Topography's Influences on Hydrological Response Units - Without Process Modelling

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Abstract. Improving the representation of hydrologically important parameters for watershed modelling requires dividing the area into hydrological response units (HRUs). The HRUs are designated by areas that have like hydrological properties, derived from topography, land cover and soil characteristics. To reduce computational effort, HRUs have often been denoted by sub-basins or regular (typically square) grid cells. The use of square HRUs is convenient in matching the resolution of remotely sensed imagery. Currently the definition of HRUs have used a variety of approaches, including sub-basin or sub-grid mosaicing of properties.

This paper examines topographic resolution and the scaling characteristics of two watersheds (Salt River Basin, Arizona and Yampa River Basin, Colorado). Using a 30-m resolution digital elevation model (DEM), the spatial characteristics are compared. The DEM is used to derive slope and northness. Northness is a variable used to compute direct incoming solar radiation and is the cosine of the aspect multiplied by the sine of the slope.

The average slope, computed at different resolutions, such as 1-km, is used to define topographic regions within each watershed, specifically mountains, foothills and plains. For each of these regions, the spatial structure of the elevation, slope, and northness is compared. This spatial structure can be considered the largest scale at which HRUs are self-similar. Anisotropy in the spatial scale is also examined.