A combined crop water balance modeling and remote sensing approach for estimating deep percolation at the irrigation district scale

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Deep percolation (DP) is the water flowing under the roots when the soil's capacity to hold water is exceeded. It is an important term of the crop water budget, controlling soil salinization, potentially impacting downstream ecosystems, and being a strong indicator of water productivity. Estimating this flux at spatial scales relevant to farmers (plot-scale) and to watershed or irrigation district managers (sub-basin-scale) is thus fundamental for a sustainable management of water, soils, and downstream rivers. However, even though it can be measured or estimated locally with lysimeters or physically-based models, respectively, DP is generally neglected or considered as a residual variable in crop water balance models. Furthermore, many studies have shown the relevance of using remote sensing data to spatialize crop water fluxes. The aim of this work is thus to estimate DP from the plot-scale to the sub-basin-scale by using a crop water balance model coupled with remote sensing observations. For this, SAMIR, a crop water balance model based on the FAO-56 method using remote sensing data to constrain the modeled vegetation and the soil water status, is used. The approach is tested over the Algerri-Balaguer irrigation district in northeastern Spain where in-situ drainage flow measurements are available at an integrated (sub-basin) scale. Those data were obtained from a network of artificial drains feeding three outlets where the drainage flow is continuously measured. Additionally, two lysimeters were installed on two experimental fields of the area. Firstly, the DP simulated by SAMIR and by a physically-based model (HYDRUS-1D) are compared with the lysimeters measurements. Preliminary results indicate that both models are able to reproduce the DP amount cumulated over the season given a site-specific calibration. Secondly, the field-scale SAMIR

DP estimates are aggregated over several sub-basins and compared against the drainage flow measurements at the outlet of the associated sub-basins. A strategy for calibrating SAMIR at the sub-basin scale is proposed. The obtained results provide a first assessment of the potential of using a satellite-driven crop water balance to retrieve agricultural deep percolation at multiple spatial scales.