ABSTRACT

Coastal areas are expected to see the greatest impact on water resources due to population increase and land development affecting the regional water budget by reducing evapotranspiration, groundwater recharge/discharge, and increase runoff. This project inspected forested watersheds in coastal South Carolina to understand their stream response to storm events. The objectives of this study were to (1) characterize the watershed conditions based on their land use/land cover, soil drainage class, and topography, (2) compare streamflow patterns using seasonal event hydrographs, and (3) compare results of analytical method of storm event hydrograph separation with that of the chemical method using stable water isotopes. Turkey Creek, a third-order watershed (5,240 ha), includes two first-order sub-watersheds. Physical and chemical hydrograph separation techniques and statistical methods were used for storm event analysis. Average annual rainfall for the study period was 1449 mm. The largest mean ROC, DBOC, direct runoff to streamflow ratio, and peak flow rate were observed for the smallest sub-watershed (Conifer) and the lowest for the largest watershed (W78). The largest baseflow to streamflow ratio was observed in W78. Stable water isotope results show surface water samples isotopically distinct compared to groundwater and rainfall samples. Isotope results indicated baseflow contribution was 58-65% of streamflow in contrast to 39-41% as estimated from the hydrograph separation method. Interpretations of the results suggest that storm response was dependent on the antecedent conditions and soil type in the watershed. Scientists and land managers can use this data to predict runoff changes in areas affected by land development.

RESEARCH QUESTIONS AND SIGNIFICANCE

Research Questions:

- What are the effects of spatial-scaling on runoff dynamics in a Lower Coastal Plain forested watershed, specifically how does the runoff response in terms of its magnitude, duration, and timing to storm events at small (~250 ha) first-order watersheds differ from a much larger (5,240 ha) third-order watershed that contains the smallest first order ones, and how do the rainfall-runoff relationships between each of the smaller watersheds and the larger watershed differ?
- What are the key factors influencing the runoff response metrics on the watershed of varying scales?
- What are the changes in groundwater and surface runoff contribution to streamflow behavior and their timings due to the scaling effects?

Significance:

- Population Growth
- Climate Change (Sea Level Rise, Storm Frequency and Severity)

LABORATORY AND DATA ANALYSIS

FIELD SITES

RESULTS