MONITORING OF THE LOW-ENTHALPY GEOTHERMAL RESOURCE IN SOUTHERN SAN JUAN PROVINCE, ARGENTINA

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1 INTRODUCTION

This study focuses on the monitoring of low-enthalpy geothermal resources in the southern area of the San Juan province, northwestern Argentina (Fig. 1). This region, characterized by extreme aridity, high temperatures and a marked water deficit (<100 mm; Suvires & Luna, 2008), comprises the Tulum oasis, which supplies water and soils to the San Juan city and surrounding areas. The growing expansion of San Juan's main city and the energy demand generated by new economic and industrial sectors in the region, promotes the need to look for new environmentally friendly alternative energies to help supply this consumption. In this context, geothermal energy could become an important source to reduce electricity demand and contribute to environmental protection.

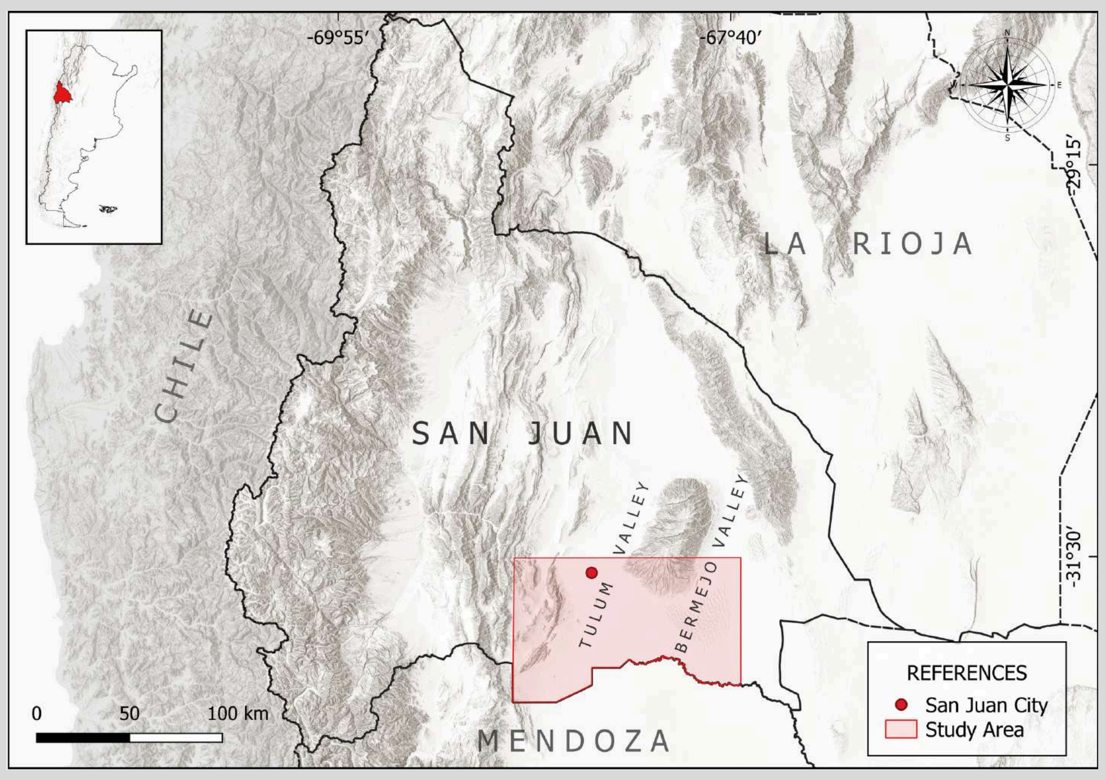

Fig. 1: Location of the study area in San Juan province, Argentina.

2 RESEARCH OBJECTIVE

Contribute to the knowledge of the geothermal potential of the southern sector of the San Juan province through the survey of thermal manifestations, their hydrochemical and isotopic characterization, estimation of the source temperature and the geological-geophysical analysis of the structures that control the geometry of the basin and aquifer levels of the study area.

