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Infiltration, Evaporation and Evapotranspiration Behaviours of Unsaturated Shirasu Soil

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1. Introduction

Infiltration, evaporation, transpiration and evapotranspiration processes are part of hydrological cycle. Measurements of pore water pressure, volumetric water content and temperature at several depths during rainy and non rainy days were conducted on two sets of soil box (i.e., bare soil and vegetated surface) and a set of weighing typed lysimeter to investigate the infiltration and evaporation behaviours of unsaturated Shirasu soil. The changes in pore water pressure, volumetric water content, temperature as well as drainage due to rainfall were also observed. Bulk formula proposed by Kondo et al. (1990) was also used to calculate the evaporation rate.

The evaluation of evapotranspiration is important in the study of the impact of climate change on water resources. Direct measurement of evapotranspiration is difficult, time consuming also costly thus generally it is estimated using available meteorological data.

2. Results and Discussions

Soil boxes test measurement results showed that at the initial stage the pore water pressure value during non rainy days was much more negative in the bare soil box than in the vegetated soil box. As the vegetation has grown up, the pore water pressure and the soil moisture content in the vegetated soil box were higher than in bare soil box due to the influence of vegetation. The lysimeter test results showed that evaporation occurred mostly during daytime and less during night time.

The evaporation rates calculated using Bulk formula showed that the calculation results were overestimated and underestimated with the measurement results obtained from lysimeter test but generally the calculation results were overestimated. This phenomenon due to some variables used in the calculation was not measured directly but only based on the assumption.

The Penman-Monteith method was used to estimate the evapotranspiration rate based on the available meteorological data obtained from Davis vantage pro2 weather station. The results showed that the rate of evapotranspiration at a given place and time depends upon the interaction of the weather.

3. Conclusions

The vegetation performs an important engineering function because of its direct influence on the soil, both at the surface, protecting and restraining the soil, and at depth, increasing the strength and competence the soil mass. The type, the amount and the distribution of vegetation are the major variables affecting the incoming precipitation.

The meteorological factors (i.e. solar radiation and wind speed) influence the evaporation process. The rate of evaporation depends on the moisture content of the soil. Evaporation does not occur during rainfall but as the rain has stopped the evaporation process is started. Several variables of the Bulk formula are still unknown thus it caused the calculation results overestimated with the measurement results.

Climate data is commonly used to estimate the evapotranspiration rate. The use of weather data to estimate daily reference evapotranspiration (ET_o) indirectly offers an easy and very reliable alternative. The rate of evapotranspiration at a given place and time depends upon the interaction of the weather.

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