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SoftwareLab Topic

Computational air flow analysis in urban structures

The analysis of wind flow patterns around buildings is an important task in civil engineering. The following issues are relevant: the convective heat and mass transfer at a building surface (building performance simulation), the pedestrian wind environment around buildings (comfort, safety), the air pollutant dispersion (health), the dynamic pressure distribution at the building facade (static load design, natural ventilation), or the impact of the wind-driven rain on the building envelope (moisture). In practice, these problems are addressed by expensive wind tunnel experiments, or by using computational fluid dynamics (CFD). In order to approximate the atmospheric boundary layer and the surface roughness, a model of the urban substructure – at a reduced level of detail but true to scale – is required, i.e., detailed knowledge of the surrounding structure is necessary. The latter geometric model can be extracted from the 3D city model of a geographic information system (GIS).

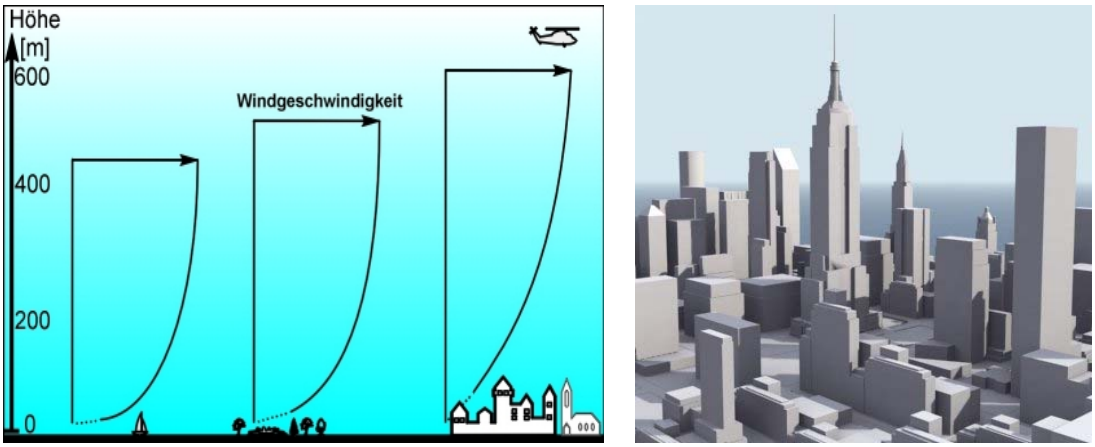

Figure: Atmospheric boundary layer profile and 3D city model (source: www.the3dstudio.com)

Within the software lab project, a relevant scene shall be extracted from a 3D model, which will be provided for the city of Dubai. For this task, a software interface shall be implemented in order to extract the relevant data from a GIS system. A given lattice Boltzmann based parallel simulation code shall be used for the CFD analysis. The numerical model shall be created with the octree-based mesh generator software provided by TUM.

Required:
Programming skills in C and C++, basic knowlegde of geometric modeling.

Partner:
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