Supporting information for

Hydrological modelling of the effect of the transition from flood to drip irrigation on groundwater recharge using multi-objective calibration

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Contents of this file

Figure S1: Irrigation transformation from 1994 to 2015.
Figure S2: Structure of the hydrological model Tetis.
Figure S3: Soil textural information.
Table S1: Monthly crop coefficients for citrus orchards.

Introduction

This supporting information contains: i) maps showing the transformation from flood to drip irrigation, ii) a schematic of the structure of the hydrological model Tetis, iii) maps with soil textural information together with a bar plot on the occurrence of soil types in flood- and drip-irrigated sectors, and iv) a table with the monthly crop coefficients for citrus orchards.

References

Allen, R.G. and Pereira, L.S., 2009. Estimating crop coefficients from fraction of ground cover and height. *Irrigation Science*, *28*(1), pp.17-34.

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Francés, F., Velez, J.I. and Vélez, J.J., 2007. Split-parameter structure for the automatic calibration of distributed hydrological models. *Journal of Hydrology*, *332*(1-2), pp.226-240.

Stamen, 2019. Map tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under ODbL, accessed 09.12.2019. https://stamen.com/

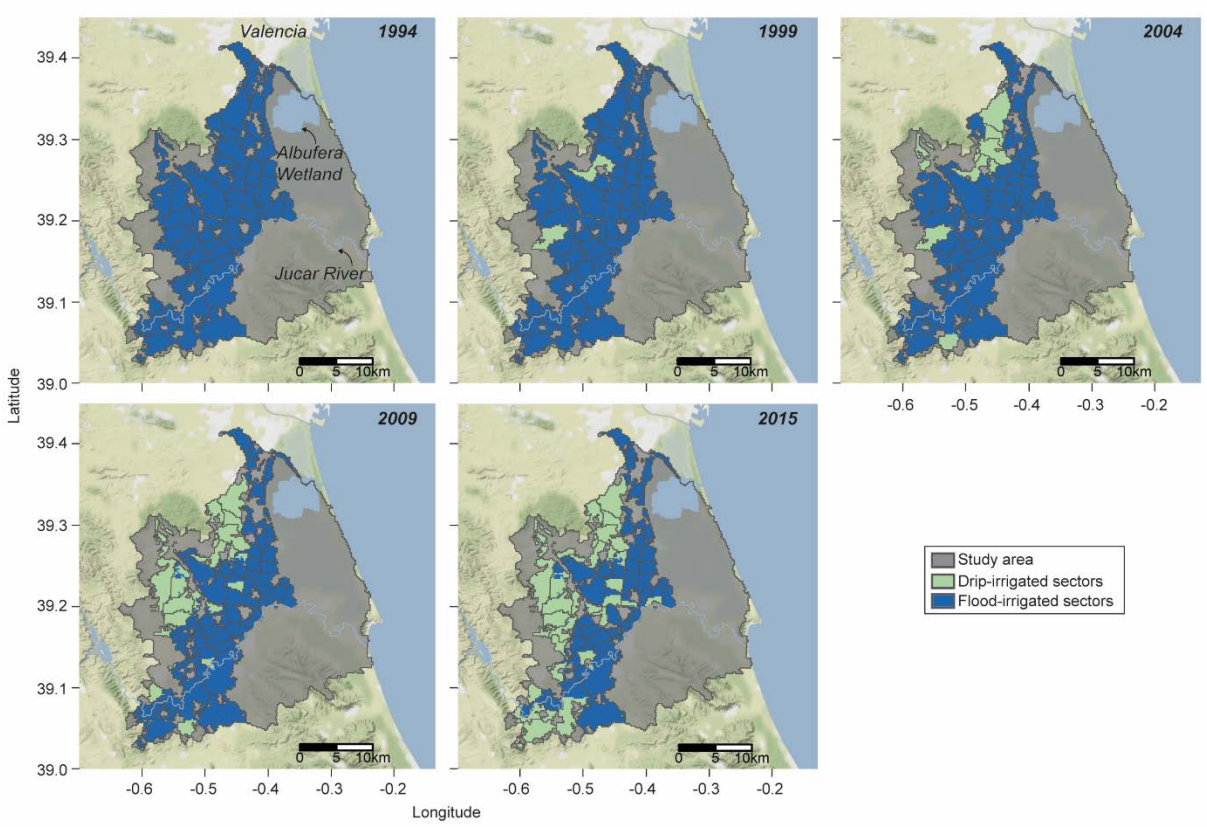

Figure S1: Irrigation transformation from 1994 to 2015. The spatial extent of flood- and drip-irrigated sectors is shown for selected years. The terrain background map was retrieved from *Stamen* [2019].

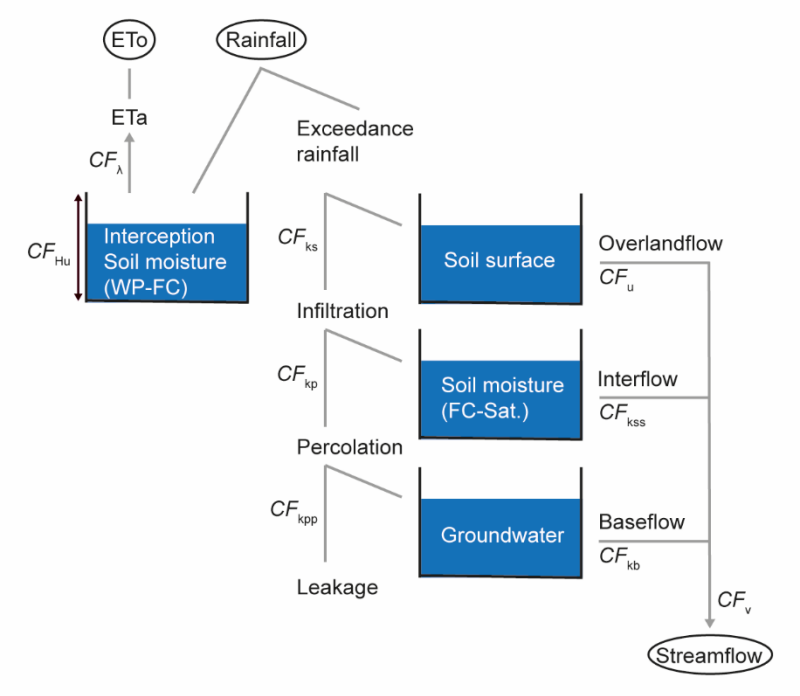

Figure S2: Structure of the hydrological model Tetis. Tetis is a distributed bucket-type model with physically-based parameters. The model consists of four storages including a combined interception and soil water storage between wilting point (WP) and field capacity (FC), a soil surface storage, a soil water storage between field capacity and saturation (Sat.), and a groundwater storage. The model consists of the nine parameters λ (vegetation cover index for each month), Hu (maximum storage between wilting point and field capacity), ks (infiltration capacity), kp (percolation capacity), kpp (groundwater leakage capacity), u (overland flow velocity), kss (interflow velocity), kb (baseflow velocity), and v (channel velocity). The effective parameter value at each cell is the product of a point-scale parameter estimate with physical meaning and a global correction factor (*CF*) that is common to all cells. A detailed description of the model and the original version of this figure can be found in *Francés et al*. [2007].

