Digital elevation model resolution and accuracy: implications for modeling hydrologic processes

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Abstract. Topography plays a crucial role in hydrologic and geomorphic processes. These processes are both influenced by topography and, in turn, reshape the existing landscape. This interrelationship allows for the correlation of physical processes to characterizations of the landscape given by topographic attributes. Digital elevation models (DEMs) offer efficient and objective procedures for estimating these attributes. Advances in land surveying technology, particularly with global positioning systems, have created options for obtaining DEMs of high resolution and accuracy. The use of topographic attributes in hydrologic modeling at a wide range of scales is now possible. Selection of an appropriate resolution and an acceptable accuracy level is an important consideration in DEM development because many attribute estimations are sensitive to these components. A comparison of various topographic attributes computed from a range of grid DEM resolutions and accuracy levels will be presented. Furthermore, several flow routing algorithms and levels of sink filling will be evaluated. Specific catchment areas and derived attributes, such as the topographic wetness index, will be computed for each DEM by these various methods. Relationships between selected attributes and the spatial organization of crop yields will be used to assess the selection of DEMs and flow routing methods for hillslope processes at a scale sufficient for site-specific agricultural management.