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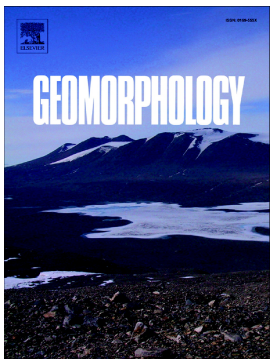

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Topographic Filtering Simulation Model for Sediment Source Apportionment

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Abstract

We propose a Topographic Filtering simulation model (Topofilter) that can be used to identify those locations that are likely to contribute most of the sediment load delivered from a watershed. The reduced complexity model links spatially distributed estimates of annual soil erosion, high-resolution topography, and observed sediment loading to determine the distribution of sediment delivery ratio across a watershed. The model uses two simple two-parameter topographic transfer functions based on the distance and change in elevation from upland sources to the nearest stream channel and then down the stream network. The approach does not attempt to find a single best-calibrated solution of sediment delivery, but uses a model conditioning approach to develop a large number of possible solutions. For each model run, locations that contribute to 90% of the sediment loading are identified and those locations that appear in this set in most of the 10,000 model runs are identified as the sources that are most likely to contribute to most of the sediment delivered to the watershed outlet. Because the underlying model is quite simple and strongly anchored by reliable information on soil erosion, topography, and sediment load, we believe that the ensemble of simulation outputs provides a useful basis for identifying the dominant sediment sources in the watershed.

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