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Changes in the frequency of extreme air pollution events over the Eastern United States and Europe

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Over the past few decades, thresholds for national air quality standards, intended to protect public health and welfare, have been lowered repeatedly. At the same time observations, over Europe and the Eastern U.S., demonstrate that extreme air pollution events (high O_3 and PM2.5) are typically associated with stagnation events. Recent work showed that in a changing climate high air pollution events are likely to increase in frequency and duration. Within this work we examine meteorological and surface ozone observations from CASTNet over the U.S. and EMEP over Europe. With innovative statistical tools – i.e. statistics of extremes (EVT) - we analyze the frequency distribution of extreme air pollution events over the Eastern United States and Europe. The upper tail of observed values at individual stations (e.g., within the CASTNet), i.e. the extremes (maximum daily 8-hour average (MDA8) O_3>60ppb) are poorly described by a Gaussian distribution. However, further analysis showed that applying Peak-Over-Threshold-models, better capture the extremes and allows us to estimate return levels of pollution events above certain threshold values of interest. The results show that changes in national ambient air quality standards had significant effect on the occurrence frequency of high air pollution episodes.