Development and evaluation of a double-canyon urban canopy scheme, and estimation of urban heat island mitigation effects

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The development of a double-canyon urban canopy scheme (DCEP) is presented. The new scheme calculates the incoming and outgoing longwave and shortwave radiation for roof, wall and ground surfaces of an urban street canyon characterized by its street and building width as well as its canyon length, and the height distribution of buildings. The scheme introduces the radiative interaction of two neighbouring urban canyons allowing for the full inclusion of roofs into the radiation exchange, both, within the canyons and with the sky. An extensive evaluation of DCEP coupled with the regional weather and climate model CCLM is done against Basel Urban Boundary Layer Experiment data. The simulated radiative and energy fluxes are compared with measurements. The results indicate a good online performance of the model system comparable to the offline one of other urban canopy schemes in terms of the fluxes.
Furthermore, CCLM/DCEP is applied to investigate possible adaption measures to extreme heat events for the city of Berlin (Germany). First, a reference simulation is carried out for each of the analysed extreme heat events with current vegetation cover, roof albedo and urban canopy parameters, and is evaluated with temperature observations from weather stations in Berlin and its surroundings. Then six sensitivity runs are examined with modified vegetation covers, with increased roof albedos, and with a combination of both. At the weather stations' grid cells, the maximum of the average diurnal change in air temperature is analysed.