GI(S) in Catchmod

Results of the meeting at the Eco-Geowater conference
held at Oriel College, Oxford, July 11th, 2002
Eco-Geowater: European Conferences
and forum to link GEO and WATER Research
http://www.gisig.it/eco-geowater/

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1. Introduction

On July 11th 2002 a session on GI(S) aspects within a number of projects of the EU CatchMod Cluster was held at Eco-Geowater conference at Oriel College, Oxford. The proposed aim was to exchange information on the role of GI(S) within several projects and possibly discuss interactions between the projects on GI(S) aspects.
The session consisted of presentation of individual projects, emphasizing the GI(S) aspects. Dr. Balabanis from DG Research - Directorate I, scientific officer of many of the projects gave a presentation on the funded research in Catchment modelling (Water Key Action) and clustering activities (see chapter 2). Furthermore Dr. Ron Thomas from UK's Environment Agency and member of the EU working group on GIS for the implementation of the Water Framework directive presented the state of play in the Working group (see chapter 3).

The individual projects presented were:

Project's name	Presenter's name	Chapter
Mulino	Carlo Guipponi	4
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It proved difficult to discuss potential clustering due to the full program and the number of attendees. However, for each project a ' fact sheet' has been produced to facilitate future discussions.

2. Water Key Action (Panagiotis Balabanis)

(DG Research - Directorate I; panagiotis.balabanis@cec.eu.int)

After presenting some statistics on the Water Key Action Dr. Balabanis gave an overview of important projects in the framework of Integrated water management projects in support to the WFD:

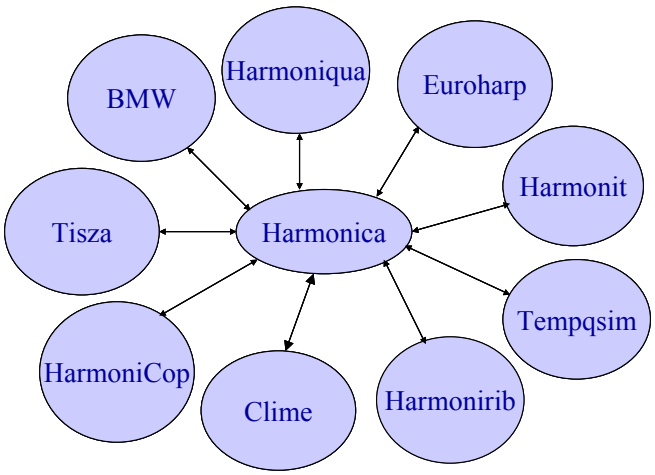
- Assessing water quality in selected river basins (EUROCAT, DANUBS, etc.)
- Transboundary catchments (MANTRA-EAST, etc.)
- Socio-economic driven projects (EUWARENESS, SLIM, ADVISOR, etc.)
- Decision Support Systems (MULINO, GOUVERNe, etc.)
- Management of scarce water resources (WaterStrategyMan, AQUADAPT, etc.)
- Catchment modelling (FIRMA, HARMONIT, BMW, EUROHARP, etc.)

Mr. Balabanis pointed out that the aims of clustering are to

- Go beyond the limited possibilities of an isolated project
- Foster the synergies between complementary projects
- Give Community water research a more strategic, leading role centred primarily on solving economic and social problems

The main current clusters are:

- Catchment modelling **(CATCHMOD)**
- European land-ocean interaction studies **(ELOISE)**
- Management of water in arid areas **(ARID)**
- Integrated Urban Water Management **(CITY-NET)**
- Endocrine disruptors **(ENDO)**
- Ecological quality assessment **(WFDEQA)**
- Residues of pharmaceuticals in freshwater **(PHARMA)**
- Flood forecasting **(ACTIF)**
- Contaminated land, landfills and sediments **(SENSPOL, IMAGE-TRAIN, SEDNET)**



This conference session focuses on the CatchMod cluster whose aim is the "Development of common harmonised modelling tools for the integrated management of water at river basin or sub-basin scales, including the

interface to the coastal zone, in order to achieve a selected number of 'European benchmark models' for the various integrated water management requirements at these scales.
The figure shows the projects within CatchMod.
Mr. Balabanis pointed out that the projects need to interact closely to many of the EU working groups on the implementation of the Water Framework Directive. These working groups are:

- WG 2.1 Analysis of pressures and impacts
- WG 2.2 Heavily modified water bodies
- WG 2.3 Reference conditions inland surface water
- WG2.4 Typology, classification of transitional, coastal waters
- WG 2.5 Intercalibration
- WG 2.6 Economic analysis
- WG 2.7 Monitoring
- WG 2.8 Tools on assessment, classification of groundwater
- WG 2.9 Best practices in river basin planning
- WG 3.1 Geographical Information Systems
- WG 4.1 Integrating testing of guidelines in pilot river basins

