Subsurface critical zone structure effects on watershed hydrology: Coupling hydrologic and geophysical field and modeling initiatives from hillslopes to regional scales

A Data Management Plan created using DMPTool

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Project abstract:

We seek to (1) characterization of water storage and flowpath behavior in the subsurface environments of two headwater catchments in the Appalachian Mountains (Western Carolina Hydrologic Research Station) and Piedmont (Duke Forest Research Watershed) physiographic provinces through coupled field-intensive geophysical, pedological, and hydrological observations, (2) mechanistically linking these hillslope dynamics to catchment outlet hydrologic behavior at event to annual time scales, and (3) apply this new field-based mechanistic understanding to assess whether conceptual rainfall-runoff models can replicate not only the hydrograph but also key hydrologic signatures reflecting differences in streamflow response along the physiographic gradient between the two research catchments. Through this coupled field and modeling initiative that bridges hillslope to regional spatial scales, we seek to further our conceptual understanding of how regional differences in landscape evolution influence contemporary hydrological processes and subsequent model structure.

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Types of data produced

This project will produce two types of data. (1) Full data sets from field experimentation research. This will include hydrological, pedological, and geophysical characterization of the subsurface critical zone along several hillslope transects at two field locations. This will also include hydrological observations from watershed outlet locations at the two field locations. (2) derived data products (hydrological signature simulations and metrics, error and uncertainy values) from 76 individual modeling structures developed for 73 US Geological Survey in-stream gaging stations.

Derived data products will be made publicly available on a Consortium of Universities for the Advancement of Hydrological Sciences (CUAHSI) -hosted website. These products will be advertised as curriculum materials for hydrological sciences secondary education classes.

Data and metadata standards

All data will be stored in file formats that can be opened by non-proprietary software (e.g., netcdf, csv, txt, jpg).

Full data sets will consist of field sampling data and field observation data.

Field sampling data: location of soil pits, pit characteristics, soil pit samples, location and depths of installed piezometers and soil sensors.

Field observation data: time series data of soil moisture and piezometer water level.

Derived data products will include model output data and visualized interpreted data.

Model output data: Computational models will output simulated data on 3D fields, timevarying grids (e.g. soil water content, critical zone water content, streamflow and stormflow).

Visualized/Interpreted data: Post-processed model outputs packaged in graphical format (e.g.,2D plots, 3D plots, animations, time series plots).

Policies for access and sharing

All data products will be made available to outside researchers in a manner that adheres to NSF policies. All data collected for this proposal will be made freely available by the time of publication in a journal or at the end of the requestedfunding period, consistent with federal agency (NSF and DoE) policy. When data are associated with a specific publication they will also be archived in an established database associated with the specific journal.

Policies for re-use, re-distribution, derivatives

This project will adopt a policy which states that an acknowledgment should accompany any publication or citation of these data. Prior to the end of the award period, the data will be made available upon request with the requirement that the user inform PI Zimmer and offer authorship as deemed appropriate. Intended and likely users of the data include other researchers working on hydrology, geology, soil science, global biogeochemical modeling, and land managers. The format for appropriate citation of our data will be detailed in our metadata file.

Plans for archiving and preservation

The full data sets and all derived data products will be available upon request and stored on GitHub (https://github.com/). Public versions of this data will be maintained for five years from the date of release.

All data and images will also be stored redundantly on instruments, PI computers, and project computers. Dr. Zimmers's computer is backed up onto the UCSC Physical and Biological Sciences Division back-up storage system on a daily basis.