Version 3.3 to Version 4.0 Changes: *Carl Mears, March 2, 2016*

This section summarizes the changes between the version 3.3 and version 4.0 TMT and TTT products of the RSS AMS/AMSU atmospheric temperature datasets.

This change represents a major upgrade. There are 4 important changes to the methods used to construct the new products.

1. The method was changed that is used to make adjustments for drifting satellite measurement time, the "diurnal adjustment". In the new V4.0 method, the model-based diurnal cycle climatology used for the adjustments was optimized so that it more accurately removes intersatellite differences due to drifting local measurement times. This is the most important change, and leads to substantially more warming during the 1999-2005 period when the NOAA-15 satellite was drifting rapidly.

2. Intersatellite offsets are now calculated separately for land and ocean scenes. This prevents errors in the much larger land measurement time adjustments from adversely affecting the ocean measurements, where the adjustments for measurement time are much smaller.

3. More fields of view are now included in the dataset. The previous version used the central 5 (out of 11 total) fields of view for MSU, and the central 12 (out of 30) fields of view for AMSU. This new version uses the central 9 MSU fields of view, and the central 24 AMSU fields of view. This reduces the size of the gaps between satellite swaths, and serves to reduce spatial noise in the monthly mean maps.

4. Two new satellites, NOAA-19 (data start in 2009) and METOP-B (data start in 2012), have been added to the dataset.

For more details on the new version, refer to the recently accepted paper describing this upgrade in the Journal of Climate. An early online edition of the paper is available online. The paper can be found at http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-15-0744.1

Some questions are answered on the RSS blog: http://www.remss.com/blog/RSS-TMT-updated.

Version 3.2 to Version 3.3 Differences: *Carl Mears, February 7, 2010*

This section describes the changes that occurred between version 3.2 and version 3.3 of the RSS MSU/AMSU atmospheric temperature datasets.

The purpose of making the version change is to include data from the AMSU instruments on AQUA, NOAA-18, and MetOP-A. Version 3.2 only used AMSU data from NOAA-15, which is now in its 13th year of operation. Figure 1 shows the satellites used during each month for the two versions.

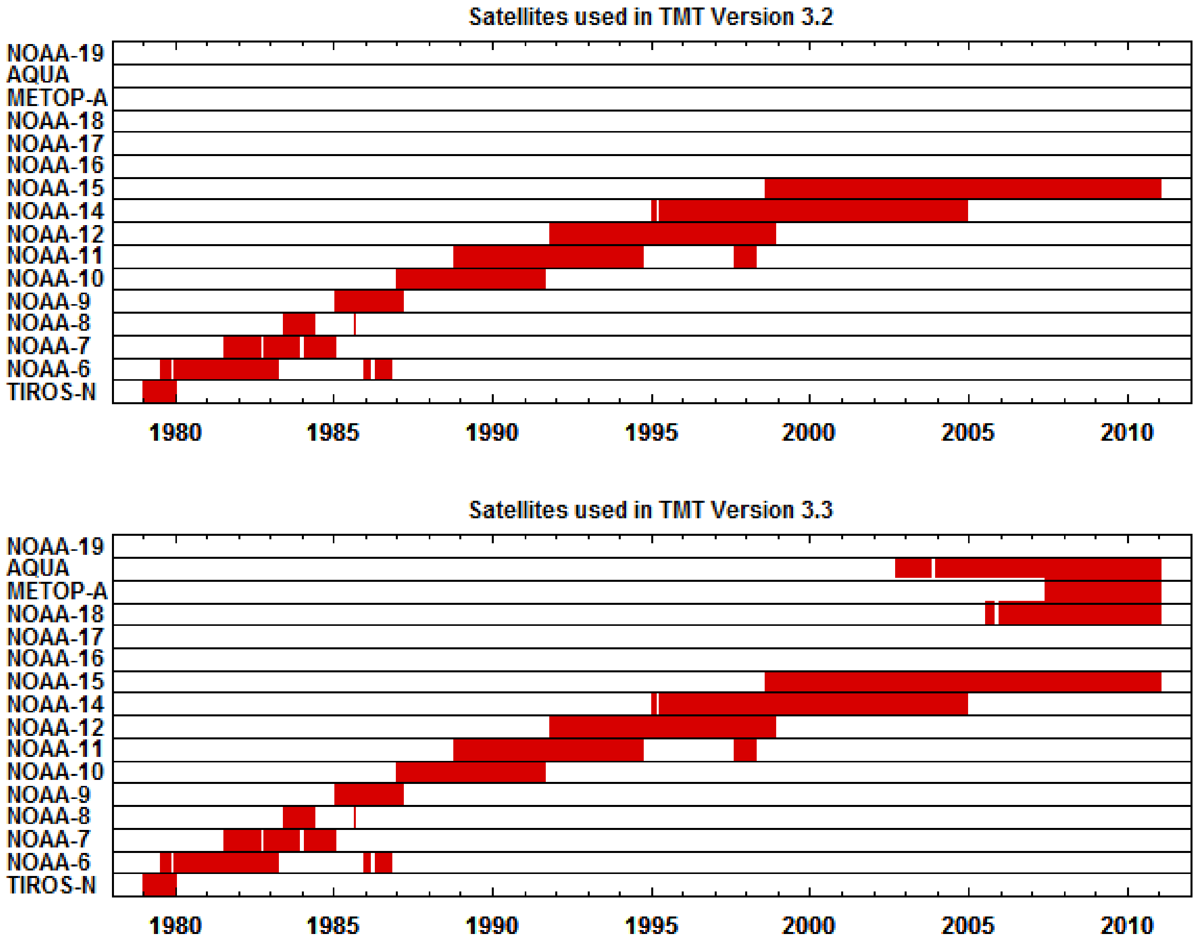

Fig. 1. Time series plots of the satellites used in versions 3.2 and 3.3. Red means that a given satellite is used in the merged product, and white means that it is not used or not present. These plots are for the middle tropospheric channel. Other channels are similar.

The addition of the newer AMSU data has several effects on the final product.

