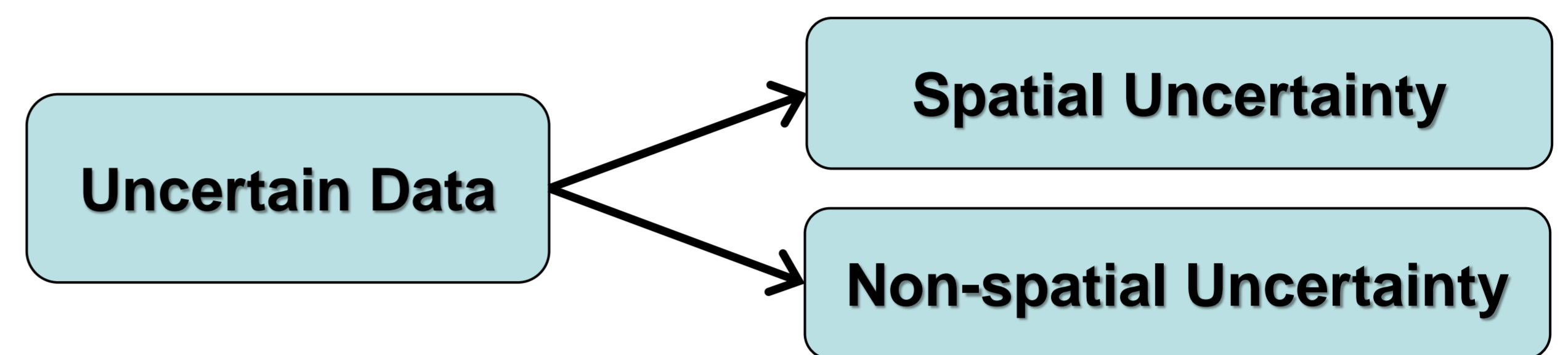


Visualizing uncertain underground information for urban management

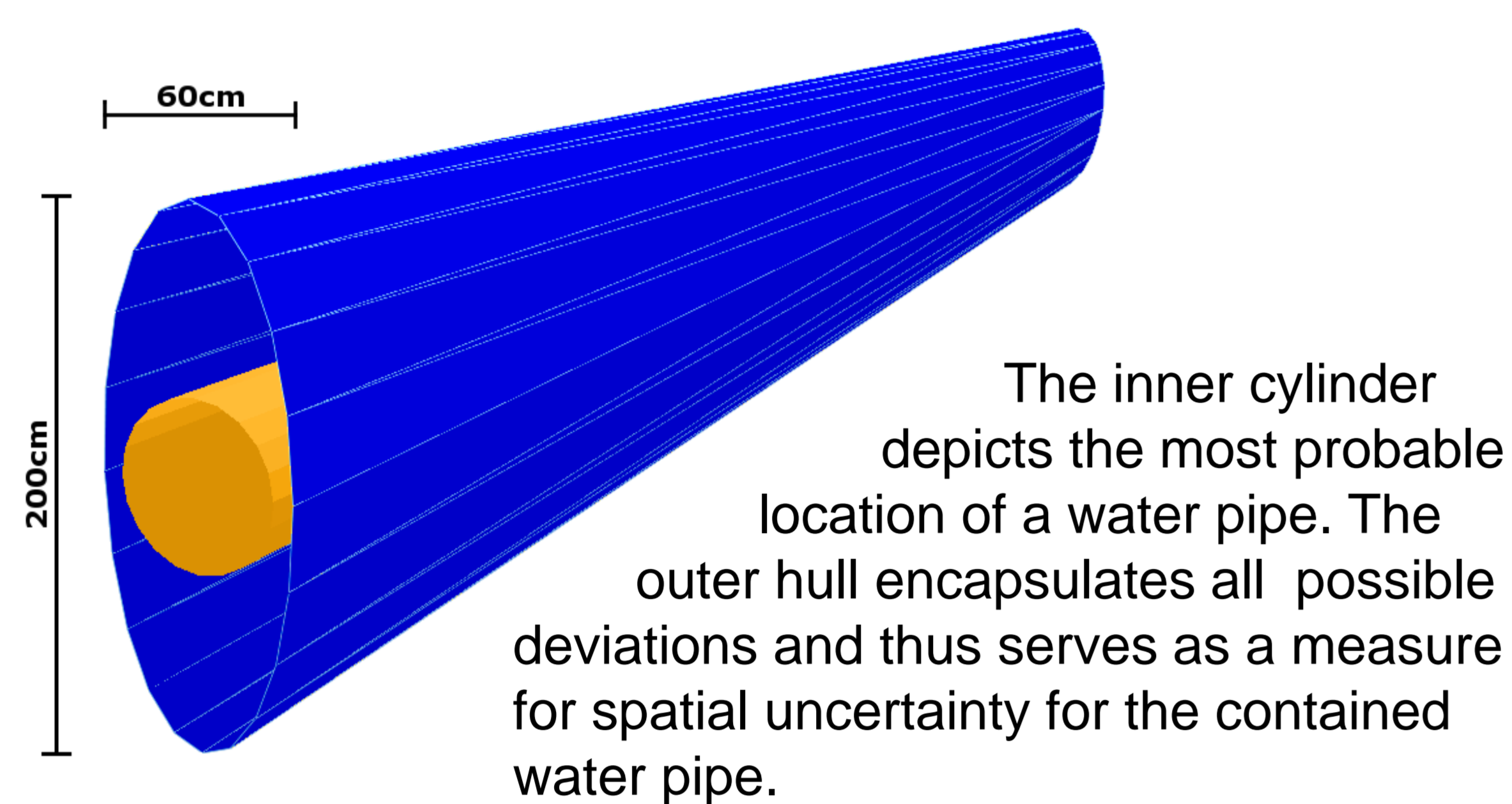
Martin Dummer, Michel Krämer, Tobias Ruppert, Jörn Kohlhammer

