Estimation of the thunderstorm asthma risk in Bavaria, southern Germany, using weather type classifications

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Besides direct impacts due to lightning strokes, heavy precipitation and gale, thunderstorms can affect human health also indirectly, as was demonstrated in several studies. In this context, the phemonenon of thunderstorm asthma describes the occurrence of unusually high numbers of partly servere asthma cases (asthma bronchiale) in connection to thunderstorm events, especially during the pollen and fungal spore season. Affected individuals comprise not only asthmatics but also persons suffering generally from pollen allergy. Proposed mechanisms include an interaction of atmospheric processes and an increase of allergen concentrations in the ambient air, but the exact mechanisms leading to thunderstorm asthma epidemics as well as the characteristics of an asthma relevant thunderstorm event remain unclear.

Utilizing meteorological data (lightning data, local as well as large scale meteorology, areawide precipitation), aerobiological data (local pollen counts differentiated by various species) and health data (daily asthma emergency cases), the study presented here, aims at examining the relationship between the occurrence of thunderstorms and elevated asthma morbidity in Bavaria, southern Germany, focusing on the region of the major city of Augsburg, for a study period including the years 2010-2017. For this purpose, the different kinds of data are combined on varying spatial and temporal degrees of aggregation.

First statistical tests (chi-square test of independence) indicate the existence of a significant (α=0.1) connection between asthma days and thunderstorm days for different Bavarian cities for the whole study period as well as for individual seasonal subsets, applying different definitions for "asthma day". Composites of the CAPE index (convective available potential energy) for days with and without the occurrence of asthma cases, respectively, show an enhanced thunderstorm probability on summer days with at least one asthma emergency case in Augsburg. Furthermore, optimized weather type classifications are used in order to identify weather and thunderstorm types with increased asthma risk and comprehensively characterize those situations with regard to large scale atmospheric circulation, local meteorology and allergen load.