

Hydrodynamics in Wetlands of Brazilian Savanna: Electrical Tomography and Geoprocessing

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Abstract : Located in the western part of the State of Minas Gerais, Brazil, the study area consists of a savanna environment, represented by sedimentary plateau and a soil cover composed by lateritic and hydromorphic soils - in the latter, occurring the deferruginization and concentration of high-alumina clays, exploited as refractory material. In the hydromorphic topographic depressions (wetlands) the hydrogeological relationships are little known, but it is observed that in times of rainfall, the depressed region behaves like a natural seasonal reservoir - which suggests that the wetlands on the surface of the plateau are places of recharge of the aquifer. The aquifer recharge areas are extremely important for the sustainable social, economic and environmental development of societies. The understanding of hydrodynamics in relation to the functioning of the ferruginous and hydromorphic lateritic soils system in the savanna environment is a subject rarely explored in the literature, especially its understanding through the joint application of geoprocessing by UAV (Unmanned Aerial Vehicle) and electrical tomography. The objective of this work is to understand the hydrogeological dynamics in a wetland (with an area of 426.064 m²), in the Brazilian savanna, as well as the understanding of the subsurface architecture of hydromorphic depressions in relation to the recharge of aquifers. The wetland was compartmentalized in three different regions, according to the geoprocessing. Hydraulic conductivity studies were performed in each of these three portions. Electrical tomography was performed on 9 lines of 80 meters in length and spaced 10 meters apart (direction N45), and a line with 80 meters perpendicular to all others. With the data, it was possible to generate a 3D cube. The integrated analysis showed that the area behaves like a natural seasonal reservoir in the months of greater precipitation (December - 289mm; January - 277,9mm; February - 213,2mm), because the hydraulic conductivity is very low in all areas. In the aerial images, geotag correction of the images was performed, that is, the correction of the coordinates of the images by means of the corrected coordinates of the Positioning by Precision Point of the Brazilian Institute of Geography and Statistics (IBGE-PPP). Later, the orthomosaic and the digital surface model (DSM) were generated, which with specific geoprocessing generated the volume of water that the wetland can contain - 780,922m³ in total, 265,205m³ in the region with intermediate flooding and 49,140m³ in the central region, where a greater accumulation of water was observed. Through the electrical tomography it was possible to identify that up to the depth of 6 meters the water infiltrates vertically in the central region. From the 8 meters depth, the water encounters a more resistive layer and the infiltration begins to occur horizontally - tending to concentrate the recharge of the aquifer to the northeast and southwest of the wetland. The hydrodynamics of the area is complex and has many challenges in its understanding. The next step is to relate hydrodynamics to the evolution of the landscape, with the enrichment of high-alumina clays, and to propose a management model for the seasonal reservoir.

Keywords : electrical tomography, hydrogeology, unmanned aerial vehicle, water resources management

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