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Reconstructing the hydrological behavior of an ancient irrigation system at "micro" scale

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Irrigation systems could be regarded as major links between human agents and their environment. In continuous interaction humans adapt to their environment overcoming the limitation of natural conditions, through modification of the environment. The paper aims at reproducing the original appearance of an ancient irrigation system and understanding the interactions among various elements constituting an irrigation system through a case study of Zhengguo canal system of China.
Human beings play a vital role on the establishment and maintenance of physical infrastructure as well as the management of water flows allocation, while geographical environment and climate strongly determine the supply of water source. In addition, the population might be the trigger for the generation of an irrigation system. Population size and crop product yields would have been closely connected; in case of crop failure, the population may have decreased. Water division expresses how much water would be available for crops; and crop water requirement manifests how much water the crops could use or would require.
We attempt to reconstruct the hydrological behavior of an ancient irrigation system by taking into account the needs of the users and the resulting daily management of the irrigation system. To do this we used a model that integrated hydroloogy and control measures. A hydraulic model (SOBEK) is used to simulate water flows pattern under different hydrological conditions and flow-control arrangements. Secondly, based on the results of above modeling, a crop model (Aquacrop) is adopted to develop a set of scenarios presenting different irrigating schedules for the calculation of crop products yields. At last, the fluctuation law between crop products and population are analyzed.
Given the climate conditions during operating periods, a series of scenarios is developed to obtain potential water allocation in the SOBEK modeling. The differences within the results of water discharges allocated into canals influence crop yield. In combination with the setting of different irrigation schedules, the results indicate how the climate affected human society and how human could react to these climatic conditions through changes in decision making. The analysis of variation between population and crop product yields system illustrates how an irrigation system could shape the response of and impose influence on human activities. As such, the analysis will feed a discussion, essential interactions between human agents and irrigation systems.