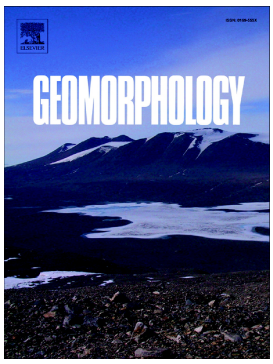

An event-based model of soil erosion and sediment transport at the catchment scale

John R. Dymond, Simon S. Vale

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An event-based model of soil erosion and sediment transport at the catchment scale

John R. Dymond*, Simon S. Vale

Landcare Research, Private Bag 11052, Palmerston North, New Zealand

***Corresponding author**. John R. Dymond, dymondj@landcareresearch.co.nz

ABSTRACT

Deforestation in New Zealand has led to increased soil erosion and sediment loads in rivers, adversely affecting aquatic ecosystems. Soil conservation actions over large areas are expensive and need to be targeted to obtain maximum benefit for least cost. Medium-complexity models of soil erosion have been used to target soil conservation, but they involve long-term averages and do not involve time variation. In this paper, an event-based model of soil erosion and sediment transport is developed. It has moderate complexity and is able to be calibrated with a modicum of data. The spatial framework is based on small subcatchments and stream links. For each storm event, the sediment yield for each subcatchment is estimated from peak storm discharge with a power function and routed through the stream network. We run the model on the Manawatū catchment in New Zealand for which all the major tributaries are monitored for water and sediment discharge. Spatial maps of sediment yield are produced for each storm event in a 5-year period from model inputs of maximum storm discharge at the tributaries. To test the model, predicted sediment loads of the storm events in the main channel of the Manawatū, at Teachers College, Palmerston North, are compared with measured sediment loads. The strong agreement between predictions and measurements suggests that the method for converting maximum storm discharge to sediment load at tributaries is robust. Analysis of the sediment concentration and discharge records for storm events revealed that sediment from channel resuspension and bank erosion was much smaller (typically <5%) than total storm sediment loads and could thus be ignored when routing storm sediment loads. The demonstrably small channel resuspension and bank erosion, relative to storm sediment loads, enabled simple routing from subcatchments to construct an event-based model at the catchment scale.

Keywords: soil erosion; sediment transport; sediment yield; event-based model