



Comparing tropospheric warming in climate models and satellite data

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Updated and improved satellite retrievals of the temperature of the mid-to-upper troposphere (TMT) are used to address key questions about the size and significance of TMT trends, agreement with model-derived TMT values, and whether models and satellite data show similar vertical profiles of warming. A recent study claimed that TMT trends over 1979 and 2015 are 3 times larger in climate models than in satellite data but did not correct for the contribution TMT trends receive from stratospheric cooling. Here, it is shown that the average ratio of modeled and observed TMT trends is sensitive to both satellite data uncertainties and model–data differences in stratospheric cooling. When the impact of lower-stratospheric cooling on TMT is accounted for, and when the most recent versions of satellite datasets are used, the previously claimed ratio of three between simulated and observed near-global TMT trends is reduced to approximately 1.7. Next, the validity of the statement that satellite data show no significant tropospheric warming over the last 18 years is assessed. This claim is not supported by the current analysis: in five out of six corrected satellite TMT records, significant global-scale tropospheric warming has occurred within the last 18 years. Finally, long-standing concerns are examined regarding discrepancies in modeled and observed vertical profiles of warming in the tropical atmosphere. It is shown that amplification of tropical warming between the lower and mid-to-upper troposphere is now in close agreement in the average of 37 climate models and in one updated satellite record.