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Application of 2D Electrical Resistivity Tomographic Imaging Technique to Study Climate Induced Landslide and Slope Stability through the Analysis of Factor of Safety: A Case Study in Ooty Area, Tamil Nadu, India

Authors : S. Maniruzzaman, N. Ramanujam, Qazi Akhter Rasool, Swapan Kumar Biswas, P. Prasad, Chandrakanta Ojha

Abstract : Landslide is one of the major natural disasters in South Asian countries. Applying 2D Electrical Resistivity Tomographic Imaging estimation of geometry, thickness, and depth of failure zone of the landslide can be made. Landslide is a pertinent problem in Nilgris plateau next to Himalaya. Nilgris range consists of hard Archean metamorphic rocks. Intense weathering prevailed during the Pre-Cambrian time had deformed the rocks up to 45m depth. The landslides are dominant in the southern and eastern part of plateau of is comparatively smaller than the northern drainage basins, as it has low density of drainage; coarse texture permitted the more of infiltration of rainwater, whereas in the northern part of the plateau entombed with high density of drainage pattern and fine texture with less infiltration than run off, and low to the susceptible to landslide. To get comprehensive information about the landslide zone 2D Electrical Resistivity Tomographic imaging study with CRM 500 Resistivity meter are used in Coonoor– Mettupalyam sector of Nilgiris plateau. To calculate Factor of Safety the infinite slope model of Brunsden and Prior is used. Factor of Safety can be expressed (FS) as the ratio of resisting forces to disturbing forces. If FS < 1 disturbing forces are larger than resisting forces and failure may occur. The geotechnical parameters of soil samples are calculated on the basis upon the apparent resistivity values for litho units of measured from 2D ERT image of the landslide zone. Relationship between friction angles for various soil properties is established by simple regression analysis from apparent resistivity data. Increase of water content in slide zone reduces the effectiveness of the shearing resistance and increase the sliding movement. Time-lapse resistivity changes to slope failure is determined through geophysical Factor of Safety which depends on resistivity and site topography. This ERT technique infers soil property at variable depths in wider areas. This approach to retrieve the soil property and overcomes the limit of the point of information provided by rain gauges and porous probes. Monitoring of slope stability without altering soil structure through the ERT technique is non-invasive with low cost. In landslide prone area an automated Electrical Resistivity Tomographic Imaging system should be installed permanently with electrode networks to monitor the hydraulic precursors to monitor landslide movement.

Keywords : 2D ERT, landslide, safety factor, slope stability
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