

TREX WATERSHED MODEL DEVELOPMENTS AND APPLICATIONS: EXTREME FLOODS AND WATERSHED CONTAMINANT TRANSPORT AND FATE

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Abstract: CASC2D is a two-dimensional, physically-based, event watershed model that can simulate rainfall, runoff and sediment transport. Researchers at Colorado State University and the Bureau of Reclamation have added several features and made modifications in order to apply the model for two different problems: extreme floods for dam safety on large watersheds (>1,000 km²); and chemical transport at the watershed scale to assess the impact of wastes from inactive and abandoned mine (IAM) sites. To meet this need, the Two-dimensional, Runoff, Erosion, and Export (TREX) watershed model was developed based on CASC2D and the WASP/IPX series of water quality models. New channel automation tools have been developed so that TREX can be applied to large watersheds. Floodplain interaction, upland soils and channel sediment layering, channel bed erosion, and chemical fate and transport routines are added to the model. A new storm model is coupled with stochastic storm transposition, so that TREX can be used for flood frequency analysis. One feature of the model is its ability to track the movement of particles from upland sources to downstream areas. Model results can be used to assess the contribution of individual contaminated areas (waste piles) to overall site impairments. Such information is useful to establish cleanup priorities and provide an improved understanding and illustration of metals transport and fate in mine waste impacted streams.

The model and results are demonstrated for two case studies: estimating extreme floods and flood frequency curves for dam safety on the 12,000 km² Arkansas River watershed above Pueblo, Colorado; and metals transport from the historical mine waste site California Gulch, a 30 km² watershed near Leadville, Colorado. The TREX model provides a unique physically-based method for determining flood frequency curves under varied scenarios of antecedent moisture conditions, space and time variability of rainfall and watershed characteristics, and storm center locations. It can now be used to assess the impact of wastes from inactive and abandoned mine sites. The model will be presented at the Wednesday Evening Demonstration Session.

Reference

Velleux, M.L., England, J.F. and Julien, P.Y. (2005) TREX Watershed Modeling Framework User's Manual: Model Theory and Description. Department of Civil Engineering, Colorado State Univ., Fort Collins, August, 83 p.