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Future changes of stratospheric sudden warmings: Any effect on the tropospheric circulation?

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Major stratospheric sudden warmings (MSWs) are the most abrupt events of boreal wintertime stratospheric variability. They also represent one of the clearest examples of the coupling between the troposphere and stratosphere in the Northern Hemisphere. Recent studies have examined a possible impact of climate change on these phenomena by analyzing chemistry climate models (CCM). However, their analyses show very different and, in some cases, even opposite results.
In this study, future changes of MSWs are analyzed in a transient simulation covering the period 1960 to 2100 using the EMAC Chemistry-Climate-Model. The EMAC transient simulation includes forcings by halogens, greenhouse gases (GHG) and volcanic aerosols as well as natural solar and QBO variability, according to the specifications for the CCMVal-SCN-B2d scenario. Sea surface temperatures (SSTs) and sea-ice distributions from a coupled climate model integration have been prescribed. The impact of climate change on the future characteristics of MSWs has been assessed by comparing the last 40 winters of the SCN-B2d simulation (2060/61-2099/2100) with the first 40 ones (1960/61-1999/2000). A special focus is made on the seasonality of MSWs and the downward propagation of their signal to the troposphere. A seasonal shift of the MSWs distribution towards late winter and a decline of the downward propagation of their signal have been found in the future, leading to a weaker impact on the tropospheric circulation due to the concurrent impact of increasing GHGs.
Complementary analyses of MSWs in different 40-year sensitivity simulations with the same model for past, present and projected future GHG concentrations and prescribed SSTs and ozone depletion substances will be presented. They allow to isolate the role of climate change on MSWs from other factors and to provide robustness to results.