HarmoniQuA

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Content

Improving the Process of River Basin Modelling Benefits for Water Managers

The use of computers to simulate environmental processes is extremely important for the management of river basins. There is increasing pressure on water managers to consider, at the river basin scale, all processes contributing to environmental problems as well as the full impacts of management activities upon an extensive range of stakeholders. Furthermore, water mangers are increasingly expected to assess the implications of future changes in climate and anthropogenic activities in river basins.

Computer models are used, in conjunction with observational data, to represent these complex environmental systems. Field observations are crucial, providing the data for process understanding and for calibrating and checking model outputs. All models are simplified representations of river basin behaviour, irrespective of whether they represent processes and interactions in detail or in a more generalised fashion. Transparency in demonstrating firstly the suitability and limitations of the model and secondly the effect of assumptions in model structure and future climate and environment scenarios is vital.

The HarmoniQuA Consortium

Wageningen University (The Netherlands), Geological Survey of Denmark and Greenland (Denmark), National Technical University of Athens (Greece), Centre for Ecology and Hydrology (United Kingdom), WL|Delft Hydraulics (The Netherlands), Cemagref (France) Bundesanstalt für Gewässerkunde (Germany), Swedish Meteorological and Hydrological Institute (Sweden), VITUKI Plc (Hungary), University of Dortmund (Germany), Laboratório Nacional de Engenharia Civil (Portugal), DHI Hydroinform a.s. (Czech Republic)

Responsibilities

Project co-ordinator	Huub Scholten (WU)
Knowledge Base	Jens Christian Refsgaard (GEUS)
Knowledge engineering and tools	Huub Scholten (WU)
Testing	Maria Kapetanaki (NTUA)
Dissemination, exploitation and public website	Gareth Old (CEH)

Problems with Computer Modelling: the need for Quality Assurance

Consultations with auditors, stakeholders and experienced modellers have highlighted several potential problems that may undermine the credibility of model results.

It is often extremely ***difficult to fully audit*** modelling studies owing to poor documentation of the modelling process. Greater confidence may be placed in model results that have been audited.

Miscommunication may occur, both within the modelling team and between the team and the water manager. Within the modelling team this is often due to members having very different backgrounds and using different terminology. Inadequate communication between the water manager and the modelling team can result in incorrectly specified objectives and modelling results that do not address the problem. Furthermore, poor communication of modelling results may lead to misinterpretation and ultimately the making of inappropriate decisions.

Stakeholders are frequently left out of the modelling process. Stakeholders should be included as they are likely to have good local knowledge and they will be directly affected by management decisions resulting from the model results.

Data quality and sources are often poorly documented. Reliable model results are dependent on the extent and quality of data used to produce and run the model. The limitations of the data and their impact on model results and subsequent management decisions should be considered.

Important stages of the modelling process may be skipped intentionally or unintentionally. For example, alternative ways of dealing with unknowns in the model structure should be assessed, results should be checked against reality, and analysis should be undertaken to provide estimates of uncertainty.

Key domains are often not integrated. Many problems need a multi-domain approach but modelling studies may not properly represent the interactions between domains. For example, water quality or ecological models may not represent the range of flow conditions that occur, or may use flow parameters only defined for extreme conditions.

The HarmoniQuA Modelling Support Tool (MoST)

Harmonising Quality Assurance in model based catchment and river basin management (HarmoniQuA) is a European project with 12 partner organisations from 10 countries. Its primary objective has been to develop the computer based Modelling Support Tool (MoST), providing harmonised support across seven domains (groundwater, precipitation-runoff, river hydrodynamics, flood forecasting, water quality, ecology and socio-economics).

MoST addresses many of the commonly occurring modelling problems discussed earlier. It has the functionality to help guide, record and report the actions of the project team throughout the modelling process. A flowchart of the modelling process is central to MoST and was produced by the project team after reviewing existing modelling guidance and consulting with experts. The flowchart, summarised in figure 1, comprises five main steps, each incorporating a number of separate tasks followed by a review by the model team, water manager and (if appropriate) other stakeholders. Clear similarities exist between this and figure 2 based on the ISO 9000:2000 Quality Management System; the main difference being that simulation and evaluation (the final product) comes after calibration and validation (measurement, analysis and improvement). An early version of the full MoST flowchart was given in the first HarmoniQuA newsletter, and an updated version is found on the project website).

