A Climatology of Stratopause Temperature and Height in the Polar Vortex and Anticyclones

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Abstract:A global climatology of stratopause temperature and height is shown using 7 years of Microwave Limb Sounder satellite data, from 2004 to 2011, and compared with the Navy's Operational Global Atmospheric Prediction System model (NOGAPS) and a 40 year run from the free running Whole Atmosphere Community Climate Model (WACCM) 4 an. Stratopause temperature and height is interpreted in the context of the polar vortices and anticyclones. Multi-year, monthly mean geographic patterns in stratopause temperature and height are shown to depend on the location of the polar vortices and anticyclones. This is the first study to show that the stratopause is, on average, 20 K colder and 5-10 km lower in the Aleutian anticyclone than in ambient air during the Arctic winter. During September in the Antarctic the stratopause is, on average, 10 K colder inside anticyclones south of Australia. The regional temperature and height anomalies, which are due to vertical ageostrophic motion associated with baroclinic instability, are shown to be climatological features. The mean structure of the temperature and height anomalies is consistent with moderate baroclinic growth below the stratopause and decay above. This work furthers current understanding of the geography of the stratopause by emphasizing the role of synoptic baroclinic instability, whereby anticyclones establish zonally asymmetric climatological patterns in stratopause temperature and height. This work highlights the need to consider zonal asymmetries when calculating upper stratospheric temperature trends.

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