Data Analysis

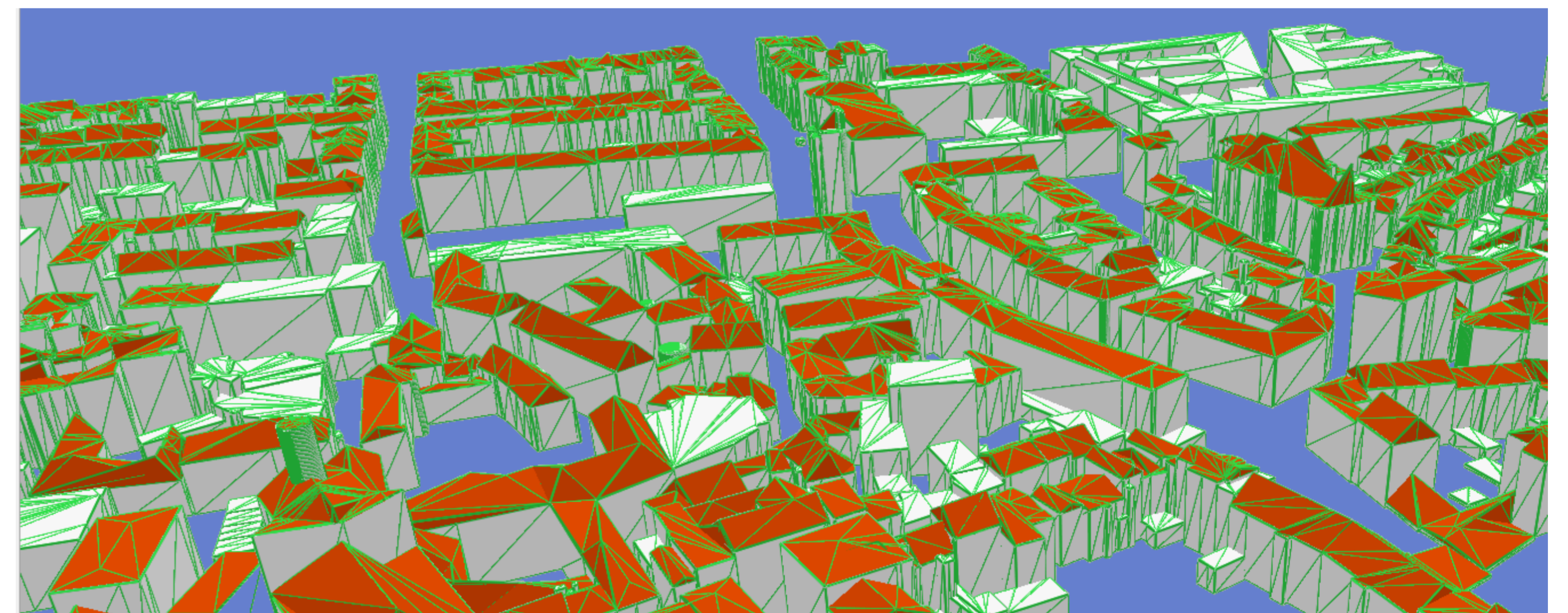
The types of uncertainty can be divided into spatial and non-spatial attributes. We investigate two different approaches for their visualization: additional hull geometry for models that have uncertain location coordinates and object highlighting for models that have non-spatial uncertainty like currency or subjectivity.



