

# TOWARD A SUSTAINABLE MANAGEMENT OF SURFACE WATERS: ENVIRONMENTAL TECHNOLOGIES AND MODELLING

The first CWR-European research partners symposium

Como 27-28 October 2005

## SYMPOSIUM PROGRAM

| 27 October  | USE AND APPLICATION OF HYDRODYNAMIC-ECOLOGICAL MODELLING AND INTEGRATED MANAGEMENT SYSTEMS  |   |
|-------------|---|---|
| 8:30-9:30   | Registration  |   |
| 9:30-9:55   | Opening   | Welcome form: Jörg Imberger<br>Gianni Tartari |
| 9:55-13:00  | <b>FIRST Session: hydrodynamic-ecological modelling</b>   |   |
| 9:55-10:00  | Chairman first session  | Chris Dallimore                               |
| 10:00-10:30 | A 3D hydrodynamics model for Venice Lagoon  | Chris Dallimore                               |
| 10:30-11:00 | Modelling permanent stratification of lakes   | Bertram Bohrer                                |
| 11:00-11:30 | Some applications of hydrodynamic-water quality modelling   | Roberto Guandalini                            |
| 11:30-12:00 | Coffee break  |   |
| 11:30-12:00 | Experimental and numerical investigation of hydrodynamics and ecological processes in the lagoon of Barbamarco (Po River Delta - Italy) | Bruno Matticchio                              |
| 12:00-12:30 | Measuring the lake thermal structure by acoustic tomography   | Gabriele D'antona                             |
| 12:30-13:00 | Discussion  |   |
| 13:00-14:25 | Lunch   |   |
| 14:25-16:30 | <b>SECOND Session: Management Systems and lakes restoration within the concept of sustainability</b>                                    |   |
| 14:25-14:30 | Chairman second session   | Jörg Imberger                                 |
| 14:30-15:00 | A Practitioners View of Modern Developments in Limnology  | Jörg Imberger                                 |
| 15:00-15:30 | TwoLe: a Multi Objective DSS for Participatory and Integrated Planning of multipurpose reservoir systems                                | Rodolfo Soncini Sessa                         |
| 15:30-16:00 | QUAL2K model as a module of the watershed integrated approach for nutrient assessment   | Joanna Boguniewicz                            |
| 16:00-16:30 | Lake management: the case studies of Lake Pusiano and Como  | Diego Copetti                                 |
| 16:30-17:00 | Discussion  |   |
| 17:00-17:30 | Coffee break  |   |

|                    |   |                |
|--------------------|---|----------------|
| <b>17:30-18:30</b> | <b>Round table.</b> Short term and long term management: an integrated view for lake management |                |
| 17.30-17-45        | New conceptual and field tools: implication for lake management and restoration                 | Jörg Imberger  |
| 17:45-18:00        | Lake management in Italy: new perspectives  | Gianni Tartari |
| 18:00 – 18:30      | Discussion  |                |
| 18:30:20:30        | Spare time  |                |
| <b>20:30-23:30</b> | <b>Social dinner</b>  |                |

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**28 October      ADVANCE IN LIMNOLOGY**

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|--------------------|---|---------------------------------|
| <b>8:55-13:00</b>  | <b>THIRD Session: Hydrodynamics</b>   |                                 |
| <b>8:55-9:00</b>   | <b>Chairman third session</b>   | Jörg Imberger                   |
| 9:00-9:30          | The effect of selective withdrawal system (SWS) operation on the environment in a dam reservoir   | Hiroshi Yajima                  |
| 9:30-10:00         | The viscous dissipation equation in the closure relations for the representation of the generalized SGS turbulent stress tensor in LES            | Francesco Gallerano             |
| 10:00-10:30        | The new field work regime   | Sheree Feaver                   |
| 10:30-11:00        | Discussion  |                                 |
| 11:00-11:25        | Coffee break  |                                 |
| <b>11:25-16:30</b> | <b>FOURTH Session: Hydro-chemical and biological processes</b>  |                                 |
| <b>11:25-11:30</b> | <b>Chairman fourth session</b>  | Gianni Tartari                  |
| 11:30-12:00        | Relation between benthic macroinvertebrates and environmental factors for Southern European lakes   | Bruno Rossaro                   |
| <b>12:00-12:30</b> | <b>Ecological assessment of lakes using macroinvertebrates in the regions of Lombardia and Trentino. Project outline and preliminary results.</b> | Gary Free                       |
| <b>12:30-13:00</b> | <b>Discussion</b>   |                                 |
| <b>13:00-14:25</b> | <b>Lunch</b>  |                                 |
| 14:30-15:00        | Pit lakes – special properties in physics and chemistry   | Martin Schultze                 |
| 15:00-15:30        | Bacteria mediated C-Cycling in two coastal Mediterranean lagoons  | Anna Maria Zoppini              |
| 15:30-16:00        | Biogeochemical processes at the soil-water interface: the role of wetlands in the Candia Lake catchment.  | Raffaella Balestrini            |
| <b>16:00-16:30</b> | <b>Discussion</b>   |                                 |
| <b>16:30-17:00</b> | <b>Meeting's closure</b>  | Jörg Imberger<br>Gianni Tartari |

