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Identification of aquifer limits inside an Andean Piedmont (between 19,5°S and 20°S - Northern Chile) with TDEM and gauging methods.

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In times of brutal climate changes and water scarcity in arid areas, the management of water resource has become a major issue. In this aim, several studies attempted to quantify the aquifer recharge and hydrodynamic processes. However, the quality of many studies depends on the characterization of aquifer boundaries. In arid areas, the amount of observation points (e.g. wells) and their spatial distribution constrain the understanding of aquifer boundaries spatial variations. In this study, we propose a methodology to characterize both water table level and boundaries of aquifer in such areas where the observation points do not exist.

The Andean Piedmont (between 19,5°S and 20°S - Northern Chile) is located in the Pampa del Tamarugal Central Depression and is bounded respectively at the westside and the eastside by the Coastal Cordillera (1100 m a.s.l) and the Precordillera mountain range (4500 m a.s.l). The piedmont and the basin floor are composed of the late-Cenozoic alluvial deposits (hundred meters thick) which contain the Pampa del Tamarugal aquifer. Due to the hyperarid context, this regional aquifer is one of the main strategic groundwater resources in Northern Chile. This aquifer is mainly unconfined and the electrical conductivity of groundwater varies around 3000 μS/cm in the study area.

The analysis of resistivity variation with depth, acquired by Time Domain Electromagnetic (TDEM) method in various points inside the piedmont, allow identifying a continuous resistivity contrast (from $\geq$ 100-40 Ω.m to $\leq$ 10 Ω.m) that varies over the study area. This continuous resistivity contrast is assumed to be related to the water table of the unconfined aquifer rather than to a lithology contrast. After validation of the observations, a piezometric map was constructed using both the available hydrogeological information and the TDEM results. In the piedmont, river sink were identified; these zones where surface water sinks are correlated with the resistivity contrast change with depth.

These surveys allowed to better define the Pampa del Tamarugal aquifer boundaries identified in former studies and to provide a conceptual model of the recharge in the Andean Piedmont.