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How do major SSWs develop in CCMVal and CMIP5 models?

S. Bancalà (1), K. Krüger (1), M. Giorgetta (2), M. Neish (3), H. Schmidt (2), T. Shepherd (4), and K. Shibata (5)

(1) GEOMAR | Helmholtz Centre for Ocean Research Kiel, Kiel, Germany (sbancala@geomar.de, kkrueger@geomar.de), (2) Max Planck Institute for Meteorology, Hamburg, Germany (marco.giorgetta@zmaw.de, hauke.schmidt@zmaw.de), (3) Department of Physics, University of Toronto, Toronto, Canada (neishm@atmosp.physics.utoronto.ca), (4) University of Reading, Reading, UK (theodore.shepherd@reading.ac.uk), (5) Meteorological Research Institute, Tsukuba, Japan (kshibata@mri-jma.go.jp)

A major sudden stratospheric warming (SSW) is a dramatic meteorological event that causes strong anomalies in the mean wintertime circulation of the stratosphere. These anomalies can then propagate downward via the stratosphere-troposphere coupling (Baldwin and Dunkerton, 2001) and affect surface weather for several weeks. The inverse relationship, the troposphere-stratosphere coupling, is observed prior to the major SSW when upward propagating planetary waves originated mainly in the troposphere interact with the stratospheric flow and lead to the break-down of the polar vortex hence the major SSW. Planetary waves of different amplitude and zonal wavenumber can propagate upward, therefore major SSWs not always develop in the same way. In a previous study, we have shown that although most of the major SSWs follows increased planetary wave activity of the zonal wavenumber-1, a quarter of these events is caused by an amplified zonal wavenumber-2. Thus, we distinguish major SSWs between wavenumber-1 (W1) and wavenumber-2 (W2) events based on the preconditioning of the polar vortex (Bancalà et al., 2012). The two type of major SSWs are related to different tropospheric dynamics, with Euro-Atlantic blocking events preceding W1 warmings and Pacific blockings occurring prior to W2 major SSWs. Increased blocking activity id also detected after the warmings demonstrating that the middle atmosphere influences the surface weather and climate. In this study, the preconditioning criterion will be used to determine how the new generation of high-top climate models represents the stratospheric winter variability. In particular we will address the ability of CCMVal and CMIP5 models to simulate the preconditioning of major SSWs and determine whether the observed W2/W1 relationship is reproduced or not. Also, by analyzing blocking activity, we will point out how these models reproduce the troposphere-stratosphere-troposphere coupling during major SSW events.