*Forecasting the weather
- ensemble techniques
in probabilistic weather prediction*

Quantification of the urban heat island effect and human comfort in the Netherlands using data from hobby meteorologists: role of vegetation in the city

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Attention for urban heat stress during summer warm episodes has recently increased. The European severe heat waves in 2003 and 2006 underlined that heat stress results in substantial thermal discomfort to citizens and adverse health effects for vulnerable groups (e.g. children, elderly, persons with cardiovascular diseases), especially during long term heat exposure. Particular in the early evening and night, urban areas remain warmer than the surrounding countryside, i.e. the urban heat island effect (UHI). To be able to adapt to or mitigate the UHI, the UHI should be quantified and its physics should be understood. This study quantifies the climatology (i.e. both mean values and variability) of the UHI in the Netherlands for urban units ranging from small villages to cities. Our focus on the Netherlands originates from the special features that belong to Dutch cities. First the ground water level in Dutch cities is relatively high, and many cities are characterized by a network of canals, so water availability is relatively high. Second, the Netherlands are located close the coast, thus sea breeze circulations may affect the UHI. Third, the western part of the Netherlands covers one of the most densely populated area in the world. Unfortunately, routine meteorological observations in urban areas are scarce, and often limited to intensive field campaigns. Therefore, long term meteorological observations by hobby meteorologists are utilized to enable UHI quantification. We find the mean daily maximum UHI is substantial in all urban areas, ranging between 1.3-3.4 K, and a 95 percentile ranging from 3.1-7.6 K. Also, UHI appears to be better related to population density of the neighbourhood than for the city's total population. Finally a significant relation between increased green vegetation and reduced UHI was established, especially for the higher percentiles.