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Assessing Statistical Model Assumptions under Climate Change

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The majority of the studies assesses climate change impacts on air-quality using chemical transport models coupled to climate ones in an off-line mode, for various horizontal resolutions and different present and future time slices. A complementary approach is based on present-day empirical relations between air-pollutants and various meteorological variables which are then extrapolated to the future. However, the extrapolation relies on various assumptions such as that these relationships will retain their main characteristics in the future.
In this study we focus on the ozone-temperature relationship. It is well known that among a number of meteorological variables, temperature is found to exhibit the highest correlation with ozone concentrations. This has led, in the past years, to the development and application of statistical models with which the potential impact of increasing future temperatures on various ozone statistical targets was examined.
To examine whether the ozone-temperature relationship retains its main characteristics under warmer temperatures we analyze the relationship during the heatwaves events of 2003 and 2006 in Europe. More specifically, we use available gridded daily maximum temperatures (E-OBS) and hourly ozone observations from different non-urban stations (EMEP) within the areas that were impacted from the two heatwave events. In addition, we compare the temperature distributions of the two events with temperatures from two different future time periods 2021-2050 and 2071-2100 from a number of regional climate models developed under the framework of the Cordex initiative (http://www.cordex.org) with a horizontal resolution of 12 x 12km, based on different IPCC RCPs emissions scenarios. A statistical analysis is performed on the ozone-temperature relationship for each station and for the two aforementioned years which are then compared against the ozone-temperature relationships obtained from the rest of the available dataseries. The analysis reveals that in the majority of the examined stations the ozone-temperature retains its main characteristics under warmer temperatures which indicates that the observed relationship combined with future temperature estimates constitutes a useful tool for determining future ozone levels.