A NATIONWIDE GROUNDWATER DATASET TO ADVANCE INTEGRATED WATER MANAGEMENT IN BRAZIL

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INTRODUCTION

There is a growing global demand for studies on surface–groundwater interactions, especially in the Southern Hemisphere. Brazil, for instance, is known for its abundance of water resources. However, certain regions of the country face declines in groundwater levels (Camacho *et al*., 2023). As such, it is essential to understand the mechanisms controlling the spatial patterns and temporal dynamics of river–aquifer interactions. However, limitations in the spatiotemporal coverage of groundwater monitoring networks continue to hinder our understanding of these dynamics (IPCC, 2022). In this study, we introduce an open-access groundwater dataset developed in partnership with the Geological Survey of Brazil (SGB). The dataset underwent rigorous quality assurance procedures to ensure accuracy and adheres to principles of transparency. It consolidates and standardizes information from over 351,000 wells, and includes approximately 450 wells with continuous daily monitoring between 2010 and 2024.

DATA AND METHODS

Step 1: Data collection

The groundwater well database presented here relies on two primary datasets from the Geological Survey of Brazil: the Groundwater Information System (SIAGAS – *Sistema de Informações de Águas Subterrâneas*) and the Integrated Groundwater Monitoring Network Project (RIMAS – *Rede Integrada de Monitoramento das Águas Subterrâneas*).

Step 2: Data standardization

SIAGAS data were collected as of March 2024, containing 371,438 records, while RIMAS data were collected as of July 2024, with 481 records. We extracted key variables, such as well location, status (e.g., active or abandoned), primary water use (e.g., domestic, agricultural, or industrial), date of the pumping test, static water level, and well capacity, among others.

Step 3: Quality control

To ensure data quality, we filtered the database to include only water and monitoring wells, excluding records inferred from surface features like springs or wetlands. We applied four steps commonly used in well database development: (i) removing non-well construction records, (ii)

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removing duplicate records, (iii) removing records outside the Brazilian territory, and (iv) removing records with unclear construction dates.

Step 4: Data validation

We validated the records by cross-checking key variables with other published datasets. For example, we assessed well locations by creating a 100-meter radius buffer around each well and calculating the percentage of land cover based on the MapBiomas Collection 8 2022 dataset (MapBiomas, 2023). Locations were classified as inconsistent if more than 50% of the buffer area was categorized as "water" or "not observed". This information allows users to select appropriate quality criteria based on their application needs and to verify the consistency of relevant variables.

Step 5: Data export

The open-access groundwater dataset developed in this study, along with all associated products, is available in the Zenodo repository Uchôa *et al*. (2025), including SIAGAS well data (available in CSV and Shapefile formats) and RIMAS well data (also available in NetCDF format).

Uncertainty

Some inconsistencies in the original reports may remain undetected despite our quality control and validation steps. Additionally, many well records are not routinely updated, meaning that unreported changes to wells may not be captured. Therefore, we recommend that users verify the data for their specific regions of interest.

CONCLUSIONS

Groundwater datasets have wide-ranging applications, including studies of recharge processes, groundwater-dependent ecosystems, and water resource planning. We also highlight the value of collaboration between research institutions and government agencies, such as the SGB, in producing reliable and user-friendly datasets. These efforts can empower policymakers to design evidence-based strategies that balance economic development with environmental conservation.

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