- A small reduction in globally averaged warming after 2002 for channels TLT and TMT
- A small increase in warming in land regions, particularly in the subtropics
- A reduction of sampling noise in monthly averaged map, particularly for TTS and TLS, during times when more than one AMSU is operating.

The first effect is due to a combination of two causes. First, the addition of the AMSU data tends to de-emphasize the effect of the warm bias in NOAA-14 relative to NOAA-15 (and AQUA) during its last years of operation. Second, the addition of the newer satellites increases the number of different local times that are sampled by the satellite system. This reduces the importance of the adjustment for the diurnal cycle after mid 2002, and reduces the effect of any errors in the diurnal cycle model we use to adjust for changing local measurement times. This is also the cause of the relative changes in land and ocean trends, the second effect from above. A third possible cause, the changes in the target factors due to the addition of the new data, is less important.

The third effect is simply a result of having more data. The effects can be seen as a reduction in "orbital striping" in the individual monthly anomaly maps available on this website, as well as in the trend maps presented below.

We would like to emphasize that these changes are well within the estimated uncertainty in our dataset. A detailed error analysis for all 4 channels has accepted by the Journal of Geophysical Research. A preprint and other explanatory material will be posted to this website shortly.

Other the following pages, we present time series and trend maps to show the differences between the two datasets explicitly.

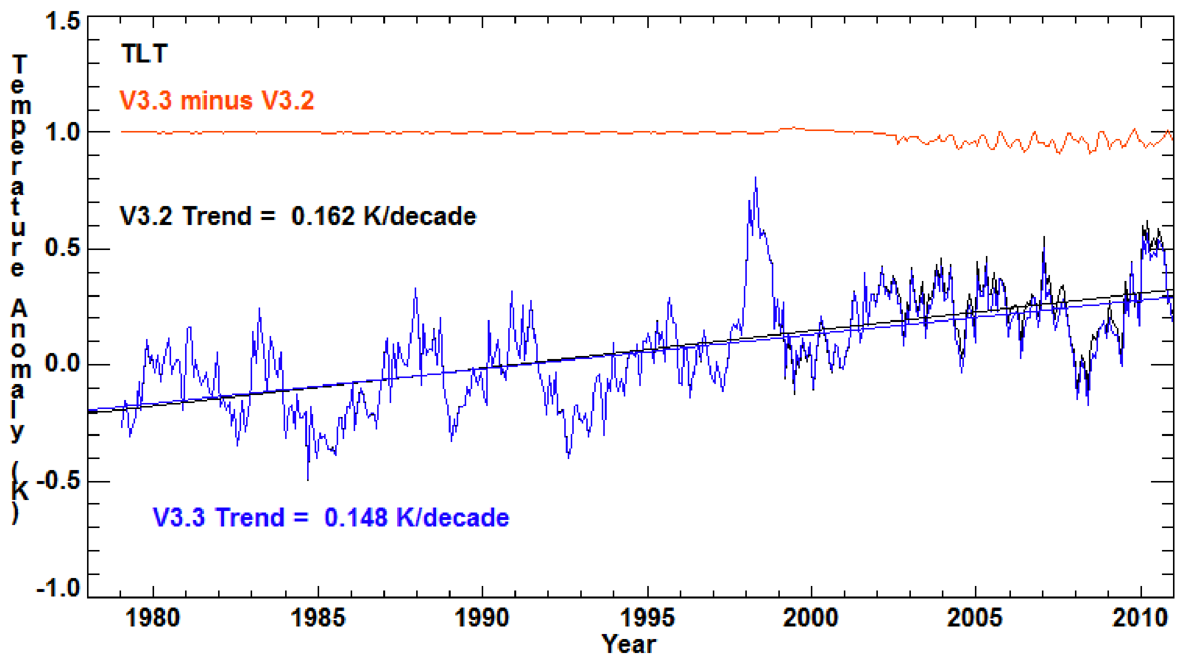

Fig. 2. Global TLT Time Series.

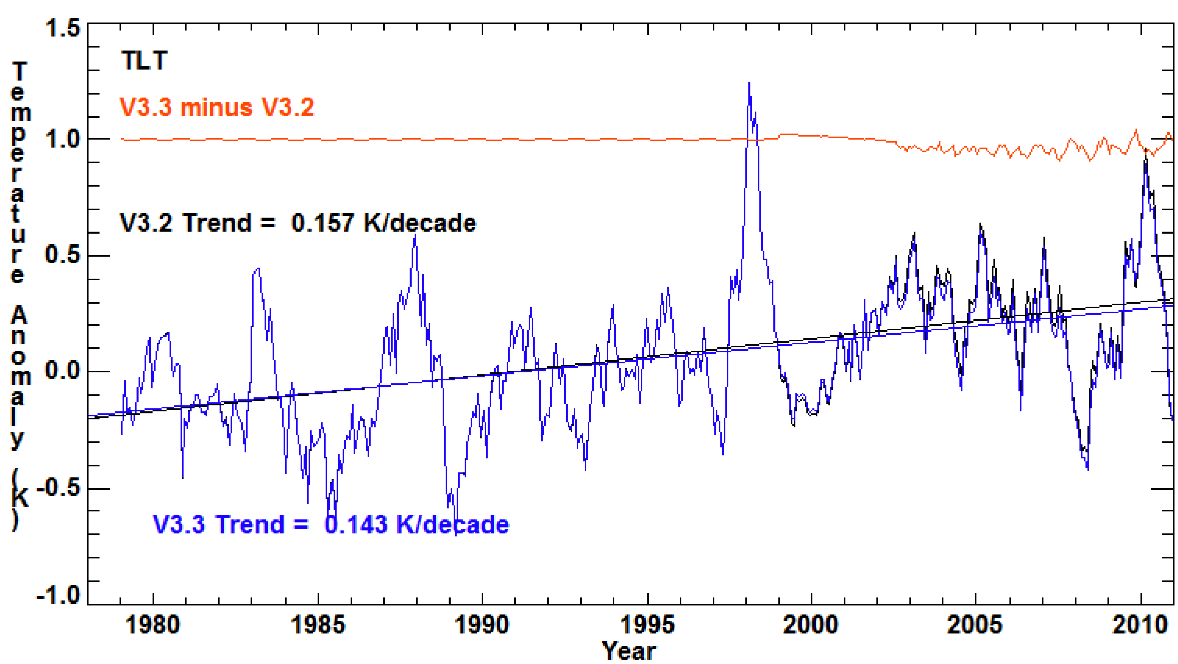

Fig. 3. Tropical (25S to 25N) TLT Time series. Trends are 1979-2010. Base period is 1979-2004

