EC FP6 Project no. 505428 (GOCE)

AquaTerra

Integrated Modelling of the river-sediment-soil-groundwater system; advanced tools for the management of catchment areas and river basins in the context of global change

AQUATERRA ONLINE INFORMATION SYSTEM (ATOIS)

TECHNICAL SUMMARY

OUTREACH

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INTRODUCTION

The information in this text is a Technical summary of the work undertaken in the EU FP6 project AquaTerra (Project number GOCE505428), which ran from April 2005 until March 2009. The aim of this technical summary is to provide a concise account of the range and nature of the work undertaken in the project relating to the subject of OUTREACH, in other words, work related to raising the awareness of the work of AquaTerra to a wider audience. The intention is to make the work of AquaTerra more accessible to stakeholders for whom the information could be of value. This document should be read with a view to following up the work it describes in more detail through the specific project deliverables, which if publically available can be downloaded from the main project website: http://www.eu-aquaterra.de.

BACKGROUND

A core part of European legislation since the introduction of the Water Framework Directive has been stakeholder interaction, the involvement of those people who would or could be affected by legislation, but who do not have a direct role in either its design or implementation. Within AquaTerra it has always been the intention that the information in such a large scientific project should be made accessible to those groups that would find the information of interest and value. In particular this focus has been on those responsible for the implementation of the first review of the WFD, as the work of AquaTerra has been completed in 2009, the year when the first River Basin Management Plans (RBMP) are due to be submitted to the European Union. Other stakeholders include those with an interest in the management policies of river basins, in particular those studied within AquaTerra (Danube, Ebro, Elbe and the Meuse), as well as the wider scientific community and the general public.

Within AquaTerra, the responsibility for outreach activities has been held by three sub projects, namely EUPOL, which investigated the links between AquaTerra science and policy demands, INTEGRATOR, which investigated key environmental issues and stakeholder interests in the study river basins, as well as socio-economic impacts of the key issues and the development of the AquaTerra Online Information System (ATOIS), while KNOWMAN has concentrated on raising awareness of the project and dissemination of information through a series of workshops and training activities. In addition to these specific sub projects, further outreach work has been undertaken within the BASIN work package through the organisation of workshops promoting interaction between stakeholders and scientists, as well as press releases and television exposure on an ad hoc basis in local areas where AquaTerra activity has been significant. There has also been the production of the AquaTerra Final Report, which provides a summary of the work in the project categorised by the individual sub projects involved. Finally there has been the production of the AquaTerra Online Information System, ATOIS. This presents the information online in the form of factsheets relating to individual knowledge and tools produced within the project, technical summaries, such as this one, which categorise the AquaTerra work according to a keyword structure related to the WFD, rather than by the sub

projects of AquaTerra, and provide a series of hyperlinks to other portals containing relevant information on soil and water science in Europe.

This technical summary is divided into five categories, reflecting the nature of the work: stakeholder interaction, science-policy interfacing, socio-economic models, training and workshops and other activities.

WORK UNDERTAKEN IN AQUATERRA

Stakeholder Interaction

Introduction

In the period September 2005 - December 2006, four stakeholder group workshops were held in the four Main AquaTerra study basins, in accordance with the planning as presented in Rijnaarts *et al.,* (2005). A series of characterisation reports (Ansink & Ruijs, 2005; Bouzit et al, 2005a; Ansink et al., 2005; Chapman & Bardos, 2005) generated baseline information about each river basin, policy and management attitudes using a combination of original research and initial consultations with relevant stakeholders. From this characterisation, key issues in each basin were identified. The aim of the workshops was to discuss the results of the relevant basin report, the key issues identified and to evaluate and characterise stakeholder demand for a conceptual model of interaction between the society and soil-water resources. The four workshops were as follows:

- Meuse Workshop, Liège (Belgium), September 2005,
- Elbe Workshop, Leipzig (Germany) November 2005,
- Danube Workshop, Budapest (Hungary), March 2006,
- Ebro Workshop, Barcelona (Spain), April 2006.

All four workshops were successful in attracting the intended target group, namely stakeholders involved in the implementation of River Basin Management (RBM) plans as part of the Water Framework Directive (WFD) and the draft Thematic Strategy for Soil Protection (TSSP). In Budapest, the road map for the Danube Basin was also worked out, as presented as part of Brils *et al.,* (2006b). Evaluation of all four workshops (van Gaans *et al.,* 2007) showed that a combination of presentations on the AquaTerra project and results with dedicated discussions was the most attractive workshop format for end-user stakeholders. To reach local and non-governmental organisations, communication in local languages appeared to be the best option. Joining up with existing stakeholder networks, such as the ICPDR, was also effective in communicating the work of AquaTerra to end-users.

