Observational-based Assessment of Contributions to Southwest U.S. Maximum Ozone Concentrations

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The 2015 U.S. National Ambient Air Quality Standard (NAAQS) requires that the Ozone Design Value (ODV) not exceed 70 ppb. The ODV is defined as the three-year average of the annual fourth-highest daily maximum eight-hour average (MDA8) ozone concentration, which represents ~98th percentile of MDA8 values observed in the warm half of the year. A time series of ODVs is thus a smoothed measure of the temporal evolution of the maximum ozone concentrations that impact a site. At any urban or rural location, ozone concentrations arise from natural sources (stratospheric input, production from natural precursors) and photochemical production from anthropogenic precursor emissions (local, that transported on regional and intercontinental scales). We focus solely on ODV time series observed in the southwest U.S., and approximately assess the time evolution of the separate contributions to ODVs from local production, regional transport and U.S. background (which includes intercontinental transport of anthropogenic ozone, plus all natural contributions). The U.S. background dominates the ODVs throughout the southwest U.S., even in the Phoenix and Las Vegas urban areas. In these two urban areas, local production enhances the ODVs by a smaller amount. Regional transport makes a major contribution only at locations immediately downwind of the Los Angeles urban area. To the east of the Sierra Nevada Mountains, no impact of regional transport of California ozone can be discerned. For example, in 2015 in Phoenix, the U.S. background ODV contribution was ~69 ppb, with an enhancement of maximum ODVs from local photochemical production of ~12 ppb. Unless the U.S. background concentration continues to decrease as it has during the past decade, it will be very difficult for Phoenix to reduce its maximum ODV to the NAAQS.

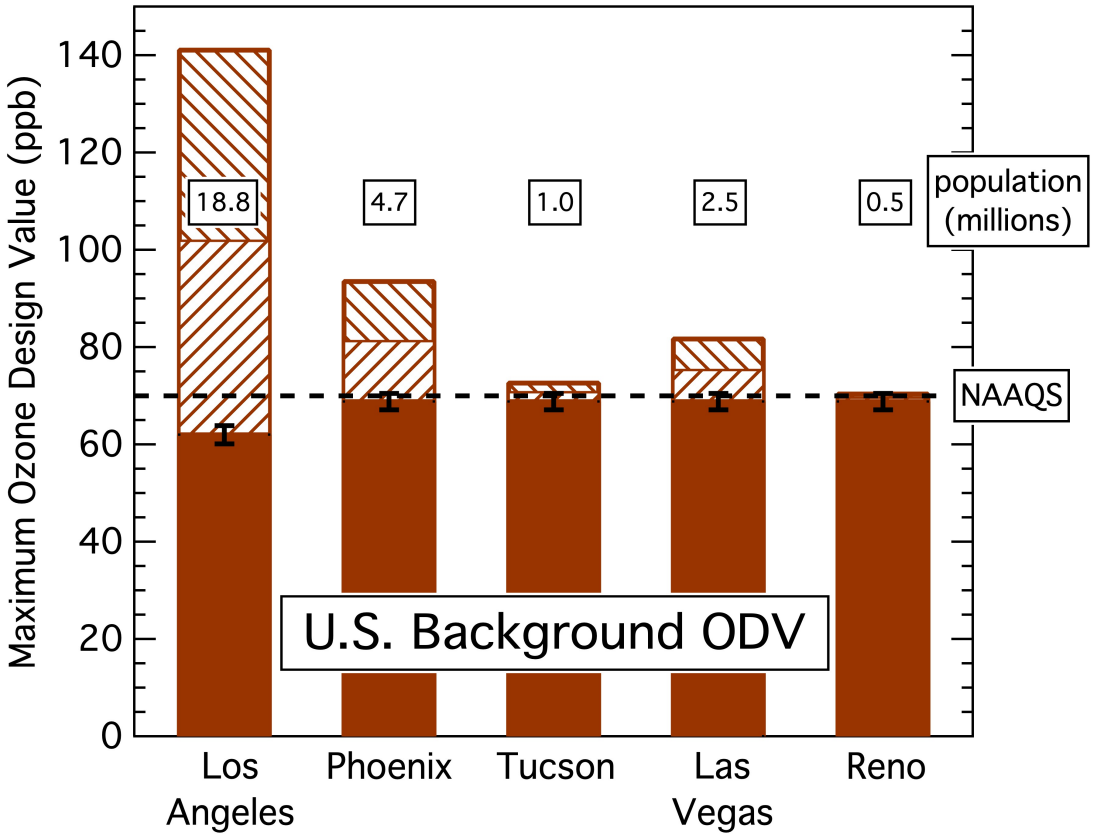

Figure 1. Comparison of maximum ODVs observed in five southwestern U.S. urban areas (populations annotated). Solid bars indicate the ODV contribution from U.S. background ozone, and the lower and upper dashed bars indicate the estimated enhancement from U.S. anthropogenic emissions in 2015 and 2000, respectively. Dashed line indicates the 2015 ozone NAAQS.