Geophysical Research Abstracts
Vol. 13, EGU2011-3819, 2011
EGU General Assembly 2011

The role of irrigation indicators in best irrigation water management practices

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Water resources are under enormous pressure due to increasing demands for more and better quality water; demands which are in turn conditioned by social, political and environmental factors. The growing difficulties to ensure that water demands are met have led to greater competitiveness for scarce water resources among traditional sectors of water users, namely agriculture, industry and urban supply.
As a result, water has come to be considered an increasingly scarce and valuable resource requiring rigorous management and extreme care. One of the keys to overcoming these problems lies in the agricultural sector given that irrigation – particularly in arid and semiarid areas – is the chief consumer of water; accounting for 70% of consumption worldwide. For this reason, it is of interest to determine the water management practices of irrigation communities having a large volume of available water as farmers may not implement the best water management practices or water use may be inefficient. By correcting such practices, it will be possible to use water more efficiently.
Attempts to adapt farmers' water demands to real crop demands could lead to more efficient water use as it would permit water to be delivered only when necessary without reducing crop productivity, while sustaining and/or increasing farmer income.
In this paper, we aim to analyze irrigation water demand and examine possible measures for modifying and rationing demand in order to achieve an efficient water management policy. To do so, it is necessary to assess water management bearing in mind existing agronomic and hydraulic processes; develop a geographical informational system in the irrigation district that relates the geospatial location of the plots with the data obtained for them; and study theoretical water requirements and their discrepancies with farmers' actual water demands using irrigation performance indicators at plot scale.
This paper examines irrigation water management in the Genil-Cabra Irrigation District of the Province of Cordoba (southern Spain) using three irrigation indicators: Relative Irrigation Supply (RIS), Relative Water Supply (RWS), and Relative Rainfall Supply (RRS). The three indicators are calculated both globally and by grouping the data according to crop type, irrigation method, soil texture, and plot size. All of the information regarding agronomic and hydraulic variables has been included in a Geographical Information System (GIS) to facilitate data management.
The results show that irrigation is deficit given that the value of the RIS indicator is relatively low (around 0.60). However, the RWS indicator achieves higher values (normally above 0.80), indicating that evaporation demand can be met throughout the crop development cycle. The RRS indicator shows less variability with values around 0.40. This indicator, together with the RWS indicator permits the evapotranspiration fraction covered by rainfall to be determined.
By calculating the irrigation indicators according to crop type, irrigation method, soil texture or plot size, it is possible to determine the influence that each individual factor has on irrigation management and take subsequent measures to improve irrigation performance.
The mean values of the calculated indicators are very useful for gaining a better understanding of irrigator behavior and general irrigation trends, although the study sample is still insufficient to characterize a large irrigation area as a whole. The simple extrapolation of the results obtained in the study plots to analyze irrigator behavior and irrigation performance in the entire irrigated zone was not satisfactory due to the small number of plots and the need to evaluate water losses in the system.