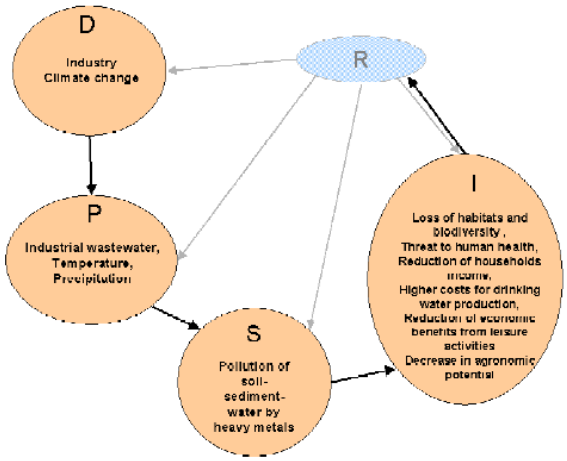
An additional Elbe stakeholder workshop was organised on May 16th, 2007 in Magdeburg, Germany; in accordance with previous findings, the workshop was held in German for better communication. The organisers succeeded in bringing together 25 stakeholders and presenting the main achievements of the AquaTerra research in the Elbe basin and set this into the context of other ongoing research and environmental activities in the basin. For future workshops of this nature it is recommended that more efforts are made to get feedback from the stakeholders present and thus make the meeting more communicative, meaning transfer of information takes place in two directions (Jansen *et al.,* 2007).

A final EUPOL workshop was held on May 14th 2009 in Paris with French-speaking river basin stakeholders. The aim was to present the information of AquaTerra in a

relevant context for the attendees. As this workshop was held at the very end of the project, further information on this meeting can be obtained from the project website rather than as a written report.

DPSIR, river basin issues and stakeholders

The integrated approach used to characterise the key issues in river basins was based on the generic DPSIR (Driver – Pressure – State – Impact - Response) framework, which is widely used by the European Environment Agency (EEA) and the European Commission (EC). The DPSIR framework, combined with a participatory approach, was developed for each component of the soil-sediment-water system and was used to describe the key environmental issues in the four selected river basins (see Figure 1).



DRIVERS	PRESSURES	STATE	IMPACTS
Industry (metal processing, manufacturing of paints and plastics…) Climate change	Industrial wastewater	Pollution of surface water Pollution of soil / sediment	Increase in the consumption of bottled water Higher costs for drinking water production Loss of habitats and biodiversity Damage for leisure activities (incl. Fishing) and tourism Decrease in agronomic potential of arable land
RESPONSES			
Moving/banning polluting industries	Taxes based on the heavy metals loads	Decontamination of polluted soils / sediments	Improvement of treatment process for drinking water production (subvention)

Figure 1 Development of DPSIR framework for heavy metal pollution in sediments

Using the DPSIR framework, the specific soil-sediment-water system components were characterised in the four river basins (Ansink & Ruijs, 2005; Bouzit *et al.,* 2005a; Ansink *et al.,* 2005; Chapman & Bardos, 2005). The common key drivers identified were demography, environmental and agricultural policy, development of industries, agriculture and climate change. These drivers have been identified

as having a major impact on the water uses and water resources and thus on the system as a whole. Pressures and States were analysed up to the present time through physical indicators, such as suspended solids and heavy metal concentrations in both water, sediment and soil components. The main impacts on ecosystems and human activities were also identified for each basin. This characterisation process allowed the description of the key environmental issues at each of the AT four selected river basins (Table 1).

Table 1: Summary of the main issues at stake in the four indicated river basins identified with stakeholders participation (Chapman *et al.,* 2006c)

Main issues at stake	Meuse	Elbe	Danube	Ebro
- diffuse (agriculture) & point source pollution of surface water	√	√	√	√
- contaminated sediments & floodplain soils (a.o. heavy metals)	√	√	√	√
- flooding	√	√	√	
- large scale groundwater pollution due to past mining/industry activity	√	√		
- damming/reservoirs & resulting sediment deficits downstream			√	√
- soil erosion			√	√
- water scarcity				√
- salinisation				√

Key results of the stakeholder workshops are summarised in Ansink & Brils (2006), Bouzit et al (2005b), Brils et al (2006a) and Chapman et al (2006b) for the Meuse, Elbe, Ebro and Danube workshops. Previous to these workshops, the impact of global change on economic activities in the four European river basins was assessed in DLI2.2. One of the conclusions was that, although considerable progress is being made in the management of pollution in the four river basins, economic and climate changes provide additional pressures. The main changes in the case study river basins are industrial growth, agricultural policy change, hydro-morphological changes, reduced stream flow and increased risk of floods and droughts.

