Geophysical Research Abstracts
Vol. 13, EGU2011-12268, 2011
EGU General Assembly 2011

New approaches in vegetation mapping – use of terrestrial laser scanning on high Andean cushion peatlands

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Cushion peatlands of the high mountainous tropical areas are unique ecosystems that are dominated by juncaceous, peat-forming cushion plants. Depending on topography and water supply they can develop high accumulation rates. The growth of corresponding taxa is spatially bound to spring outlets on slopes or in valley bottoms at altitudes ranging from 4000 m to 5000 m a.s.l. For the first time, so called spring hillocks were investigated. These small mounds typically cluster around wells within the upper catchment area of the cushion peatlands. In general their size is relatively small (about 3-10 m in diameter) and due to their densely-green habitus, they overlook the surrounding vegetation by about 1-2 m. The study at hand focuses on a special spring hillock in the western cordillera of the southern Peruvian Andes. As opposed to the above-mentioned hillocks, it is situated on a gently inclined slope in the semiarid puna of the altiplano. Hence, it represents an azonal habitat. Terrestrial laser scanning (TLS) techniques are used first-time in order to provide new insights into the spatial distribution-pattern of vegetation with special regard to aspect, water supply and dimension of spring hillocks. The investigations are based on one of the latest 'time-of-flight'-scanners (Riegl VZ-400) with online waveform processing technology. Both the geometrical and radiometric information provided by full-waveform TLS are taken into account. Parallel on-site vegetation mapping allows to calibrate and equip the TLS data with obtained attributes. Backscatter values resulting from different species and reflection properties, respectively, give detailed information on the taxonomic composition and the different plant endmembers. In addition to the planimetric distribution, laser scanning also allows to determine and to quantify both the vertical extent of the spring hillocks and their volume. As documented by the results, the morphology of hillocks is in sharp contrast to the geomorphic landforms in their surroundings, which are also precisely captured in the 3D scans. Moreover, the biogenic mounds induce different geomorphodynamic processes on both the microscale and at close range. Future investigations will focus on establishing a semi-automated workflow for highly detailed 3D vegetation mapping on cushion peatlands. As spring hillocks are heavily affected by grazing and episodic rainfalls, multitemporal studies will be carried out to provide new insights into adaption strategies of vegetation to changing environmental conditions.