Note from the editor:
Useful entry point web-sites on WFD and working groups are:
WFD main page: http://europa.eu.int/comm/environment/water/water-framework/index_en.html
WFD on the CIRCA (**C**ommunication **I**nformation **R**esource **C**entre **A**dministrator) site :
http://forum.europa.eu.int/irc/env/wfd/info/data/wfd%20circa%20welcome%20text.htm

3. Water Framework Directive GIS Working group (Ron Thomas)

Ron Thomas, Senior Database Scientist, National Centre for Environmental Data and Surveillance,
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After the publishing of the Common Implementation Strategy 10 specific working groups were established. The CIS Working Group 3.1 deals with GIS aspects and is lead by Jürgen Vogt (JRC – IES). Ron Thomas pointed out that GIS is not much mentioned in the WFD text, but that the use of “maps” is very often advocated. The WFD requires spatial data for the preparation of the River Basin Management Plans and reporting to the Commission. The current focus of the GIS WG is on the reporting obligations, though longer term use for analysis also being considered.
The working group works on a guidance document which identifies

- the datasets necessary for reporting,
- their content and structure
- and how to access or transfer them.

Two options exist for implementing a common GIS:
(a) centralised system to which all data will be transferred
(b) a distributed system with access to the data through common standards and protocols.
The working group aims for option (a) on short term and (b) on the long run.
The structure of the guidance document will be:

- How to Use the Guidance Document

1 Implementing the WFD

2 Common Understanding
3 Technical Specifications
3.1 GIS Layers and Metadata
3.2 System and Architectural Standards
4 Harmonization, Coordination and Organizational Issues
5 Experiences from the Prototype
6 Concluding Remarks
7 Annexes

Technical Specifications: 3.1. GIS Layers and Metadata

- Requested Data Layers, spatial accuracy, level of detail
- Data Validation (e.g., spatial acc., domains, harmonised boundaries, ..)
- Reference System (ellipsoidal coordinates with reference to ETRS 89 datum)
- Metadata (ISO 19115)

Technical Specifications: 3.2. System and Architectural Standards

- Data Model (short and long term, entities and their relationships, data dictionary, multilingual aspects, …)
- Coding System (unique identifier for all WBs)
- Standards for Data Exchange and Access (short and long term)

Take account of developments under INSPIRE !!!

On aspects of Harmonization, Coordination, Organization work will be carried out on:

common geometry

- vertical integration of different layers
- handling of common edges
- what implications for co-ordination arise from the implementation of a decentralised system?
- who should be in charge of a centralised system?

The time frame for the production of the guidance documents is:

- 18th and 19th June 2002: 3rd WG Meeting at JRC, Ispra
- discussion and further drafting of individual sections
- 19 July 2002: Re-worked section drafts to JRC
- 31 July 2002: Draft GD to Member States for written comments
- 14 Sept. 2002: Last date for receiving written comments
- Early October: Next WG Meeting
- final discussion of draft Guidance Document
- Late October: Forward Draft Guidance to SCG

4. Mulino (Carlo Guipponi)

Full title	MULti-sectoral, INtegrated and Operational Decision Support System for Sustainable Use of Water Resources at the Catchment Scale
Web-site	http://www.feem.it/web/loc/mulino/index.html
Status	January 2001, 3 years
Main objectives	The goal of the MULINO project is the provision of a Decision Support System (DSS) to be used for the management of water resources at the catchment

	scale. The project aims to produce an operational tool that meets the needs of European water management authorities, by involving decision makers from five different countries in the DSS design. The MULINO project is characterised by achieving three main objectives: ▪ Design and implement an operational DSS tool to support decisions based on hydrologic modelling, multi-disciplinary indicators and a spatial multi-criteria evaluation procedure; ▪ Use an application-driven approach which focuses on the needs of six European case studies (in Portugal, the UK, Belgium, Italy and Romania); ▪ Adopt the principles of the Water Framework Directive and work closely with the Catchment-based Information System (CIS) developed at the JRC Ispra. A common structure has been designed for the MULINO-DSS, integrating hydrologic, socio-economic and environmental models in a multi-criteria analysis tool, allowing it to cope with real problems and issues arising from variegated and conflicting water uses and demands. Three subsequent versions of the DSS are planned: the first release aims at supporting the decision process mainly through the suitable structuring of the decision problem and through preference modelling. The second release will loosely integrate a comprehensive hydrological model, whereas the third release will tightly integrate simplified (or meta) models derived from those used for the project case studies. During the three year term of the project, results will be disseminated through local and international workshops, multilingual newsletters, a web site and a final CD-Rom.
Role of GI(S)	There are three principal ways in which GIS plays a role in the MULINO project: • The storage and manipulation of spatially-variable datasets for each of the case study regions for the purpose of modelling and the implementation of the DSS; • The visualisation of spatial information within the MULINO DSS itself ; • The links between MULINO and the Catchment Information System (CIS), e.g. transfer of spatial data in appropriate data formats. The GIS software packages that is being used in MULINO was defined by : • the requirements of individual hydrological models (e.g. SWAT is developed as an ArcView extension) ; • the preferences of individual modellers; • the requirements for the development of the DSS interface. ESRI data formats were therefore chosen as an appropriate way of exchanging geographic data between the partners and as an interface with the MULINO DSS. The project partners agreed that each local team should take responsibility for the development of the GIS within their own case study region. This decision was intended to facilitate the application of appropriate modelling techniques

