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# Quantifying the effect of different urban planning strategies on heat stress in current and future climates in the Netherlands

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Climate adaptation for heat resilient cities has become a hot topic in the Netherlands. The national government is concerned about the consequences of increased heat stress in cities due to climate change. In addition the government has the challenge to realize 1 million houses by 2040, which mainly needs to be realized within the built environment.
In this data driven study, we investigate the effect of different urban planning strategies on heat stress for the current climate and future climate scenarios for the urban agglomeration of the Hague. This is performed by applying a diagnostic equation for the daily maximum urban heat island based on routine meteorological observations and straightforward urban morphological properties (Theeuwes et al., 2017). The equation is based on observational data of 14 cities across Western Europe differing in size and appears to be very robust. Additionally, the results are verified by a selection of high quality citizen weather stations in the agglomeration of The Hague. The sky-view factor and vegetation fraction are the two explanatory urban morphological variables in this equation. The urban planning strategies differ in replacing low- and mid-rise buildings with high-rise buildings (which reduces the sky-view factor) and developing vegetated areas within urban neighbourhoods (which reduces vegetation fraction). For the future climate scenarios we have transformed the routine meteorological data series for temperature and radiation.
We found that mostly vegetation fraction is a more critical parameter than the sky view factor to minimize the extra heat stress when densifying the residences in a neighbourhood and an urban planning strategy choice makes sense. The climate scenarios display, however, that favourable urban planning measures cannot prevent extra heat stress in 2050 with equal housing density. With unchanged housing we find a three to four fold increase in the frequency of tropical nights in cities with the same urban characteristics in the warmest climate scenario for 2050. For the city of The Hague this amounts to 16 tropical nights per year in 2050 in dense built areas (warmest climate scenario). For the warmest summer (2006) in our data series this increases up to 32 nights with minima above 20 ºC.

References

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