# Dam overtopping and flood routing with the TREX watershed model

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**Abstract.** Modeling dam overtopping and flood routing downstream of reservoirs can provide basic information about flood events that can be beneficial in dam engineering, emergency action planning and floodplain management. In recent years there has been considerable progress in model code development, computing speed and capability and available elevation, vegetation, soil type, and land use data which has led to much interest in multi-dimensional modeling of dam failure, overtopping and flood wave routing. The purpose of this study is to ascertain the capabilities of the Two-dimensional Rainfall-runoff Erosion and Export (TREX) model to simulate flooding from dam overtopping as the result of large scale precipitation events. The model has previously been calibrated for the California Gulch watershed near Leadville Colorado. The California Gulch model configuration was used for all of the simulations preformed for this study. This watershed model setup includes a raster resolution of 30 meters by 30 meters for a total of 30.6 square kilometers of area. The model includes data for 17 soil types and 13 land use types of the same resolution. TREX can simulate the reservoir filling and overtopping process by inserting an artificial dam into the digital elevation model (DEM) of a watershed. To test the numerical stability of the model for large precipitation events, the global maximum precipitation was simulated overtopping a 29 meter high dam. Three estimated global maximum precipitation events (the 1 hour, 6 hour and 24 hour duration events), were simulated for the watershed with a 29 meter high dam and the minimum time step necessary to maintain numerical stability of the model was determined to be 0.01 seconds. A series of artificial dams ranging from 5 to 20 meters high was inserted into DEM. Probable maximum precipitation (PMP) level events were simulated and the attenuation of the downstream flood wave was quantified. The maximum attenuation of the peak discharge at the outlet of the watershed was 173% for a 20 meter high rectangular dam for the 1 hour PMP event. The maximum attenuation of the peak outlet discharge for a 20 meter high dam for the 6 hour PMP event was 63%.