	and the implementation of the MULINO DSS at a local level.
Interaction with other CatchMod projects on GI(S)	No interaction with other projects specifically related to GIS is foreseen at the present time. Special attention will however be given on the outputs of the WFD GIS Working Group.
Interaction with other CatchMod projects other than GI(S)	MULINO could use products/results from: • HarmoniCA: collaborative planning, results communication • HarmonIT: data transfer mechanisms between models and DSS software • HarmoniRIB : methods for assessing uncertainty • HarmoniCoP : stakeholder interaction methods MULINO's products/results could be used by: • HarmoniCA: techniques for group decision making • HarmoniQuA: Mulino can be seen as a reporting tool for different types of stakeholders • HarmoniRIB: our case studies could be used to test the methods
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5. HarmoniCA (Michiel Blind)

Full title	Harmonised Modelling Tools for Integrated Basin Management Concerted Action
Web-site	Not available (reserved url: www.harmoni-CA.info)
Status	October 2002
Main objectives	**Main objectives** The overall objective of the large scale concerted action 'HarmoniCA' is to create a forum for unambiguous communication, information exchange and harmonisation of the use and development of ICT-tools relevant to integrated river basin management, and the implementation of the WFD. The communication, information exchange and harmonisation is geared towards the development of a widely accepted, flexible, harmonised modelling toolbox, including ICT-tools, guidance and methodologies, which can be applied by the various stakeholders in river basins. HarmoniCA will deliver a framework for harmonising ICT-tools and guidelines for integrated river basin management. This objective includes dealing with all difficulties in utilising ICT-tools in river basin management elaborated in chapter 1. Acceptance is sought amongst politicians, managers, scientists, modellers and end-users. Though much of the work involves ICT-tools, HarmoniCA is not about ICT-tools as such: HarmoniCA is about harmonisation and guidance on proper

development and use of ICT-tools in the light of effective and efficient development of integrated river basin management plans and the implementation of the WFD.

Tasks objectives

Several specific tasks within the large-scale concerted action are identified:

1) The objective of the task "*Establishing a communication forum / HarmoniCA Management*" is **to build an infrastructure for exchanging knowledge, to guide the process to harmonisation, and to report on the outcome**. This task also includes organisation of conferences and workshops. Emphasis is placed on the participation of all stakeholders. Periodic reports on the outcomes from the communication processes will be provided.
2) The objective of the task "*Toolbox*" is to **provide easy and guided access to approved (benchmarked) ICT-tools** necessary for the development of River Basin Management Plans. This leads to an open, flexible, "scientific sound" toolbox for present and future integrated, harmonised ICT-tools. Easy access is not limited to technical access to resources, but also includes training material, demo case studies, protocols dealing with conditions for utilisation, rights of ownership, intellectual property rights and finance. Access to tools will be provided through a web-site that contains (references to) ICT-tools, benchmarking reports, and a tools selection tool, which guides the user to the tools based on the issue at hand, the characteristics of the river basin, the data availability etc.
3) The "*General Methodology and Guidance Documents*" activity **delivers guidance and methodology documents on the development and use of ICT-tools from the viewpoint of implementing the WFD**. Existing knowledge is integrated and gaps in knowledge are identified. Advice on future RTD-needs will be provided. The guidelines will safeguard the reproducibility and comparability of the outcome of modelling exercises. Moreover, they contain recommendations how water management tools should be adapted better to the objectives of the WFD. This task aims at providing: a) a classification of the tools with regard to their potential contribution to the objectives of the WFD, b) a list of the gaps and weaknesses and c) advice on how to use the tools and improve their performance of effectiveness with respect to the WFD.
4) The task "*Joint use of monitoring and modelling tools*" aims at **providing the link between modelling, monitoring and data needs of models**. Emphasis is put on data quality and quantity and how well implemented models represent their target entities. Data gaps will be identified for each type of model and advises how to improve the data availability will be provided. Furthermore, the feasibility of establishing a European network of experimental river basins suitable for RTD projects in integrated water resources management will be assessed. Finally, guidelines for good practise in combining monitoring and modelling will be prepared.
5) "*Integrated Assessment and the science-policy interface*" aims to **offer insights to the research community for prioritisation of their efforts, as well as to the decision-making community for the design of their policies**. Integrated assessment is policy-motivated research to develop a new understanding of various water problems. This understanding is not based on disciplinary boundaries, but on boundaries defined by the problem. As a prerequisite a set of criteria and requirements will be derived especially for the intentions of the WFD.

