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# Assessment of key design features of a new seismological station in the southwestern region of São Paulo state

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## Introduction

A new seismological station (MRDB) has been installed within the Morro do Diabo preservation area, located in the southwestern region of São Paulo state. This station filled the seismic monitoring gap left by the deactivation of the former Terra Rica station (TRCB) in 7/2024. The chosen site is situated approximately 7.0 km from the city of Teodoro Sampaio/SP, 11.5 km from the preservation area base, and 1.5 km from the nearest highway. It lies within a secure area previously used as a landing strip. In addition to the broadband seismometer, the station is equipped with temperature sensors (three located within the seismometer vault and one in the datalogger vault), as well as a barometric pressure sensor and a relative humidity sensor, to enable environmental monitoring and improve data quality assessment. Seismic data from this station are streamed in real time to the USP Seismological Center and shared with partners. Environmental data are also transmitted in real time but are not shared.

## Method and/or Theory

The installation followed key design principles to minimize instrumental noise. Elements above ground level were kept to a minimum. Solar panels were positioned ~40 m away from the seismometer to reduce any vibrations induced by its structure. A thermally insulated roof was installed above the datalogger vault to enhance temperature stability. All cabling between the seismometer, datalogger, and power system was routed through underground conduits. The seismometer itself was mounted within a metal casing securely anchored into a vibrated concrete pier to ensure mechanical stability and optimal coupling, vegetable coal was used to retain humidity inside the casing. The sensor was installed at 1.5 meters deep, and the vault is covered by 1 m of soil. A Raspberry Pi 4 is used to log environmental data, which is periodically transmitted to USP via an implemented push service. An instance of the SeisComP SeedLink server collects and archives seismic data from the Nanometrics datalogger, providing a backup to the real-time transmission. Data collected during the station's initial months enabled an assessment of local noise characteristics, as well as the performance of the constructed sensor vault. Connectivity is provided over a mobile phone 3G link.

## Results and Conclusions

After sealing the sensor vault, the sensor cover temperature stabilized at 2.65°C and 2.90°C warmer than the aluminum and metal casings, respectively, within two days. Once stable, it tracked long-term temperature trends without daily fluctuations, indicating a sufficient installation depth. Humidity started at 58% and varied inversely with temperature, while pressure changes remained below 15 hPa and were anticorrelated with daily temperature cycles. Daily temperature variation inside the datalogger vault stayed below 2°C — much lower than in masonry (7.75°C) and portable stations (17.9°C) construction. This was due to the use of a thermal insulated roof and buried side walls. The average seismic noise level at MRDB station was only 5% above the NLNM (New Low Noise Model) at long periods (>100 s), and 15% above at intermediate periods (up to 1 Hz), though elevated peaks appeared at 3 Hz and 10 Hz. This installation strategy enabled us, for the first time, real-time monitoring of temperature, pressure, and humidity in the sensor and datalogger vault during broadband station deployment in noisy soil conditions associated with areas lacking large superficial rock outcrops.