

EDITORIAL PREFACE

Special Issue on Advances in 3D GeoInformation Science

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An important aspect of the IJ3DIM's mission is to encourage developments in the field of 3D GeoInformation Sciences. 3D Geographical/Geospatial Models & Systems (GIS) have been an area of research for the last 20-30 years in different domains including Urban Management, City Modeling, Logistics, Environmental Management and Conservation, Emergency Response, Public Participation, Gaming, Infrastructure Management, Water Resources Management, Defense, Geology/Mining. Today, the overall interest in 3D GIS is growing as, 3D Geospatial Models (e.g. GML3 / Google KML) are becoming well-known and mature, and City Modeling standards (such as City GML) are becoming global. A key dimension of the journal's scope is supporting the sharing of research related to 3D GIS and its applications in multiple domains. A key annual event in the field of 3D GeoInformation Sciences is 3DGeoInfo Conference series. 3DGeoInfo series aims at bringing together international state-of-the-art research and facilitating the dialogue on emerging topics in the field of 3D GeoInformation. The conference with the focus of 3D GeoInformation offers an interdisciplinary forum in the fields of 3D data collection

and modelling; reconstruction and methods for 3D representation; data management for maintenance of 3D GeoInformation, 3D data analysis and visualization. A pre-conference workshop on 3D aspects of Oracle Spatial was conducted by Mike Horhammer (Oracle) and received considerable attention and excellent feedback from the conference participants. A remarkable speech on academic publishing was given by Christopher Gold in the 2nd day of the conference. During the conference, 1st meeting of the International Executive Board of 3DGeoInfo is conducted with the participation of Alias Abdul Rahman, Jantien Stoter (also representing Sisi Zlatanova), Jiyeong Lee, Philippe De Maeyer, Thomas Kolbe, Jacynthe Pouliot, Umit Isikdag, Claire Ellul, Christopher Gold, and Martin Breunig. There were 60+ papers presented by authors from all over the globe. This issue is based on (a selection of) extended versions of the papers which are presented during the conference.

In the first paper of the issue Bahu et al presents a 3D Spatial Urban Energy Modelling Approach. The authors indicated that today's needs to reduce the environmental impact of energy use impose dramatic changes for energy

infrastructure and existing demand patterns (e.g. buildings) corresponding to their specific context. In addition, future energy systems are expected to integrate a considerable share of fluctuating power sources and equally a high share of distributed generation of electricity. Energy system models capable of describing such future systems and allowing the simulation of the impact of these developments thus require a spatial representation in order to reflect the local context and the boundary conditions. This paper describes two recent research approaches developed at EIFER in the fields of (a) geo-localised simulation of heat energy demand in cities based on 3D morphological data and (b) spatially explicit Agent-Based Models (ABM) for the simulation of smart grids. 3D city models were used to assess solar potential and heat energy demand of residential buildings which enable cities to target the building refurbishment potentials. Distributed energy systems require innovative modelling techniques where individual components are represented and can interact. With this approach, several smart grid demonstrators were simulated, where heterogeneous models are spatially represented. Coupling 3D geodata with energy system ABMs holds different advantages for both approaches. On one hand, energy system models can be enhanced with high resolution data from 3D city models and their semantic relations. Furthermore, they allow for spatial analysis and visualisation of the results, with emphasis on spatially and structurally correlations among the different layers (e.g. infrastructure, buildings, administrative zones) to provide an integrated approach. On the other hand, 3D models can benefit from more detailed system description of energy infrastructure, representing dynamic phenomena and high resolution models for energy use at component level. The proposed modelling strategies conceptually and practically integrate urban spatial and energy planning approaches. The combined modelling approach that will be developed based on the described sectorial models holds the potential to represent hybrid energy systems coupling

distributed generation of electricity with thermal conversion systems.

