Geophysical Research Abstracts
Vol. 12, EGU2010-11669, 2010
EGU General Assembly 2010

Use of a hydrological model to evaluate the effects of climate change on adaptative capacity of a maize and fennel cultivation in an area of Southern Italy.

Antonello Bonfante (1), Angelo Basile (1), Francesca De Lorenzi (1), Ezio Riggi (1), Giovanni Avola (1), and Massimo Menenti (2)

(1) ISAFoM, National Research Council (CNR), Ercolano (NA), Italy (antonello.bonfante@gmail.com), (2) Delft University of Technology, Delft, The Netherlands

Crop production depends significantly on the pedoclimatic conditions. The evolution of climate may thus endanger not only yield (IPCC, 2007), but, more significantly, the sustainability of the cultivation of current varieties. Adaptation of current production systems may be feasible, but requires a timely evaluation of weather adaptation to climate evolution might be limited to improving crop and soil management or should involve replacement of varieties or species altogether.
This study addressed this question by evaluating the adaptive capacity of a flat area of 22.000 ha “Destra Sele” (Campania Region, Southern Italy) where the main crops are is maize for livestock and fennel.
Two climate scenarios have been considered at + 5 and + 30 years, generated by a regional climate model applied to Europe and the Mediterranean Basin. For each climate scenario the hydro-thermal regime of the soils of the selected study area has been calculated by means of a simulation model of the soil-water-atmosphere system (SWAP). Synthetic indicators of the regimes (e.g., crop water stress index, available water content, soil temperature) have been calculated and compared with the thermal and water requirements of a set of maize and fennel varieties, including the ones currently cultivated in the area.
The hydrological model SWAP was applied to the representative soils of the entire area (20 soil units): their soil hydraulic properties were derived applying the pedo-transfer function HYPRES which reliability was tested and validated on three soils of the same area. Upper boundary conditions were derived from the regional climate scenarios. Unit gradient in soil water potential was set as lower boundary condition. Crop-specific input data and model parameters were estimated on the basis of literature and assumed to be generically representative of the species. This applies to Leaf Area Index (LAI), crop coefficient (Kc) and the root water uptake function parameters.
From the comparison of model outputs with the variety-specific climate and water requirements of a number of maize varieties, some varieties proved to be adaptive to the predicted hydro-thermal regimes at +5 and +30 years for each soil unit considered.
This approach is being applied to other crops and other production systems towards quantitative, realistic studies on the adaptation of agriculture to climate evolution.

Keywords: Plant Adaptive capacity , SWAP, Climate changes, Maize, Fennel