



## Estimating irrigation requirements in Europe

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Agriculture is an essential driving force in the management of water use. Especially in Southern European countries, irrigation is an essential element of agricultural production and agricultural water use accounts for around 50% of total water use. The presented work contributes to the assessment of impacts of irrigated agriculture on water resources at European scale. A model-based approach to estimate irrigation requirements in Europe is developed and first results are presented.

The approach comprises two parts: First, a European Irrigation Map (EIM) was compiled to provide information on the distribution of irrigated areas in EU25 for modeling studies. The EIM complements to the underlying land use map, combining FSS statistics on irrigated area and crop area and information from the Global Map of Irrigated Areas (Siebert et al. 2005). The map was used to derive irrigated areas (as total and per crop) for spatial modeling units. Second, the soil water and crop growth model EPIC was applied to estimate irrigation requirements for irrigated areas in Europe based on a 10x10km raster. Different irrigation strategies were defined to analyze the effect of application rates and irrigation intervals on water requirement. The final results were selected per raster cell and per crop, based on the most efficient irrigation strategy (maintaining optimum yield with lowest irrigation). Main results are specific irrigation requirements (irrigation per unit irrigated area), total irrigation volume per raster cell and the spatial distribution of the selected optimum irrigation strategies. Based on irrigation requirements, resulting water abstractions were calculated using thumb-values of irrigation efficiency and conveyance efficiency and compared with national water abstraction data.

The results provide a spatial overview on irrigation requirements in Europe. Irrigation

strategies show considerable differences of irrigation requirement maintaining comparable crop production. The results may be used to define 'minimum' and 'maximum' irrigation requirements, indicating water saving potentials or irrigation targets for water management.

Limitations of the proposed methodology are given by uncertainties in model conceptualization and parameterization as well as by uncertainties associated with available statistical data and further improvement is possible. Constraints are put especially on a meaningful validation and plausibility analysis of the results, as available data on water supply and abstractions have to be corrected for application and conveyance efficiencies. These are currently included as indicative values only. Another constraint is given by statistics of irrigated area, for many regions reporting either irrigable or irrigated area. Using data on irrigable area where irrigated areas were not reported resulted in gross overestimation of irrigation volume required in some countries (specifically in Northern and Central Europe).

The approach allows pressures of agriculture on water resources to be assessed throughout Europe at considerable high spatial resolution and based on a harmonized methodology. In combination with a comprehensive assessment of water availability, further information on sustainability of agricultural production can be obtained. Possible applications of the modeling approach range from resource management, analysis of agricultural pressures to applications in climate change and land use change research. Future work aims at regional validation of the approach and extension to the Mediterranean basin, including Northern Africa and West Asia. Further assessment of water productivity and green water fluxes may be included.