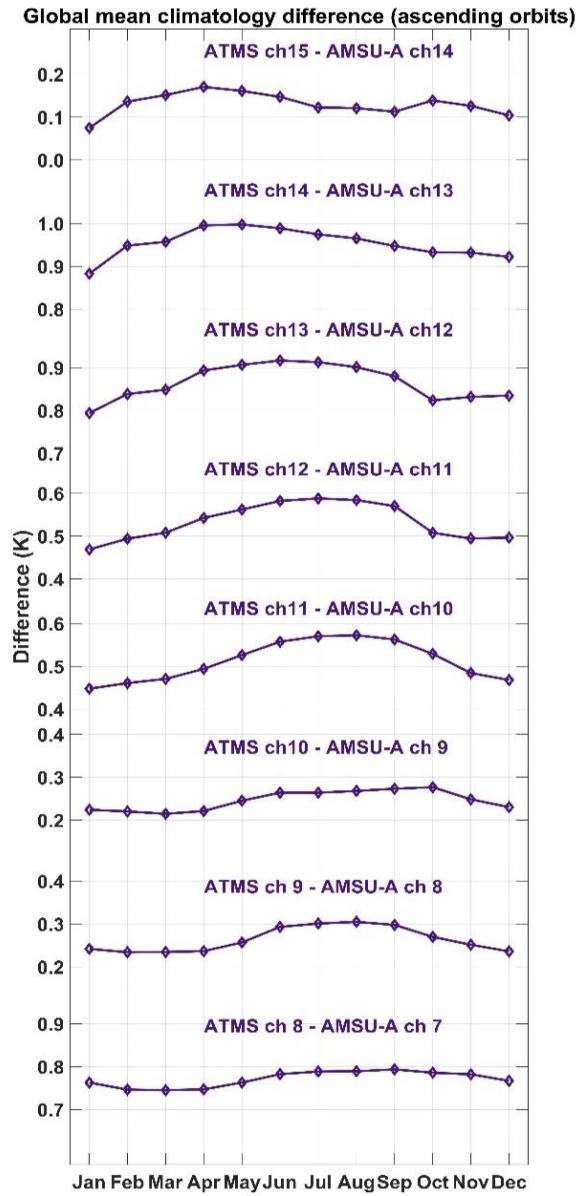
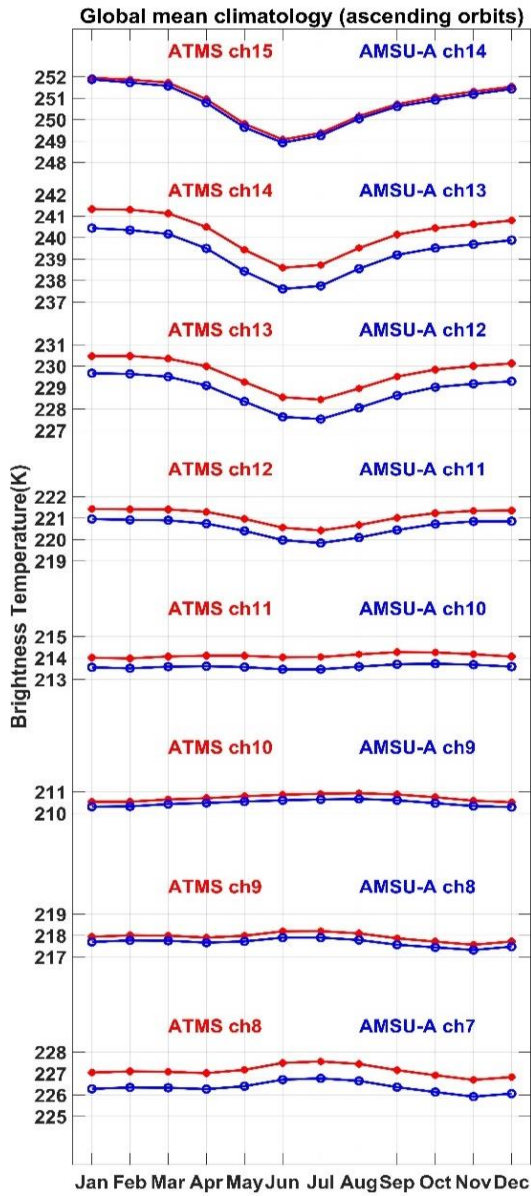


