5.109 Climate versus emission drivers of ozone pollution trends and extremes.

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Abstract:

Understanding the response of ozone to global trends in emissions as well as to interannual variability in climate and extreme weather has significant implications for designing effective pollution control policies. We examine these conjoined processes over the past four decades through an integrated analysis of observational records and a suite of global chemistry-climate model hindcasts driven by observed meteorology (GFDL-AM3). We contrast several regions of northern mid-latitudes: the polluted eastern China and eastern U.S., the relatively remote western U.S. that mainly reflects baseline conditions, and Europe. Analysis of model simulations and sparse observations indicates that spring and summertime surface ozone has increased by almost **40 ppbv** over 1980-2015 in eastern China, attributed mainly to rising regional precursor emissions. Our model captures the salient features of observed ozone trends, including the overall increases over the western U.S., the larger decreases in the 95th versus 50th percentiles over the eastern U.S., and its north-to-south trending pattern. The southeast U.S., with warmer temperatures, is most responsive to regional NO_X reductions. Over the western US during spring, the strong interannual variability from stratospheric influence complicates the unambiguous attribution of ozone trends derived from short and sparse observational records. Rising Asian emissions and global methane from 1980s to 2000s raised ozone over the western U.S. by **6 ppbv** during spring and **4 ppbv** during summer. Despite the stronger increase of Asian emissions in the 2000s than the 1990s, observations at Lassen National Park in California show a leveling-off of ozone in the 2000s. AM3 captures the observed leveling-off and attributes it to U.S. NO_X controls for summer and to weakening hemispheric pollution transport in the 2000s for spring, as a result of more frequent La Nina conditions. Further, we will discuss the complications introduced by climate variability when detecting and attributing trends in surface ozone.