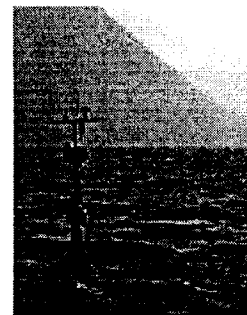
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# Toward a sustainable management of surface waters: the First CWR/European Symposium

## ABSTRACTS

Thursday, 27 October 2005

### USE AND APPLICATION OF HYDRODYNAMIC- ECOLOGICAL MODELLING AND INTEGRATED MANAGEMENT SYSTEMS



#### HYDRODYNAMICS-ECOLOGICAL MODELLING

Title: A 3D hydrodynamics model for Venice Lagoon

Authors: Dallimore, C., P. Yeates, J. Antenucci, & J. Imberger.

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#### Abstract

Venice Lagoon is a region of enormous cultural, historic and ecological significance. Due to sinking foundations and rising sea levels Venice City is in danger of sinking into the lagoon. The frequency of high flood events (Aqua Alta) events in the of Venice has increased substantially in recent history. This has led to the proposal of a system of buoyant watertight gates at the three inlets to the lagoon (Lido, Malamocco, and Chioggia). The gate will be hinged to concrete foundations submerged in the seabed, by pumping compressed air into the gates, they can be raised during high tides. During low tide the air is flushed from the gates and the gates lie flat on the seabed allowing flushing of the Lagoon via the Adriatic.

In order to investigate possible effects of the any flood remediation strategies The Centre for Water Research carried out numerical simulations of Venice using the Estuary, Lake and Coastal Ocean Model - ELCOM. ELCOM solves the unsteady Reynolds-averaged Navier - Stokes equations using a semi-implicit method similar to the momentum solution in the TRIM code with the addition of quadratic Euler - Lagrange discretization, scalar transport using a conservative flux-limited approach, and elimination of vertical diffusion terms in the governing equations via a novel turbulent mixing algorithm.

The model was configured to simulate tidal heights, salinity and temperature in Venice Lagoon and the model performance was assessed by comparing the simulation results with field data. ELCOM was applied to Venice Lagoon on a 30m x 30m x 1m grid for the period 30 October to 8 November 2002 and the results illustrate that ELCOM accurately reproduced the tidal signal observed at locations throughout the lagoon and the volume flux observed near the Lido inlet. Simulation results indicate the presence of strong vertical stratification due to baroclinic flow generated by the combination of an initial horizontal salt stratification, stratified tidal forcing and freshwater inflow from rivers along the western margin of the lagoon. Flow and tracer analysis of model results suggest the rapid set-up of a southward residual flow during strong Bora wind events

Title: Modelling permanent stratification of lakes

Authors: Bohrer, B.

measurement, to name but a few. Thus, programs to monitor and model the quality and quantity of water are essential. Pusiano Integrated Lake/catchment Experiment Project (PILE Project) appeared as an attempt to provide a methodology and develop a useful tool to allow effective water management decisions making. In order to carry out a complete pollution load assessment, a steady-state simulation model QUAL2K (Chapra and Pelletier 2003) and Soil and Water Assessment Tool (SWAT, Arnold et al. 1997) were implemented. A Geographic Information System (GIS) tool was used to assist in database development. Monitoring of water quality was designed to help assess the role of CSO discharges and to support improvement of QUAL2K calibration. This presentation presents development and implementation of an integrated approach to characterize nutrient loads in watershed scale.