fig. S3A

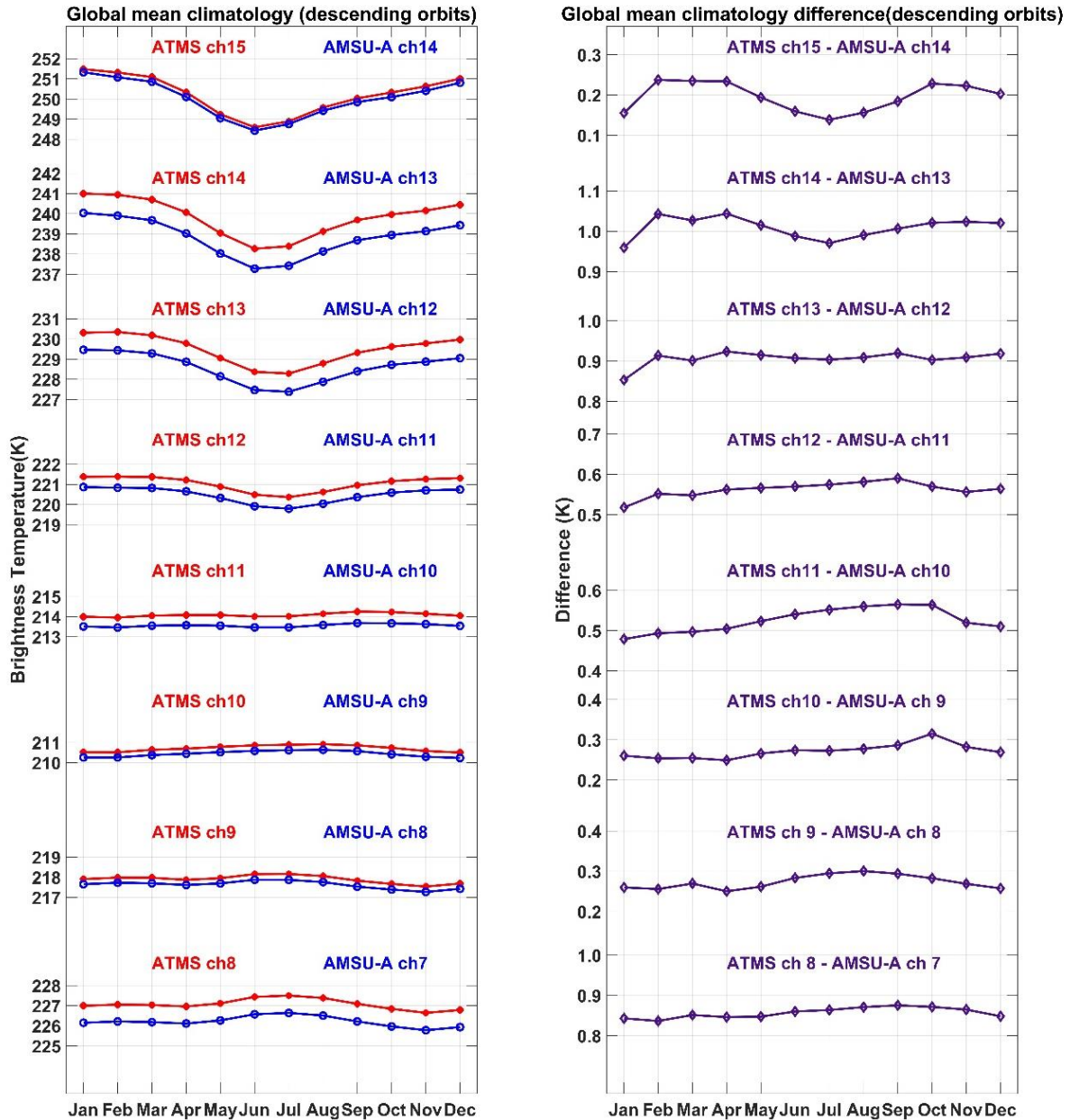


fig. S3B

Fig. S3. Global mean climatology for all analyzed SNPP/ATMS and Aqua/AMSU-A channels. Global mean climatology for SNPP/ATMS (red, left panel) and Aqua/AMSU-A (blue, left panel) and their differences (right panel) for each channel for ascending (A) and descending (B) orbits, respectively. The constant offset for their differences represents a time-invariant calibration bias in either instruments (9-10). Note that local observation time is different at different geolocations. As such, these global averages are not climatology for a specific time and only used for demonstrating calibration biases and their seasonal changes.

