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Geophysical Applications in Mapping and Environmental Management of the Karst Aquifer in the Metropolitan Region of Curitiba, Paraná, Brazil

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Introduction

The Karst Aquifer, located in the Metropolitan Region of Curitiba (PR), is a geological-carbonate system of strategic importance for water supply, mining and regional urban planning. However, its exploitation is challenged by natural weaknesses and anthropogenic pressures, such as karst collapses and intensive use of the soil. In this context, geophysical methods have been considered essential tools for structurally characterizing the subsoil and supporting the delimitation of hydrogeological compartments.

The interpretations of the aerogeophysical data on the Karst Aquifer are intended to facilitate the integrated management of natural resources and the formulation of policies for directing land use and occupation in the Metropolitan Region of Curitiba. The data obtained will compose a georeferenced database for the Instituto Água e Terra (IAT), thereby providing technical support for environmental licensing processes, water resource concessions, and territorial planning. The application of geophysics in the karst context demonstrates potential for identifying risks and facilitating the sustainable utilization of subterranean and mineral resources in the region.

Method

In this work, the utilization of aerogeophysical methods was proposed in the area of relevance of the karst aquifer, with a focus on the characterization of carbonate rock compartments. The study incorporates the qualitative and semi-quantitative interpretation of aeromagnetic and aerogamma-spectrometric surveys. This interpretation utilizes ratios and enhancement filters that have been established in the literature. Additionally, new processing filters are employed to delineate contacts between lithostratigraphic units, define karst hydrogeological cells, and determine the depth of magnetic sources.

Results and Conclusions

The aerogeophysical interpretations are intended to provide input for revising the geological-geotechnical mapping, with an emphasis on detecting fractured structures that facilitate the formation of underground conduits. They also aim to delimit contacts, estimate the depth of magnetic sources, and correlate with hydrogeological data (wells, sinkholes, springs) in order to complement the geological model of regions with a history of subsidence and collapse processes related to karst processes.