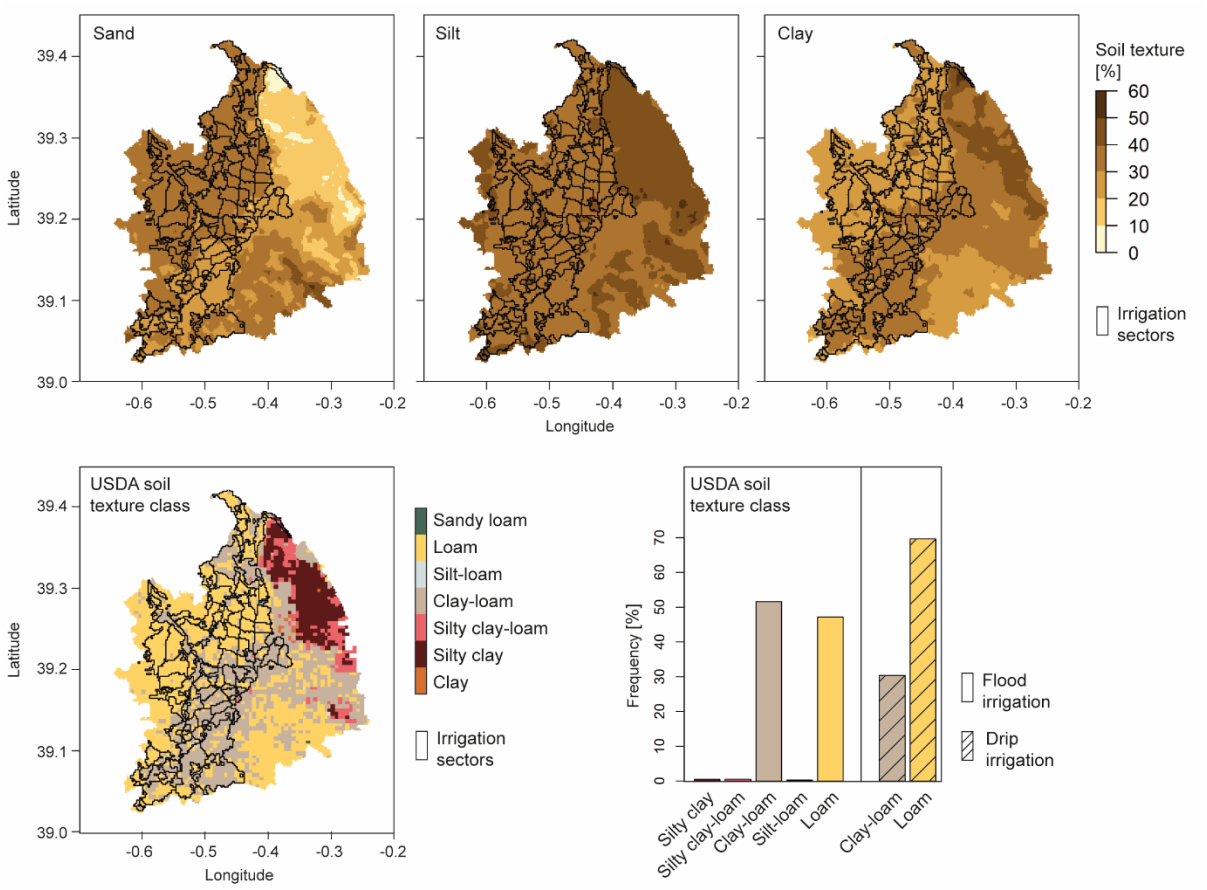

Figure S1: Soil textural information. The top row shows the spatial distribution of the percentage of sand, silt, and clay in the soil. The bottom row shows the resulting USDA soil texture class and its occurrence in flood- and drip irrigated sectors in 2015. Soil textural information was retrieved from the European soil database [*ESDB*, 2019].

Table S1: Monthly crop coefficients for citrus orchards. K_{cf} are crop coefficients for citrus in flood-irrigated orchards, K_{cdw} are crop coefficients for citrus in the wet part of drip-irrigated orchards, and K_{cdd} are crop coefficients for weeds in the dry part of drip-irrigated orchards. Crop coefficients for citrus in flood-irrigated orchards were extracted from *Allen and Pereira* [2009]. Crop coefficients for citrus and weeds in drip-irrigated orchards were adapted from *Allen and Pereira* [2009] using Eq. 2 of the manuscript.

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
K_{cf}	0.80	0.80	0.79	0.78	0.76	0.75	0.75	0.75	0.75	0.75	0.75	0.75
K_{cdw}	1.38	1.38	1.36	1.35	1.34	1.33	1.33	1.33	1.33	1.33	1.33	1.33
K_{cdd}	0.15	0.15	0.14	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10