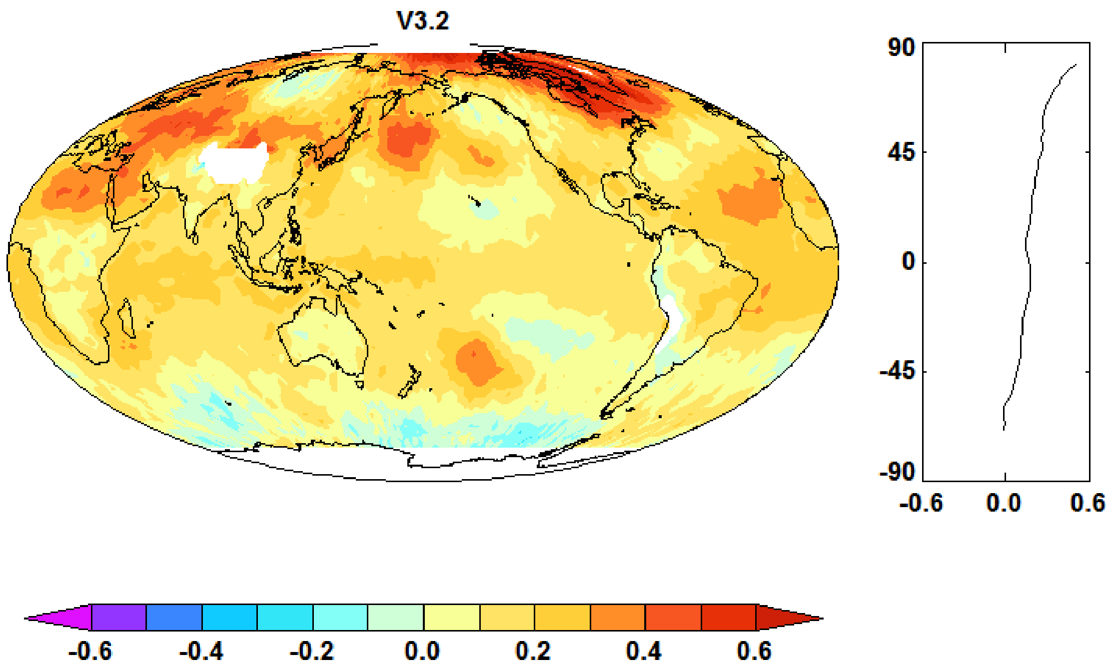

Fig. 4. V3.2 TLT Trends

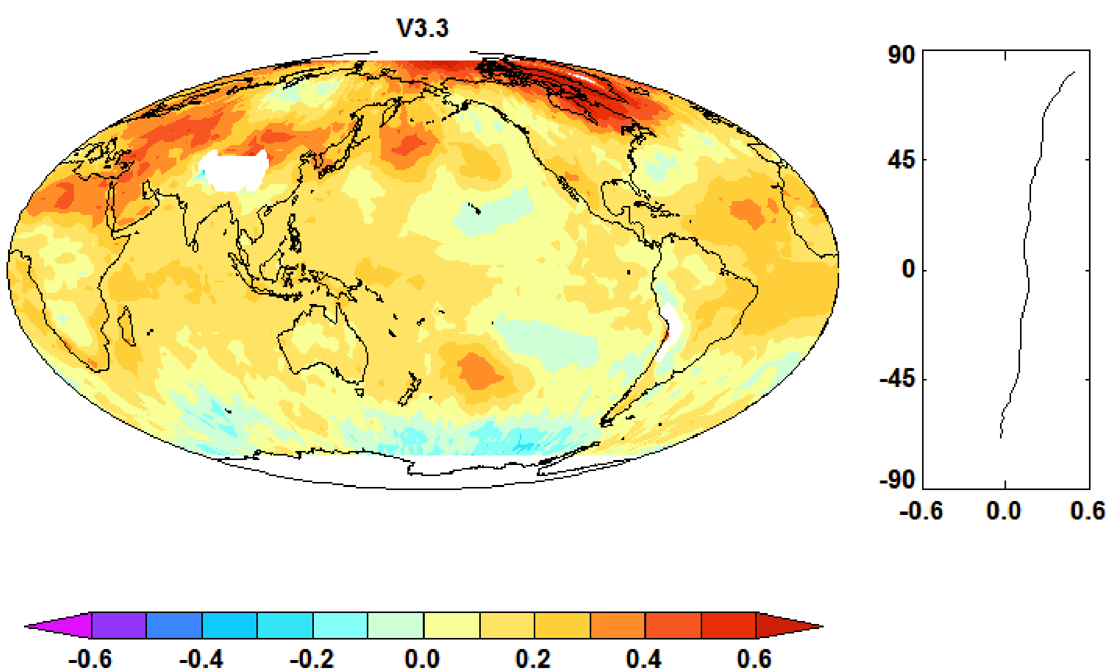

Fig. 5. V3.3 TLT Trends

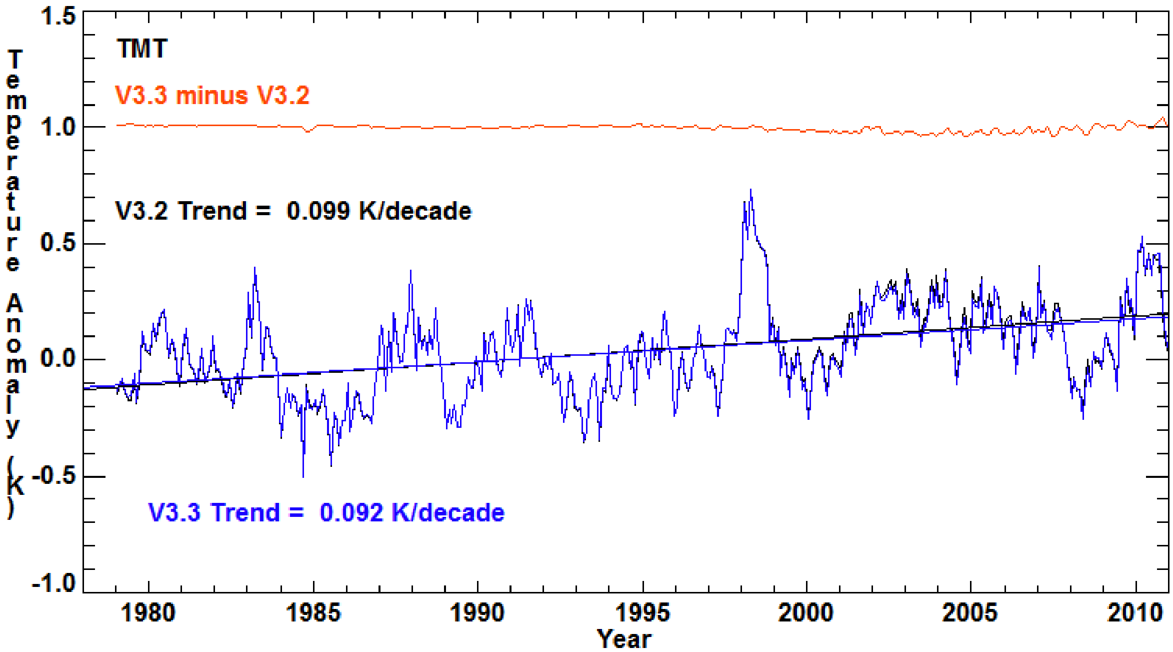

Fig. 6. Global Times TMT Time Series.

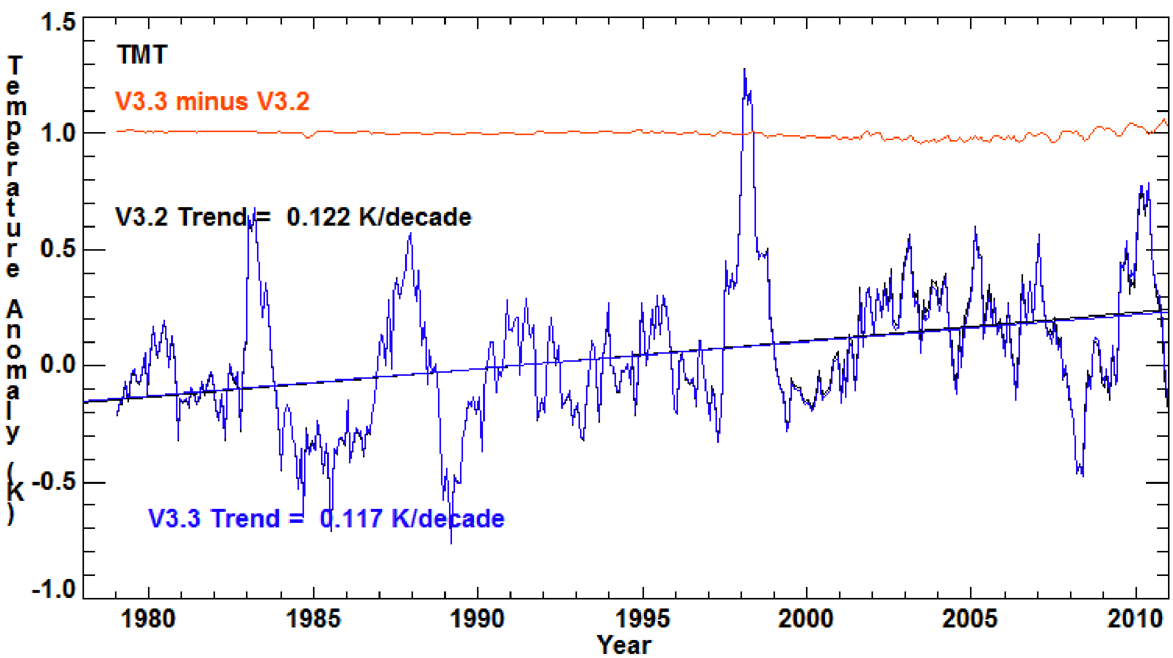

Fig. 7. Tropical (25S to 25N) time series, 1979-2010. Note that despite the reduction in overall trend, by the end of the current time period, V3.3 is warmer than 3.2. This suggests that the trends would become closer together as time goes on, if we chose to continue processing the data using V3.2 methods.

