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NUMERICAL MODELING OF TEMPERATURE FIELD ACROSS A PRISMATIC ELEMENT OF A SOIL

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ABSTRACT

Temperature distribution in the soil around the study area [Coordinates $5^0$31'N 5045'E/5.517^{0}N 5.750^{0}E] are simulated by a two-dimensional model based on conduction heat transfer, with the help of SCILAB, Microsoft Excel and minitab16 user interface tool. In this system, heat is transferred, basically from the surface of the earth dominantly by conduction, convection, or both. However, the modeled developed, had convective heat transfer neglected. ''The spatial variation of the magnitude of conductive heat transfer represented by lateral variation of observed surface heat flow values is heavily related to the subsurface temperature distribution, the pattern of which is directly controlled by the variation of rock thermal conductivity values.'' Therefore, it may be inferred that the information about subsurface temperature distribution may provide insight for the interpretation of the thermal structure of a computational space. This insight, it is believed, could help in studies of the negative impact bush burning has on the mineral and soil structure. In this research, numerical forward modeling procedure of 2-D conductive heat transfer using finite difference solution of the steady state heat conduction equation via a Gauss-Seidel scheme was performed. The main physical parameters used as the input in the modeling procedure are rock thermal conductivity values as well as temperature boundary conditions. The modeling scheme was applied on an elemental portion of the substrate, soil, by using appropriate thermal conductivities and temperature boundary conditions for the abstracted computational space. The results, from the numerical studies and the modeling procedure, adopted, were able to effectively characterize the thermal structure and surface heat flow patterns of the computational space, soil substrate. Results from the numerical simulation shows that temperatures on the soil substrate represented by a rectangular plate, at steady state with known boundary temperatures using three different techniques gave the same temperatures, validating the results.