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tempQsim news

Evaluation and improvement of water quality models for application to temporary waters in Southern European catchments

Keywords temporary waters, water quality, water quality models

Objectives

The aim of the *tempQsim* project is to provide tools to improve the integrated management of water resources in Mediterranean and other dryland river catchments through quantifying the water quality dynamics of these ephemeral and temporary waters and through the development of improved water quality models.

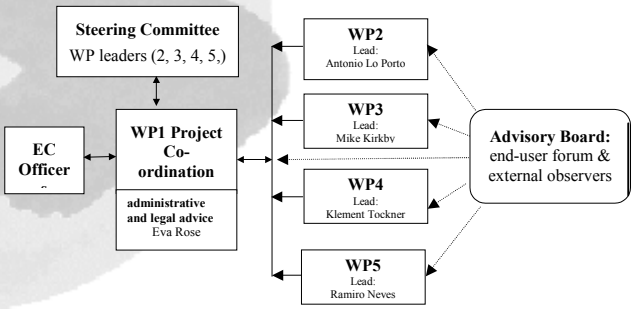
This research comprises a pan-European collaboration of 14 participants and is supported by measurement programmes based on seven new and existing research catchments across the range of European dryland environments.

Existing computer simulation models are being tested to consider their suitability for describing the water quality dynamics for the special case of so called “temporary streams”. *tempQsim* is part of the Catchmod Cluster within the Framework 5 research program, which will improve forecasting of pollution dynamics and help to plan efficient measures to protect scarce surface water resources.

By doing so it will increase the “water security” of the Mediterranean, and have application to water-scarce regions world wide.

Organisation of the project

The project is organised as shown in the following figure:



Workflow and *decision making structure* (solid lines), external advice (dotted lines)

In this issue

Case study sites

River Degebe (Portugal)

Tributary of the Guadiana (right shore, Portuguese ba-sin). The Degebe watershed develops from its head-waters through the rich plain "Campos de Évora" to the entrenched schist rocky channel through which it reaches the Guadiana where some kilometres up-stream of the gorge the Alqueva Dam is being built. It's catchment area covers 1,527 km^2 and a sub-humid dry type C1 climate with average values of precipitation between 598 and 632 mm are characteristically for this region.

El Albujón (Spain)

The Rambla de El Albujón is the main tributary of the coastal lagoon (Mar Menor). The catchment area is 400 km². The topography is characterized by two dis-tinct zones: head water areas with steep slopes and torrential gullies systems and a lower area very flat, where some disconnections between hydraulic pathways. The land use is mainly intensive agriculture: irrigated and green houses systems that are increasing since the last 10 years.

Vallcebre (Spain)

The catchment is located in the southern Pre-pyrenees, where a semi-humid area with annual rain-fall of 925 mm and a marked water deficit in summer months prevails. The interest of this area is because large variations in the runoff between summer and the beginning of the wet season have large implications in the natural quality of water.

Vène (France)

Vène River is a 12 km long river located in the catch-ment area of the Thau lagoon (near Montpellier). Its catchment area covers 67 km^2. A karstic spring is lo-cated 500 m upstream the catchment outlet and drains deep waters from the Jurassic karst. The Vene catchment is representative of Mediterranean catchment due to that storm flows can occur after a long period of low water. The main agricultural land use is vineyard.

Flumendosa (Italy)

The Flumendosa (V = 347 Mm^3) and the Mulargia reservoirs (V = 316 Mm^3) are located in Sardinia. They are managed by the E.A.F. since the middle 50's. The Flumendosa river and Mulargia torrent feeding these reservoirs are collecting runoff from the south-eastern regions of Sardinia. In this central eastern part of Sardinia, both natural and human made landscapes are characterised by great variability in time and space.

Fiume Tagliamento (Italy)

The Fiume Tagliamento in NE Italy is the last large gravel-bed river in the Alps that has escaped intensive river management. The Tagliamento is characterised by a flashy pluvio-nival hydrological regime, with high-est discharge during spring and autumn (average ca. 70 m3/s). The river connects the Alps with the Mediterranean, and enters the Adriatic Sea. The transition of different climatic and geological conditions, and the increasing extend of the alluvial aquifer leads to a se-verity of summer low flow.