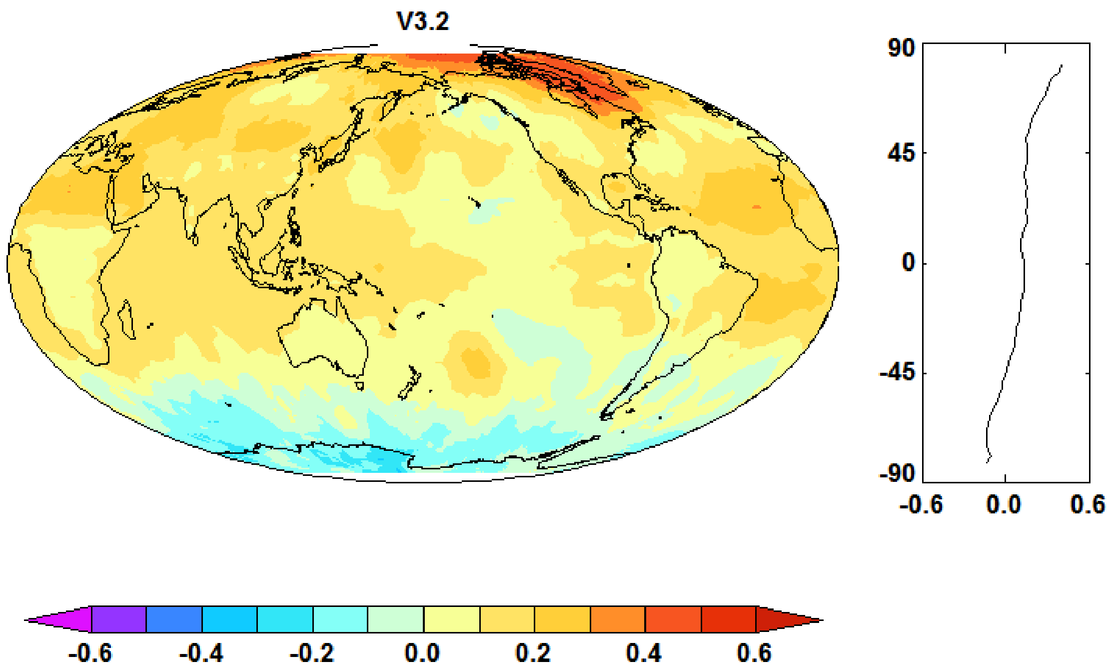

Fig 8. V3.2 TMT Trends.

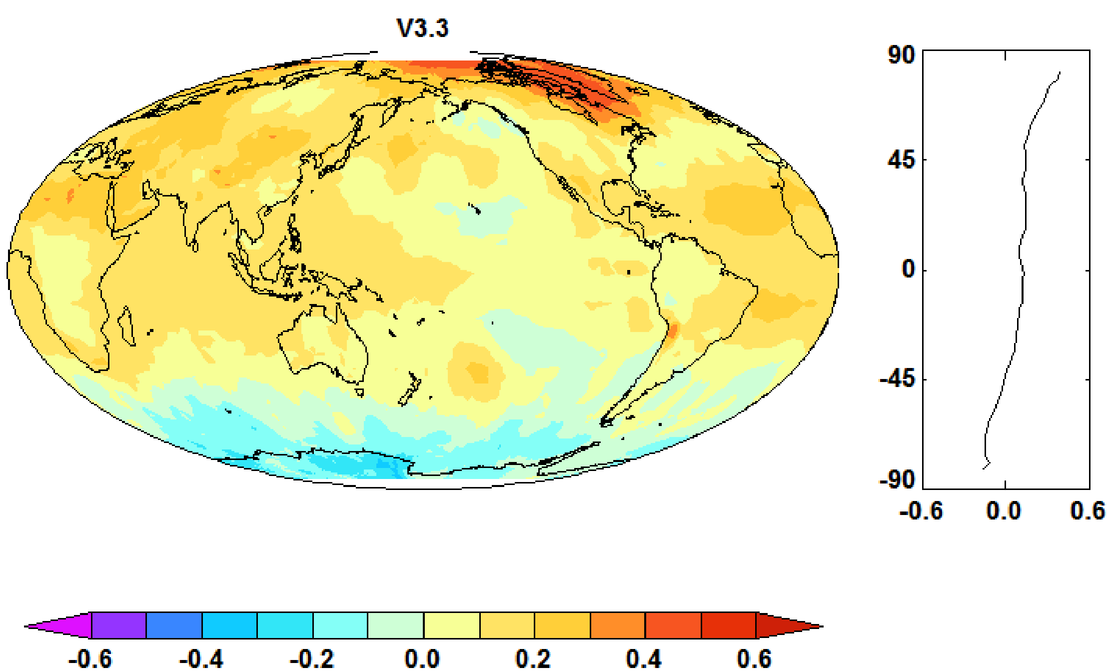

Fig. 9. V3.3 TMT Trends. Note the small increase in land trends , most visible in Africa.

