Geophysical Research Abstracts
Vol. 16, EGU2014-12778, 2014
EGU General Assembly 2014

Management model application at nested spatial levels in Mediterranean Basins

Antonio Lo Porto (1), Anna Maria De Girolamo (1), and Jochen Froebrich (2)

(1) Water Research Institute (IRSA-CNR), Dept. Water Resources, Bari, Italy (antonio.loporto@ba.irsa.cnr.it), (2) Wageningen UR - Alterra, NL

In the EU Water Framework Directive (WFD) implementation processes, hydrological and water quality models can be powerful tools that allow to design and test alternative management strategies, as well as judging their general feasibility and acceptance. Although in recent decades several models have been developed, their use in Mediterranean basins, where rivers have a temporary character, is quite complex and there is limited information in literature which can facilitate model applications and result evaluations in this region. The high spatial variability which characterizes rainfall events, soil hydrological properties and land uses of Mediterranean basin makes more difficult to simulate hydrological and water quality in this region than in other Countries. This variability also has several implications in modeling simulations results especially when simulations at different spatial scale are needed for watershed management purpose. It is well known that environmental processes operating at different spatial scale determine diverse impacts on water quality status (hydrological, chemical, ecological). Hence, the development of management strategies have to include both large scale (watershed) and local spatial scales approaches (e.g. stream reach).

This paper presents the results of a study which analyzes how the spatial scale affects the results of hydrologic process and water quality of model simulations in a Mediterranean watershed. Several aspects involved in modeling hydrological and water quality processes at different spatial scale for river basin management are investigated including model data requirements, data availability, model results and uncertainty. A hydrologic and water quality model (SWAT) was used to simulate hydrologic processes and water quality at different spatial scales in the Candelaro river basin (Puglia, S-E Italy) and to design management strategies to reach as possible WFD goals.

When studying a basin to assess its current status and anthropogenic pressures acting on it to define management policies, three spatial levels must be taken into account: the basin, sub-basin and reach level. The common experience showed that different issues can be properly assessed and handled at these three levels. Furthermore different difficulties and problems affect modeling at the same spatial levels.

The basin scale is the geographical unit (as required by the WFD) in which coherent management policy must be designed and a Program of Measures must be implemented. At this spatial level a comprehensive understanding of processes acting in the basin area is synthesized (i.e. nutrient loads delivered to the sea).

In Mediterranean region land use is commonly very fragmented and also because of complex geomorphology the use of remote sensing can be not easy or sufficient to derive reliable land use maps of agricultural areas. The sub-basin level (<100 km2) is the most suited to gather information on land and water resources use, agricultural practices and pressures by using direct surveys and local knowledge. At this spatial resolution soil and rainfall variability are somehow “averaged” and the model simulation tend to attenuate the complex, local patterns of runoff generation. As a results, an acceptable flow modeling is possible, being this a common issue in the Mediterranean areas where intermittency of rivers is the rule.

The reach level is the spatial unit in which physical and ecological processes can be assessed. It is sufficiently narrow to observe peculiarities of geomorphology and water works (i.e. check dams, water abstractions) that can greatly interact with natural flow. At this level modeling often fails in simulating actual streamflow. At local scale field observations can help also to overcome recorded flow measurements inconsistencies, due to the difficulties in metering low flows (i.e. rivulets can detour and skip flow meters) that often lead to underestimate extreme low flow.

The modeling of Mediterranean river basins is then rather a challenge and the understanding of potential issues inherent in the focusing on different spatial levels must be recognized.