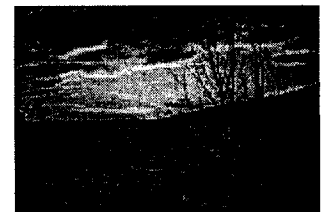
**Title:** Lake Management in Italy: the case studies of Lake Pusiano and Como

**Authors:** Copetti D., G. Tartari, F. Salerno & J. Imberger  
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**Abstract**

**Friday, 28 October 2005**

## ADVANCE IN LIMNOLOGY



## HYDRODYNAMICS

**Title:** The effect of selective withdrawal system (SWS) operation on the environment in a dam reservoir

**Authors:** Yajima, H.  
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**Abstract**

Ono dam is now being constructed, by the Ministry of Land Infrastructure and Transport, near Tottori University. I am now examining the operational method of SWS in the reservoir. It is estimated that the most important environmental problems are released water temperature and sedimentation. To minimize these problems, I conducted long term (through a year) and short term (flood period) simulation using DYRESM and ELCOM considering some methods of SWS operation.

**Title:** The viscous dissipation equation in the closure relations for the representation of the generalized SGS turbulent stress tensor in LES

**Authors:** Francesco Gallerano & Lavinia Melilla  
University of Rome  
Email: [francesco\\_gallerano@yahoo.it](mailto:francesco_gallerano@yahoo.it)

**Abstract:**

In this paper a new model for the generalized SGS turbulent stress tensor is proposed in which, in order to adequately account for the anisotropy of both the turbulence length scales and the turbulence velocity

## HYDRO-CHEMICAL AND BIOLOGICAL PROCESSES

**Title:** Relation between benthic macroinvertebrates and environmental factors for Southern European lakes

**Authors:** Rossaro B., L. Marziali, A. C. Cardoso, A. Solimini, G. Frezzi  
Department of Biology  
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### **Abstract**

The relationships between benthic macroinvertebrates and physical - chemical variables [lake volume and depth, water temperature, conductivity, alkalinity, pH, dissolved oxygen, transparency, total phosphorus (TP),

nitrate (N-NO<sub>3</sub>), ammonia (N-NH<sub>4</sub>) etc.] from different Italian lakes were analyzed, to relate species response to environmental factors. Linear multivariate analysis (principal component analysis, canonical correlation analysis and multiple regression) and non linear neural networks (self organizing maps, multilayer perception with backward propagation) were carried out to analyze benthic macroinvertebrates community structure and response to environmental factors. Results were:

1. morphometry (volume, depth) influenced the community composition, with the largest lakes (Garda, Como and Maggiore) being richest in taxa
2. conductivity, alkalinity and pH accounted for large percentage of variation
3. different lake typologies cannot be pooled to develop one oxygen response-trophic index, valid for all lakes: validation of indexes built using sites belonging to only one typology (small prealpine lakes for example) gave poor results
4. at present at least 4 typologies must be separated:
  - a. large lakes
  - b. small prealpine lakes
  - c. alpine lakes
  - d. volcanic lakes
5. more typologies (swamps, brackish waters etc.) will be defined in the future as research will progress

At the present state of knowledge the use of benthic macroinvertebrates as lake quality indicators in Southern European lakes is hindered because lakes were investigated with different sampling effort, the available information is therefore inconsistent.

**Title:** Ecological assessment of lakes using macroinvertebrates in the regions of Lombardia and Trentino. Project outline and preliminary results.

**Authors:** Free G., A. C. Cardoso, B. Rossaro, V. Lencioni, A. Solimini, B. Maiolini, L. Marziali, M. Ramirez, R. Giacchini.

European Ecological Water Quality Assessment and Intercalibration,  
Joint Research Centre, Ispra  
Email: [gary.free@irc.it](mailto:gary.free@irc.it)

#### **Abstract**

Macroinvertebrates are one of biological elements required to be monitored by the Water Framework Directive. Unfortunately, there are currently no working assessment systems in use for lakes based on benthic invertebrates in Europe. This presentation introduces a research project started in 2005 based on 12 lakes in the regions of Lombardia and Trentino. The sampling design is based on 3 transects per lake with each transect being sampled in the littoral, sub-littoral and profundal zones (2 replicates per site). Preliminary results are presented. It is hoped that the results will allow the research to lead to a more extensive survey of interest in a broader European context.

**Title:** Pit lakes – special properties in physics and chemistry

**Authors:** Schultze, M., B. Boehrer & W. Geller  
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D-39114 Magdeburg, Germany  
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#### **Abstract**

Pit lakes are one of the long-term consequences of surface mining. They are formed when the dewatering is abandoned after closure of mines. Due to their origin, these lakes have some special properties which have important consequences for their development.

If pit lakes are situated in a soft rock environment, they have intensive exchange with ground water. Pit lakes in hard rock environments often have high relative depth making them prone to become merimictic.

Oxidation of sulphide minerals during and after mining in the mine itself, in the dewatered underground or in waste rock dumps or tailings often results in acidification. pH-values between 2 and 3 and sulphate concentrations of some grams per litre are common. The acidification is accompanied by elevated