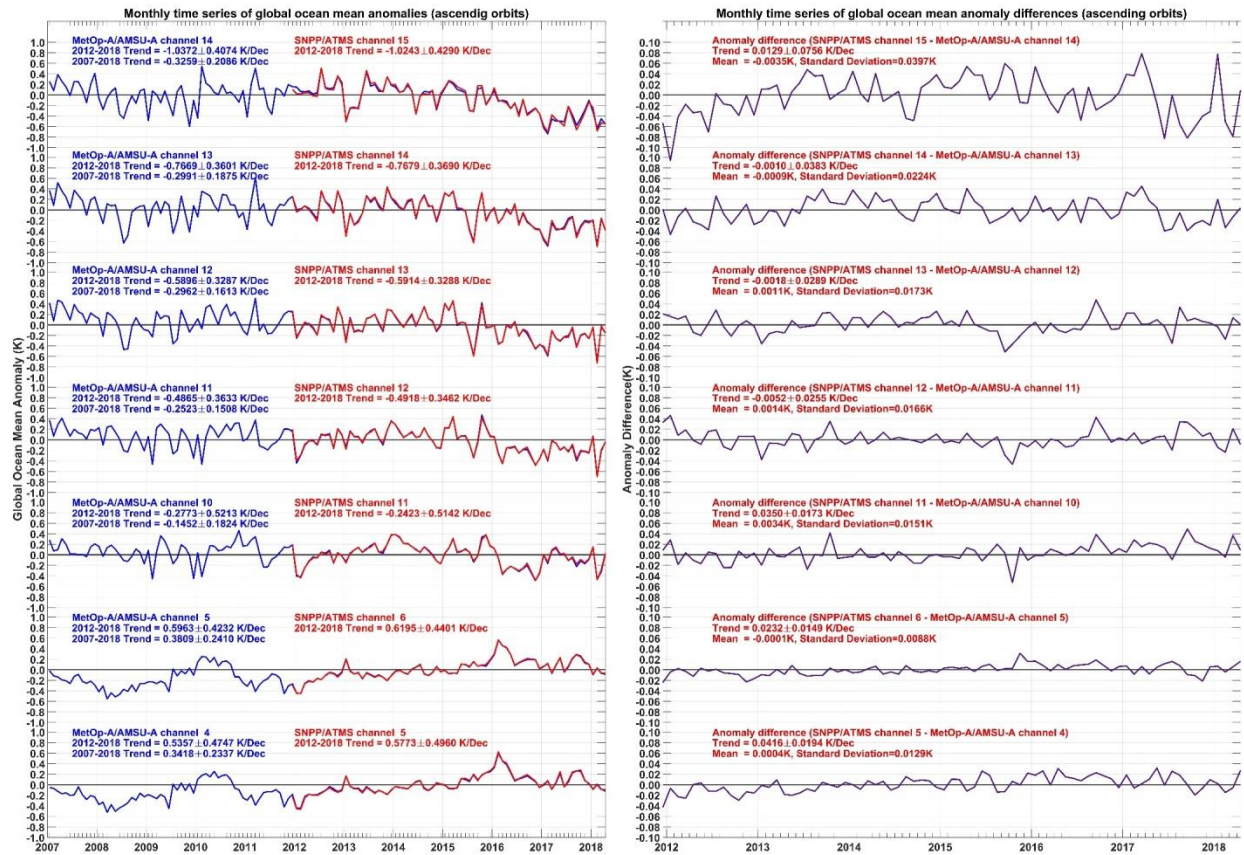


fig. S4A

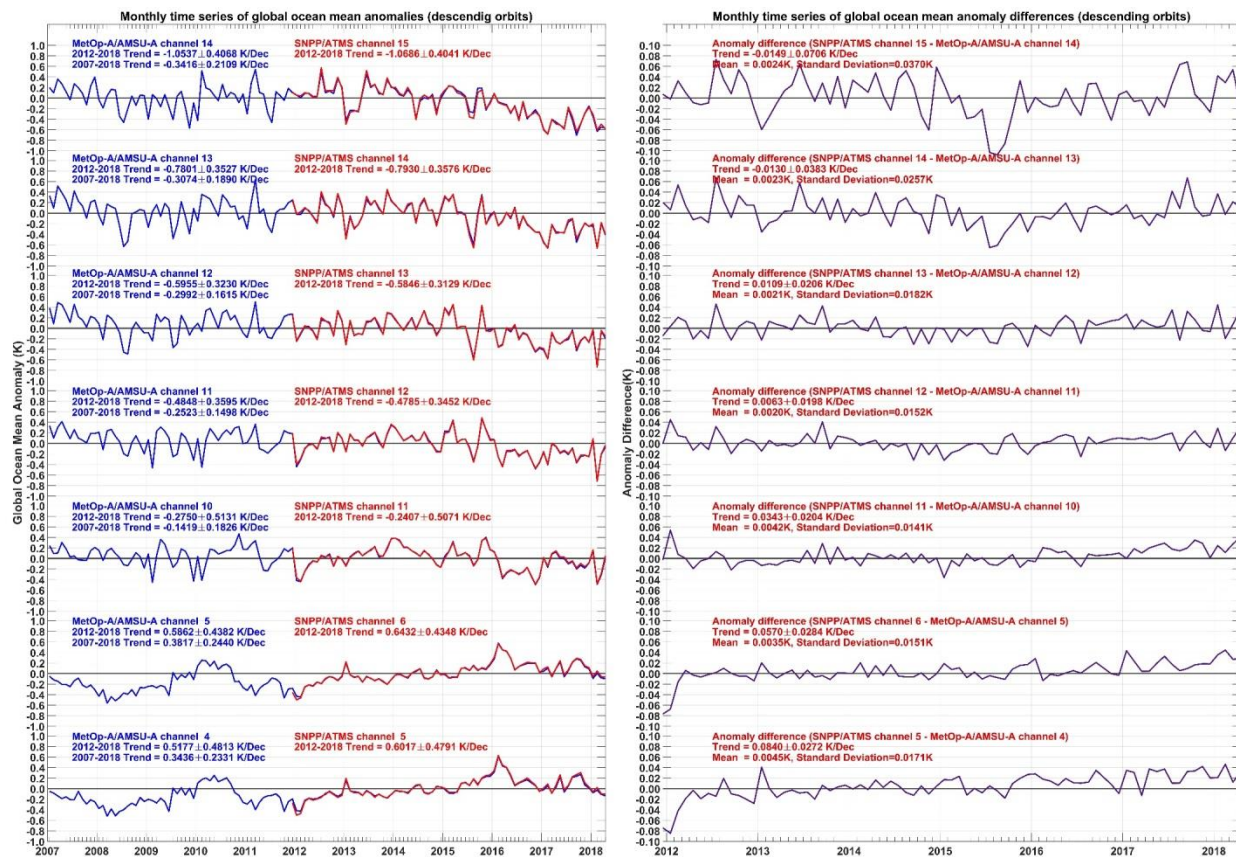


fig. S4B

Fig. S4. Anomaly time series for assessment of radiometric stability and asymmetric diurnal temperature trends over ocean for all analyzed SNPP/ATMS and MetOp-A/AMSU-A channels. Monthly anomaly time series of global ocean mean brightness temperatures for AMSU-A channels 4, 5, and 10 through 14 onboard MetOp-A (blue, left panel) versus ATMS channels 5, 6, and 11 through 15 onboard SNPP (red, left panel) and their differences (right panel) for ascending (A) and descending (B) orbits, respectively. The AMSU-A and ATMS data are respectively from January 2007 and December 2011 to April 2018. The AMSU-A time series are overlaid by ATMS during their overlapping period from 2012 to 2018. Both ATMS and AMSU-A data are from limb-adjusted views. Uncertainties in trends represent 95% confidence intervals with autocorrelation adjustments.

