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ERT and GPR Characterization from Soil Pipe System in Brazilian Tropical Soil

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A Soil Pipe System (SPS) were identified in Candói region, located in the Paraná state, southern Brazil. This region is constituted of intensive agriculture and cattle raising. SPS correspond to a structure associated to an erosive processes stage in downhill slope that tend to increase over time. The growth of the SPS results in instability to the terrain and the possibility of collapse, in this case the collapse can be accelerated by external factors, such as the overload of agricultural machinery and animals that circulate around the site, may leading to the machinery loss, animal's death or even risk to worker safety. Frequently, the SPS are identified by surface methods that don't provide parameters such as shape, distribution and depth. In this research, Electrical Resistivity Tomography (ERT) and Ground Penetrating Radar (GPR) were used to obtain a 3D characterization of the SPS identified in a farm in Candói region to estimate the soil cover over the structure, the subsurface channels distribution and identify potential collapse risk portions. Seven ERT profiles using dipole-dipole array and twenty-one GPR profiles of 200 MHz antenna were acquired, covering an area of 900 m². The results were combined in a block diagram, which enabled: i) identify the subsurface channels distribution and direction, ii) estimate the average soil cover thickness, with 1.5 m over the whole structure. The possible connection between subsurface secondary and primary channels has also been suggested in results interpretation through of identification of a channel parallel to acquisition profiles direction. It was verified that in structure portions closer to the river next to the slope, the SPS ceiling has larger dimensions than the walls, suggesting areas with increased vertical tension, which was classified as potential collapse risk areas.