Coupling Multi-Resolution GIS/BIM Models to Environmental Numerical Simulation

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ABSTRACT

Due to the increasing availability of 3D geometric models on different scales, entire cities, landscapes, or even countries can be made available through digital information. On the large or global scale, Geographic Information Systems (GIS) are typically used, while on the small or local scale Building Information Models (BIM) are nowadays available for more and more buildings and infrastructure. These GIS/BIM models come with a high degree of detail including semantics or context information. By facilitating both global and local model information in a *mashup* (such as Google Earth), a multi-scale data exploration becomes possible that allows users to exploit detailed information on different scales.

One question is how these multi-resolution GIS/BIM models can be made available to multi-scale numerical simulations in order to evaluate effects of natural catastrophes such as earthquakes or floods on urban regions, built infrastructure, and also single buildings. In this work, we will present a parallel data access framework [1] with interfaces to all parts of the simulation pipeline such as preprocessing, numerical simulation, and postprocessing. We will focus on suitable distributed data structures to store these GIS/BIM models using a forest of space-trees as well as how to derive all necessary input for a numerical flow simulation on several scales (city → block → building → room). This allows to answer not only questions which parts of a city/which buildings will be influenced by floods, but also which rooms of a single building will be exposed to water (i. e. height of water level).

The applicability of the complete approach presented in this work is shown by simulating urban floods including surface flow of a city, the pipe network interaction, and its consequences to individual buildings.

References:

[1] V. Varduhn: *A Parallel Multi-Resolution Framework for Handling Large Sets of Complex Data, from Exploration and Visualisation to Simulation.* Doctoral Dissertation, TU München, 2014.