

ABSTRACT

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Methodologies of Watershed Modeling with GIS and DEMs for the Parameterization of
the WEPP Model. Major Professor: Dennis C. Flanagan.

Two methods called the Hillslope and Flowpath methods were developed that use geographical information systems (GIS) and digital elevation models (DEMs) to assess water erosion in small watersheds with the Water Erosion Prediction Project (WEPP) model. The Hillslope method is an automated method for the application of WEPP through the extraction of hillslopes and channels from DEMs. Each hillslope is represented as a rectangular area with a representative slope profile that drains to the top or sides of a single channel. The Hillslope method was further divided into the Calcleng and Chanleng methods, which are similar in every way except on how the hillslope lengths are calculated. The Calcleng method calculates a representative length of hillslope based on the weighted lengths of all flowpaths in a hillslope as identified through a DEM. The Chanleng method calculates the length of hillslopes adjacent to channels by matching the width of the hillslope to the length of adjacent channel. The Flowpath method works by applying the WEPP model to all possible flowpaths within a watershed as identified from a DEM. However, this method does not currently have a channel routing component, which limits its use to predicting spatially variable erosion on hillslopes within the watershed or from watersheds whose channels are not in a depositional or erodible mode. These methods were evaluated with six research watersheds from across the U.S., one from Treynor, Iowa, two from Watkinsville, Georgia, and three from Holly Springs, Mississippi. The effects of using different-sized DEM resolutions on simulations and the ability to accurately predict sediment yield and runoff from different event sizes were studied. Statistical analyses for all methods, resolutions, and event sizes were performed by comparing predicted vs. measured runoff

and sediment yield from the watershed outlets on an event by event basis. Comparisons to manual applications by expert users and comparisons of runoff and sediment loss from only hillslopes were also conducted. Results from the analysis of these six watersheds suggest that, for a given range of DEMs and valid input data for a simple watershed, the Hillslope methods can be used to facilitate the application of WEPP and that the predictions should be comparable to an expert user's application.