Geophysical Research Abstracts
Vol. 17, EGU2015-713-1, 2015
EGU General Assembly 2015


# Prediction of soil stability and erosion in semiarid regions using numerical hydrological model (MCAT) and airborne hyperspectral imagery

Anna Brook and Lea Wittenberg

Remote Sensing Laboratory, Center for Spatial Analysis Research (UHCSISR), Department of Geography and Environmental Studies, University of Haifa, Haifa,Israel (anna.brook@gmail.com)

Long-term environmental monitoring is addressed to identify physical and biological changes and progresses taking place in the ecosystem. This basic action of landscape monitoring is an essential part of the systematic long-term surveillance, aiming to evaluate, assess and predict the spatial change and progresses. Indeed, it provides a context for wide range of diverse studies and research frameworks from regional or global scale. Spatial-temporal trends and changes at various scales (massive to less certain) require establishing consistent baseline data over time. One of the spatial cases of landscape monitoring is dedicated to soil formation and pedological progresses. It is previously acknowledged that changes in soil affect the functionality of the environment, so monitoring changes recently become important cause considerable resources in areas such as environmental management, sustainability services, and protecting the environment healthy. Given the above, it can be concluded that monitoring changes in the base for sustainable development.

The hydrological response of bare soils and watersheds in semiarid regions to intense rainfall events is known to be complex due to multiply physical and structural impacts and feedbacks. As a result, the comprehensive evaluations of mathematical models including detailed consideration of uncertainties in the modeling of hydrological and environmental systems are of increasing importance. The presented method incorporates means of remote sensing data, hydrological and climate data and implementing dedicated and integrative Monte Carlo Analysis Toolbox (MCAT) model for semiarid region. Complexity of practical models to represent spatial systems requires an extensive understanding of the spatial phenomena, while providing realistic balance of sensitivity and corresponding uncertainty levels. Nowadays a large number of dedicated mathematical models applied to assess environmental hydrological process. Among the most promising models is the MCAT, which is a MATLAB library of visual and numerical analysis tools for the evaluation of hydrological and environmental models. The model applied in this paper presents an innovative infrastructural system for predicting soil stability and erosion impacts. This integrated model is applicable to mixed areas with spatially varying soil properties, landscape, and land-cover characteristics. Data from a semiarid site in southern Israel was used to evaluate the model and analyze fundamental erosion mechanisms. The findings estimate the sensitivity of the suggested model to the physical parameters and encourage the use of hyperspectral remote sensing imagery (HSI).

The proposed model is integrated according to the following stages: 1. The soil texture, aggregation, soil moisture estimated via airborne HSI data, including soil surface clay and calcium carbonate erosions; 2. The mechanical stability of soil assessed via pedo-transfer function corresponding to load dependent changes in soil physical properties due to pre-compression stress (set of equations study shear strength parameters take into account soil texture, aggregation, soil moisture and ecological soil variables); 3. The precipitation-related runoff model program (RMP) satisfactorily reproduces the observed seasonal mean and variation of surface runoff for the current climate simulation; 4. The Monte Carlo Analysis Toolbox (MCAT), a library of visual and numerical analysis tools for the evaluation of hydrological and environmental models, is proposed as a tool for integrate all the approaches to an applicable model. The presented model overcomes the limitations of existing modeling methods by integrating physical data produced via HSI and yet stays generic in terms of space and time independency.