3 METHODS

- The potential thermal anomaly zones were selected using the database reported by the Instituto Nacional del Agua - Centro Regional de Aguas Subterráneas (INA-CRAS).
- Four types of HOBO data logger sensors have been installed in soils and aquifer wells with a measurement interval time of 10-minute (Fig. 2). These devices record temperature, absolute pressure and electrical conductivity over time.
- Barometric corrections have been applied, consulting the database reported by the Servicio de Agrometeorología Estación Experimental San Juan - Instituto Nacional de Tecnología Agropecuaria (EEA-INTA).
- The obtained data are collected using a computer after a measurement period of approximately 5 months.
- In situ measurements (temperature, conductivity and pH) are taken in each well with a sonic piezometric probe and a portable digital conductivity and pH meter (Fig. 3).
- Water samples have been taken from the hot springs for hydrochemical and isotopic analyses (Fig. 3).
- Representative rock samples have been collected from the hydrogeologic basement for petrophysical analysis (Fig. 4).
- Water and rock analyses are carried out in the laboratories of the Ruhr-Universität Bochum (RUB).

Fig. 2: Sensors used in this research.

Fig. 3: Water sampling procedures.

Fig. 4: Rock sampling.

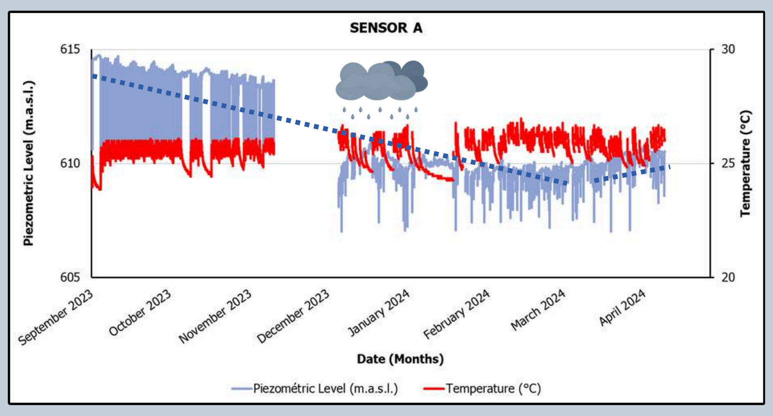

Fig. 6: Sensor A - Temperature vs. Piezometric Level over time.

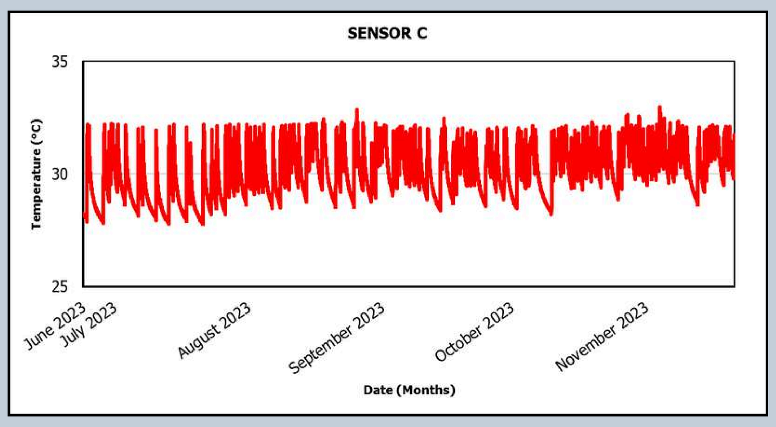

Fig. 7: Sensor C - Temperature over time.

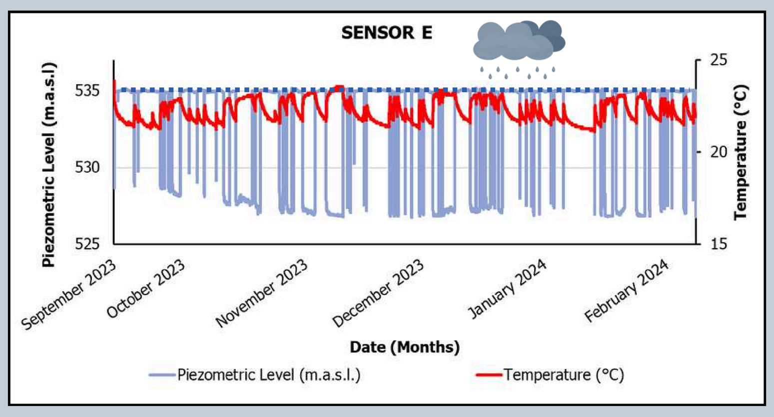

Fig. 8: Sensor E - Temperature vs. Piezometric Level over time.

