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A SIMPLIFIED METHOD TO DETERMINE THE PRIMARY DRYING AND WETTING CURVES OF THE SOIL WATER DIFFUSIVITY

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Within the framework of a research project examining the spatial variability of hydraulic characteristics of soil intended for irrigation, a verification has been made of some of the more frequently used analytical expressions describing the laws linking diffusivity D to the water content of the soil δ . By studying the flow field of the soil samples tested in laboratory, under one-dimensional wetting and drying cycles, it has been found that the laws of hydraulic diffusivity of the exponential types can be ascribed to them. Finally a simplified laboratory method has been proposed which, with the aid of nomographs, allows the definition of the law $D(\Delta)$ to be arrived at easily.

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ASSESSMENT OF EVAPOTRANSPIRATION MODELS FOR A MAIZE AGRO-ECOSYSTEM IN IRRIGATED AND RAINFED CONDITIONS

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A high level of accuracy in the estimation of crop evapotranspiration (ET) may lead to significant savings of economic and water resources in irrigated agriculture. Although ET is a fundamental process in many applications, it cannot be directly measured but it has to be estimated by monitoring the exchange of energy/water above the vegetated surface (micrometeorological methods), or as a residual term of the hydrological balance (lysimeters, soil water budget). The techniques to be adopted are often complex, costly and require specific equipment. Thus, since the '50s, many researchers have devoted their activity to the development of models for its estimation. The available approaches can be classified in "direct" methods, based on the original Penman-Monteith (PM) equation, in which the canopy resistance r_c is modelled, and "indirect" methods, based on the preliminary calculation of ET for a well-watered reference grass (ET₀) with a constant r_c , which is then multiplied by a crop coefficient K_c and, in case, by a stress coefficient K_s to obtain ET. Even if the latter approaches are more widely adopted for their practical simplicity, many authors show that the former often provide better ET estimates in absence of calibration of crop parameters. In this study the performances of different direct and indirect methods were evaluated in the case of a surface irrigated and of a rainfed maize grown in the Padana Plain (Northern Italy). The following models were considered: the "one-layer" original PM equation with three different models for r_c (Monteith, Jarvis, Katerji-Perrier), the "two-layers" PM model proposed by Shuttleworth and Wallace, the "single" and "double" crop coefficient models illustrated in the Paper FAO-56. Latent heat fluxes measured in 2006 and 2011 in an experimental maize field by eddy-covariance were used to evaluate the models accuracy. Crop, soil and meteo data monitored contextually were used for the implementation of the different models. Results confirm that direct methods are more performing for both irrigated (2006) and rainfed

(2011) conditions, with the SW model providing the best results and the FAO-56 models with generalized crop coefficients overestimating ET, especially during the middle growth stage.

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MANUALLY OPERATED PILE DRIVER TO USE IN THE SOUTH IRAQI MARSHLANDS

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The marshes of southern Iraq are of great local and global importance, because of their extension and their specificity. For some years the re-flooding of marshes is in progress. The sustainable development of their use for agricultural and zootechnical purposes, and to some extent also for tourist purposes, has to be accompanied by the creation of micro-infrastructures having very low environmental impact and not significantly altering the existing natural status. These micro-infrastructures consist mainly of riparian fixings, small channels dams, small earth roads, moorings, piers, walkways and other similar constructions. To be an effectively part of a sustainable development, these infrastructures must be characterized by a slight environmental impact in relation to their construction, permanence, deconstruction and disposal. As we can see in every part of the world, the infrastructures having these qualities are mainly made in natural materials, primarily wood. For their construction the insertion of wooden poles in the ground is practically required. For obvious environmental, economic and technical reasons in Iraqi marshlands the vibrating pile driver mounted on the arm of excavators are not proposable. For this reason, a manually operated pile driver, which operates according to the model used by man for millennia, have been designed and built. Moreover, to allow the use in water, a simple floating pier, that can accommodate the pile driver, have been designed. The pile driver has been planned taking into account the below boundary conditions: manually operated; made of elements easily transportable and easily assembled on the site of use, therefore hand movable and not longer than 3 m; made from very simple mechanical parts and able to be built in a basic blacksmith workshop, so that it can be replicated on site. An executive design was drawn up. The pile driver was built in the workshops of Department (GESAAF) and then transported to Iraq for use in the field.

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EXPERIENCES OF IMPROVING WATER ACCESS IN RURAL AREAS IN GUATEMALA

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The GESAAF Department of the UNIFI has been involved in the project "Gestione ambientale e del rischio nel dipartimento di Sololá" in the period 2011-'12 aiming at guaranteeing water access to people leaving in rural areas in the Sololá Department in Guatemala, in collaboration with the two NGOs Movimento Africa '70 and Oxfam Italia. Methodology Appropriate technologies, such as EMAS pump and well drilled with the Bautista-Boliviana technique, have been proposed and utilized for improving water access in areas where lack of water represented a limiting factor for the human development. They can be both considered compatible with local, cultural and economic conditions: in fact locally available materials are used and the tools can be maintained and operationally controlled by the local users. Monitoring activities on the 52 installed pumps have been carried out in order to check the performances of the pumps and the knowledge level acquired by the users.