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# Vertical soil water fluxes under high evaporative demand in south east Spain.

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In this work, the performance of two models of vertical soil water fluxes was evaluated under high evaporative demand In the south east of Spain. To this end, a Bowen station was installed to measure actual evaporation (E) over a sandy clay loam soil with a residual amount of wheat stubble for a whole drying period. Also an Enviroscan device was installed to monitor soil water content at 10, 20, 30 and 50 cm depth. These two devices were operated with a time resolution of 20 min. The data were collected during 42 days in summer. At the start of this period, there was a rain event of three days (37 mm in total). The subsequent drying period was 39 days. Using the data of the Bowen station, the evaporative demand according to Penman Montieth (ETo) was calculated. This demand was used to apply two models: Hydrus 1D and FAO 56. The data showed that the water extracted by evaporation reaches the level of 20 cm depth, and after 39 days the soil was still evaporating. The change from phase I to phase II occurred a few hours after rain had stopped. Infiltrating water reached the 50cm soil water content sensor after five days, but the volumetric water content at this depth just increased by 3% at the end of the experiment. The FAO 56 model presented problems with the definition of the soil depth used as input when calculating E. To achieve good results, this depth had to be increased to 16 cm (compared to 10 cm suggested by FAO 56). Furthermore, the reduction coefficient (Kr) had to be corrected to fit the measured E. The simulation with Hydrus 1D also presented problems under these conditions. The problems were attributed to the difficulty of obtaining a correct parameterisation for the Richards equation based Hydrus model and the high variation of soil temperature, which could increase the actual E through enhanced vapour

transport. Water movement in the vapour phase is not included in the model.

This study showed that under these extreme conditions of temperature and evaporation demand, models such as FAO 56 need to be adjusted. In the case of the more mechanistic Hydrus 1D, it is necessary to obtain an adequate model parameterization and to verify that all assumptions of the model are satisfied. In this case, the assumption of isothermal water transport might not have been satisfied, which could have resulted in an underestimation of E.