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Influence of well-resolved stratosphere on the simulated tropospheric climate

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Many studies have shown that the stratosphere can influence the tropospheric climate, however many climate models do not have a well-resolved stratosphere. We examine here the influence of a raised model lid and better resolved stratosphere on the changes in the simulation of mean climate and climate variability in the Community Earth System Model (CESM).

We examine the tropospheric response to the El Nino Southern Oscillation (ENSO) as well as coupling between the stratosphere and troposphere via sudden stratospheric warmings (SSWs). In our simulations, even though both models show similar downward extension of the Northern Annual Mode (NAM) during SSW events from the stratosphere to the troposphere, the persistence time in the model with lower top is substantially shorter. We find that the response to ENSO is much more variable in the model with a better resolved stratosphere as compared to the default model. We also find that the tropospheric ENSO response is modulated by the quasi-biennial oscillation (QBO), which is only present in the model with a better resolved stratosphere.