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# The importance of interactive ozone chemistry for simulating stratospheric temperature variability in Earth-System Models

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Climate models have become increasingly more complex over recent decades, by evolving from General Circulation Models to coupled Earth-System Models. The Coupled Model Intercomparison Project Phase 5 included both stratosphere resolving (high-top) models and models whose top has been well below the stratopause (low-top models). However also only a limited fraction of high-top models include interactive stratospheric ozone chemistry. Thus, the coupling between ozone, the circulation and climate is neglected in most models, and the impact of this simplification on the model's variability is still unclear. Here we investigate the effect of interactive stratospheric ozone chemistry on polar stratospheric temperature in the Whole Atmosphere Community Climate Model. We contrast two time-slice simulations with perpetual year 2000 forcings, one with interactive ozone chemistry and one without. The results show a statistically significant difference in stratospheric spring-time temperatures over the Arctic (and Antarctic) polar caps. Including interactive ozone leads to a significant increase in the magnitude of temperature extremes: this is particularly pronounced for cold extremes. Temperature changes that are within the envelope of natural variability in simulations with interactive chemistry could be erroneously classified as significant in models with non-interactive chemistry. Hence, our results suggest that caution is needed when interpreting temperature trends from model simulations without interactive ozone, as these may underestimate the variability arising from the coupling between ozone chemistry and the circulation.