Geophysical Research Abstracts
Vol. 13, EGU2011-9598, 2011
EGU General Assembly 2011

Unique Challenges in Modelling Post-mining Landforms Using Landform Evolution Models

Garry Willgoose (1) and Greg Hancock (2)

(1) School of Engineering, The University of Newcastle, Callaghan, Australia (garry.willgoose@newcastle.edu.au), (2) School of Earth Sciences, The University of Newcastle, Callaghan, Australia (greg.hancock@newcastle.edu.au)

This talk discusses our experience in developing and adapting LEMs (mostly the 1st author's SIBERIA LEM) for engineering site rehabilitation applications. Aspects of post-mining landforms and nuclear waste containment structures make the application of landform evolution models (LEM) very different from the application of LEMs on natural landforms. However, we have recently been able to apply some of this rehabilitation research to natural surfaces in a breakthrough that allows us to model the evolution of natural soil profiles, making this work of relevance to geomorphology researchers outside the narrow area of mine rehabilitation. The rehabilitation specific challenges revolve around (1) the need to quantitatively calibrate the model to site specific monitoring data and quantitatively testing the LEM predictions, (2) the typically unnatural shapes of the rehabilitated landforms leading to unusual spatial patterns of erosion, (3) the rate at which the surface materials (soils, rock armour) change their characteristics as a result of armouring and weathering so that soil erodibility cannot be assumed to be either temporally invariant or independent of evolving landscape form and/or position, (4) the timescales needed for predictions (100-10,000 years) which are long by agricultural erosion standards but short by geomorphic standards, and (5) the need to quantitatively assess the likelihood (i.e. probability of failure) of very specific containment structure failure mechanisms (e.g. gully depth and location so we can assess the likelihood of penetration of cover layers protecting the hazardous materials). Each of these points has led to a range of practical and science research challenges. We will discuss these challenges and how we have addressed them in this presentation. For instance, we developed the ARMOUR 1D physically based armouring-weathering model to model the runoff driven, event-scale, evolution of the soil/spoil surface over periods of up to 1000 years. This work showed that surface erodibility could evolve for periods of up to 200 years, and only stabilised after considerable time had elapsed and significant erosion (and landform and surface erodibility evolution) has occurred. This work has formed the scientific basis for our on-going work (the mARM3D model) simulating natural soil profile evolution and the spatial organisation of soil properties.