Multi-sourced 3D Geospatial Terrain Modelling: Issues and Challenges

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Abstract: The use of Digital Terrain Models (DTMs) is rapidly and intensively growing in many scientific disciplines as a computerized mapping and modeling infrastructure of our natural environment. Many different sources of wide-coverage DTMs that are generated by various acquisition and production techniques, which differ significantly in terms of geometric attributes, resolution and accuracy currently exist. Due to these differences, these sources often describe the same coverage area by discrepant representation of the topography. Geospatial analysis, such as comparison or integration, of two (or more) of these databases acquired on different epochs, while relying solely on their coordinate reference systems, will usually result in a wrong outcome. This occurs mainly because of inherent non-uniform topographic and topologic inconsistencies – as well as morphologic changes transpired – between the databases. Investigating and monitoring these factors prior to actual data analysis is essential. Another important issue is the question of the accuracy and mainly the vertical (relative as well as absolute) accuracy of these different databases. Previous studies have shown that the inner vertical accuracy of an individual wide-coverage DTM is not homogeneous, and cannot be expressed by a single global accuracy value. Still, in terms of quality analysis, most studies continue to investigate the accuracy of topographic models globally while ignoring inner quality aspects. Spatial regional inner-accuracies analysis that is based on terrain characteristics and local trend detection is the basis for performing a geostatistical spatial accuracy classification leading to define polygonal sub-areas of the DTMs into error-classes, and then to address the vertical absolute accuracy measures on a regional (and not a global) scale. The lecture will review these, as well other, issues and will focus on the challenges that the mapping and surveying discipline is facing today.

Keywords: digital terrain models, topographic models, geospatial analysis, accuracy of databases, quality analysis