



## **Temperature trends observed in the middle atmosphere and future directions**

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Temperature trends in the lower and middle stratosphere during the last decade are evaluated using measurements ground-based Lidar, GPS Radio Occultation (RO) and Aqua Advanced Microwave Sounding Unit (AMSU) on board Aqua satellite. While trends have slowdown around the 2000's, in the last decade the stratospheric temperature trends continued to cool over most of the globe with a rate ranging from -0.4 to -0,7 K/decade. Seasonally resolved trends from the two data sets are in excellent agreement, whereas the trends derived from ERA-Interim reanalysis appear strongly biased. The meridionally and vertically resolved trends from high-resolution GPS-RO data exhibit a marked inter-hemispheric asymmetry and highlight a distinct boundary between tropospheric and stratospheric temperature change regimes matching the tropical thermal tropopause. The seasonal pattern of trend reveals significant opposite-sign structures at high and low latitudes, providing indication of seasonally varying change in stratospheric circulation. In winter, the occurrence of the sudden stratospheric warmings is critical for trend estimates. In the mesosphere lidars will play a critical role to insure inter-satellite calibration while GOMOS will provide useful information.