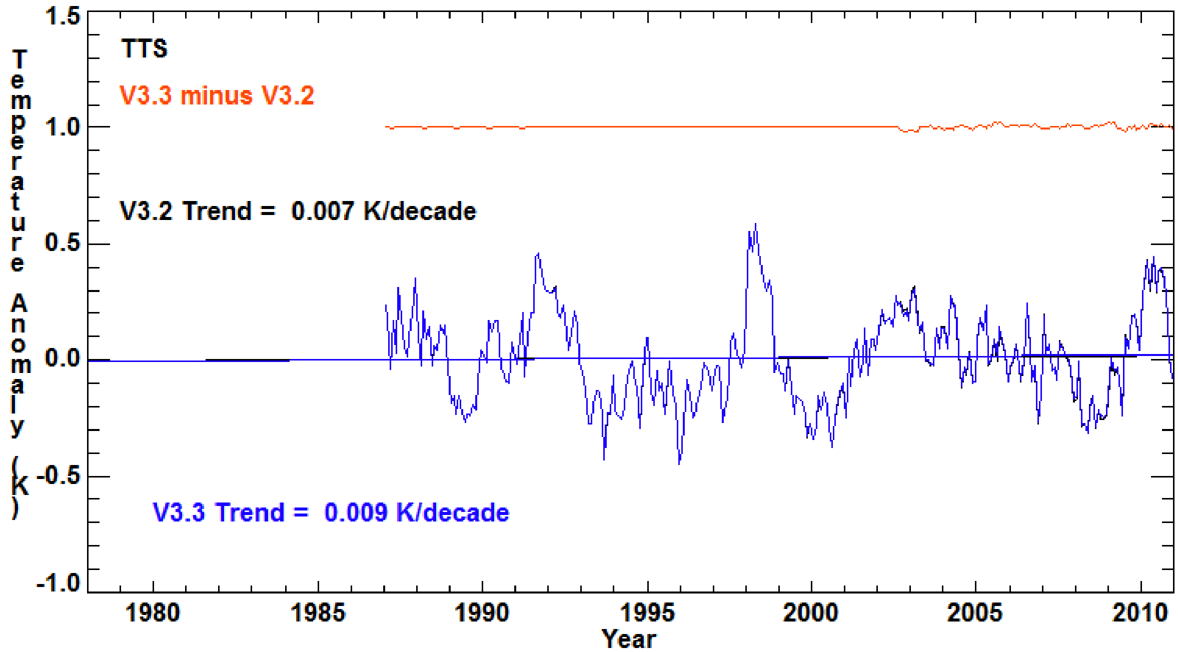

Fig. 10. Global TTS Time Series

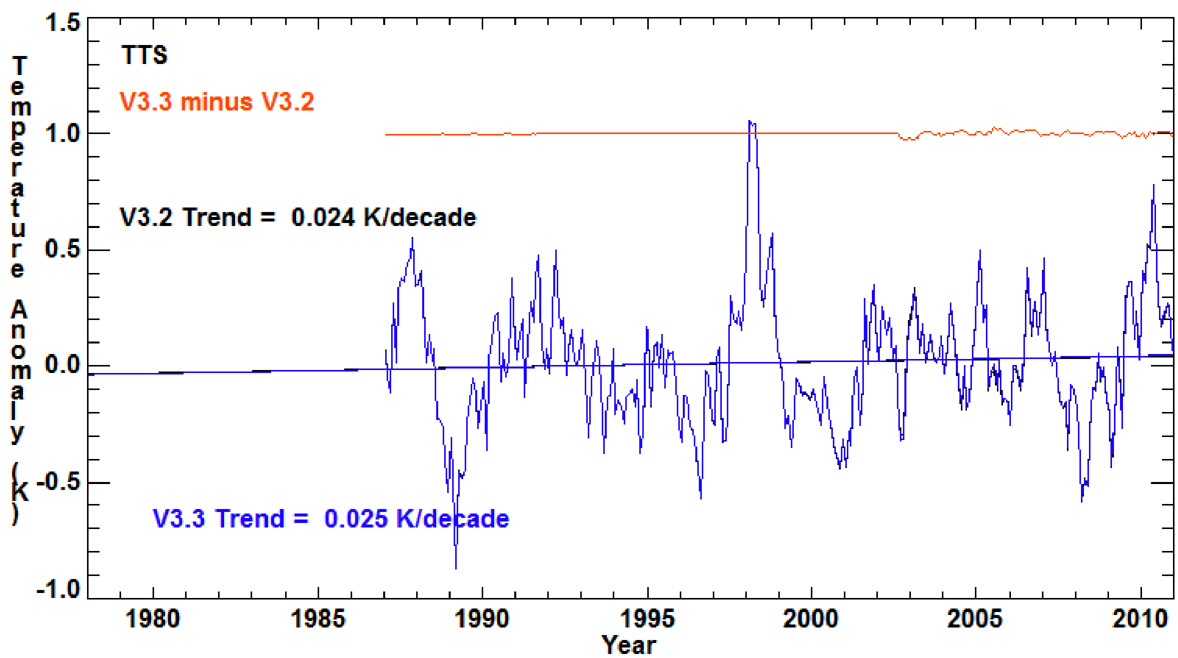

Fig. 11 Tropical (25S-25N) time series

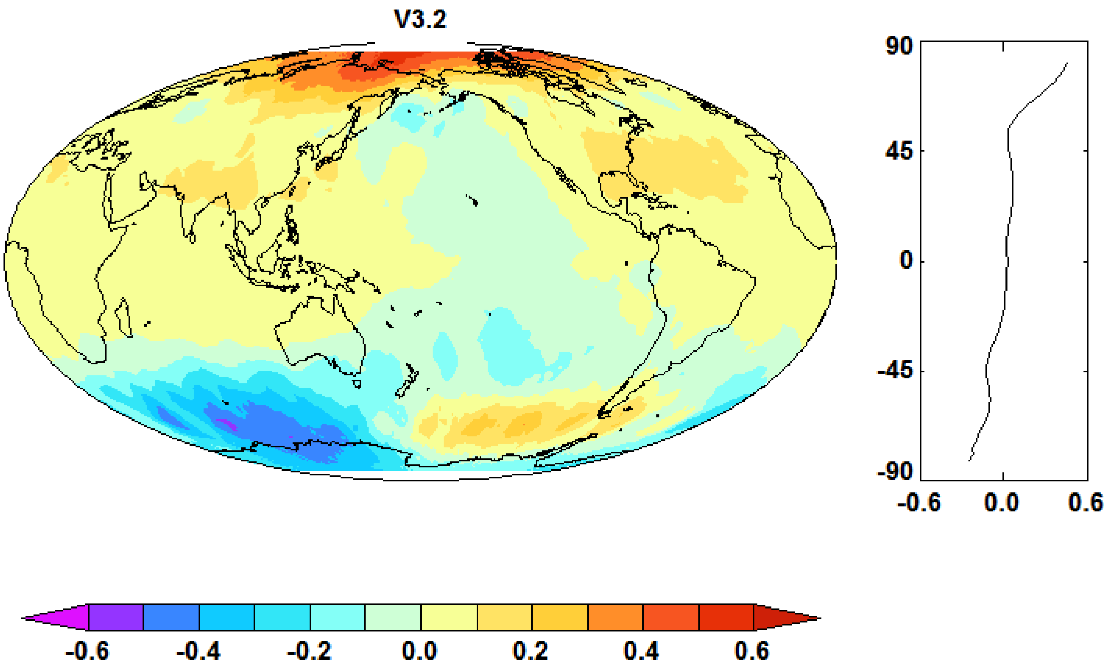

Fig 12. V3.2 TTS trends

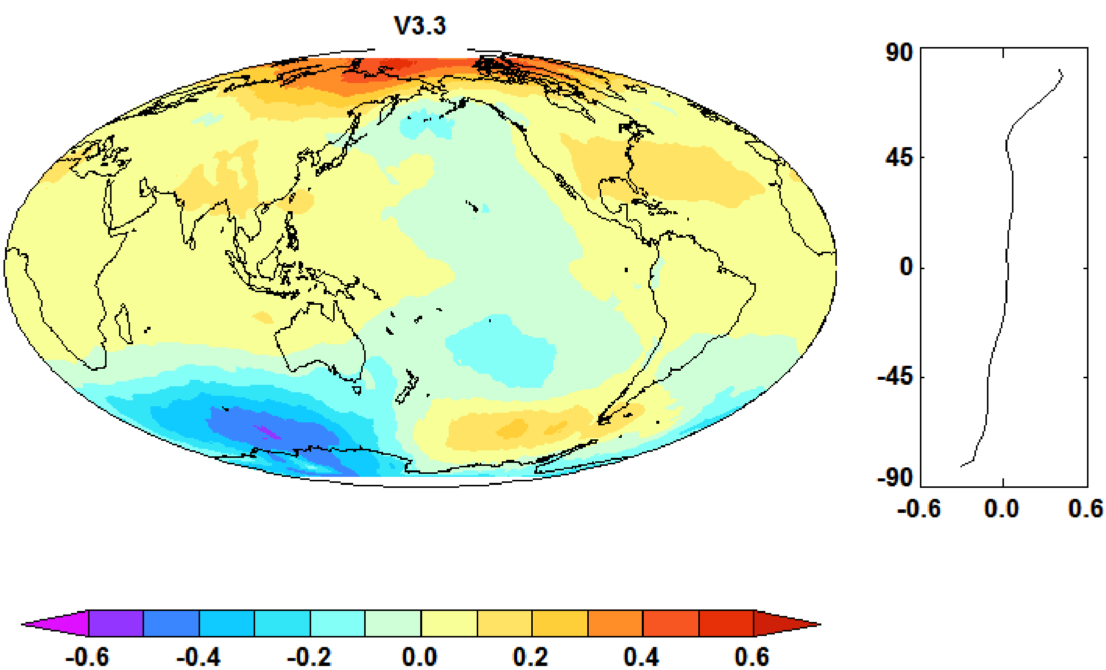

