

The Time-Lapse Digital Elevation Models Difference for Change Detection of Earth's Topography

Kazimierz Becek (Poland)

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SUMMARY

The earth's topography changes continuously due to natural and anthropogenic processes, including erosion, seismic, tectonic displacements and volcanic activities, groundwater changes, deformations due to mining operations, engineering projects, constructions of new buildings. In addition, the topography of the canopy of vegetation covering the earth's surface is also on the move resulting from seasonal changes, growth or deforestation. Monitoring these changes is paramount for modelling underlying processes and planning purposes. Digital Elevation Models (DEM) is a contemporary method of representing the topography of the earth's surface. While DEMs are an active research topic, relatively little attention of the research community has been offered to investigate the properties and utility of the difference of DEMs captured at some distant points in time. In this contribution, we report on investigating properties of difference of two semi-global DEMs, i.e., the Shuttle Radar Topography Mission (SRTM) and the Copernicus DEM. Both DEMs were captured some 15 years apart. Therefore, besides typical measurement errors, their difference should contain a signal due to changes in the earth's surface topography. To investigate the sensitivity level or the applicability of the DEMs difference for topography change assessment, we selected a few test sites representing various land cover types, including forest, agricultural land, subsidising mining area and bare land. As found, visual inspection of the raster of DEMs difference does not reveal a small topography change. Therefore, we used spatial statistical methods to reveal these otherwise obscured changes in topography. We found that freely available DEMs can be used to study earth's surface topography change, providing that the time-lapse or the magnitude of the topography change is large enough. We point out that a crucial determinant of the sensitivity of the DEMs difference is the slope of the terrain.

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