CESAR

Climate and Environmental change and Sustainable Accessibility of the Randstad

Developing and Evaluating a Modelling Framework for Urban Weather and Climate Studies

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What is the research question?

Urban factors have an effect on the urban microclimate – particularly on temperature. What are these contributing factors? How do water features, greenery and the geometric shape of roads affect the temperature and thermal comfort in the city?

What are the findings?

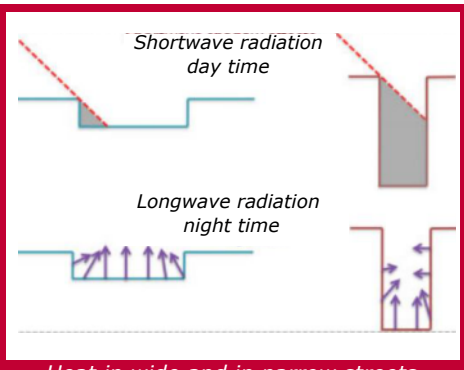
- Experiments in Rotterdam have shown that the WRF weather model (Weather Research and Forecasting model) is a useful tool to study city weather in all four seasons.
- During the daytime, water features in the city have a cooling effect, but both model simulations and observations in the Netherlands show that at night, water has a warming effect due to the large thermal inertia of water features. This is especially relevant in the second half of the summer and the beginning of autumn. This is a new insight that is not yet being used in the daily practice of urban planning and design.
- The cooling effect of water features results in improved thermal comfort for city-dwellers. However, evaporation from water features means increased atmospheric humidity and offsets thermal comfort as a result of cooling by 33%.
- Spatial distribution of small water features in the city affects a larger part of the city than a single large water feature. The temperature effect, however, is the greatest with a single, large body of water.
- A new conceptual model shows that street temperature is determined by a combination of shading from solar radiation and of 'retention' of thermal radiation from buildings. What is new is the realisation that as buildings get higher and streets narrower, the urban heat island effect decreases rather than increases in the summer. In the winter it is exactly the opposite.
- Greenery reduces the urban heat island effect by about 0.6 degrees per 10% more greenery.

What are the recommendations?

- To reduce the urban heat island effect it is better to use greenery than water features in the city, provided that the greenery is well irrigated.
- Narrower streets provide more cooling in the summer and warmth in the winter, if the emission of heat produced by people remains the same.

For more information go to http://www.climateplanning.tk/

Effects of water and greenery in the city



Heat in wide and in narrow streets

Well irrigated vegetation suitable

CESAR is part of the NWO-programme Sustainable Accessability of the Randstad

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