The second paper is authored by Tsiliakou et al, and presents on Procedural Modeling in 3D GIS Environment. The authors indicated that 3D space registration and visualization has become an imperative need in order to optimally reflect all complex cases of rapid urbanization of property rights and restrictions. Besides, current technological advances as well as the availability of sophisticated software packages (proprietary or open source) call for 3D modeling especially in the GIS domain. Within this context, GIS community's present demands concerning the third dimension are discussed, while a variety of 3D modeling techniques is presented, with special emphasis on procedural modeling. Procedural modeling refers to a variety of techniques for the algorithmic generation of detailed 3D models and composite facade textures from sets of rules which are called grammars. In this paper procedural modeling is employed via CityEngine software focusing on the 3D visualization of the National Technical University of Athens (NTUA) campus' three-dimensional model, rendering a higher detail on the School of Rural and Surveying Engineering (SRSE). This algorithmic modeling concept is based on the principle that all real world buildings are defined by rules, since repetitive patterns and hierarchical components describe their geometry. The detailed geometries of the model derived from the application of CGA (Computer Generated Architecture) shape grammars on selected footprints, and the process resulted in a final 3D model, optimally describing the built environment and proved to be a good practice example of 3D visualization.

The third paper is authored by Klimke et al. and elaborates on Scalable Multi-Platform Distribution of spatial 3D Contents. The authors stated that Virtual 3D city models provide powerful user interfaces for communication of 2D and 3D geoinformation. Providing high quality visualization of massive 3D geoinformation in a scalable, fast, and cost efficient manner is still a challenging task. Especially for mobile and

web-based system environments, software and hardware configurations of target systems differ significantly. This makes it hard to provide fast, visually appealing renderings of 3D data throughout a variety of platforms and devices. Current mobile or web-based solutions for 3D visualization usually require raw 3D scene data such as triangle meshes together with textures delivered from server to client, what makes them strongly limited in terms of size and complexity of the models they can handle. In this paper, they introduce a new approach for provisioning of massive, virtual 3D city models on different platforms namely web browsers, smartphones or tablets, by means of an interactive map assembled from artificial oblique image tiles. The key concept is to synthesize such images of a virtual 3D city model by a 3D rendering service in a pre-processing step. This service encapsulates model handling and 3D rendering techniques for high quality visualization of massive 3D models. By generating image tiles using this service, the 3D rendering process is shifted from the client side, which provides major advantages: (a) The complexity of the 3D city model data is decoupled from data transfer complexity (b) the implementation of client applications is simplified significantly as 3D rendering is encapsulated on server side (c) 3D city models can be easily deployed for and used by a large number of concurrent users, leading to a high degree of scalability of the overall approach. All core 3D rendering techniques are performed on a dedicated 3D rendering server, and thin-client applications can be compactly implemented for various devices and platforms.

In the final paper of the issue, Roßmann et al presents a GML-based Data Management and Semantic World Modelling for a 4D Forest Simulation and Information System. The authors indicated that Various types of 3D simulation applications benefit from realistic forest models. They range from flight simulators for entertainment to harvester simulators for

training and tree growth simulations for research and planning. Their 4D forest simulation and information system integrates the necessary methods for data extraction, modelling and management. Using modern methods of semantic world modelling, tree data can efficiently be extracted from remote sensing data. The derived forest models contain position, height, crown volume, type and diameter of each tree. This data is modelled using GML-based data models to assure compatibility and exchangeability. ForestGML is the name of a new schema family developed to provide a common basis for forestry data. A flexible approach for database synchronization is used to manage the data and provide caching, persistence, a central communication hub for change distribution, and a versioning mechanism. Combining various simulation techniques and data versioning, the 4D forest simulation and information system can provide applications with “both directions” of the fourth dimension. This paper outlines the current state, new developments, and integration of tree extraction, data modelling, and data management. It also shows several applications realized with the system.

This 4th paper concludes the Issue 3-3 of the journal. Our next issue will be focusing on how BIM would be beneficial for housing. I would like to use this chance to thank to the contributors of this special issue, to the editorial review board of the journal and 3D GeoInformation Conference without which this Issue would not be possible. I would also like to conclude by encouraging all readers of the journal to submit their research results related BIM and 3D GeoInformation Sciences to our journal. We are very much looking forward to work with you towards publishing your work in IJ3DIM.

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