Geophysical Research Abstracts
Vol. 16, EGU2014-15987, 2014
EGU General Assembly 2014

Accuracy analysis of height difference models derived from terrestrial laser scanning point clouds

Philipp Glira (1), Christian Briese (1,2), Norbert Pfeifer (1), Jana Dusik (3), Ludwig Hilger (3), Fabian Neugirg (3), and Henning Baewert (4)

(1) Department of Geodesy and Geoinformation, Vienna University of Technology, Vienna, Austria, (2) LBI for Archaeological Prospection & Virtual Archaeology, Vienna, Austria, (3) Physical Geography, Cath. University of Eichstaett-Ingolstadt, Eichstaett, Germany, (4) Institute of Geosciences and Geography, Martin-Luther-University Halle-Wittenberg, Germany

In many research areas the temporal development of the earth surface topography is investigated for geomorphological analysis (e.g. landslide monitoring). Terrestrial laser scanning (TLS) often is used for this purpose, as it allows a fast and detailed 3d reconstruction of the sampled object.

The temporal development of the earth surface usually is investigated on the basis of rasterized data, i.e. digital terrain models (DTM). The difference between two DTMs - the difference model - should preferably correspond to the terrain height changes occurred between the measurement campaigns. Actually, these height differences can be influenced by numerous potential error sources. The height accuracy of each raster cell is affected primarily by (a) the measurement accuracy of the deployed TLS, (b) the terrain topography (e.g. roughness), (c) the registration accuracy, (d) the georeferencing accuracy and (e) the raster interpolation method. Thus, in this contribution, height differences are treated as stochastic variables in order to estimate their precision.

For an accurate estimation of the height difference precision a detailed knowledge about the whole processing pipeline (from the raw point clouds to the final difference model) is essential. In this study, first the height difference precision is estimated by a rigorous error propagation. As main result, for each raster cell of the difference model, a corresponding height error is estimated, forming an error map. A statistical hypothesis test is presented in order to judge the significance of a height difference. Furthermore, in order to asses the effect of single factors on the final height difference precision, multivariate statistic methods are applied. This analysis allows the deduction of a simple error propagation model, neglecting error sources with small impact on the final precision.

The proposed method is demonstrated by means of TLS data acquired at the Gepatschferner (Tyrol, Austria). This study was carried out within the research project PROSA (high-resolution measurements of morphodynamics in rapidly changing PROglacial Systems of the Alps).