Storm event hydrograph separation at nested spatial scales in Skin Gulch, Northern Colorado

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Abstract. The separation of hydrographs into base flow and surface runoff components provides insight to how surface water and groundwater exchange during storm events. There exists a wide variety of graphical, analytical, and theoretical methods for baseflow separation making a situational selection of a single method difficult. We collected continuous depth and electrical conductivity (EC) measurements throughout the summer of 2015 in Skin Gulch, a 15 km^2 watershed in the Rocky Mountain foothills of northern Colorado. Measurement stations were set up at six locations along the channel network, with nested drainage areas ranging from 2.5 to 9 km^2. We measured discharge using the velocity-area method or a salt dilution method at each site throughout the summer and constructed depth-discharge rating curves for each station, providing continuous simultaneous discharge and EC readings for each location. There were six storms that produced a measurable runoff response across all sites as well as several localized storms. Each storm hydrograph was separated into base flow and runoff components using three methods: 1) The Web-based Hydrograph Analysis Tool (WHAT), which applies a recursive digital filter to discharge time series data; 2) a recession curve analysis based on the Boussinesq equation and reservoir storage models; and 3) an isotopic tracer base flow separation approach measured through surface-water specific conductance. For each nested location, we compute the base flow index (BFI) and slope of the log transformed recession curve (k), and we explore the extent to which the ranges of these parameters may be controlled by channel network structure and local topographic characteristics.