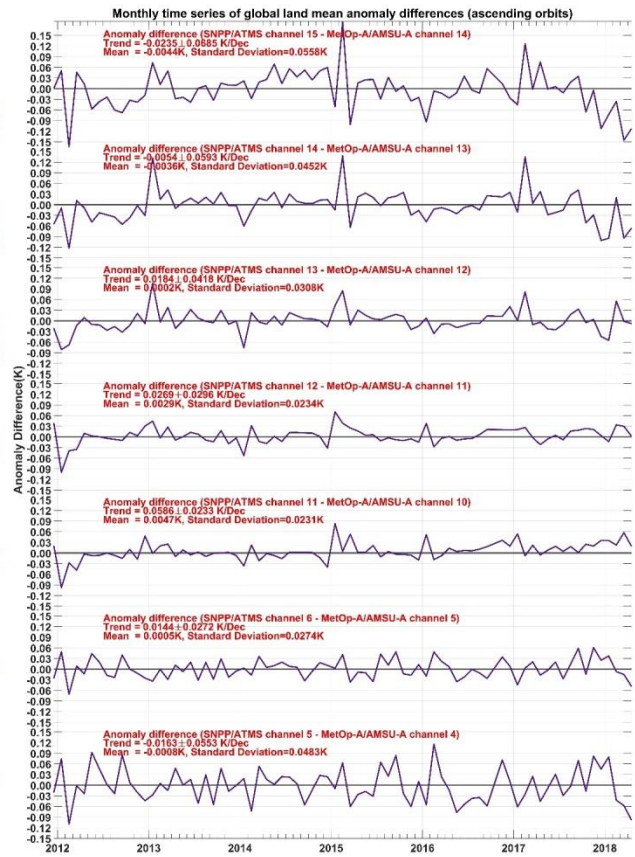
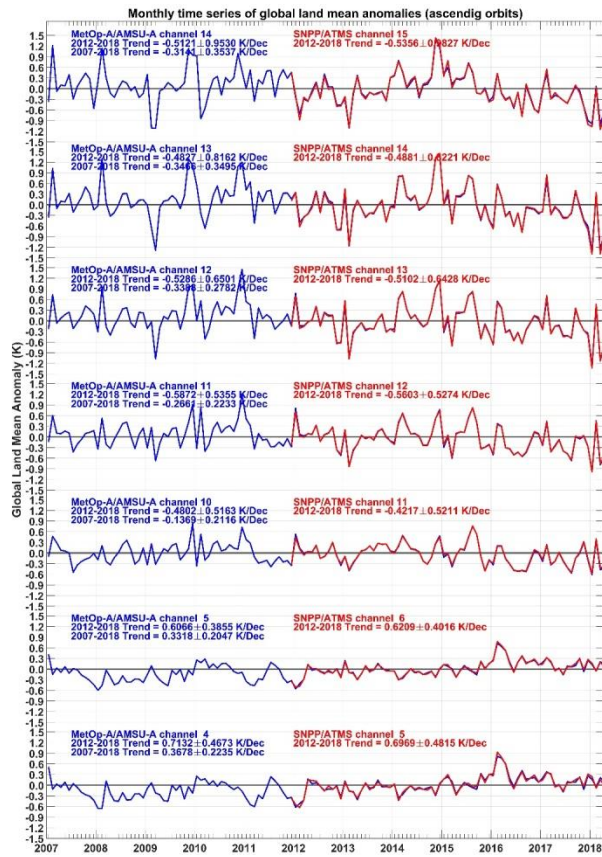