Spatial Uncertainty Visualization

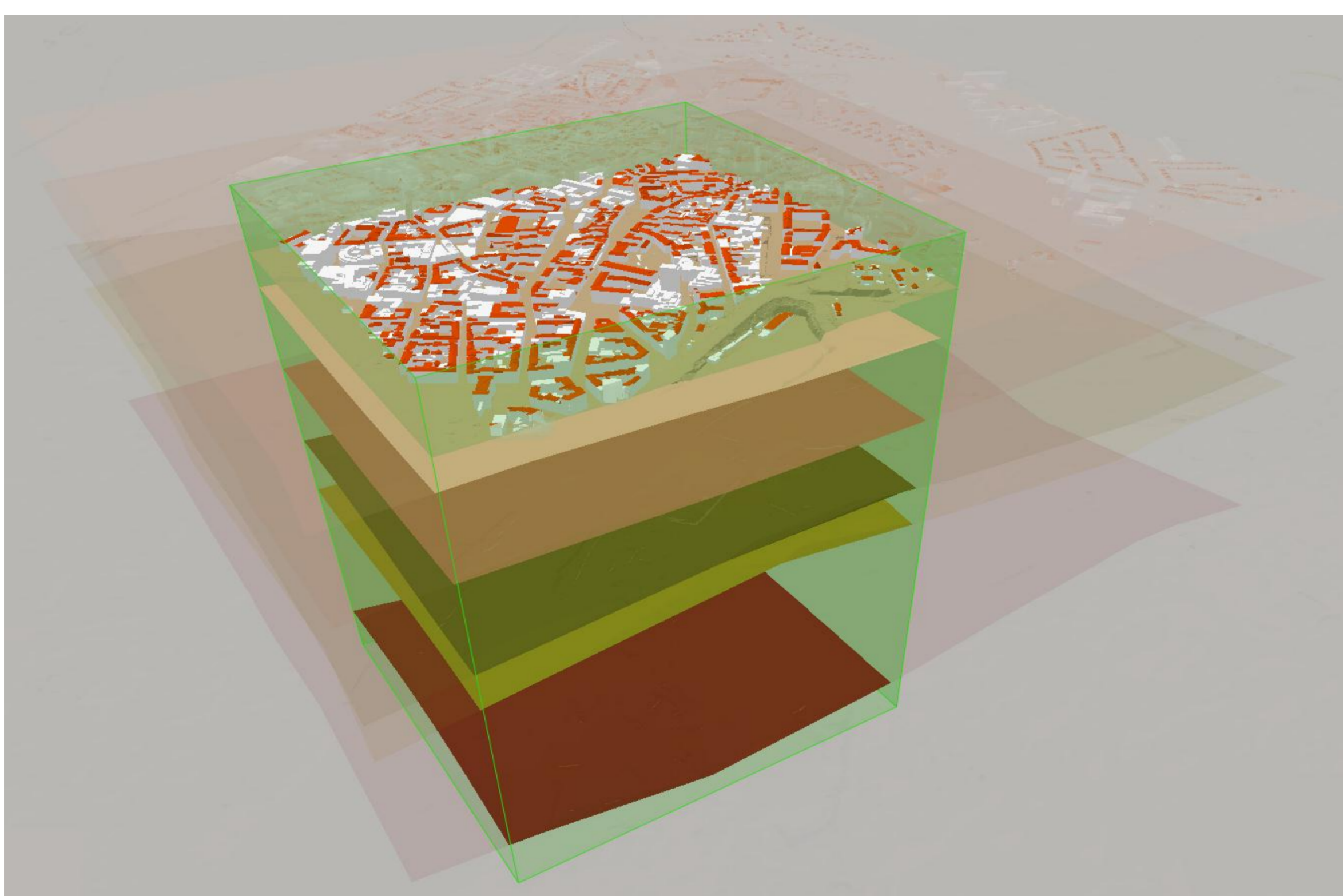


Non-Spatial Uncertainty Visualization



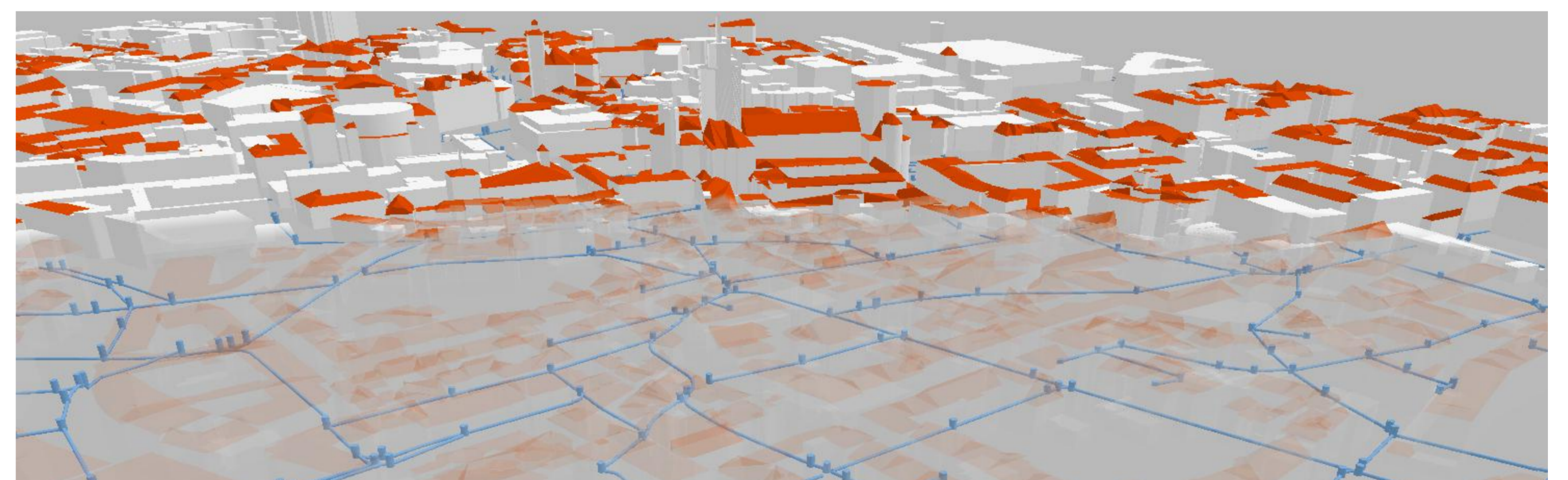
The wireframe outline of the objects reflects the trustworthiness of the user in the overall data quality. Green color indicates high confidence.

Focus on the Interesting Parts



The visible part of the scene has been reduced to a cube to be able to focus on the interesting, smaller part of a larger city. The rest of the scene is hardly visible but gives an idea of the surrounding.

Hide Objects that Block the Sight



Bird's eye view on the city center. Irrelevant information like buildings are hidden automatically depending on the distance to the camera. The pipeline network is highlighted in blue to increase its visibility.

Future Work

- Integration of diverse underground data formats
- Interaction tools for geological cuts, etc.
- Rule-based modification of visual data representation

Related Work

- M. Krämer, T. Ruppert, E. Klien, and J. Kohlhammer. DeepCity3D: Integration von 3D-Stadtmodellen und Untergrundinformationen. In Proceedings of Geoinformatik, pages 72 – 80, 2010.
- R. Roth. The role of uncertainty during decision making. *Cartography and Geographic Information Society*, 36(4), 2009.
- T. Zuk. *Visualizing uncertainty*. PhD thesis, University of Calgary, 2008.

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