

The potential to narrow uncertainty in projections of stratospheric ozone over the 21st century

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Future stratospheric ozone concentrations will be determined both by changes in the concentration of ozone depleting substances (ODSs) and by changes in stratospheric and tropospheric climate, including those caused by changes in anthropogenic greenhouse gases (GHGs). Since future economic development pathways and resultant emissions of GHGs are uncertain, anthropogenic climate change could be a significant source of uncertainty for future projections of stratospheric ozone. In this pilot study, using an "ensemble of opportunity" of chemistry-climate model (CCM) simulations, the contribution of scenario uncertainty from different plausible emissions pathways for ODSs and GHGs to future ozone projections is quantified relative to the contribution from model uncertainty and internal variability of the chemistry-climate system. For both the global, annual mean ozone concentration and for ozone in specific geographical regions, differences between CCMs are the dominant source of uncertainty for the first two-thirds of the 21st century, up-to and after the time when ozone concentrations return to 1980 values. In the last third of the 21st century, dependent upon the set of greenhouse gas scenarios used, scenario uncertainty can be the dominant contributor. This result suggests that investment in chemistry-climate modelling is likely to continue to refine projections of stratospheric ozone and estimates of the return of stratospheric ozone concentrations to pre-1980 levels.