Geophysical Research Abstracts
Vol. 15, EGU2013-13729-1, 2013
EGU General Assembly 2013

Evaluation of the geomorphometric results and residual values of a robust plane fitting method applied to different DTMs of various scales and accuracy

Zsófia Koma (1), Balázs Székely (1,2), Peter Dorninger (3), and Gábor Kovács (1)

(1) Department of Geophysics and Space Sciences, Eötvös University, Budapest, Hungary, (2) Research Groups Photogrammetry and Remote Sensing, Department of Geodesy and Geoinformation, Vienna University of Technology, Vienna, Austria, (3) D-IT GmbH, Pfaffstätten, Austria

Due to the need for quantitative analysis of various geomorphological landforms, the importance of fast and effective automatic processing of the different kind of digital terrain models (DTMs) is increasing. The robust plane fitting (segmentation) method, developed at the Institute of Photogrammetry and Remote Sensing at Vienna University of Technology, allows the processing of large 3D point clouds (containing millions of points), performs automatic detection of the planar elements of the surface via parameter estimation, and provides a considerable data reduction for the modeled area. Its geoscientific application allows the modeling of different landforms with the fitted planes as planar facets.

In our study we aim to analyze the accuracy of the resulting set of fitted planes in terms of accuracy, model reliability and dependence on the input parameters.

To this end we used DTMs of different scales and accuracy: (1) artificially generated 3D point cloud model with different magnitudes of error; (2) LiDAR data with 0.1 m error; (3) SRTM (Shuttle Radar Topography Mission) DTM database with 5 m accuracy; (4) DTM data from HRSC (High Resolution Stereo Camera) of the planet Mars with 10 m error.

The analysis of the simulated 3D point cloud with normally distributed errors comprised different kinds of statistical tests (for example Chi-square and Kolmogorov-Smirnov tests) applied on the residual values and evaluation of dependence of the residual values on the input parameters. These tests have been repeated on the real data supplemented with the categorization of the segmentation result depending on the input parameters, model reliability and the geomorphological meaning of the fitted planes.

The simulation results show that for the artificially generated data with normally distributed errors the null hypothesis can be accepted based on the residual value distribution being also normal, but in case of the test on the real data the residual value distribution is often mixed or unknown. The residual values are found to be dependent on two input parameters (standard deviation and maximum point-plane distance both defining distance thresholds for assigning points to a segment) mainly and the curvature of the surface affected mostly the distributions.

The results of the analysis helped to decide which parameter set is the best for further modelling and provides the highest accuracy. With these results in mind the success of quasi-automatic modelling of the planar (for example plateau-like) features became more successful and often provided more accuracy.

These studies were carried out partly in the framework of TMIS.ascrea project (Nr. 2001978) financed by the Austrian Research Promotion Agency (FFG); the contribution of ZsK was partly funded by Campus Hungary Internship TÁMOP-424B1.