fig. S5A

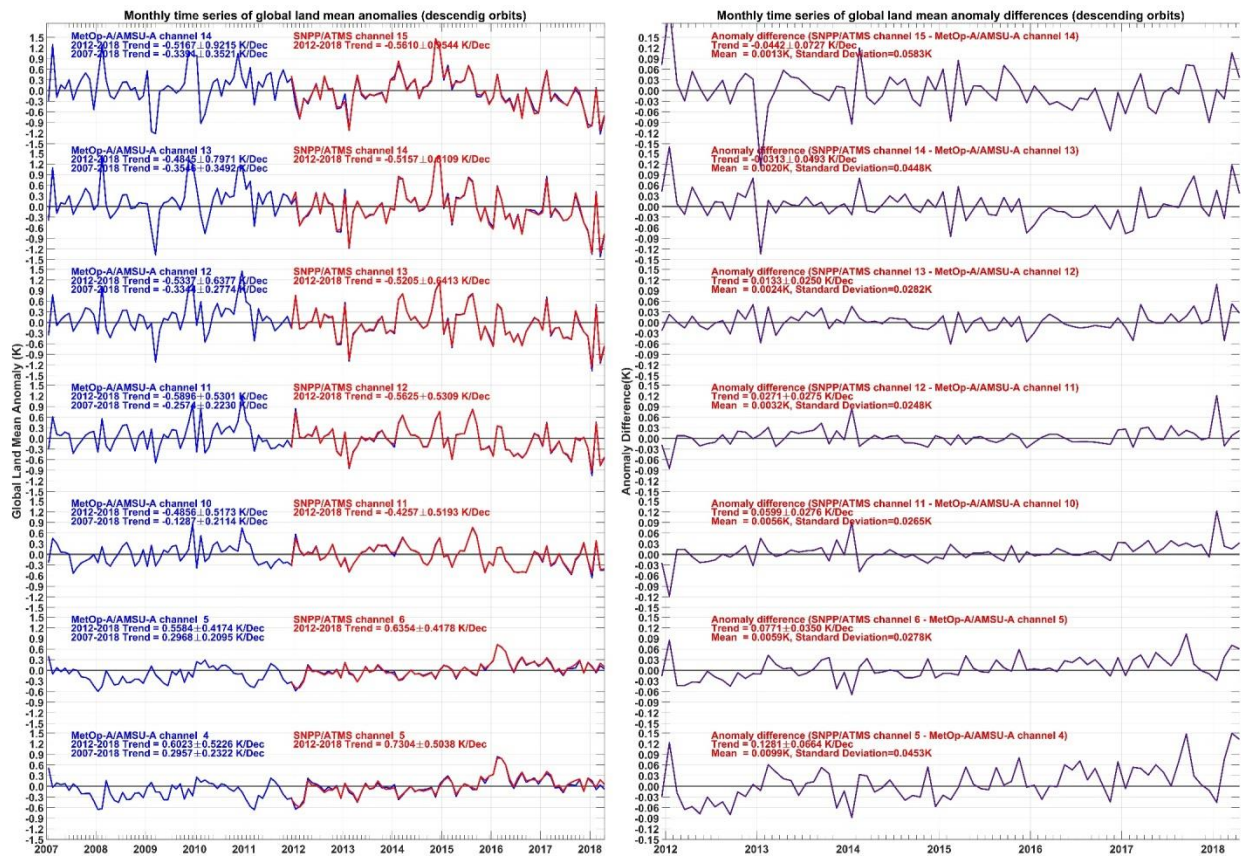


fig. S5B

Fig. S5. Anomaly time series for assessment of radiometric stability and asymmetric diurnal temperature trends over land for all analyzed SNPP/ATMS and MetOp-A/AMSU-A channels. Monthly anomaly time series of global land mean brightness temperatures for AMSU-A channels 4, 5, and 10 through 14 onboard MetOp-A (blue, left panel) versus ATMS channels 5, 6, and 11 through 15 onboard SNPP (red, left panel) and their differences (right panel) for ascending (A) and descending (B) orbits, respectively. The AMSU-A and ATMS data are respectively from January 2007 and December 2011 to April 2018. The AMSU-A time series are overlaid by ATMS during their overlapping period from 2012 to 2018. Both ATMS and AMSU-A data are from limb-adjusted views. Uncertainties in trends represent 95% confidence intervals with autocorrelation adjustments.