"*Co-ordination ongoing & future RTD-activities*" **increases the output and benefit of ongoing research**, speeds-up the (re-) use of developed products, avoids large overlaps between projects and reduces the chance of duplicating activities. This will be achieved by applying a variety of activities leading to a closer co-ordinating and synchronising of ongoing and planned research. The task will consider ongoing and future projects dealing with issues relevant to

	the implementation of the WFD.
Role of GI(S)	*Note: Since HarmoniCA did not start yet, the following text is written on a personal basis by Michiel Blind.* GI(S) is not specifically mentioned in the proposal of HarmoniCA. However, HarmoniCA is planning to play a central role in ICT related research relevant to the WFD, this includes GIS aspects. Obviously, GI(S) will play a role in task 6, which aims at co-ordinating and clustering research. However, also in other tasks GIS will possibly be important: ➢ Tool/data availability and accessibility (task 2 / 4) ➢ Rights of ownership and commercial issues of tools (task 2 / 4) ➢ Data needs and data quality (task 4) ➢ Data standards and metadata (task 4) ➢ Scaling issues (task 6) ➢ GI(S) in River basin management methodology (task 3) ➢ GI(S) in the science policy interface (task 5) HarmoniCA thus will require and provide all types of GI(S) relevant information.
Interaction with other CatchMod projects on GI(S)	HarmoniCA should function as an information pivoting point. It will actively seek to present what is going on in the field and promote work done. As such it aims at providing the Catchmod projects with relevant GI(S) information, but also use the products to prepare HarmoniCA products. Interaction with WFD working groups, especially with the GIS group will be crucial for HarmoniCA.
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6. HarmoniQuA (Huub Scholten)

Full title	Harmonising Quality Assurance in model based catchment and river basin management
Web-site	http://www.info.wau.nl/harmoniqua/
Status	Jan 2002, 4 years
Main objectives	The overall goal of HarmoniQuA is to improve the quality of model based river basin management and enhance the confidence of all stakeholders in the use of models. HarmoniQuA has 4 specific objectives: 1. To develop a generic, scientifically based methodology and a set of guidelines for the modelling process; 2. To develop tools to support modellers and water managers throughout the quality assurance process;

	3. To test the methodology/guidelines and the support tools in real-life cases; 4. To disseminate the results of the project to users in the academic education sector, the water managers and model users and to other interested stakeholders.
Role of GI(S)	GIS is a technology which can be used on modelling & simulation for water management. HarmoniQuA aims at improving M&S methodology for model based decision support in water management. HarmoniQuA is relevant for M&S projects in which GIS is used for I/O handling as well as for models which have a GIS M&S engine. The HarmoniQuA principles have been proved to be successfully used in GIS-based course on spatial modelling and visualisation.
Interaction with other CatchMod projects on GI(S)	no obvious interaction relevant
Interaction with other CatchMod projects other than GI(S)	HarmoniQuA can use products/results from: • HarmoniCA (methodologies, GMP) • HarmonIT (to test plug-in HarmoniQuA tools) • HarmoniRIB (proper use of data, uncertainty issues) • Tisza River project (testing HarmoniQuA products) • BMW (model selection support methods and tools) • HarmoniCoP (stakeholder interaction methods) HarmoniQuA products/results can be used by: • HarmoniCA (methodologies) • HarmonIT (HarmoniQuA plug-in tools) • HarmoniRIB (uncertainty issues) • Tisza River project (HarmoniQuA products to improve overall M&S quality)
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7. HarmonIT (Roger Moore)

