“On the role of stratospheric ozone feedbacks in the climate system”

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Stratospheric ozone plays a key role in shaping the thermal structure of the middle atmosphere. Large changes in stratospheric ozone can also have a sizable impact on tropospheric climate. Examples for this are the effects of chlorofluorocarbons (CFCs) driven ozone depletion and recovery on the SH mid-latitude jet and on the subtropical dry-zone edge. However, the role of stratospheric ozone as a feedback to externally-driven (e.g., solar and CO2) changes in the climate system remains unclear. Given the large inter-model differences in the treatment of the coupling between stratospheric ozone and circulation, a careful assessment of this feedback can shed light into a potential source of inter-model spread in future projections. By carrying out model simulations from the Community Earth System Model (CESM), we explore the impacts of coupling the stratospheric ozone chemistry onto the model's sensitivity to solar and anthropogenic greenhouse gases. We accomplish this, by using a version of the Whole Atmosphere Community Climate (WACCM) model, which allows coupling and decoupling stratospheric chemistry, without altering the dynamical core and physical parameterizations. We show that interactive stratospheric ozone chemistry significantly reduces the model response to both greenhouse gases and solar forcing, albeit through two fundamentally different mechanisms. According to our findings, stratospheric ozone responses yield an important, and yet undocumented, negative feedback in the climate system.