PREFACE TO THE SPECIAL ISSUE

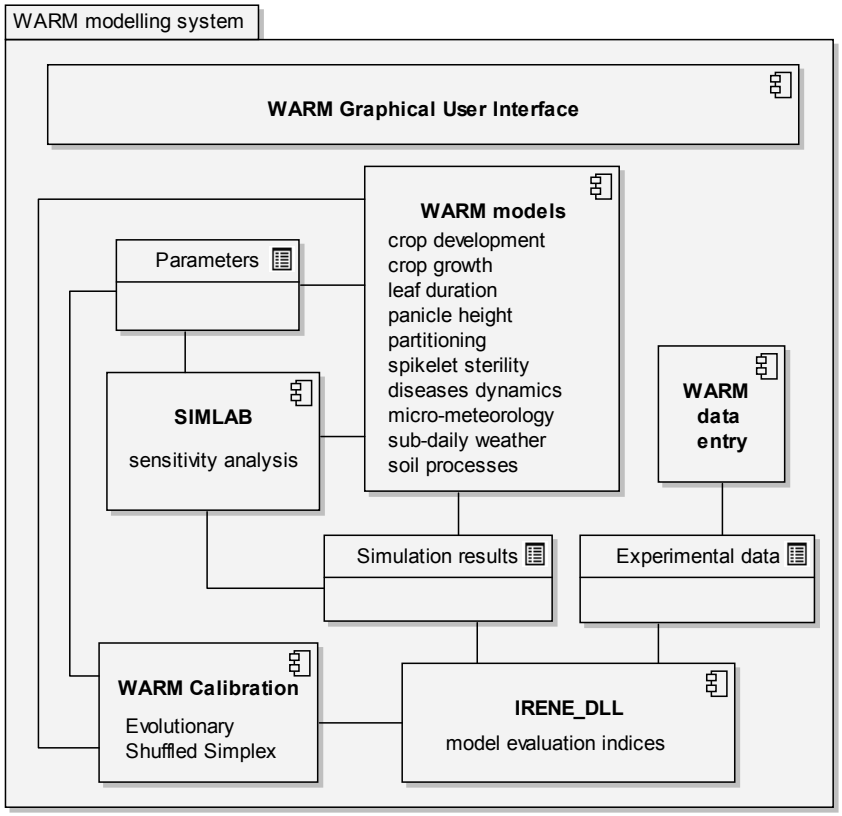
INTRODUZIONE AL NUMERO SPECIALE

Roberto Confalonieri
Institute for the Protection and Security of the Citizen, Joint Research Centre of the European Commission, AGRIFISH Unit, MARS-STAT Sector, TP 483 - 21020 Ispra (VA), Italy
roberto.confalonieri@jrc.it; mars-stat@jrc.it

The open research group which is developing WARM (Water Accounting Rice Model) was presented for the first time on this Journal (Italian Journal of Agrometeorology 10, issue 2, 2005) with an open letter titled "WARM: a scientific group on rice modelling". I gratefully acknowledge the Editor for the opportunity given to the WARM group of coming back to this Journal for publishing seven papers based on contributions to the "1st European Meeting on WARM: a rice modelling experience", held in Ispra (VA, Italy) on February 2, 2006. The meeting was organized by the MARS-STAT Action of the Joint Research Centre of the European Commission. Activities related to the WARM group are coordinated within the MARS-STAT Action which collects and harmonizes the conceptual and informatic products coming from the different sub-teams involved in the project.
The second acknowledgement is for the members of the WARM group (http://agrifish.jrc.it/marsstat/warm/) which have placed a sizeable effort to develop the papers of this special issue. The papers presented face with real priorities for rice modelling in temperate areas and represent a concrete result of the activities of a motivated, interdisciplinary group.

