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Health-relevant, compound ozone and temperature events over Europe

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High concentrations of ground-level ozone (O₃) and elevated levels of air temperature both represent natural hazards and health-relevant events. Two natural hazards occurring at the same time and contributing to a severe human health risk are defined as compound events. Co-occurring and hence compound ozone and temperature events pose a significant health risk and can lead to an intensified health burden for the European population (e.g., Hertig et al. 2020).

Previous studies already point to the fact that the relationship of underlying main drivers with one or both hazards, their linkage as well as projected future frequency shifts of compound occurrences show spatial and temporal variations (e.g., Otero et al. 2016; Jahn, Hertig 2020). There is also evidence that compound events become more frequent in Europe during the 21st century due to climate change (e.g., Jahn, Hertig 2020; Hertig 2020). Consequently, recent and upcoming European protection and resilience strategies need to focus on region-specific current and future environmental and climatic conditions.

In our current contribution we focus on health-relevant compound events by jointly evaluating elevated ground-level ozone concentrations and air temperature levels at a regional scale in Europe. A regionalization based on cluster analysis divides the European domain into regions of coherent ozone and temperature characteristics and variability. Spatiotemporally varying meteorological conditions which strongly influence the occurrence of compound events in the regions are identified. For projections until the end of the twenty-first century, the output of eight Earth System Models (ESMs) from the sixth phase of the Coupled Model Intercomparison Project (CMIP6) is used.

The results from this study show the regional character of ozone and temperature patterns and variabilities as well as respective recent and future compound event occurrences. The results can be used as a basis for further research to adjust and specify current air pollution and climate change mitigation and adaption strategies.

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