Full title	IT Frameworks
Web-site	www.harmonit.org and www.harmonit.com
Status	Started 01/01/2002
Main objectives	**Problems to be solved** Integrated catchment management has arisen because managing environmental processes independently does not always produce sensible decisions when the wider view is taken. However, the problem for those

	charged with integrated management is the complexity of the process they are attempting to manage. They are therefore turning to decision support systems. The models used in these systems tend to address single issues. However, the catchment manager needs to understand all the possible impacts of pursuing any given policy. Implicit in this is a requirement both to understand and to be able to model not only the individual catchment processes but also their interactions. This project is about making possible the construction of whole catchment models in order to facilitate the integrated catchment management called for in the Water Framework Directive. **Scientific objectives and approach** The objective of this project, therefore, is to develop, implement and prove a European Open Modelling Interface and Environment that will simplify the linking of models and hence allow catchment managers to explore the likely outcomes of different policies. The major deliverable will be a published standard. However, the project includes a development phase in which the leading European vendors will implement the standard and develop tools for linking models, monitoring their performance and displaying results. Fourteen organisations are participating from seven European countries.
Role of GI(S)	The OMI does not '**use**' spatial data or GIS in the ordinary sense. The project is about designing a mechanism by which data can be passed between one model and another. However, the models to be linked represent processes that take place in 1D, 2D, 3D & 4D space and the information to be passed between them will need to be spatially referenced. The function of the OMI will not only be to link one model to another but will also be to link models to databases, including spatial databases, and GUI's, including map based GUI's. OMI tools will use geographic position in defining connection points at which information can be sent to or received from other models.
Interaction with other CatchMod projects on GI(S)	No interaction with other projects specifically related to GIS is foreseen at the present time. HarmonIT will, however, be keeping a close watch on the outputs Working Group 3.1 and how it interprets the GIS requirements of the Water Framework Directive.
Interaction with other CatchMod projects other than GI(S)	HarmonIT's hopes that through interaction with other projects, it will achieve greater understanding of user needs. It also hopes that, where there is mutual benefit, HarmonIT will be able to use the other projects as a test bed for the OMI. HarmonIT has been approached by the Tisza River project with a view to collaborating on model linking, especially with respect to the linking of hydraulic and ecological models.
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	Wallingford Oxon OX10 6HU UK rvm@ceh.ac.uk and cit@ceh.ac.uk

8. Tisza River project (Istvan Zsuffa)

Full title	The Tisza River Project Real-life scale integrated catchment modelling for supporting water-related environmental management decisions
Web-site	http://www.tiszariver.com/
Status	started 01/01/2002
Main objectives	The Tisza catchment is located in the geographical centre of Europe and crosses the near-future boundary of the European Union. The outstanding ecological values, the extreme dangers of both the excess and shortage of water, the multiple hazards of diffuse and point source pollution, the clicking time-bomb of further potential accidents and the very high all-European political, social and economic concerns, straightforwardly define the objectives of the Project: **To help saving the water resources and ecological values with the help of integrated catchment management tools and to secure the sustainable use of the resources of the Tisza River Basin.** The scientific and technological objectives are as follows: • Establishment of real management oriented exchange of data and information among the countries sharing the Tisza basin. Creation of a unique international data base. • Identification and quantification of basin scale water and environmental issues and management alternatives with special regards to the fate of hazardous substances and the relevant preventive, remedial and emergency actions. • Promotion of the operational use of high resolution satellite remote sensing and GIS integrated with non-point source pollution modelling and monitoring at local and Community level. • Establishment of a set of catchment modelling tools, that can provide the basis of analysing the likely outcome of potential management actions (scenarios, alternatives). Within this the objectives are the development of • Hydrological and hydraulic models to support the solution of excess water and water shortage problems and to provide basis for other models; • Catchment models focussing on the control of non-point source pollution; • River water quality models for nutrients, oxygen household processes and specific other pollutants that might prove to be necessary when

	issues are fully identified; • Pollution spill models, to form the basis of the establishment of an operative quasi-online pollutant wave propagation forecasting system; • Wetland and reservoir ecosystem models to help managing the unique aquatic ecosystems. • Promotion of the application of the novel eco-hydrological means of water and environmental management in a catchment where a high number of unique riparian wetlands exists and are endangered.
Role of GI(S)	GIS will be used for building up the International Tisza Database (ITDB) as well as for the different spatial hydrological and water quality models. The ITDB is going to be a fully GIS based database where spatial data such as DEM, land use, soil, water courses etc. are stored in the form of GIS coverages. Temporally distributed datasets of the database (e.g. recorded flow rates and precipitation) will be accessible through the vector-point GIS coverages of monitoring stations. Each GIS map in the database will have a unique set of metadata information. These metadata tables follows the prescription of the Draft International Standard ISO/DIS 19115 for Geographic information – Metadata.
Interaction with other CatchMod projects on GI(S)	
Interaction with other CatchMod projects other than GI(S)	Interaction with the HarmonIT project is envisaged in the field of linking of different hydrological, hydraulic, water quality and ecological models.
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9. Medis (Mariel Delhom)