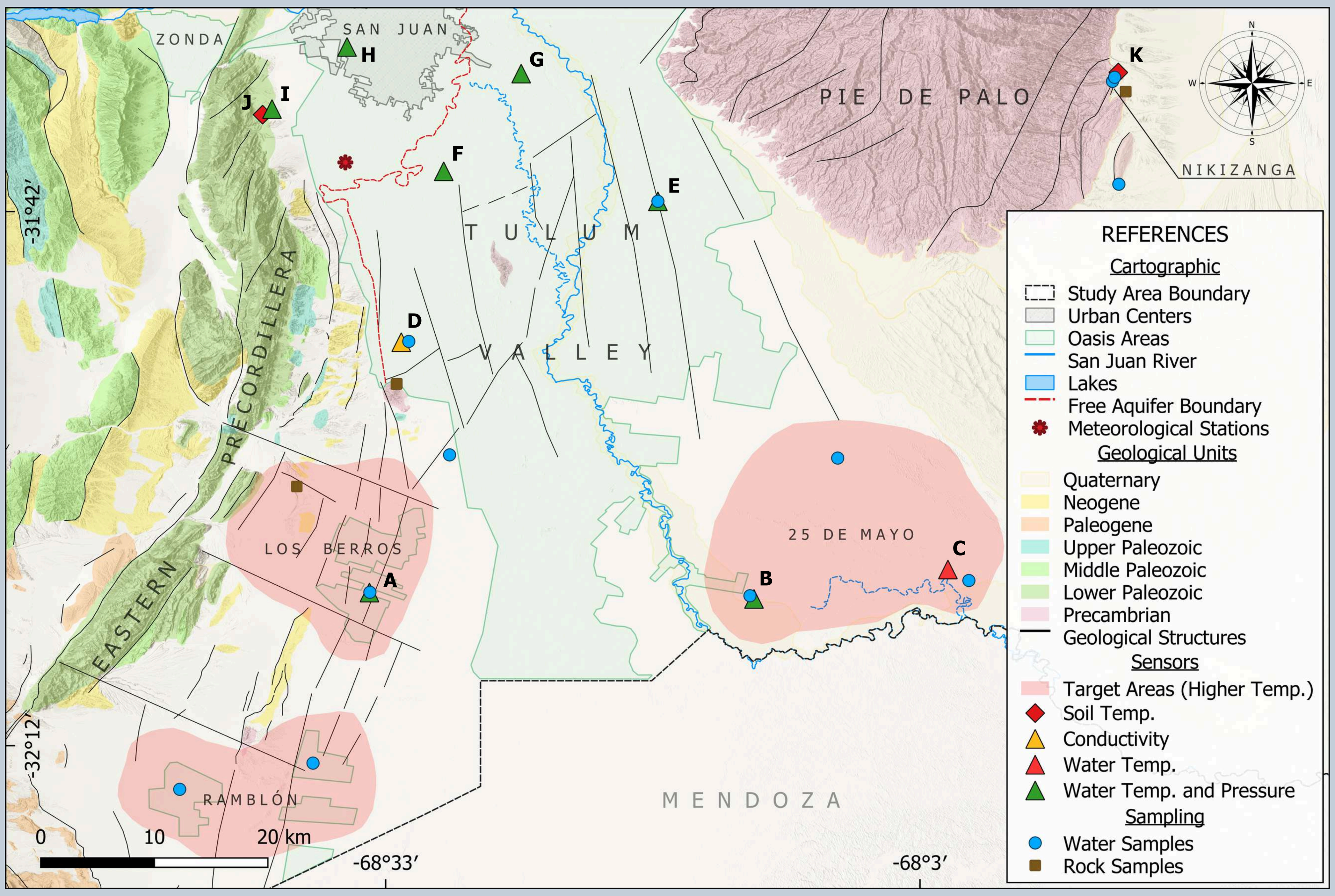

Fig. 5: Geological map with the location of the sensors installed in the study area. Compilation of structures taken from Zambrano & Suvires (2008) and Ramos et al. (2000). The boundary between free aquifers (left of the red line) and semi-confined and confined aquifers (right of the red line) used in this work is that reported by INA-CRAS.