Fig 13. V3.3 TTS Trends. Note reduction in “orbital striping”, most visible in the southern ocean. This is due to a reduction in sampling noise for time periods where more AMSUs are available.

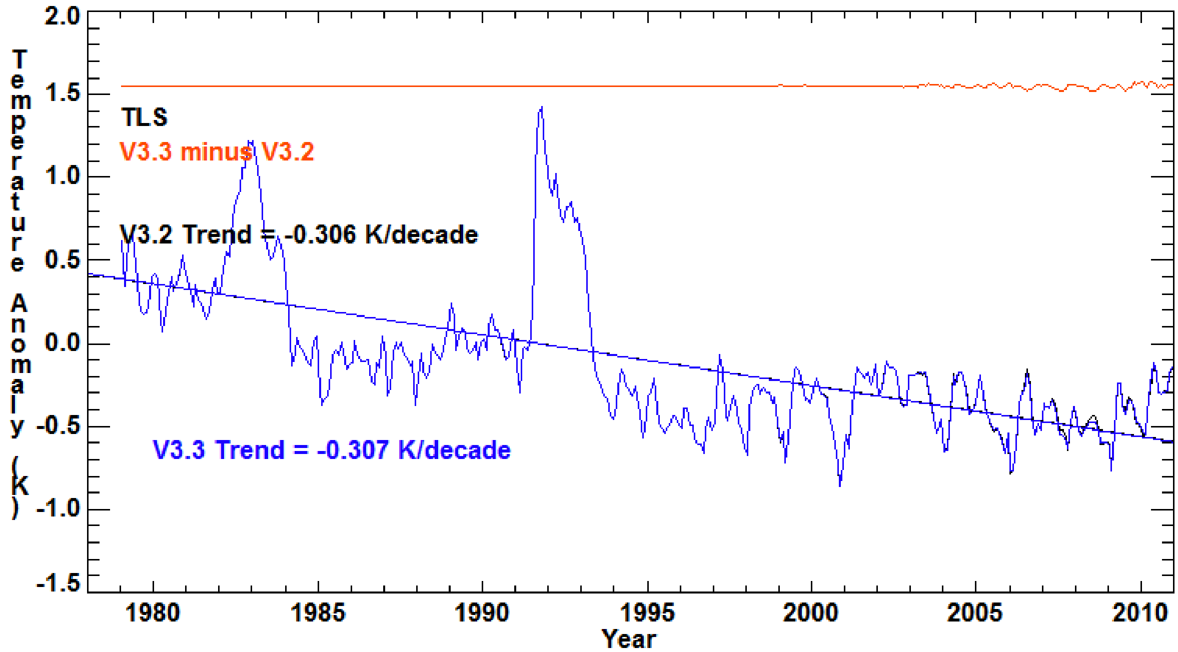

Fig. 14. Global TLS Time Series.

