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Modelling reduction of the Urban Heat Island effect via increasing the reflective properties of buildings

Konrad Andre (1), Maja Zuvela-Aloise (1), Hannes Schwaiger (2), David Neil Bird (2), and Heinz Gallaun (3)

(1) ZAMG, Zentralanstalt für Meteorologie und Geodynamik, Department Climate Research, Vienna, Austria, (2) JOANNEUM RESEARCH Forschungsgesellschaft mbH, RESOURCES, Institute for Water, Energy and Sustainability, Graz, Austria, (3) JOANNEUM RESEARCH Forschungsgesellschaft mbH, DIGITAL, Institute for Information and Communication Technologies, Graz, Austria

The increased intensity or frequency of heat waves due to a changing climate could have far reaching implications. The phenomenon of Urban Heat Islands (UHIs) observed in cities is expected to strengthen and will further contribute to heat stress, creating an increased need for energy for cooling and ventilation as well as lowering human comfort.
The KELVIN project studies the effects of modifying the reflective properties of buildings and urban areas to reduce the UHI-effect. The improvement of the reflection properties of roofs and other surfaces is one possible way to increase the energy efficiency in urban areas and at the same time adapt to climate change by addressing the problem of the UHIs. Within the project, low-cost adaptation measures to reduce heat stress are investigated. These measures are constrained, in historical city centres, because the colouring of tile roofs should not be changed significantly, and the appearance should remain as unchanged as possible. The project examines the potential of a climate adaptation measure to reduce the UHI-effect through changes in properties of the urban surfaces (roof albedo, green roofs etc.) and related emission-reduction through decreased cooling demand. It uses the city of Vienna as an example. The input parameters required for climate modelling, such as surface albedo, are determined based on the satellite image time series for Vienna from 2000 to 2014. Urban climate model simulations are conducted using high-resolution topography and land use data for Vienna. Potential changes in local climate in the urban environment resulting from the changes in surface albedo are examined and the possibility of reducing the heat load on a city scale is quantified. Results of modelling the city climate serve as a basis for calculating the potential reduction in electricity demand for cooling (including CO_2- equivalent savings) in metropolitan landscapes. In addition, the potential change in radiative forcing induced by changing the surface albedo is estimated.