**PhD Topic 5: Coupled Multi-level Models for Performance Assessment of Built Environments**

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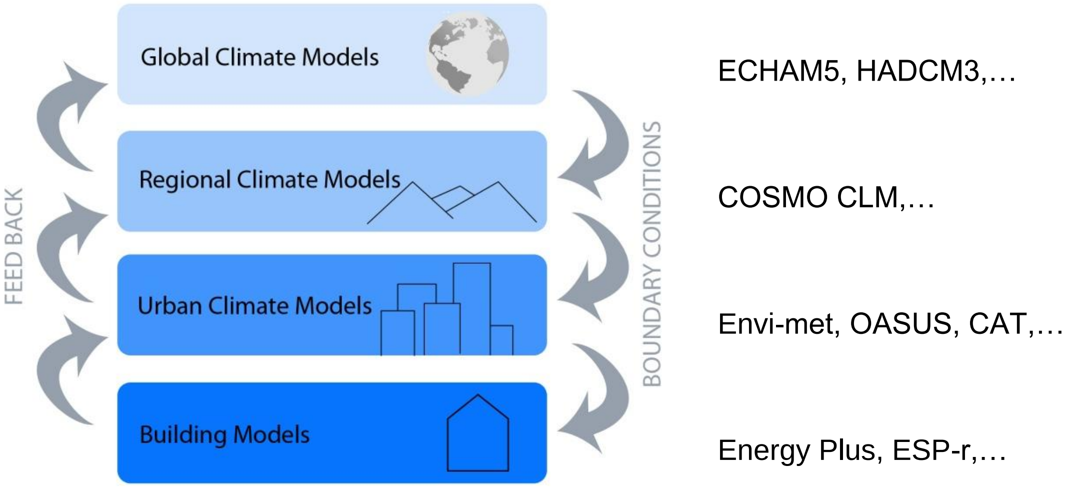
| **Interdisciplinary References** | C1, C4, D1, E1, E4 |

The thorough understanding of the behavior of buildings, settlements, and urban conglomerations in view of energy and environmental performance requires high-resolution models of the climatic boundary conditions. Specifically, such models need to incorporate both temporal dynamics and the spatial variance of climatic conditions. In this context, the primary objective of the doctoral research project is to establish a coupled "top-down" (meteorological) and bottom-up (built environment) computational modeling environment (see Figure below). Such a modeling environment is necessary in order to, amongst other things, computationally predict the implications of alternative mitigation strategies in the context of UHI (Urban Heat Island) effects. Thereby, cost-benefit analyses of such strategies and measures could be carried out in a more reliable and transparent manner. To arrive at such a modeling environment, the aforementioned coupled (top-down and bottom-up) approach is to be pursued. Thereby, the top-down step involves the application of general (large-grid) meteorological models that can provide data on large-scale UHI effects. Such data are very useful to obtain a general estimate of the extent and intensity of UHI effect on broad scale. But their resolution (granularity) is not high enough to directly translate into micro-scale models of the built environment. To bridge this gap, the data generated in this first step must be subsequently translated into the boundary conditions for medium-scale and small-scale thermal modeling tools of the built environment. Such tools typically model the detail geometry of buildings and building ensembles and allow thus for the detailed assessment of parameters such as building component shading and emissive and reflective surface properties. Toward this end, the potential of transfer functions will be explored, that derive from the top-down general meteorological (weather-station level) data, high-resolution micro-climatic conditions at the immediate proximity of built structures.

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