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Influence of evapotranspiration on thermal comfort in central European cities

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In future, more and more people will be exposed to the negative thermal effects of urban climate, which will be exacerbated by predicted climate change. In regard to urban climate studies, it is necessary to develop adaptation and mitigation strategies tailored to the problem area and to include them in the local planning process. Urban green spaces or water bodies could help to mitigate the radiation and air temperature.
For this purpose eddy-covariance technique has been carried out in Oberhausen (Germany; 51° N, 6° E) between 15 August 2010 and 14 August 2011 to quantify turbulent sensible and latent heat fluxes in areas with various types of urban land use.
The results show that sensible heat flux (QH) is 20 % higher, latent heat flux (QE) 90 % lower at the urban (URB) site compared to the suburban one (SUB). Furthermore, partition of the turbulent heat fluxes (QH/Q* resp. QE/Q*) clearly depends on plan area density (λP). The human-biometeorological thermal index, the physiologically equivalent temperature (PET), demonstrates that green spaces counteract growing thermal stress on city-dwellers due to improving thermal comfort. Aside from the positive effect of shading, inner-city green spaces can only be effective if an adequate water supply is ensured. Otherwise, the positive thermal effects of green spaces resulting from transpiration will be reduced to a minimum or eliminated entirely, which is confirmed by the measured values.
Additional planning recommendations for urban planners within cities located at mid-latitudes derived from measuring results are given.