1.084 Regional shifts in the diurnal cycle of surface ozone.

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Abstract:

Reductions in NO_X emissions have driven important decreases in peak summertime ozone concentrations in many parts of the United States and Europe. However, the magnitude and even sign of these trends can change when considering nighttime ozone, as lowering NO_X emissions can reduce nighttime ozone titration by NO_X. The shape of the ozone diurnal cycle has implications for human health and vegetation studies, since some ozone metrics depend on peak hourly ozone while others consider ozone concentrations over an 8 or 12-hour window. We use a high-resolution global atmospheric simulation constrained by MERRA-2 meteorology to investigate changes in the diurnal cycle of ozone for different seasons and regions of the world. The simulation reproduces the trends in tropospheric column NO_2 observed by the OMI instrument, as well as the reduction in the amplitude of the diurnal cycle of ozone in the northeast United States seen in CASTNET observations. The simulation shows an increase in the magnitude of the diurnal cycle in surface ozone over China in response to increasing NO_X, in contrast to the decrease in magnitude in regions with negative NO_X trends. We attribute the changes to shifts in the timing of net ozone production and loss.