Geophysical Research Abstracts
Vol. 12, EGU2010-3964, 2010
EGU General Assembly 2010

Factors influencing base flow in the Swiss Midlands - Can results from different base flow separation methods help to identify these factors?

Raphael Meyer (1,2), Bruno Schädler (1,2), Daniel Viviroli (1,2), Rolf Weingartner (1,2)

(1) Institute of Geography, Hydrology Group, University of Bern, Switzerland (raphael.meyer@giub.unibe.ch), (2) Oeschger Centre for Climate Change Research, University of Bern, Switzerland

Base flow is a desirable entity to know, for water management in general and particularly for climate change impact studies. Base flow is most often defined as that part of total discharge which origins from delayed storages in a river catchment. During a prolonged period without rain, base flow is the sole contributor to discharge. Base flow therefore makes a river perennial. A high base flow contribution to total annual discharge makes a river more stable in respect of meteorological droughts. Annual base flow from a catchment cannot be determined exactly. Only total discharge can be measured with high accuracy. Therefore, base flow has to be estimated with appropriate methods. Calculating an entity which cannot be verified by measurements is easy. By defining the entity with a calculation procedure, the result is numerically always right. It is actually much more difficult to understand the results, i.e. how these outcomes should be interpreted.

The present study investigates the application of three different base flow separation procedures for numerous (up to 40) meso-scale catchments in Switzerland. The methods Demuth (1993), Wittenberg (1999) and Institute of Hydrology (1980) are different approaches to determine base flow, based on daily runoff data. The method Demuth, and the separation of base flow according to Institute of Hydrology, are statistical methods. Demuth is based on the graphical approach of Kille (1970), and the procedure of the Institute of Hydrology is an empirical smoothing method. In contrast to this, the method by Wittenberg does not presume linearity between storage and outflow. Analyzing the results, among each other and in comparison with physiographic characteristics of the catchments under consideration, leads to a more detailed picture of the ongoing processes. At least the dominant control factors for base flow in the Swiss Midlands should be detectable. These are expected to be found first of all among geology and climate, which is generally accepted in the literature, secondly in land cover, and, especially for the Swiss Midlands, in aquifer area and aquifer volumes.

In this contribution the results of the different methods are presented and conclusions as to control factors are drawn from the results. The data base for river flow analysis in the low flow range is ideal in Switzerland. There are long time series, a dense gauge network and a comprehensive knowledge about uncertainty of the runoff measurements during low flow. This allows, in addition to the obtained process understanding, a well-founded comparison between the methods applied, which is going to be presented as well.

Demuth, S. (1993) Untersuchungen zum Niedrigwasser in West-Europa (European low flow study). Freiburger Schriften zur Hydrologie, Band 1, Freiburg, Germany.

Institue of Hydrology (1980) Low Flows Studies Report, 3 volumes. Institute of Hydrology, Wallingford, UK.

Kille, K. (1970) Das Verfahren MoMNQ, ein Beitrag zur Berechnung der mittleren langjährigen Grundwasserneubildung mit Hilfe der monatlichen Niedrigwasserabflüsse. Zeitschrift der deutschen Geologischen Gesellschaft, Sonderheft Hydrogeologie Hydrogeochemie, 89-95.

Wittenberg, H. (1999) Baseflow recession and recharge as nonlinear storage processes. Hydrol. Process., 13, 715–726.