Krathis (Greece)

Krathis River is situated also on northern Peloponnisos and flows in the Korinthiakos gulf. Its catchment area covers 149 km^2 and has a mean annual runoff at its midway of about 0,07 km^3 with seasonally variations between 4 m^3/s (March) and 0,9 m^3/s (August). In late summer-autumn, the lowland part of the river dries out. The mean annual rainfall varies between 600 mm at the lowlands and over 1000 mm on the mountains.

Iskar (Bulgaria)

The Iskar River is the longest in the territory of Bulgaria (368 km), and have a catchment area size of 8650 km². The average water resources of the river at its inflow to the Danube River are 50 m³/s. The river is of great importance for the municipal water supply be-cause many cities, including the capital Sofia, are de-pending on it.

Summary first reporting period

Scientific achievements

WP2 Model testing

As a preliminary to model testing, existing data from the seven catchments have been collated and analysed. These include digital elevations (DTM), climate, soil type, vegetation cover, land use practices and channel network geometry. These data have been adapted to the needs of the candidate water quality models. These are the SWAT, HSPF, ATHYS-POL, PESERA and Cascade models, all of which are been applied to the selected study sites to simulate time series for run-off and relevant water quality variables. Challenges for users of models originally developed outside Europe have included identifying the best model parameterisations for the vegetation of Mediterranean countries, and the acquisition of suitable data to characterise the hydrological properties of the soils in the study catchments.

WP3 Hydrology

Seven catchments have been instrumented, where possible building on existing infrastructure and data series, and following a common methodology agreed at our Lisbon meeting in May 2003. Catchment wide measurements complement detailed monitoring of a study reach in each study area. Water quality is monitored through a combination of continuous measurement probes (for turbidity, DO, Conductivity and pH), automatic water samplers programmed to collect repeatedly through each flood hydrograph, and rising stage automatic samplers at sites where flow is infrequent. Spring and Summer 2003 were used to carry out preliminary model runs, acquire and collate past data, and install new instrumentation, which was ready to provide good sample series from the first flush floods of Autumn 2003.

WP4 Channel bed processes

In the seven test catchments surface drying and rewetting has been quantified at both the local (study reach) and the regional (catchment) scale. Bed sediments have been characterized and protocols developed to monitor sediment processes. The first quantitative data on the importance of surface drying and surface-subsurface exchange rates on sediment respiration, biofilm development, and organic matter decomposition are now available from the autumn flush of 2003. Protocols for setting up standardised mesocosm experiments in the laboratory have also been discussed among the project partners.

WP5 Modules

Catchment models can incorporate the addition of dry period processes either by modifying existing models or by integrating existing subroutines into a module-based approach to generate a new model. One concept being considered for a new model is the creation of a common modular tempQsim base library, integrating a number of object-oriented sub-modules for the individual processes. If one or more existing models are adopted, a major challenge will be to integrate suitable new modules within the existing code. A detailed SWOT analysis of both approaches is currently being undertaken to evaluate the alternatives in conjunction with assessing the performance of the existing models within WP2.

Socio-economic relevance and policy implications

Research outcomes of the tempQsim project will underpin target-driven catchment management, and contribute to mitigating pollution of scarce water resources in the northern Mediterranean and similar semi-arid regions.

Conclusions

The temporary character of the streams is associated with the low density of existing water quantity and quality time series. The lack of runoff data and water quality data also leads to problems of appropriate monitoring and reporting to support implementation of the European Water Framework Directive.

Model testing indicates the relevance of adaptive reaction of models to short time scale fluctuations during flush flood events.

Within the selected catchments, there is great variety in the contraction and expansion dynamics of temporary waters a. The range of experience will be used to provide adaptive monitoring strategies. The results of these findings have been used for our initial proposals on general model improvement strategies, and these must now be implemented within the framework of individual models

Project participants

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