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From sensors to decisions: Data flows to enhance irrigation efficiency for smallholder orchards

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In the Mediterranean area, agriculture is subject to numerous demands caused by the interplay of climate change, population growth, changing food production patterns and the increasing need for nature conservation measures, enforcing an efficient usage of resources and the creation of resilient production systems. To ensure a more sustainable water use, water policies have been adopted in the European Union as well as in Northern Africa countries, such as Morocco and Egypt as irrigation is the largest water user in the Mediterranean region. Small farmers make up to two thirds of the agricultural areas and are therefore an important part of areas agricultural community. Estimates see up 35% possible water savings could be achieved by more efficient irrigation systems. New technologies and practices are currently adopted mostly by large farms. The challenge is therefore to increase the usage of efficient irrigation techniques by small farmers. We present a concept of data handling in a data chain, from the collection in the field towards calculated irrigation recommendations that are provided via mobile application. The idea behind it is to provide an irrigation management tool that aims to overcome barriers in adapting new technologies for smallholders. It is designed to provide irrigation recommendations for orange and olive orchards based on a bottom-up approach. The derived irrigation recommendations are dependent on the available input data based on sensor systems: the FAO-56 approach based on climate data, or a soil water balance model relying on soil moisture data. As the calculation of irrigation recommendations is based on the collected climate and soil moisture data, we are focusing on the possibilities of automated data quality control and the methods and obstacles of the data handling when providing the recommendations. The final product is derived in form of an application for mobile devices that is intuitive and easy to use. The data handling is hereby done using the python programming language and RESTful application programming interfaces, and the transfers are executed periodically using dockerized applications. The main advantage of the proposed workflow is the possibility to integrate data from a variety of sensors and platforms and the access for smallholders can be done via mobile phones. This way, the currently measured data

on the agricultural fields and up-to-date irrigation needs are easily accessible. The system is currently under validation. We present the whole framework, starting at measured values by sensors and ending in the irrigation recommendation for the farmers available in the App.