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Response of Urban Systems to Climate Change in Europe: Heat Stress Exposure and the Effect on Human Health

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Climate change is driven by global processes such as the global ocean circulation and its variability over time leading to changing weather patterns on regional scales as well as changes in the severity and occurrence of extreme events such as heavy rain- and windstorms, floods, drought, heat waves, etc. The summer 2003 European heat wave was the hottest summer on record in Europe over the past centuries leading to health crises in several countries like France and caused up to 70.000 excess deaths over four months in Central and Western Europe.
The main risks induced by global climate change in urbanised areas are considered to be overheating and resulting health effects, increased exposure to flood events, increased damage losses from extreme weather conditions but also shortages in the provision of life-sustaining services. Moreover, the cities themselves create specific or inherent risks and urban adaptation is often very demanding. As most of Europe's inhabitants live in cities, it is of particular relevance to examine the impact of climate variability on urban areas and their populations.
The present study focusses on the identification of heat stress variables related to human health and the extraction of this information by processing daily temperature statistics of local urban climate simulations over multiple timeframes of 20 years and three different European cities based on recent, near future and far future global climate predictions. The analyses have been conducted in the framework of the NACLIM FP7 project funded by the European Commission involving local stakeholders such as the cities of Antwerp (Belgium), Berlin (Germany) and Almada (Portugal) represented by different climate and urban characteristics. Apart from the urban-rural temperature increment (urban heat island effect), additional heat stress parameters such as the average number of heat wave days together with their duration and intensities have been covered during this research.
In a subsequent step, the heat stress variables are superposed on relevant socio-economic datasets targeting total population and its distribution per age class as well as vulnerable institutions such as hospitals, schools, rest homes and child/day care facilities in order to generate heat stress exposure maps for each use case city and various climate, urban planning and mitigation scenarios. The specifications and requirements for the various scenarios have been consolidated in close collaboration with the local stakeholders during dedicated end-users workshops.
The results of this study will allow urban planners and policy makers facing the challenges of climate change and develop sound strategies for evolving towards sustainable and climate resilient cities.