universität innsbruck
Arbeitsbereich für Umwelttechnik

Masterarbeit Arbeitsbereich Umwelttechnik

Using the SUEWS model to investigate urban climate and climate-sensitive urban design in Innsbruck

Content:

With over half of the world's population now living in urban areas, developing sustainable cities that preserve the health and wellbeing of their inhabitants is a highly relevant topic, particularly given the changing climate. In this project the urban climate of Innsbruck will be investigated using the Surface Urban Energy and Water Balance Scheme (SUEWS). SUEWS is a relatively simple model that calculates energy and water fluxes using minimal input requirements (basic meteorological data and information about the surface). First, the performance of the SUEWS model in Innsbruck will be assessed using a variety of observational datasets including short-wave and long-wave radiation, energy balance terms, soil moisture, leaf area index, surface temperature and pedestrian-level air temperature. Next, realistic urban design scenarios will be developed, such as those involving blue-green infrastructure (BGI). BGIs are multi-benefit adaptation measures that, among others, aim to reduce pressure on the urban drainage systems, reduce flooding and cool the urban environment. As they are mostly characterised by vegetation, the effects of prolonged droughts (water scarcity) are increasingly relevant for optimising citywide strategies. The SUEWS model will be used to investigate the potential impact of urban design scenarios on the energy balance, water balance and thermal comfort, and to explore their efficacy under different meteorological conditions. In addition to the model, two monitoring stations, which will be set up in spring 2024, will continuously measure specific meteorological parameters, surface characteristics (e.g., NDVI - Normalised Difference Vegetation Index, surface temperature) and soil properties (e.g., soil temperature and moisture) of different surface types (e.g., green grass, tarmac). The datasets from these monitoring stations can be used for validation and/or parameterisation of the above model.

This is a joint project between the Department of Atmospheric and Cryospheric Sciences and the Department of Environmental Engineering.

Introductory reading:

- Järvi, L., Grimmond, C. S. B. & Christen, A. 2011. The Surface Urban Energy and Water Balance Scheme (SUEWS): Evaluation in Los Angeles and Vancouver. Journal of Hydrology, 411, 219-237 https://doi.org/10.1016/j.jhydrol.2011.10.001
- Järvi, L., Grimmond, C. S. B., Taka, M., Nordbo, A., Setälä, H. & Strachan, I. B. 2014. Development of the Surface Urban Energy and Water Balance Scheme (SUEWS) for cold climate cities. Geosci. Model Dev., 7, 1691-1711 https://doi.org/10.5194/gmd-7-1691-2014
- Ward, H. C. & Grimmond, C. S. B. 2017. Assessing the impact of changes in surface cover, human behaviour and climate on energy partitioning across Greater London. Landscape and Urban Planning, 165, 142-161 https://doi.org/10.1016/j.landurbplan.2017.04.001
- Ward, H. C., Kotthaus, S., Järvi, L. & Grimmond, C. S. B. 2016. Surface Urban Energy and Water Balance Scheme (SUEWS): Development and evaluation at two UK sites. Urban Climate, 18, 1-32 https://dx.doi.org/10.1016/j.uclim.2016.05.001

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Beginn und Dauer: 4-5 Monate; Beginn nach Vereinbarung

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