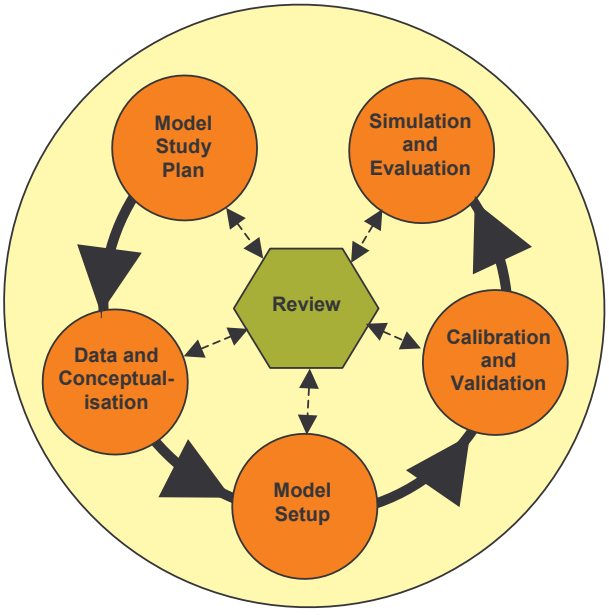

Figure 1: MoST model process flowchart

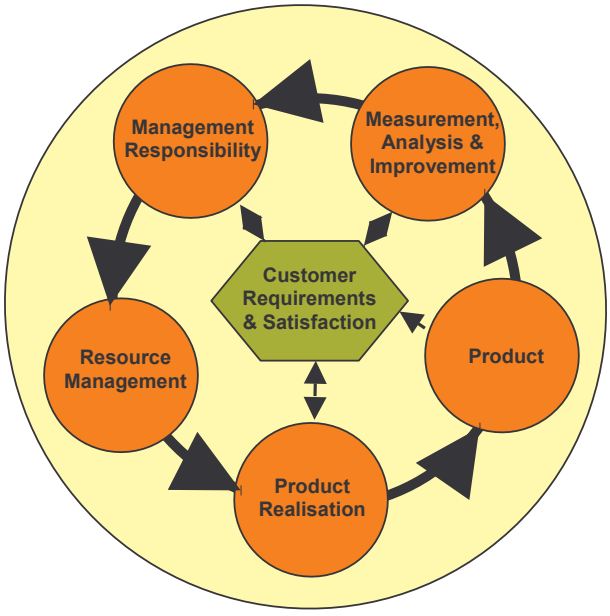

Figure 2: ISO 9000 Quality Management

Within MoST the guidance functionality helps ensure that, throughout the entire modelling process, there is appropriate: ***communication*** (within and outside modelling team), ***consideration of each stage***, ***integration of domains***, ***selection of methods*** and ***awareness of pitfalls***. The use of standard terminology is encouraged by the inclusion of a glossary of terms.

The recording functionality allows ***a log of decisions***, ***methods and data*** to be held in a structured model journal. For simple jobs, the journal may be held on a stand-alone PC, but for larger jobs involving teams of modellers may be held on a central server, with password-protected access for different domains, functions and user-types (including modellers and stakeholders) controlled by a project manager.

The reporting functionality creates reports from the model journal that can be dedicated to specific users and their particular needs. These reports provide information that ***increases the transparency of the modelling process and facilitates model audits***.

The first release of MoST, available from the project website (www.HarmoniQuA.org), has undergone internal and external testing. The final project version, with improvements in project initiation, reporting, and guidance on pitfalls, will be available in the autumn. The project team believes that MoST will help to enhance the credibility of modelling studies by making user-friendly QA procedures readily available. It should also facilitate stakeholder involvement in the modelling process.

MoST will be demonstrated with opportunities for hands-on experience at ***workshops*** that are being held throughout Europe during 2005. Specific dates and locations can be found on the project website.

The project team is convinced that MoST is already a useful tool, but is capable of considerable further development. They would be glad to hear from stakeholders and users of projects where they could benefit from the use of MoST, or of ways in which MoST could be applied and improved in the future. Comments and questions may be posted on the discussion pages of the project website, or emailed to HarmoniQuA@ceh.ac.uk.