

Expedient Simulation of Flood Extent over Large Land Areas using Digital Elevation Data and Flow Estimates

Michael L. Follum

Department of Civil and Environmental Engineering, Colorado State University

Abstract. This study demonstrates how the AutoRoute model utilizes readily-available Digital Elevation Model and flow estimate data to provide estimates of flood delineation over large land areas quickly and efficiently. Through an automated process, the model derives numerous channel cross-sections along stream profiles throughout a basin, and then uses basic hydraulic equations to estimate the flood extent of high-flow volumes. The target application of the AutoRoute model is in areas where Digital Elevation Model and flow estimates are the only data available. The AutoRoute model can utilize multiple types of flow estimates within the channels, including: uniform flow over the entire domain; flow as a function of drainage area (similar to the regional regression equations utilized by the U.S. Geological Survey); and spatially-varied flow estimates from a distributed hydrologic model. The hydraulic calculations within the model are tested by comparing simulation results against observed flood inundation at four sites in the mid-western United States during the June 2008 floods. The results of the study show that the model is accurate in areas of limited man-made structures. In areas of highly-engineered systems the results show that the Digital Elevation Model data may not adequately represent the channel, and errors in flood extent occur. Additional examples show how the model utilizes flow regression equations from the U.S. Geological Survey to provide initial flood extent estimates for the 10-, 50-, and 100-year flood events in a section of West Virginia. These examples show that the model is well-suited to provide initial estimates of flood extent over large land areas when elevation and estimates of flow data are the only data available.