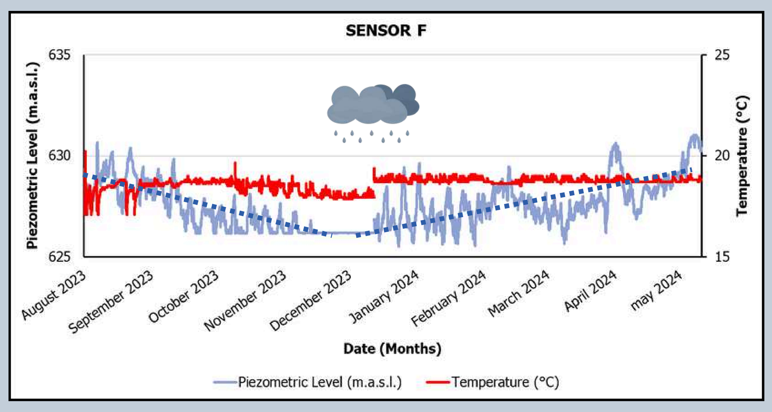

Fig. 9: Sensor F - Temperature vs. Piezometric Level over time.

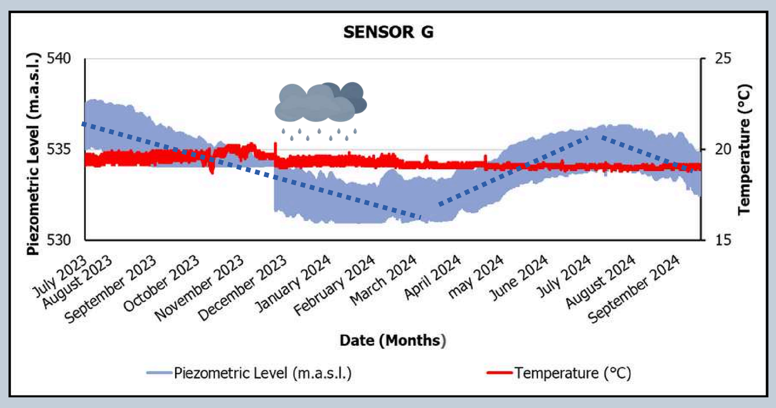

Fig. 10: Sensor G - Temperature vs. Piezometric Level over time.

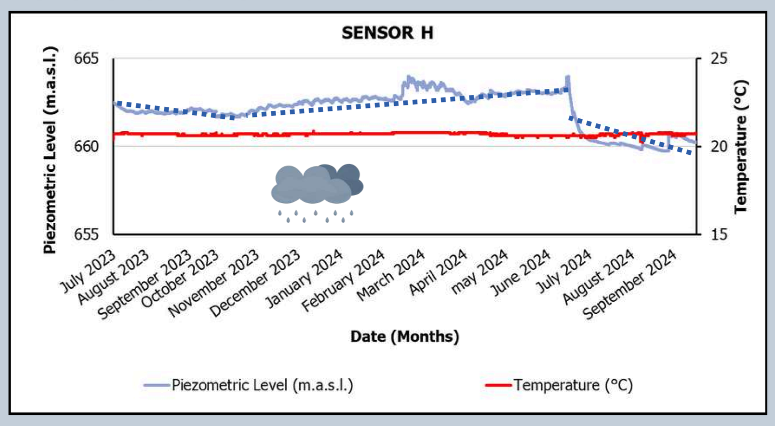

Fig. 11: Sensor H - Temperature vs. Piezometric Level over time.

Main rainfall

4 RESULTS

- Constant temperatures over time.
- Defined target areas (T>25°C).
- In situ temperature measurements at the Ramblón wells indicate T>29°C, while at 25 de Mayo they may exceed T>31°C.
- Piezometric levels and temperature behaviors related to intense well pumping.
- Trend of negative piezometric levels in the Tulum semi-confined and confined aquifer from August to April and positive from April to July.
- Trend of positive piezometric levels in the Tulum free aquifer from November to June and negative from July to November.
- Sensors B, D, I, J and K still recording new information.
- Water and rock samples still under analysis.

5 CONCLUSIONS

- Preliminar results indicate that groundwater temperature increases southward, reaching 32°C and showing a correlation with geological structures. These data indicate that the study area has a low-enthalpy geothermal potential.
- In situ measurements indicate that aquifer temperatures in the south are higher (>25°C) than in the centre-north of the study area.
- First-order structures could act as pathways for the ascent of higher temperature fluids.
- The trend of piezometric levels in the Tulum aquifers is generally negative from July to December and positive from February to June, showing a seasonal behaviour with recharge in the main rainfall months (December, January and February).
- However, piezometric levels fall by > 4 meters in the measured periods, mainly in the semi-confined and confined aquifers.
- The high temperature areas can be potentially used by the community in the future for balneology purposes, application in air conditioning/heating systems for homes and greenhouses, in the production of sanitary hot water, among others.

ACKNOWLEDGEMENTS

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