The first guideline of the WARM group was to develop a network of scientists and technicians working in different fields of rice research and modelling. Such a network was meant to allow developing a modelling framework able to take into account an increasing number of processes with a strong influence on crop growth and development. The network was aimed also at supporting the development and validation processes with high quality data, both from field and growth chamber experiments. Interdisciplinarity is a feature of a modelling team which should be considered necessary, although not-sufficient, for developing coherent models, that is models which are not characterized by extreme levels of complexity in the representation of some processes and (absolute) lack of information in other compartments of the system studied. I think that this has been achieved by the group and the interdisciplinarity of the papers published in this special issue supports this view.
The second guideline was related to the concept of accessibility. The word accessibility refers to the WARM software architecture, which has been designed to facilitate the participation of scientists which are not necessarily professional programmers (e.g. biologists, soil scientists, phytopathologists). This to avoid the exclusion of processes which, although crucial for a realistic representation of the system, are usually not included in crop models because of constraints due to technical barriers or to the lack of resources for coding the developed algorithms. The word accessibility also refers to model users, as several tests in a wide range of conditions are needed to collect information in order to continuously improve a model. To achieve this

Fig. 1 - Unified Modelling Language component diagram of the WARM simulation environment.
***Fig. 1** - Diagramma Unified Modelling Language dei componenti dell'ambiente di simulazione di WARM*



goal, a wide diffusion of the model is required. Consequently, specific attention has been dedicated to increase the usability of the model. WARM is the first example of crop model software with integrated tools (i) for Monte Carlo based sensitivity analysis, (ii) for automatic calibration (based on simple and genetic evolutions of the simplex optimization method), and (iii) for the evaluation of model performances (graphics and all the main statistical indices describing the agreement between simulations results and observations have been implemented). This special issue is an evidence of the effort invested by the WARM group for the accomplishment of the objectives stated by the accessibility guideline.

The first paper describes the algorithms implemented in the WARM model and evaluates the developed approaches and the adopted level of detail in reproducing the system through a comparative study with other well known modelling approaches which implement alternative choices. The second, third, and fourth papers illustrate the tools integrated in the WARM simulation environment which help analyzing and handling the model. The second paper is about a study carried out on WARM, CropSyst and WOFOST modelling systems to analyze their structure using techniques for sensitivity analysis. The WARM integrated tool for sensitivity analysis is briefly presented. The third paper presents a study aiming at integrating tools for automatic calibration in the WARM environment. The implemented methods, derived from the downhill simplex and from the evolutionary shuffled simplex, have been tested using standard benchmark functions and adapted for being included in the WARM environment. A demonstration on how they can perform with complex agronomic datasets is provided. The fourth paper describes the integration of IRENE_DLL, a software component implementing several statistics for evaluating simulation models, in the WARM environment. The fifth paper presents measured values for some of the most important parameters used by the main modelling approaches for the simulation of rice growth. These values, proposed separately for Indica– and Japonica–type cultivars, can be used for reducing the degrees of freedom during the calibration. The sixth paper presents a procedure for the estimation of plant nitrogen concentration from remotely sensed data. This study is contextualized within the effort carried out by part of the WARM group for analyzing and modelling the combined effect of plant nitrogen concentration and development stage on radiation use efficiency. This paper could be crucial for forcing the model during large scale simulations, as an alternative to the direct simulation of plant nitrogen concentration. The seventh paper describes SiRBInt, a model coupling a simplified version of the *Oryza* model for rice growth and a new approach for the simulation of rice blast disease. After the 2006 WARM meeting, the BLAST algorithms were extracted by SiRBInt and re-designed in order to develop a software component able to interact with all the main approaches for the simulation of rice growth.

The current activities of the WARM group are focused on the improvement of some of the algorithms involved with daily biomass accumulation and partitioning, with the floodwater effect on vertical thermal profile, and with extending the integration of IRENE_DLL in the WARM simulation environment. This will allow using features of IRENE_DLL currently not enabled in the WARM software. The WARM soil model, able to simulate the peculiar hydrology of paddy fields, is under test.

The Unified Modelling Language component diagram of the WARM simulation environment is shown in Figure 1.

The WARM software (current version 1.9.5; 26 October 2006; download for free at: http://agrifish.jrc.it/marsstat/warm/archive.htm) is currently developed using Microsoft COM technology. The use of the .NET platform is under discussion. A version of WARM running under the CGMS database (Crop Growth Monitoring System; http://agrifish.jrc.it/marsstat/Crop_Yield_Forecasting/cgms.htm) is currently used by the European Commission for rice yield forecast at EU-25 level (http://agrifish.jrc.it/marsstat/Bulletins/2006.htm). This version can be released for free after request to the developers (roberto.confalonieri@jrc.it; mars-stat@jrc.it).