Full title	Towards Sustainable Water Use on Mediterranean Islands: Addressing Conflicting Demands and Varying Hydrological, Social and Economic Conditions
Web-site	Not yet developed.
Status	Jan 2002 / 4 Years
Main objectives	The overall goal of MEDIS is to contribute towards the sustainable use of water on Mediterranean islands where conflicting demand for water is combined with a wide range of hydrological, social and economic conditions.
Role of GI(S)	it is too early to answer the question
Interaction with other CatchMod projects on GI(S)	it is too early to answer the question
Interaction with other CatchMod projects other than GI(S)	(dito)

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10. TempQsim (Jochen Fröbich)

Full title	Evaluation and improvement of water quality models for application to temporary waters in Southern European catchments
Web-site	www.tempQsim.net (under construction)
Status	expected to start November 2002, duration 36 moths
Main objectives	The aim of the project is to provide tools for an efficient integrated water management in Southern Europe and other semi-arid regions. To meet this aim, the particular dynamics of temporary waters will be incorporated into existing catchment and in-stream water quality models. Practical aim of the project: To provide innovative and operable water management strategies for semiarid regions, obtained from experience of testing the models at selected case study sites. Specific objectives: 1)To define the requirements to be met by water quality models for application to catchments with temporary waters; 2)To develop and test *hydrological modules* which account for the different runoff generation mechanisms as well as surface/ground water exchanges; 3) To develop *sediment modules* to account for accumulation, resuspension and transformation processes of organic matter and nutrients during dry and wet periods; 4) To improve *water quality models* by integrating the sediment and hydrological modules
Role of GI(S)	GIS will be used to provide information on mass inputs into water courses, especially particulate organic matter. There is no focus on special GIS software. The project aims to improve water quality models like SWAT, HSPF, ATHYS-POL and others which are using GIS interfaces to support the processing of model input data. The improvement of models will hence improve the GIS applicability in semi arid regions for management of scarce water resources.
Interaction with other CatchMod projects on GI(S)	Links are expected to the experience of EUROHARP and BMW in using catchment models in semi arid regions.
Interaction with other CatchMod projects other than	Links are expected to the TISZA river project (related to water quality modelling), HarmonIT (related to best practice in programming and

GI(S)	model development), TRANSCAT (related to the experience of water management of Mediterranean transboundary rivers), HarmoniQuA (related to best practice in model application). A close contact to CLIME is of interest to discuss the impact of climate change on the selected Mediterranean study sites.
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11. Eurolakes (Kurt Duwe)

Full title	Integrated Water Resource Management for Important Deep European Lakes and their Catchment Areas
Web-site	www.hydromod.de/Eurolakes
Status	Ongoing – 40 months duration until October 2003.
Main objectives	Large deep lakes (mostly glaciated lakes) play a very important role for the water supply of several regions in Europe. In contrast to the very detailed water management strategies concerning small lakes, river basins, or more locally, catchment areas these „small oceans“ have not been subject to such a detailed integrated inter-disciplinary approach. Local initiatives which combine management efforts for a lake and its surrounding water basin have concentrated mainly on site-specific problems. Here EUROLAKES wants to gather experiences from a number of such regional developments to reach common strategies. Additionally many scientific water quality assumptions for smaller lakes are not valid (or only to some limited extent) for large water bodies like deep alpine lakes. EUROLAKES wants to improve and build upon existing experimental and modelling expertise of specific examples of lakes in combination with catchment area management strategies and the needs of drinking water supply to concentrate European knowledge in this field. One major aim of this project is the qualitative and quantitative identification of conflicting uses of the lakes and the lakes‘ basins where undoubtedly the drinking water aspect is of primary but not exclusive importance. Here solutions for these conflicts are sought with minor overall disadvantages. Moreover some scientific investigations are essential in this field to look at annual or even longer-term evolution of key processes in such lakes and their associated catchment areas. As a consequence of project investigations recommendations for European legislation and guidelines will be drawn to further water resource management objectives on the river basin scale.

