Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06897, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06897
EGU General Assembly 2008

Water surface mapping using airborne laser scanning elevation and signal amplitude data

B. Höfle (1), N. Pfeifer (1), C. Ressl (1), M. Rutzinger (2) and M. Vetter (3)

(1) Christian Doppler Laboratory for Spatial Data from Laser Scanning and Remote Sensing, Institute of Photogrammetry and Remote Sensing, Vienna University of Technology, Gusshausstrasse 27-29, 1040 Vienna, Austria, (2) alpS - Centre for Natural Hazard Management, Grabenweg 3, 6020 Innsbruck, Austria, (3) Institute of Geography, University of Innsbruck, Innrain 52, 6020 Innsbruck, Austria (bh@ipf.tuwien.ac.at)

In recent years Airborne Laser Scanning (ALS) evolved to the state-of-the-art technology for topographic data acquisition. Our contribution shows that ALS is suited for automated mapping of water surface areas, which are required for topographic, hydrological, and hydraulic analysis and simulation. The primary result of an ALS campaign is a three-dimensional point cloud, generally used to produce high-resolution digital elevation models with high accuracy. Most ALS sensors additionally record the backscattered signal amplitude for each reflection, which has already been used for the detection of different land surface classes (e.g. snow, ice and roads). We present a new method for water surface mapping by combining the spatial and amplitude information provided by ALS. The reflection characteristics of water surfaces in the near-infrared wavelength (1064 nm) of the ALS system along with the surface roughness information provide the basis for the differentiation between water and land areas. Water areas are characterized by a high number of laser shot dropouts and predominant low amplitudes mainly caused by strong absorption and specular reflection not directed towards the receiver. The availability of the timestamps for each recorded measurement and knowing the pulse repetition frequency makes it possible to model the location of all laser shot dropouts with signal amplitude set to zero. A seeded region growing segmentation applied to the point cloud and the modeled dropouts is used to delineate regions with similar amplitudes. Additionally only minor elevation changes are allowed within a segment. The resultant segments are then classified by

their mean signal amplitude and roughness into water and non-water. We demonstrate that the proposed workflow succeeds for a small river (river Rofenache/Tyrol, approx. 15m width) with low turbidity and rough water surface as well as for a broad river (Inn/Tyrol, approx. 70m width) with high turbidity and smooth surface. Validation of the delineation and classification accuracy is performed by comparing the results with terrestrial orthophotos collected at the time as the ALS data acquisition. The results show the capability of ALS data for operational water surface mapping and elevation model generation providing valuable datasets for a number of applications in hydrology, such as automatic stream mapping, area-wide water level retrieval, and flood mapping.