

# Interoperability of Environmental Data and 3d City Models Based on Correspondences between Ontologies

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Various environmental data and information models have been developed and are used in the urban domain, to perform for example air quality calculation, building energy consumption analysis or traffic simulation. The use of urban models, particularly 3D city models representing the structure of a city in three dimensions, is increasing in urban planning.

There are two ways of developing relations between environmental models and 3D city models. An integrated approach is the joint use of different models, most of the time in an interconnected way able to model the urban issues together with their inter-relations. 3D city models play a central role in this approach since the knowledge related to different urban issues and models can be integrated within or interconnected with 3D models. This approach leads to semantically enriched 3D city models that are well suited to decision support. Those models can also be used for a 3D visualisation of this knowledge.

Interoperability between environmental data and data coming from 3D city models is another way of relating information models – it is also a problem very complex to manage, due to the data heterogeneity, as well as in terms of syntax as in terms of semantic content. Developing interconnection mechanisms is thus necessary to take into account the complexity of the different issues.

Ontology-based approaches provide a generic and robust way to interconnect different information models. Sometimes, a direct approach, consisting in establishing direct links between concepts can be adequate. However, in most cases, it is necessary to take into consideration the possibility of computations, or more complex processes involved in the correspondences between the different data models.

In this paper, the role of correspondence mechanisms between ontologies is presented as a tool to reach a high level interoperability between environmental models and 3D city models. This interoperability is described through two examples :

- This kind of model is commonly used in standards, such as GML, INSPIRE, ISO 191xx series, etc ... . An approach based on ontologies will help creating high level representations of those standards, as ontologies. A further stage then consists in defining alignments among those ontologies, starting from a high level where only high level concepts are mapped. This kind of approach can be considered as a powerful way to improve the interconnexion and the interoperability of standards.

- This approach provides also an important contribution helping to build a semantic web for environmental data, it is one of the investigations this paper intends to present.

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**Keywords:** ontologies, interoperability, environmental data, 3D city models, integration, semantic web