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10E.7: Microscale Modelling of Biometeorological Influence of Urban Water Surfaces

Thursday, August 09, 2018
03:00 PM - 03:15 PM
City College of New York - SH - 207

Open water surfaces in urban areas influence air temperature, moisture, radiative fluxes and wind. Therefore, they impact all parameters that generate the thermal environment to which the human body responds. Hence, to evaluate the role of urban water surfaces for designing thermally comfortable neighborhoods, a human-biometeorological assessment is required. Such an assessment for water surfaces with different characteristics and surroundings for climatological relevant weather situations is the aim of the current study.
To achieve this goal, the obstacle resolving meteorological MIcroscale TRAnsport and Stream model MITRAS is applied. To do so, MITRAS is further developed to be used for thermal comfort studies by incorporating the calculation of mean radiant temperature. Additionally, the radiation scheme is updated to include the radiative interaction of buildings both for streets with and without vegetation. The simulated values of mean radiant temperature, air temperature, humidity and wind are used as inputs for the calculation of two biometeorological indices, Physiological Equivalent Temperature and Universal Thermal Climate Index. These indices have been selected, since they differ in complexity, in their treatment of clothing and in their sensitivity to the different input parameters and consequently may lead to different conclusions. Simulations with idealized urban morphologies for several meteorological situations are carried out to derive the impact of surrounding morphology, vegetation, water extent and meteorological conditions on the magnitude and extent of the influence of water surfaces on thermal stress. The four chosen idealized urban morphology scenarios all correspond to Local Climate Zone 5, but consist of two different building configurations and two vegetation configurations. Two cases for urban water extent are studied: a narrow canal and a broad river. All scenarios are analyzed for several meteorological situations that represent relevant situations in a maritime mid-latitude climate to determine the meteorological influence on the impact of water surfaces. Based on the simulation results, the value of water surfaces for thermal comfortable design will be discussed.

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