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Assessment of 16 years of satellite temperature profiles from SABER and MLS using lidar temperature profiles from OHP

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We have compared 2433 nights of Rayleigh lidar temperatures measured from January 2002 to March 2018 at L'Observatoire de Haute Provence (43.93 N, 5.71 E) with co-located temperature measurements from the Microwave Limb Sounder (MLS) and the Sounding of the Atmosphere by Broadband Emission Radiometry instrument (SABER). We have found systematic differences between the temperatures measured from the ground-based lidar and those measured from the space-borne satellites. In particular, a recurring winter stratopause relative cold bias in the satellite measurements with respect to the lidar (-6 K for SABER and -17 K for MLS), a summer mesospheric relative warm bias for SABER (6 K near 60 km), and a vertically structured bias for MLS (-4 to 4 K).

By making use of the precise ranging information in the lidar data we have adjusted the stratopause geopotential altitude of the satellite measurements and have seen an improvement in the subsequent comparison. The winter relative cold bias between the lidar and SABER has been reduced to 1 K in both the stratosphere and mesosphere and the summer mesospheric warm bias is reduced to 2 K. Stratopause altitude corrections have reduced the relative cold bias between the lidar and MLS by 4 K in the early autumn and late spring but further work is required to address the apparent vertical oscillations in the MLS temperature profiles.