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Seawater intrusion dynamic at the Casetta farmland (Venice). Characterization using HYDRUS-1D

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Soil and groundwater salinization due to seawater intrusion is among the most important problems in coastal farmlands. Inverse estimation of unsaturated soil hydraulic and solute transport properties represents a fundamental step to understand saltwater intrusion dynamics. A three-year study was conducted in a maize field bounding the southern Venice Lagoon. Volumetric water content θ, soil matric potential ψ, and apparent electrical conductivity (ECa) were monitored hourly by five automatic monitoring stations at four depths (0.1, 0.3, 0.5 and 0.7 m). Groundwater electrical conductivity (EC) and depth to the water table were measured in five wells. In addition, soil water and groundwater samples were collected and analyzed to determine the chemical composition. Soil hydraulic parameters for the van Genuchten-Mualen equations were determined using the inverse method in Hydrus-1D. The water flow was modelled based on the daily averages of θ at the four depths and the θ values measured in the lab at selected ψ on undisturbed soil cores extracted from the five monitoring stations. Precipitation, crop transpiration, soil evaporation and depth to the water table were used as time-variable boundary conditions. Root water uptake was estimated by using Feddes model. Finally, the major ion chemistry module of HYDRUS-1D was used to model solute transport and root water uptake reduction due to osmotic stress. The use of HYDRUS-1D to understand saltwater dynamics would enable the developing of mitigation strategies to limit its detrimental effect on farmland productivity and groundwater quality.