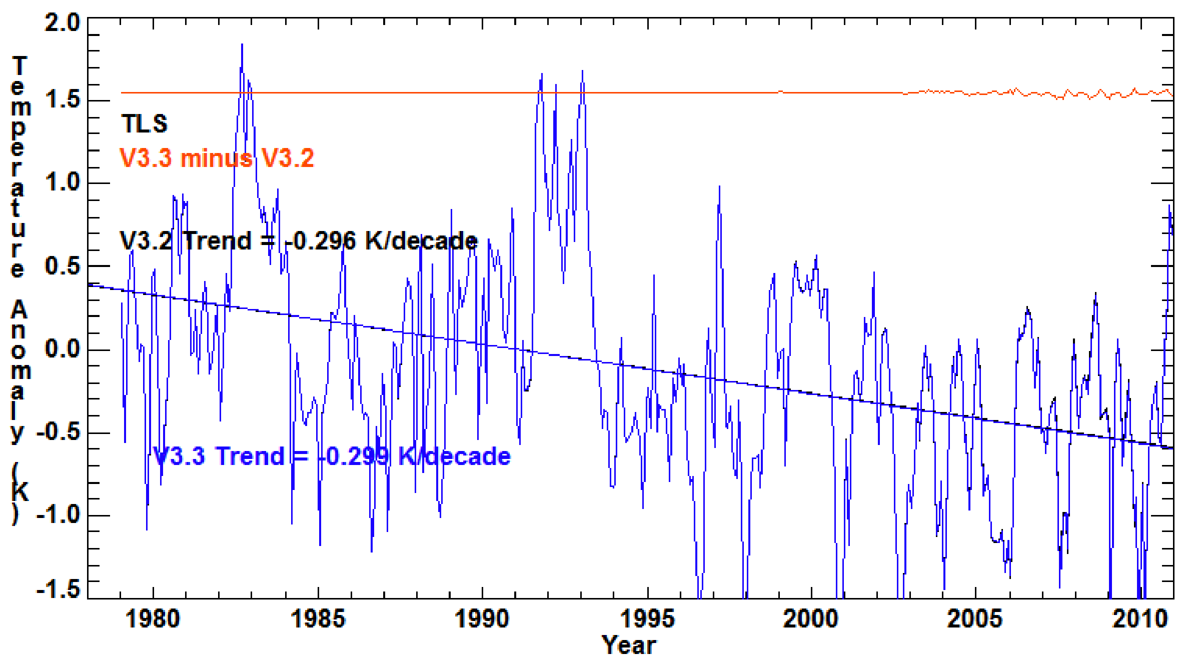

Fig. 15. Tropical TLS Time Series

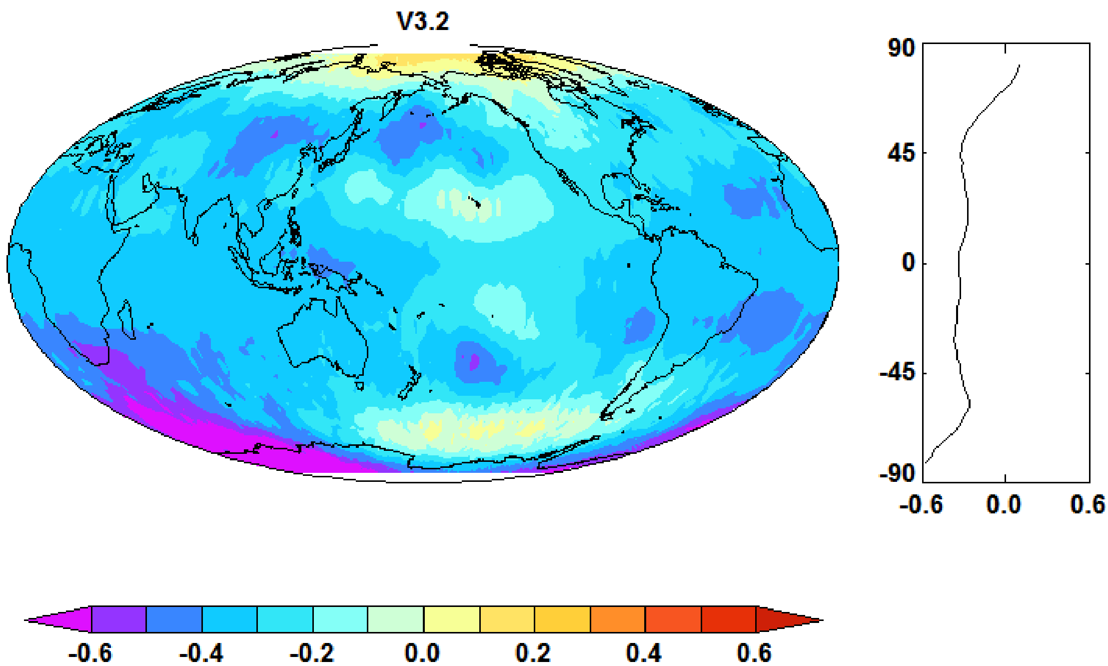

Fig. 16. V3.2 TLS Trends

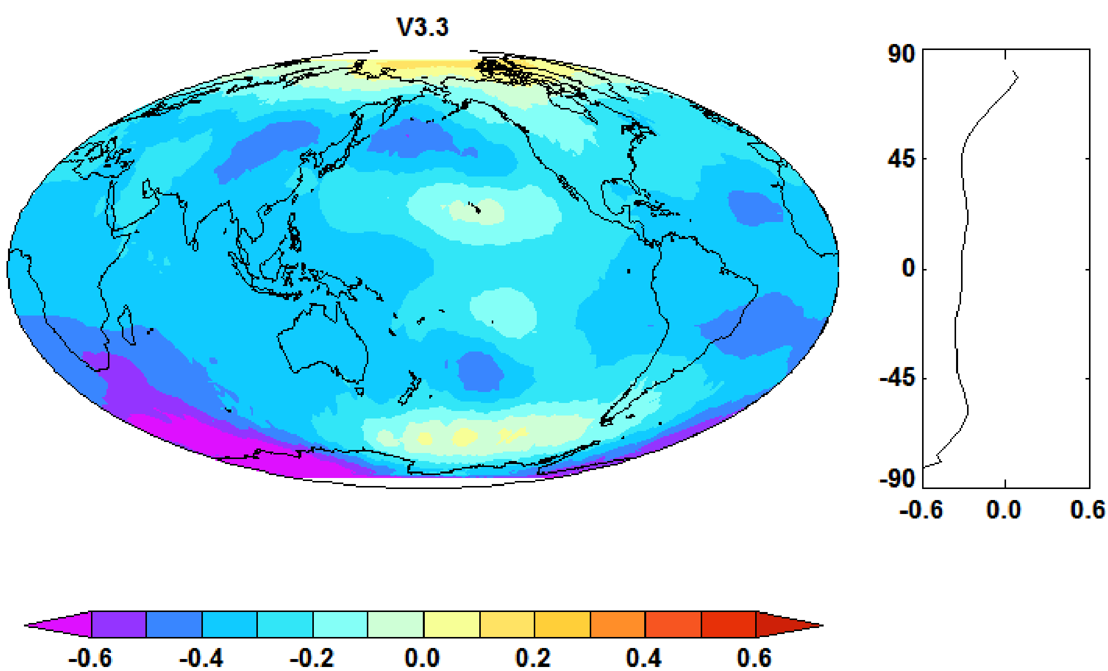

Fig. 17. V3.3 TLS Trends. Again, note reduction in orbital striping and overall increase in smoothness in the trend maps.