Geophysical Research Abstracts
Vol. 12, EGU2010-7183, 2010
EGU General Assembly 2010

Teaching geographical hydrology in a non-stationary world

Martin R. Hendriks and Derek Karssenberg
Department of Physical Geography, Utrecht University, The Netherlands

Understanding hydrological processes in a non-stationary world requires knowledge of hydrological processes and their interactions. Also, one needs to understand the (non-linear) relations between the hydrological system and other parts of our Earth system, such as the climate system, the socio-economic system, and the ecosystem. To provide this knowledge and understanding we think that three components are essential when teaching geographical hydrology.

First of all, a student needs to acquire a thorough understanding of classical hydrology. For this, knowledge of the basic hydrological equations, such as the energy equation (Bernoulli), flow equation (Darcy), continuity (or water balance) equation is needed. This, however, is not sufficient to make a student fully understand the interactions between hydrological compartments, or between hydrological subsystems and other parts of the Earth system.

Therefore, secondly, a student also needs to be knowledgeable of methods by which the different subsystems can be coupled; in general, numerical models are used for this. A major disadvantage of numerical models is their complexity. A solution may be to use simpler models, provided that a student really understands how hydrological processes function in our real, non-stationary world. The challenge for a student then lies in understanding the interactions between the subsystems, and to be able to answer questions such as: what is the effect of a change in vegetation or land use on runoff?

Thirdly, knowledge of field hydrology is of utmost importance. For this a student needs to be trained in the field. Fieldwork is very important as a student is confronted in the field with spatial and temporal variability, as well as with real life uncertainties, rather than being lured into believing the world as presented in hydrological textbooks and models, e.g. the world under study is homogeneous, isotropic, or lumped (averaged). Also, students in the field learn to plan and cooperate. Besides fieldwork, a student should also learn to make use of the many available data sets, such as google earth, or as provided by remote sensing, or automatic data loggers.

In our opinion the following sequence of activities should be applied for a student to attain a desirable working knowledge level. As mentioned earlier, a student first of all needs to have sufficient classical hydrological knowledge. After this a student should be educated in using simple models, in which field knowledge is incorporated. After this, a student should learn how to build models for solving typical hydrological problems. Modelling is especially worthwhile when the model is applied to a known area, as this certifies integration of fieldwork and modelling activities. To learn how to model, tailored courses with software that provides a set of easily learned functions to match the student's conceptual thought processes are needed.

It is not easy to bring theoretical, field, and modelling knowledge together, and a pitfall may be the lack of knowledge of one or more of the above. Also, a student must learn to be able to deal with uncertainties in data and models, and must be trained to deal with unpredictability. Therefore, in our opinion a modern student should strive to become an integrating specialist in all of the above mentioned fields if we are to take geographical hydrology to a higher level and if we want to come to grips with it in a non-stationary world. A student must learn to think and act in an integrative way, and for this combining classical hydrology, field hydrology and modelling at a high education level in our hydrology curricula, in our opinion, is the way to proceed.