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Investigating the occurrence, likelihood and regional variability of extreme ozone pollution episodes across the UK

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Warm summer temperatures provide ideal conditions for the occurrence of extreme ground level ozone pollution episodes. Given the well-established negative impacts of ozone on human and plant health, understanding and attributing these extreme events is of importance to the scientific and wider community, particularly as heatwaves may become more frequent due to climate change. Extreme Value Analysis provides a powerful and flexible framework in which to statistically model unusually large observed values of ozone extracted from historical data. Here, a temperature dependent Peaks-Over-Threshold method based upon the Generalised Pareto Distribution is used to carry out a regional comparison of extreme ozone pollution episodes within the UK. Our analysis uses surface ozone observations from the UK's extensive Automatic Urban and Rural Network. The statistical model was used to quantify the frequency and magnitude of extreme ozone events, including a probabilistic assessment of exceeding UK public health thresholds, conditional on temperature. Return levels are provided for each monitoring site demonstrating the expected future projections of extreme ozone pollution events across the UK. We find that across UK rural background sites, return periods for a daily maximum 8-hr ozone level of 100 $\mu\text{g}/\text{m}^3$ (a 'moderate' level of air pollution in the UK's Air Quality Index) range from 32-147 days, based on analysis of the data in the decade 2010-2019. Similarly, for urban background sites the range is 36-869 days. An analysis of the spatio temporal variability in UK ozone extremes, along with their temperature dependence, will be presented.