

学 位 論 文 要 旨	
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題 目	Study on effects of soil hydraulic parameters for water balance simulation on the sugarcane field in Miyakojima (宮古島サトウキビ畑における水収支計算に土壤水分特性が及ぼす影響に関する研究)
<p>In the Okinawa region, temperatures are predicted to rise in response to climate change, while annual rainfall is expected to decrease, with resultant depletion of groundwater resources becoming a concern. The main land use on Miyakojima is sugarcane farming; thus, understanding both water movement in the unsaturated zone of the farmland soil and the total water budget is important. HYDRUS-1D software package has often been used for analyses of these type of problems. HYDRUS-1D provides versatile numerical modeling of the movement of moisture, solutes, and heat in soil. One option in the code is to estimate soil hydraulic properties by using pedo-transfer functions (PTFs). The HYDRUS-1D software package has often been used for analyses of these type of problems. HYDRUS-1D provides versatile numerical modeling of the movement of moisture, solutes, and heat in soil. One option in the code is to estimate soil hydraulic properties by using pedotransfer functions (PTFs). PTFs that estimate them from readily measurable soil characteristics, such as particle size distribution and bulk density provide a very attractive tool for numerical analyses. It was confirmed that the performance of the PTFs depends strongly on the data that has been used for the development of the PTFs. So, in this study, 1) we examined influences of the bulk density for the retention curve and the hydraulic conductivity of Shimajiri maji soil at first, and applied the PTFs (ROSETTA) to evaluate the practicality. 2) We examined the influence of input soil hydraulic parameters on HYDRUS-1D simulations of evapotranspiration and volumetric water contents (VWCs) in the unsaturated zone of a sugarcane field on the island of Miyakojima, Japan. We first optimized the parameters for root water uptake and examined the influence of soil hydraulic parameters on simulations of evapotranspiration. We then compared VWCs simulated using measured soil hydraulic parameters with those using pedotransfer estimates obtained with the ROSETTA software package. As a result following concluded. 1) It was confirmed that there were some errors in applying the ROSETTA to estimate the retention curve of the Shimajiri maji soil. 2) ptimized values of h_{50} were dependent on the parameters defined by the retention curve. Simulated and measured total evapotranspiration rates agreed well for all four cases considered. Since, for normal growth the amount of suction required to deplete VWCs is about 1000 cm, we consider the h_{50} values we obtained that were closest to 1000 cm to be the more realistic. Thus, our HYDRUS-1D simulations using the measured soil hydraulic parameters provided better results than those based on parameters estimated by ROSETTA. VWCs simulated by HYDRUS-1D using parameters estimated by ROSETTA were lower than the measured values, whereas those using measured parameters agreed well with measured values. Our results confirm that it is important to always use soil hydraulic parameters based on measured data, if available, when simulating water balance, rather than pedotransfer functions.</p>	