Comment [AS1]: Full refeences

The interaction of AquaTerra project members with local stakeholders has helped to validate the work undertaken, the approaches used and the results obtained. It has also helped raise awareness of the project with potential users of the information.

Science-Policy Interfacing

As one of the innovations of AquaTerra, the project dedicated considerable effort to examining the nature of the uptake of scientific information by policy and consequently aimed to link policy demands to the scientific information being generated by the project in order to bring the scientific output to a wider, more influential field. The main objectives of this outreach work were as follows:

- To contribute to a future EU policy framework covering climate change, land use and water, groundwater, sediment and soil management, by supporting the development and elaboration of a consistent policy framework and facilitating the interaction between AquaTerra scientists and policy makers.
- To identify the impact of the AquaTerra results on the Water Framework Directive, the Groundwater Daughter Directive and the proposed Soil Framework Directive.
- To advice for future development of integrated soil and water quality management and policies in Europe based on this analysis.

There were four key achievements of this work: the identification of policy questions; the scientific framework for linking questions to deliverables; recommendations for integrated river basin policies; facilitation of the conversation between policy makers and researchers.

As a first stage in the process of science-policy interaction within and beyond the project, it was necessary to identify the nature of the key topics of concern to policy makers. Therefore, a scientific framework was developed, to first identify the major questions of policy makers and then to assess how such questions could be, at least in part, addressed by AquaTerra research. A range of 54 policy questions were identified from four brainstorm sessions, questionnaires and interviews (Chapman *et al.,* 2005). These were grouped into broad categories of reference, to show which scientific areas were of particular interest to policy makers. The distribution of questions among these categories is shown in Figure 2. The questions were mostly related to land use, river basin management, water and climate change, while questions related to agriculture and soil were the least common. However, the distribution of policy questions reflected the level of interest in these areas reasonably accurately.

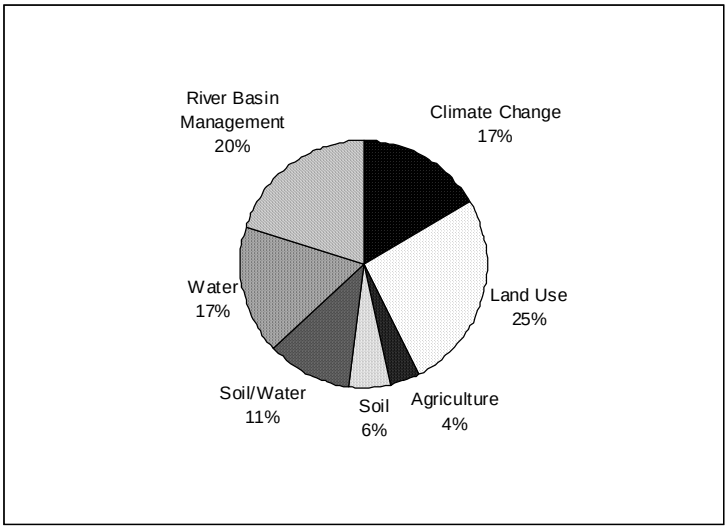


Figure 2: The distribution of policy questions by subject (Slob et al., 2007)

Having identified the nature of policy demand through these questions, the next stage was to assess how this demand could be linked to the supply of scientific

information from AquaTerra. The Scientific Framework that was developed to link them is effectively a matrix that moves from each subproject, through its individual research deliverables to the policy needs of stakeholders and policy makers and vice versa. The subprojects were all assessed as to how well their work may answer the policy questions with their respective deliverables. In total there were 286 research deliverables listed for the relevant subprojects over the first 30 months of AquaTerra (the period during which this work took place), representing its scientific output; each one was ranked as being of high, medium or low relevance to each policy question. The results of this work, categorised by the sub projects of AquaTerra, are shown in figure 3 below.

