5.070 The Stratospheric Contribution to Tropospheric Ozone Variability and Trends.

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Abstract:

Chemistry-climate models predict an intensification of the stratospheric circulation over the next century in response to greenhouse gas forcing, with uncertain consequences for tropospheric ozone and climate. We examine the role of the stratosphere in present-day tropospheric ozone variability and trends as measured by the Tropospheric Emission Spectrometer (TES) and Microwave Limb Sounder (MLS) onboard NASA's Aura satellite. Our previous work has shown that interannual variability in the stratospheric circulation of ±40% leads to changes of ±25% in northern midlatitude lower stratospheric ozone and ±2% in northern midlatitude tropospheric ozone. Here we examine in more detail the drivers of stratospheric circulation variability and the subsequent ozone response using the Whole Atmosphere Chemistry-Climate Model (WACCM) in order to better understand the relationship between interannual and long-term changes in circulation and ozone. We find that both the stratospheric Quasi-Biennial Oscillation (QBO) and El Nino / Southern Oscillation (ENSO) drive stratospheric circulation changes but that both the circulation changes and ozone response depend critically on the timing of QBO and ENSO relative to one another and to the seasonal cycle. We also examine the role of stratospheric variability in tropospheric ozone trends over the past decade and show that

this variability can confound quantification of emissions-driven changes. We discuss the implications of our work in terms of reducing uncertainties in long-term projections of tropospheric ozone.