	EUROLAKES has the following main objectives: 1. **Improving strategies concerning long-term management, short-term pollution control, and integrated monitoring regarding deep European lakes and their catchment areas**: This will be accomplished by assessing available local experiences, defining appropriate model studies and integrating results for planning priorities, and environmental and socio-economic benefits in the investigation sites selected. 2. **Describing the seasonal and intra-annual dynamics and quantifying of key processes and parameters in deep European lakes** such as key parameters from both nutrient pathways, i.e. dissolved and particulate organic carbon and heterotrophic bacteria for the „organic pathway“ and phosphate, nitrate and phytoplanktonic cells for the „mineral pathway“ and zooplankton as the integrative level of both preceding pathways of matter and energy fluxes. 3. **Establishing additional ecological criteria to substantiate water and ecosystem quality targets** for the management and policies in deep lakes and their surroundings concentrating on issues like annual best zooplankton quality or the wave impact on bank erosion/reed destruction. 4. **Generalisation of a combined water quality lake/catchment management model** to assess the impact of changing uses where main factors investigated will be water intakes, land use, and tourism. 5. **Recommendations to support European legislation and especially the EU Water Framework Directive**. The recommendations will consider the specific problems and circumstances of integrated water management of deep lakes in connection with their respective catchment areas**.**
Role of GI(S)	In Eurolakes, an integrated water management model structure for investigating key processes deep European lake and catchment area will be set up. Model results will be exported to a Geographical Information System. Various elements (lake ecosystem environmental indicators, integrated lake and catchment area model results available under GIS, evaluation of the uncertainty of these model results) will be the constituents of a prototype decision-making support system for lake environmental managers.
Interaction with other CatchMod projects on GI(S)	It would be very valuable to co-operate with the MULINO project and take into consideration their software developments as possible link between the GIS and a dashboard system for decision-makers.
Interaction with other CatchMod projects other than GI(S)	Not essential.
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12. HarmoniRiB (Roger Moore)

Full title	Harmonised Techniques and Representative River Basin Data for Assessment and Use of Uncertainty Information in Integrated Water Management
Web-site	Not yet developed.
Status	Probable start date – October 2002
Main objectives	**Problems to be solved** The Water Framework Directive (WFD) provides a European policy basis at the river basin scale. The river basin management and planning process prescribed in the WFD focuses on integrated management, involving all physical domains in water management, sectors of water use, socio-economics and stakeholder participation. As such, the WFD poses new challenges to water resources managers. The traditional physical domain specific and sectoral approaches need to be combined and extended to fulfil the WFD requirements. In practise, the preparation of the river basin management plans, prescribed in the WFD, is in addition to these new challenges, influenced by uncertainties on the underlying data and modelling results. The preparation of integrated water management plans for the WFD will require making a large number of decisions by operational agencies in Europe. A decision maker has to make decisions based on available information. In most cases this information is deficient, incomplete and uncertain. How should this affect the decision making. Therefore, there is a clear and urgent need for developing new methodologies and tools that can be used to assist in implementing the WFD. In order to support such research and development, it is necessary to have a network of representative river basins with datasets suitable for this purpose. This implies that the datasets, in addition to covering the diversity in terms of ecological regimes and socio-economic conditions found across Europe, must have built-in information on the uncertainties in the data. **Scientific objectives and approach** The overall goal of HarmoniRiB is to develop methodologies for quantifying uncertainty and its propagation from the raw data to concise management

	information. The four specific project objectives are: • To establish a practical methodology and a set of tools for assessing and describing uncertainty originating from data and models used in decision making processes for the production of integrated water management plans. It will include a methodology for integrating uncertainties on basic data and models and socio-economic uncertainties into a decision support concept applicable for implementation of the WFD; • To provide a conceptual model for data management that can handle uncertain data and implement it for a network of representative river basins. • To provide well documented datasets, suitable for studying the influence of uncertainty on management decisions for a network of representative river basins and to provide examples of their use in the development of integrated water management plans. • To disseminate intermediate and final results among researchers and end-users across Europe and obtain and incorporate feedback on the methodologies, tools and the datasets. **Expected impacts** The two major outputs are (1) a set of methodologies, tools and case studies for assessment of uncertainties and for integration of uncertainties and socio-economic factors into preparation of river basin management plans, and (2) the infrastructure and the datasets containing uncertainties from the network of representative river basins. Both outputs will contribute significantly to enhancing the scientific and technological level in the implementation of the Water Framework Directive. Project objectives and key deliverables The objectives and key deliverables of this project are: • To establish a practical methodology and a set of tools for assessing and describing uncertainty originating from data and models used in decision making processes for the production of integrated water management plans. It will include a methodology for integrating uncertainties on basic data and models and socio-economic uncertainties into a decision support concept applicable for implementation of the WFD. Deliverables: an uncertainty analysis toolkit comprising tested and demonstrated methodologies and tools for identifying, assessing and quantifying uncertainty and risk in decision making. • To provide a conceptual model for data management that can handle uncertain data and implement it for a network of representative river basins. *Deliverables: functional and technical requirement specifications and implemented software*. • To provide well documented datasets, suitable for studying the influence of uncertainty on management decisions for a network of representative river basins and to provide examples of their use in the development of integrated water management plans. The data will be publicly accessible