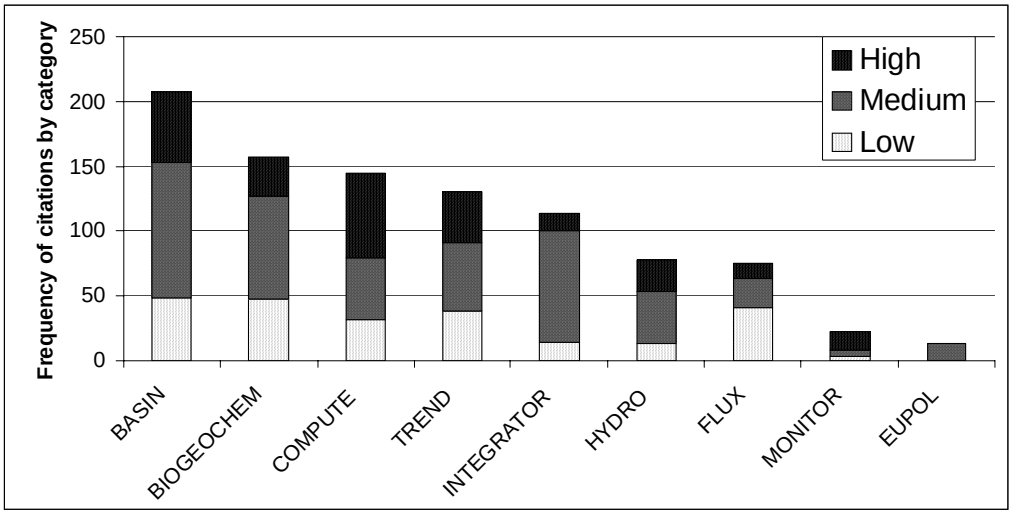


Figure 3: The relevance to the policy questions of the deliverables in each work package (Chapman *et al.,* 2006a)

According to the results from the Scientific Framework several questions could be answered very well by combining information from research deliverables, although a match in itself is no guarantee that the knowledge generated would be taken up by policy makers. Much of the information generated by AquaTerra must subsequently be interpreted, digested, restructured and combined with information from other sources before it can be considered of genuine use and value to policy makers who have to use it in order to make an informed decision. To provide an example, a question that was shown to be of high relevance is described below in Text Box 1:

TEXT BOX 1: an illustration of how AquaTerra science relates to policy using the Scientific Framework developed in AquaTerra (Chapman et al, 2006a)

How will the quality of soil, water, sediment and groundwater improve or deteriorate under present and future conditions?

This is an essential question for river basin management in a broad sense as the answers could give the EU a direction for policy countermeasures. One of the major elements of AquaTerra is to describe trends in water systems influenced by natural and human factors. Based on the work of the TREND and many of the BASIN sub projects, detailed information will be available on changes in water and soil quality in test locations. Some of the modelling work in COMPUTE and FLUX will make it easier to calculate the soil and sediment dynamics in a river environment. The better

understanding of the water- soil system generated by these sub projects will help to find adequate actions to improve the quality of the water/soil system.

Relevant deliverables (till month 30)
TREND: High 2.2; 2.3; 2.5; 2.6; 3.4; 3.12 Medium 1.4; 1.5; 1.16; 1.17
BASIN R1 R2 R5: High 5.1 5.9 5.12 Medium 1.2; 1.3; 1.5; 1.7; 1.8; 2.8
BIOGEOCHEM: Medium 1.6; 2.4; 2.11; 2.12; 4.4; 4.8; 5.2; 5.4; 5.6; 5.8
COMPUTE: High 2.2; 2.3; Low 3.2; 3.3
FLUX: Medium 3.7; 3.8

As well as the challenge of improving interaction between the different communities (i.e. policy makers, politicians, stakeholders and scientists) in order to promote the uptake of scientific information, a second challenge exists of bringing scientists from very different disciplines together to generate a better understanding of the river basin system. Essentially this requires the creation of a common social network in which people can meet, share ideas and learn from each other: the research community in itself encompasses many smaller factions, grouped around separate disciplines.

The interface between science and policy is more problematic than was previously thought. One conclusion that is commonly cited in literature is that an intensive interaction between researchers, policy makers and stakeholders from an early stage appears to improve the uptake of scientific information (Lavis *et al.,* 2002; Lomas *et al.,* 2003, Joyce, 2003). Landry *et al.* (2001) found that the extent of the dissemination efforts undertaken by researchers is a good predictor for the uptake of scientific information by policy makers and that the context of the researchers as well as that of the policymakers influences knowledge utilization. They have concluded that knowledge utilization is much more dependent on factors related to the behavior of researchers and the users' context, than on the attributes of the research products. Therefore, it is necessary to look at science policy interfaces as social processes (Slob *et al.* 2007, van den Hove, 2007).

