Geophysical Research Abstracts
Vol. 20, EGU2018-12980, 2018
EGU General Assembly 2018

Modelling on-farm ponds for irrigated agriculture under different climates

Lucia Tamburino and Giulia Vico
Swedish University of Agricultural Sciences (SLU), Crop Production Ecology, Sweden (lucia.tamburino@slu.se)

Continuous water availability is a key factor in agriculture. Nevertheless, in many regions, rainfall does not reliably meet crop water demands, a situation which may be exacerbated due to climate change. The need of supplemental irrigation had often led to an over-exploitation of groundwater. On-farm ponds may provide an alternative, more sustainable solution, as they can store water when it is abundant, to be used during the shortage periods.
An increased use of such water reservoirs is hence desirable. Studies are needed in order to identify the best way of designing and managing reservoirs. We present a model specifically developed for this purpose, with focus on the identification of the optimal size.
Reservoirs must be sized so that the amount of water they store is sufficient to meet the water requirements under most years. Because in general the depth of the pond is a building constraint, the only way to store a larger quantity of water is to increase the pond area. A larger area implies a better water availability but at the same time reduces the cultivated area, which can result in a decrease of the yield. The goal of our model is to find the optimal trade-off, a non-trivial task due to the unpredictability of rainfall. The optimum has been defined according to different criteria, one of them taking into account a possible risk aversion by the farmer.
Consistently with previous works, the model is based on a system of discrete equations coupling crop development and soil moisture, with rainfall represented as a stochastic process. We introduced a third equation representing the water into the reservoir, which allows the irrigation applications.
The model also helped to identify the optimal irrigation strategy. In addition, it was used to explore different climate scenarios by varying those parameters most sensitive to climate. Simulation results highlighted that larger water reservoirs will likely be required under a scenario of global warming. On the other hand, due to the longer intervals between rainfall events, it will become harder to reconcile the goal of maximizing the average crop with a strong risk aversion: a farmer must choose between aiming for a big harvest or being cautious and minimizing the losses. A choice that cannot be escaped, not even with reservoirs.