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Stratosphere-troposphere coupling: The stratospheric seasonal cycle in CMIP5 models

Robert Black[†]; Brent McDaniel
[†] Georgia Institute of Technology, USA
Leading author: rob.black@eas.gatech.edu

It is now widely accepted that stratospheric climate variability provides an important influence upon the troposphere. The CMIP5 project includes, for the first time, a large number of coupled climate models with a fully resolved stratosphere (so-called high-top models). This provides a ready means for better understanding and quantifying the impact of stratospheric climate change on the troposphere. A key step in this process is to assess the performance of the new high-top models in comparison to standard low-top climate models. The current study contributes to this assessment with a detailed diagnostic analysis of the seasonal cycle of the stratospheric circulation with a particular emphasis on stratospheric final warming events and their attendant dynamic coupling to the tropospheric circulation. The primary focus is on comparing the performance of high-top and low-top models in the reproduction of recent past stratospheric climate variability. Of particular interest in the current study are the climatological-mean spatial structure and seasonal evolution of the stratospheric polar vortex along with the interannual variability in its annual demise (i.e., the so-called stratospheric final warming). The latter is also then related to concomitant tropospheric variability. By contrasting the model diagnoses with parallel observational analyses we will contribute to the assessment of the potential limitations of low-top and high-top models in representing future global climate variability linked to stratospheric variability.