Interaction between policy makers, researchers and stakeholders is a key element in the generation and utilization of scientific information and it should be organized in such a way that questions and answers can be generated simultaneously. Intensive interaction in workshops with stakeholders, policy makers and scientists should be organized to support the uptake of scientific results by policymakers and stakeholders. A collaborative process approach is needed for an intensive interaction between the scientific community, the policy community and stakeholders who make use of the river basin to come to a common understanding of the societal relevance of results of the scientific work, and vice versa to validate this scientific knowledge with the local and lay knowledge of the stakeholders. In this way the understanding of the river basin system can be improved. These approaches still need to be tested and applied in actual research projects operating at a system level of a river basin. If policy-science linkages are undertaken using a similar format across different disciplines, this will aid consistency and understanding at an inter-departmental level within major political institutions such as the EU. As a result, the Scientific Framework, or a development of it has the potential to be a very valuable means of improving understanding and increasing the transparency of local, national and international policy and decision making. Another issue that came up during our work but that it was not possible to address is the role of political representatives

in river basin management. While the scientific debate is dominated by a search for the truth, the dominant values in the political debate are consensus, agreement and compromise. The role of scientific knowledge and system understanding in political decision making should be further elaborated, especially in the larger research programmes.

The core hypothesis developed during this work in AquaTerra is that developing a shared vision among researchers and basin managers on river basin management contributes to the creation of a social network with researchers and policy makers. A shared concept of "good" river-basin-management-principles will facilitate the convergence of research results and provide policy makers with a language to interact with the research community. Knowledge production should acknowledge the multiple rationalities and different viewpoints that are brought in by the variety of stakeholders that are involved. It is recommended that future research methods should, first of all, consider the importance of interaction with policy and should therefore contain the following key elements (E1.9: recommendations for integrated policy):

Comment [AS2]: Full reference

- Multi- or transdisciplinary research methods
- Involvement of stakeholders in the research process
- Emphasis on learning processes in policy making

Socio-economic models

Background

The development of a conceptual integrated-model representing the interactions of economic activities with the quality of soil and water resources at the river basin scale was a key aspect of the outreach work of AquaTerra. The integrated models developed aimed to provide a framework to characterise and assess direct impacts (e.g. those involving physico-chemical processes) and indirect impacts (e.g. those involving economic and social processes) on river basin quality. Implementation of selected conceptual models was achieved through the identification of case study areas and issues to be addressed at the local level as well as the relevant driving forces and potential trends in each driving force, to simulate the effects of policies in the medium and long term. The development of decision-making models in three case study areas was undertaken using a combination of modelling economic sectors having an impact on soil-water resources and sectors depending on soil-water resources. In the case of the Geer and Ebro case studies, the conceptual models were validated in collaboration with local stakeholders.

The initial objective of this aspect of AquaTerra was to design a generic conceptual model of decision making processes applicable across the EU, based on the synthesis of the different basin conceptual models. The development of conceptual models aimed to describe possible scenarios for future developments in groundwater, soil, and sediment quality and quantity, as affected by soil-groundwater-river interactions at different geographic scales. The experience gained during AquaTerra has led to the refining and adaptation of these objectives. On the basis of the results obtained in AquaTerra, five case studies were proposed for the development of conceptual models integrating the economic analysis and physical processes (DLI2.5). These are summarised in the Table 2:

Table 2: Main socio-economic sub-systems considered in the conceptual models of the INTEGRATOR case studies (Herivaux *et al.,* 2006)

Case study area	Environmental issue considered	Main external drivers	Socio-economic sectors and sub-systems considered
Geer Catchment (Meuse, Walloon region)	diffuse nitrate pollution in groundwater	Agricultural policy Environmental policy (e.g. Nitrates Directive)	Drinking water sector Household water use Industry (agro-food) Agriculture
Kempen area (Meuse, Flanders and Netherlands)	soil contamination by heavy metals	Industrial policy Health policy & food safety policy Land planning Environmental legislation	Population (health) Drinking water sector Agriculture Urban development
Central Ebro River Basin (Ebro, Spain)	soil and surface water degradation because of salinity/sodicity	Agricultural policy Tourism development Population growth Industrial development Water policy (e.g. National Hydrological Plan)	Agriculture Drinking water sector Industry & public equipments Fishery (?)
Krska kotlina aquifer (Danube, Slovenia)	groundwater pollution by nitrates and pesticides	Population growth Tourism development Agricultural policy Environmental & water policy (UWWT & Nitrates directive)	Agriculture Municipal (household) water service sector Disconnected households Thermal tourism
Meuse river basin (Flanders & Netherlands transboundary part)	water quality and water quantity (low flows, high flows) problems	Economic growth Population growth Climate change Water policy implementation	Navigation Agriculture Industry Drinking water

Of the case studies identified, the Ebro and Geer catchments, as well as the Kempen Region were selected to form the basis of coupled biophysical and socio-economic analysis modelling, which were developed as described in the following section.

