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Surface water and groundwater interaction on a hill island

Rasmus Rumph Frederiksen, Keld Rømer Rasmussen, and Steen Christensen
Aarhus University, Geoscience, Denmark

A number of recent studies have indicated that the hydrological system in stream valleys is often complex and exchange of water takes place through semi-permeable contacts and flow paths may be quite diverse. Yet, surface water and groundwater interaction in one of the major Danish landscapes – the hill islands – is relatively unknown. This study aims at providing new information about the rainfall-runoff processes in hill island landscapes where surface water and groundwater interaction is expected to have a dominant role and hill-slope processes not.
Through stream flow measurements, field observations, and existing geological and geophysical data, we have investigated the surface water and groundwater interaction in the Abild Stream catchment (<70 km2) on Skovbjerg hill island in the western part of Denmark.
Existing discharge data are limited but the hydrographs downstream Abild Stream appear to be strongly influenced by event flow indicating that shallow control by low permeable sediments is important. Nevertheless irrigation is intensive which indicates that the soil and shallow sediments are permeable. Since July 2014 we have measured stream flow during quarterly campaigns at 11 stations along the stream representing different spatial scales and using Acoustic Doppler techniques (ADCP) as well as current-meters. Furthermore we have mapped topography, soil types, geomorphology, ditches, drains and land use through field observations and digital maps. The shallow subsurface geology has been mapped using abundant well described geological data (boreholes) and geophysical data (airborne TEM).
Our stream flow measurements show that the tributaries from west and north dry out during the summer period. Significant drained areas in the NW- and SW-part of the catchment have been observed from old topographical maps as well as in the field. The geological data indicate shallow low permeable sediments primarily on the western side of Abild stream, and the geophysical data indicate shallow low resistivity layers on the western side of the stream. All these findings indicate a catchment with at least two different hydrogeological settings.
To further investigate the spatial variation along the stream we plan to finish the hydrogeological interpretation and build a model and on this basis choose appropriate locations for further monitoring of discharge at different spatial scales (gaging stations), monitoring hydraulic head variations and quantifying hydraulic parameters (piezometers), mapping the shallow subsurface more detailed (DC/IP) and qualifying flow components at representative stream sections through temperature methods (temperature loggers and distributed temperature sensing).
We will present an overview of the initial investigations in a poster.