Direct upscaling of drainage networks

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Abstract. Scaling of any earth sciences phenomenon depends on the physical processes that control the space/time distributions underlying the phenomenon. Upscaling, that is any sort of spatial averaging, has to take this physical process into account. Watersheds form a basic landscape unit useful for describing hydrological and ecological processes. Digital elevation models (DEM)s used for obtaining flow networks are often at much finer scales than other spatial information such as vegetation, soil and climatic data. Flow networks are typically required at a much coarser resolution than the DEM resolution for input into hydrological process models. Upscaling of flow networks must take into account properties of the flow networks and also preserve mass flux and travel times. An upscaling methodology is proposed. The flow directions and slope along the flow directions are upscaled. Upscaling of flow directions is such that connectivity to the outlet is ensured. Upscaling of the slope values is based on preservation of travel times. An example of upscaling of a watershed from the Yakima river basin is presented.