Development of conceptual models

Through the work undertaken in AquaTerra to characterise the study river basins (Ansink & Ruijs, 2005; Bouzit et al, 2005a; Ansink et al., 2005; Chapman & Bardos, 2005), as well as the interaction activities with stakeholders (Ansink & Brils, 2006; Bouzit *et al.,* 2005b; Brils *et al.,* 2006a; Chapman *et al.,* 2006b) it was concluded that there is no one generic model suitable for all sites and all environmental issues. Therefore, the model on interaction between socio-economic activities and water-soil physical modelling was expanded into three case studies that illustrated various key issues identified in the basins.

Development of the case studies consisted in assessing the cost effectiveness and benefits of management options proposed to mitigate key environmental issues. For each case study, links with other work in AquaTerra were established (see Figure 4, which illustrates the process for the Geer basin). Details of the development of the conceptual models, together with an assessment of the validation process can be found in Herivaux *et al.* (2006).

The development of the case studies has proved to be one means by which the integration of the multidisciplinary results produced in AquaTerra could be achieved and led to further recommendations for model development. The case studies illustrate how a combined approach of biophysical analysis and economic analysis can serve as a basis for policy and river basin management recommendations.

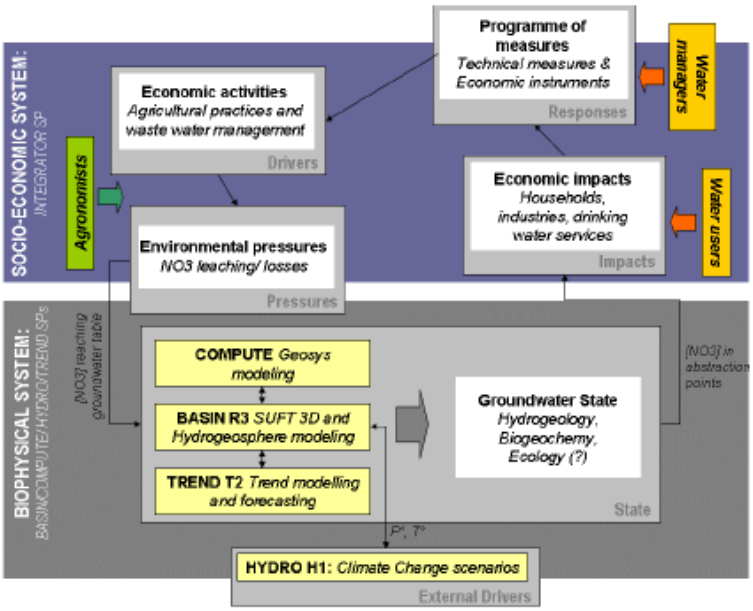


Figure 4 DPSIR scheme relationship between Integrator, other AquaTerra sub-projects and stakeholder on the Geer case study (Herivaux *et al.,* 2008)

Training and workshops

Training: a variety of training activities organised by AquaTerra took place in a range of strategic locations across Europe, intended to maximise their accessibility for potential participants at local and national level. These included scientific training related to the different disciplinary results (for young scientists, consultants and specific stakeholders), thematic training on global issues (for national and/or local authorities and industries) and Civic meetings at local level for specific end-users such as Local Authorities and water companies. A brief description of the training courses is given below:

- A training course on "Experimental and Monitoring Techniques" in Tübingen (Germany) from 26-27/9/2005. It included innovative site investigations such as direct push technologies, accompanied by on-site field demonstrations at the Tübingen aquifer test site, as well as innovative groundwater sampling methods and approaches to the evaluation of atmospheric deposition of organic contaminants on catchment scales.
- A course on the Ebro river basin, including innovative analytical protocols tested predominantly on the Ebro River and with chemometric modelling 15-16/5/2006 in Barcelona (Spain) in conjunction with the SWIFT – AquaTerra workshop.
- A Modelling and software demonstration, in Blaubeuren, Germany (12/2006) provided a communication platform for the modelling community in AquaTerra as well as a link to other modellers outside.
- A course on the biodegradation and storage of pollutants in Tübingen (Germany) was held in March 2007, with a focus on the Brévilles Basin. This course bought together AquaTerra workers and people working on the Brévilles and other Basins.

