Geophysical Research Abstracts
Vol. 16, EGU2014-10306, 2014
EGU General Assembly 2014

Using remote sensing for volumetric analyses of soil degradation by erosion

Marketa Vlacilova, Josef Krasa, and Petr Kavka

CTU in Prague, Fakulty of Civil Engineering, Department of Irrigation, Drainage and Landscape Engineering, Czech Republic (marketa.vlacilova@fsv.cvut.cz)

Soil degradation by erosion can be effectively monitored or quantified by modern tools of remote sensing with variable level of detail accessible. The presented study deals with rill erosion assessment using stereoscopic images and orthophotos obtained by UAV (unmanned aerial vehicle). Advantages of UAVs are data in high resolution (1-10 cm/pixel), flexibility of data acquisition and price in comparison with standard aerial photography.
Location attacked by intensive rainfall event in the spring 2013 was selected for this study of volumetric assessment of soil degradation by erosion. After the storm, rills and ephemeral gullies in different scales were detected on several fields in the target area. The study was focused on a single parcel catchment (12.5 ha) which attach to the main ephemeral gully in the monitored field. DEM of the location was obtained from UAV stereo images and official LIDAR data.
At the same time, in-situ monitoring was effected for comparison and validation of methodology. The field measurement consisted of soil sampling and taking detailed stereo photographs of erosion rills. The photographs were processed by PhotoModeler Scanner software to obtain detailed surface data (TIN) of particular rills. The model for automatic and precise volumetric assessment of single rills was developed within ArcGIS.
The whole study area DEM obtained from UAV was also analysed in ArcGIS using similar methodology for computation of rill volumes. The UAV DEM detected most rill bottoms and shapes however the level of detail was too low for actual sediment transport volume estimate. Therefore the volume obtained from UAV DEM was calibrated by the detailed models of single rills acquired by field measurement. Prior the calibration the UAV DEM volume was underestimated by 40-85% based on the rill size. Afterwards the target area was split into twelve separated regions defined by intensity and form of soil degradation (orthophoto-classified rill density). Equally, at least one representative square plot in each section was created. Next, the volume of erosion rills in each square plot was calculated and corrected by referenced relation. These results were extrapolated to the whole of the study catchment.
The study contains volumetric evaluation of actual soil loss by rill erosion in detailed scale and in addition, there is a model for rill volume evaluation in highly detached fields. The results illustrate that the volume of soil loss can reach extreme values in detached areas after only one intensive rainfall event. Hundreds of cubic metres of soil can be transported in rills and ephemeral gullies from a single hectare of arable land. Findings are useful for development and verification of procedures for the identification and evaluation of actual degradation of agricultural land by water erosion.
The research has been supported by the project No. QJ330118 „Using Remote Sensing for Monitoring of Soil Degradation by Erosion and Erosion Effects“.