



Observing moisture and energy exchange of urban soils and the impact on local climate

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Soil as a storage and transmitter for water and thermal energy is able to influence and modify the local climate. The aim of this research project Hamburg Urban Soil Climate Observatory (HUSCO) is a more precise understanding of the interactions between pedosphere and atmosphere in urban environments. HUSCO focuses on the impact of soil hydrology in typical urban structural units, like housing areas, green spaces and sealed courtyards. The local effect of groundwater and soil properties on meteorological variables in the urban environment will be assessed by meteorological and in-situ soil measurements, and supplementary integrated flux measurements over two urban districts with different groundwater table depth. The results should open up opportunities to make more definite predictions about the impacts of climate change in urban areas and to develop adaptation strategies for urban planning.

Long-term measurements started in summer 2010 in the city of Hamburg, Germany. To detect the local climate effects, namely the heterogeneity of temperature and humidity in urban areas, "Meteo-stations" have been set up at reference sites to analyze core atmospheric parameters. In addition, various soil-measurement-stations have been installed to analyze processes and seasonal variations in soil water balance and soil thermal properties. To quantify the climate-controlling processes, like fluxes of energy and water, two Eddy covariance systems will be deployed in early 2011. Furthermore, data of a 250 m high meteorological measurement tower in Hamburg will be used to evaluate the greater meteorological conditions.

The reference sites were selected with regard to the local groundwater table, the type of housing estate, size and vegetation of the green space, as well as soil properties. Two sites – i.e. two urban districts – with different groundwater table depths are examined: a low groundwater table depth of < 2.5 m and a high groundwater table depth of > 5 m. Each site features two meteorological measurement stations, one located in a housing estate and one in a green space. Another station is located inside a sealed courtyard. The two Eddy covariance stations will be mounted at heights of about 30 – 40 m located in the housing estates. In addition to the pedological sensors located directly at the Meteo-stations, further soil-measurement-stations supplement these measurements to give information about the heterogeneity of the soil water balance within the green spaces and the housing estates.

In this contribution a project overview is given, and the design of the experiments and first results of evaluated data of the Meteo-stations and the soil-measurement-stations are presented. The effects of different urban structural units and groundwater level on the atmospheric parameters are analyzed at the local and micro scale. The events that lead to the greatest variability between the reference sites are examined. A comparison of the references sites in case studies, e.g. reaction to rainfall events and dry episodes, will help answering the question: Is capillary flux a significant influencing factor for the local climate?

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