- A socio economic and legal aspects course, which led to integrative discussions in the AquaTerra community, was held directly after the General Assembly in Menorca (Spain) in April 2007.
- An excursion to the Elbe catchment, including a visit to a lysimeter station and suction cap site, was organised in May 2007. This brought together people working in the Elbe basin with other AquaTerra basins such as the Meuse.
- Two courses; one on the effects of organic pollutants with special focus on ecosystem and human health effects (Tübingen, Germany, 3rd and 4th of March 2008) and the other in conjunction with the EUROSOIL congress in Vienna (Austria) in August 2008 with focus on pollutant dynamics in flood plains.

Workshops: a number of workshops were organized to communicate the results of AquaTerra to specific target groups, including the scientific community, local and regional authorities, policy-makers and environmental resource managers. In the first year of AquaTerra most effort was put into internal AquaTerra workshops, to initiate and facilitate cooperative research among the AquaTerra partners, such as the workshops set up prior to the start up of sampling campaigns in the river basins. As a result of these activities, the AquaTerra Danube Survey was carried out successfully during August 2004, and other joint sampling and research activities have been started up in the other case study river basins. In addition to these AquaTerra workshops, participation and organisation of external workshops has also been undertaken; some examples are provided below:

- AquaTerra Special Sessions at ConSoil October 2005: Bordeaux, France.
  - Natural processes occurring in the river-sediment-soil-groundwater system
  - Science meets policy
- Soil and Water, 2005, 2006, 2007, Woudschoten, The Netherlands. An annual workshop for young scientists.
- Participation of AquaTerra project workers and presentation of AquaTerra information at an International Meuse Commission Symposium, May 2006, Sedan, France.

This list is not exhaustive; the results of work produced as a result of AquaTerra have been presented at many conferences and seminars worldwide. For more information about the dissemination of AquaTerra at conferences, see the project website (http://www.eu-aquaterra.de).

Other activities

AquaTerra Factsheets

To assess the range of data available within AT, all deliverables produced in AquaTerra up to February 2007 were broadly reviewed and assessed with respect to their environmental, social and economic characteristics (basin location, scale, key pressures in the selected areas, the types of contaminant present and so on). This screening work enabled the assessment of existing data available in AquaTerra and anticipated the main issues for data delivery and integration (Merly & Blanchard, 2007). It showed that AT results were heterogeneous (temporal scale, location and spatial scale) and covered a range of disciplines (biophysical, policy and socio-economy). Based on these analyses, recommendations on integration were drawn and a delivery / integration

methodology was developed (Figure 5). This methodology was tested with a WP leader's consultation by phone interviews using questionnaires to provide a structure to the interview. This determined key findings by AquaTerra and clarified how these could address river basin management issues. The interview activity also identified potential end-user types who could benefit from the results produced up to February (Merly *et al.,* 2007b; Merly *et al.,* 2009). This process has produced 53 Knowledge & Data -type findings factsheets and 43 Tools factsheets based n the work of AquaTerra.

