

EGU23-9635, updated on 21 Feb 2024

<https://doi.org/10.5194/egusphere-egu23-9635>

EGU General Assembly 2023

© Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.



Seasonal solar radiation input of building surfaces depending on latitude, orientation and urban design- implications for urban greening

Yannick Dahm and Thomas Nehls

Technische Universität Berlin, Ökologie, Ökohydrologie, Germany (y.dahm@tu-berlin.de)

Photovoltaic electricity, heat, or biomass are potential products of transformed solar radiation on building envelopes. In the urban landscape all of these energy forms can be used. Walls can be heated when left blank (in winter) and plants can generate biomass, which stores CO₂. Roof- and facade greening are both discussed climate change mitigation and adaptation strategies, whereas its cooling performance is of highest interest in order to prevent indoor heat stress in urban areas, e.g. in the mid latitudes. Shading is the most effective cooling process before transpiration and insulation, its impact depends on the solar radiation. Therefore, solar radiation must be quantified for a set of typical urban conditions in order to prioritize roof or façade greening as the most effective cooling strategy.

The latitude and the regional climatic conditions have an impact on the radiation absorbed by the roofs and the facades of a city. Additionally, the urban design (street canyon height-to-width ratio, roof-to-facade area ratio, altitude of the facade and roof, albedo) and the building orientation play an important role.

We simulated idealized (clear sky conditions, constant albedo and elevation) and realistic scenarios (accounting realistic mean annual weather conditions) with three simplified urban designs (street canyon height-to-width ratio =1, 0.5, 0), using the meteorology database for seven latitudinal evenly distributed cities between the equator and Svalbard. We present results for buildings with a roof to facade ratio of 1, 2 and 3 and discuss the corresponding effectiveness of roof and facade greening.