	and may be used by European scientists and end-users to assess the appropriateness of models and other tools. Deliverables: fully documented datasets and examples of their use. • To disseminate intermediate and final results among researchers and end-users across Europe and obtain and incorporate feedback on the methodologies and the network of representative river basins. The ultimate aim is that the results will be used to improve the understanding and assessment of uncertainty to provide more robust integrated water management plans for implementing the WFD. Deliverables: upgraded methodologies and data, results of open discussions, website, strategy for incorporating uncertainty in decision making.
Role of GI(S)	The first and most important thing to say here is that HarmoniRiB has yet to start and that no decisions have been made on GIS. However, areas where GI and GIS might be used are: Creating representative basin data sets Assessing uncertainty in data Designing and developing the database system Populating the database Case studies
Interaction with other CatchMod projects on GI(S)	To early to say, but hopefully HarmoniRiB will be able to offer datasets for testing.
Interaction with other CatchMod projects other than GI(S)	Again, it is too early to answer the question, but HarmoniRiB would probably hope to offer other projects: • Methods for assessing uncertainty • A database design that can record uncertainty • Representative basin data sets • Support to Working Groups What does HarmoniRiB hope to gain? • Understanding of the requirements of WFD • Case studies for testing the methods
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13. Summary, Syntheses & Conclusions

The workshop proved to be very informative for the public in general and the CatchMod project managers specifically. The number of presentations was high, leaving too little time for discussions and synthesis concerning tuning of GIS efforts in between projects. As a result this summary reflects to some extend the views of the editor.

The idea of tuning projects may not be new, but in practise it is difficult to accomplish. On one hand this is caused by the difficulties of running (EU) projects on time and on budget. The benefit of keeping up with surrounding developments and possibly adapting one's plans accordingly is uncertain, whilst the effort is not negligible. On the other hand the specific topic of the meeting, GI(S) is for most projects just a vehicle for accomplishing their mission, and its specific use is likely to be more determined by in-house available experience and methods, than by higher goals of tuning. Playing only such a supporting role in research projects, additional effort in "side issues" is difficult to realise.

The objective of clustering is to enhance dissemination, test and re-use other projects' (intermediate) results – in short enhancing the impact of a project and its results. What can be said about the projects presented at the meeting?

The first 'project', the WFD working group on GIS will set guidance on GI(S) within the WFD implementation. Obviously, compliance to the standards set by the working group, will help linking one's project to developing river basin management plans. This holds for all projects utilizing GIS.

Of the RTD projects only the Mulino project has been running since 2001and produced a type of 'generic DSS' which makes use of GI(S). This product or its specification could be of use to other projects aiming at DSS development, depending on the necessity to have commercial GIS-software available.

The HarmonIT, HarmoniRiB and HarmoniQuA projects all aim at building (amongst others) some part of a modelling infrastructure. Though GIS is not a specific issue in HarmonIT, GI data and standards will make part of the communication protocols (open modelling interface). HarmonIT needs to make sure that other projects are supplied with the interface specifications, and in other projects during the development stage of software HarmonIT could play a beneficial role. The HarmoniRiB project is likely to use GIS and furthermore work on uncertainty in GI data, defining methods to quantify the uncertainties. The methods could be used in case studies. HarmoniQuA deals with general modelling methodologies. HarmoniQuA does not utilize GI(S). It's quality assurance methodologies could however be useful for transparent, reproducible and portable use of GIS in RTD projects.

The projects Tisza river project, Medis, TempQSim and Eurolakes deal with specific problems in water management and all make use of GIS (as a vehicle). The Tisza river project will make use of meta-data standards, for other projects this is to be determined.

In conclusion only few projects (HarmonIT, HarmoniRiB) put specific effort in standardisation and as such need to closely interact with the working group on GI(S) and other initiatives (beyond CatchMod). Though not crucial to the success of other CatchMod projects some tuning of the use of GI(S) and exchange of knowledge and software tools may be beneficial and effective. Agreement on standards (e.g. a variety of acceptable file standards, meta-data standards, etc.) would allow re-use of tools in various projects. This would also allow others to work easily with the tools and knowledge emerging from CatchMod, utilizing them on cases of their own interest. In short, making our work more fun, more research and more productive!

Identifying potential co-operation, stimulating the use of standards and promoting the co-operation between projects is first of all the responsibility of individual projects. However, the concerted action HarmoniCA will provide means to these activities and play an active role in projects interaction and knowledge transfer in and beyond the CatchMod cluster. On the specific issue of GI(S) will attempt to increase synergy on GI(S) issues between projects, taking into account the needs of the Water Framework Directive.

With exception of HarmoniQuA, the above synthesis focuses on the role of GI(S). However, there are other potential topics for information transfer. For all projects aiming at DSS-s, for example, lessons could be learned and products re-used from the MULINO project. MULINO approached its DSS building on the DPSIR cycle, which is a strongly promoted methodology for management purposes. Other topics could be similar approaches to stakeholder and end-user involvement in the projects, non-GIS data metadata standards, scaling issues, dissemination, etc.