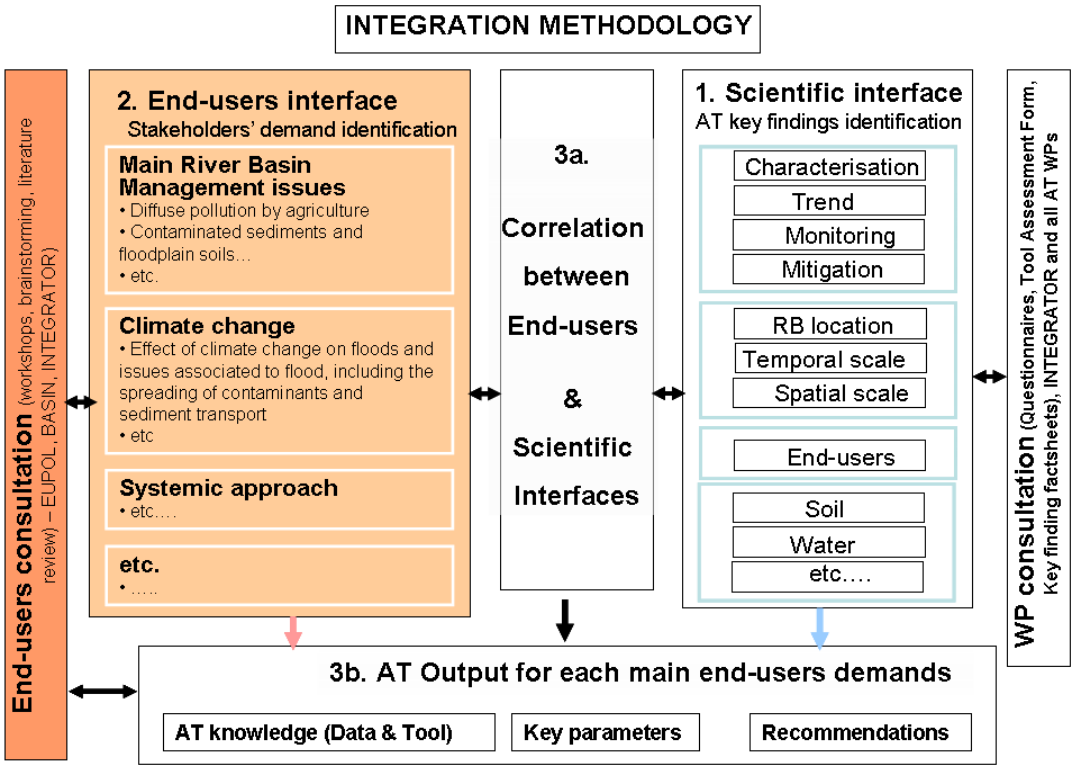


Fig. 5 Methodology for the integration of information and delivery of AquaTerra factsheets (Merly *et al.,* 2009)

Websites

The main AquaTerra project website (http://www.eu-aquaterra.de) has been a major source of information and a tool for dissemination throughout the life of the project. Core functions of the website have been the compilation and integration of project activities and results, updates on progress in the project and other news, notification of conferences and meetings, as well as any reports of events involving AquaTerra, and the 'who is who?' interface, which presents brief biographic details and contact information of AquaTerra participants, including their research background and contribution to the project. The website has been widely used both by AquaTerra project members and external users making enquiries related to the project.

As well as the main project website a second website, the AquaTerra Online Information System (ATOIS) has been produced.

Linking to other projects

Finally, the inter-relationships between AquaTerra and other scientific projects were identified and assessed (Merly *et al.,* 2007). Interviews with AquaTerra work package leaders, along with internet searches and conference workshops, have enabled to identify potential and existing collaborations. AquaTerra developed a large and successful network of knowledge and contacts at the European, national and local scale. Strong collaboration was further developed with projects including RISKBASE, SEDNET, MODELKEY, AquaTrain, Norman, Swift and EUGRIS and opportunities for collaboration with SPI-WATER, WISE-RTD and NEWATER are being explored.

Published work and outputs in other media

As well as striving to develop a significant profile outside of the immediate scientific sphere in which AquaTerra has operated, it has also aimed to produce a significant body of published work. In the course of five years over 200 peer-reviewed scientific journal papers and book chapters have been produced, as well as the deliverables produced as part of the project itself. A full list of the published work produced as a result of AquaTerra can be found on the main AquaTerra website at the following link:

http://www.attempto-projects.de/aquaterra/8.0.html

In addition to formal academic writing, reports, training and workshops, a range of informal reports relating to AquaTerra work in the media were produced during the course of the project. These included press articles, television reports and interviews, all of which helped to increase the profile of the project work in local areas with non-scientific stakeholders. These activities have mainly taken place. A full list of the publicity activities is available on the main AquaTerra website at the following link:

http://www.attempto-projects.de/aquaterra

CONLUSIONS

As a whole, AquaTerra has made significant efforts in a variety of outreach activities, ranging from the conventional (peer-reviewed publications, websites, conferences) to the more unconventional (Television, radio). A key aspect of the outreach work has been stakeholder interaction, both to inform potentially interested groups about the project and the results and to obtain feedback on the methods used in the work. Communication has taken place at a variety of scales within the project, from individual workers and small groups of workers operating at a very local level with small groups or individuals, to larger scale workshops and high profile participation in international conferences. Where it has been possible to do so, the workshops held in the local languages have proved especially successful in raising awareness, interest, and in several cases active involvement of local stakeholders.

Much of the outreach work has been based on the communication, use, application and adaptation of scientific information produced in AquaTerra. From the production of factsheets summarising specific aspects of the work, to the development of the ATOIS website to bring together information in the context of

key elements of the river basin, to the work investigating the demands of policy and the methodology to link them to AquaTerra, to the models of the economic impacts of environmental quality in the context of global change, there has been a conscious effort to adapt the information of AquaTerra to suit the demands of the WFD and other key European legislation. This activity reflects the modern reality of scientific research in the European Union. It is no longer sufficient to produce science in isolation, either from other scientific work or from policy makers, stakeholders and the general public; successful outreach work is a crucial aspect of modern research.

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