Geophysical Research Abstracts
Vol. 17, EGU2015-15302, 2015
EGU General Assembly 2015

Assessing Surface Hydrological Processes on a Rehabilitated Mine Landform in Northern Australia

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To assist with the evaluation of the proposed rehabilitation designs for the mine closure at a Uranium Mine, Northern Territory, Australia, a trial landform (200 m $\times$ 400 m) was constructed using waste rocks, with its surface ripped along the contour. The surface hydrological performance of this landform was investigated in this study. Field infiltration measurements were conducted using both large and regular ring infiltrometers to investigate the surface hydraulic properties, and water contents and surface runoff were monitored continuously in two 30 m $\times$ 30 m runoff plots for four years. A Cellular Automata based runoff model (RunCA) was also used to simulate the runoff behaviors under different rainfall conditions. Results showed a higher infiltration capacity in the areas of rip lines than the non-ripped areas due to the disturbance to the surface. Runoff coefficient was less than 6% and 10% for 80% of the 304 observed rainfall events on plot 1 and plot 2, respectively. The low levels of runoff were well explained by the simulated flow maps of RunCA, which demonstrated the roles of the rip lines in storing flow water and discontinuing the runoff paths. However, when the maximum storage capacity of these rip lines was exceeded during several large rainfall events, the runoff became much more significant and led to high potentials for erosion and landform instability. RunCA simulations on the virtual landforms with higher rip lines indicated dramatically reduced runoff rates. Therefore, it is suggested here that the current landform may be subjected to great runoff and erosion risks under extreme rainfall events, and raising the rip line height may potentially solve this problem.