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Experimental Field for the Study of Soil-Atmosphere Interaction in Soft Soils

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Abstract : The interaction between atmospheric variables and soil properties is a determining factor when evaluating the flow of water through the soil. This interaction situation directly determines the behavior of the soil and greatly influences the changes that occur in it. The atmospheric variations such as changes in the relative humidity, air temperature, wind velocity and precipitation, are the external variables that reflect a greater incidence in the changes that are generated in the subsoil, as a consequence of the water flow in descending and ascending conditions. These environmental variations have a major importance in the study of the soil because the conditions of humidity and temperature in the soil surface depend on them. In addition, these variations control the thickness of the unsaturated zone and the position of the water table with respect to the surface. However, understanding the relationship between the atmosphere and the soil is a somewhat complex aspect. This is mainly due to the difficulty involved in estimating the changes that occur in the soil from climate changes; since this is a coupled process where act processes of mass transfer and heat. In this research, an experimental field was implemented to study in-situ the interaction between the atmosphere and the soft soils of the city of Bogota, Colombia. The soil under study consists of a 60 cm layer composed of two silts of similar characteristics at the surface and a deep soft clay deposit located under the silky material. It should be noted that the vegetal layer and organic matter were removed to avoid the evapotranspiration phenomenon. Instrumentation was carried on in situ through a field disposal of many measuring devices such as soil moisture sensors, thermocouples, relative humidity sensors, wind velocity sensor, among others; which allow registering the variations of both the atmospheric variables and the properties of the soil. With the information collected through field monitoring, the water balances were made using the Hydrus-1D software to determine the flow conditions that developed in the soil during the study. Also, the moisture profile for different periods and time intervals was determined by the balance supplied by Hydrus 1D; this profile was validated by experimental measurements. As a boundary condition, the actual evaporation rate was included using the semi-empirical equations proposed by different authors. In this study, it was obtained for the rainy periods a descending flow that was governed by the infiltration capacity of the soil. On the other hand, during dry periods. An increase in the actual evaporation of the soil induces an upward flow of water, increasing suction due to the decrease in moisture content. Also, cracks were developed accelerating the evaporation process. This work concerns to the study of soil-atmosphere interaction through the experimental field and it is a very useful tool since it allows considering all the factors and parameters of the soil in its natural state and real values of the different environmental conditions.

Keywords : field monitoring, soil-atmosphere, soft soils, soil-water balance
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