INSTITUTO DE PESQUISAS TECNOLÓGICAS

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Key design feattures of a new seismological station in the São Paulo state

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SBGf Conference
18-20 NOV | Rio'25
Sustainable Geophysics at the Service of Society

Key design features of a new seismological station in the São Paulo state

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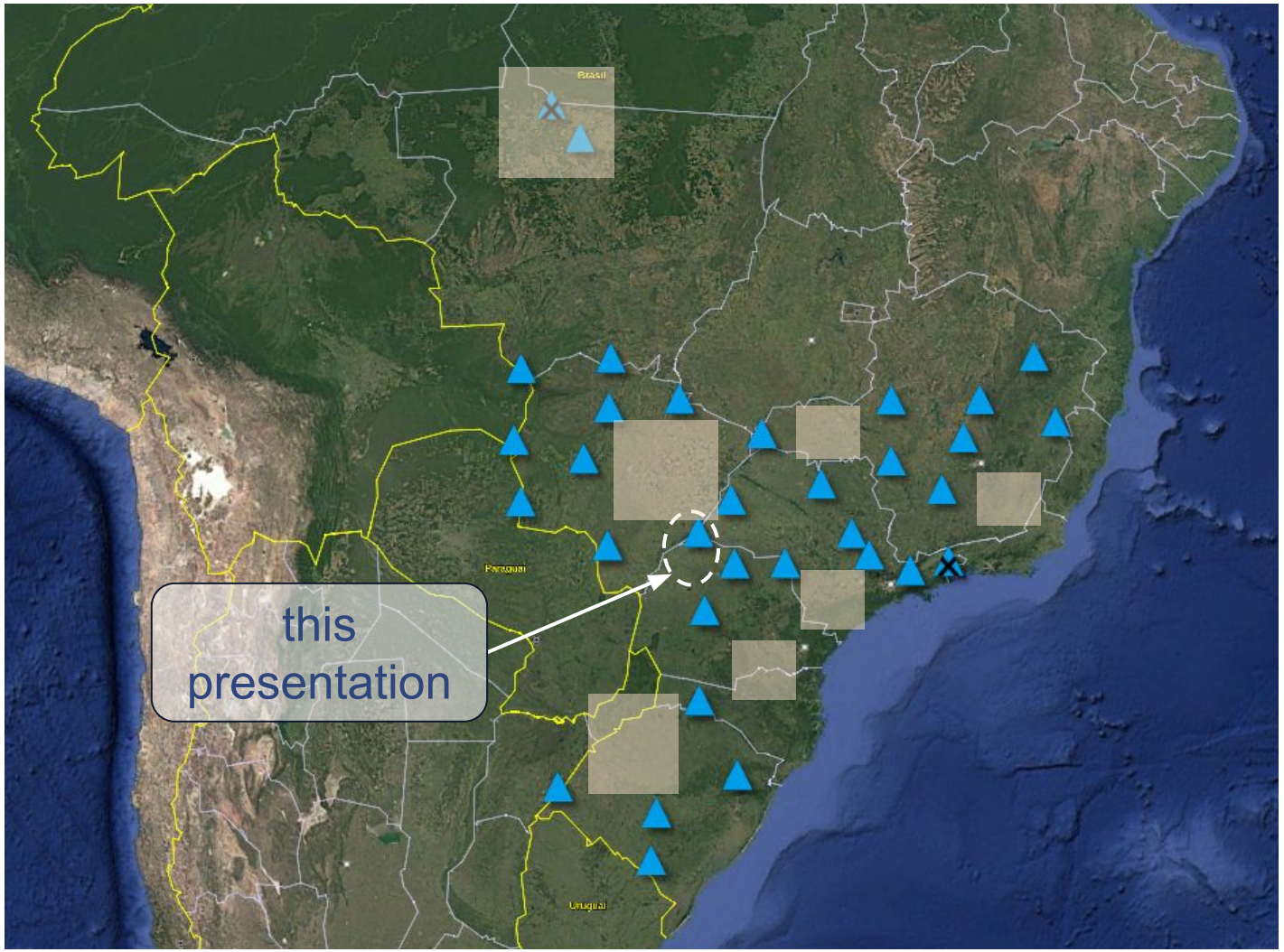
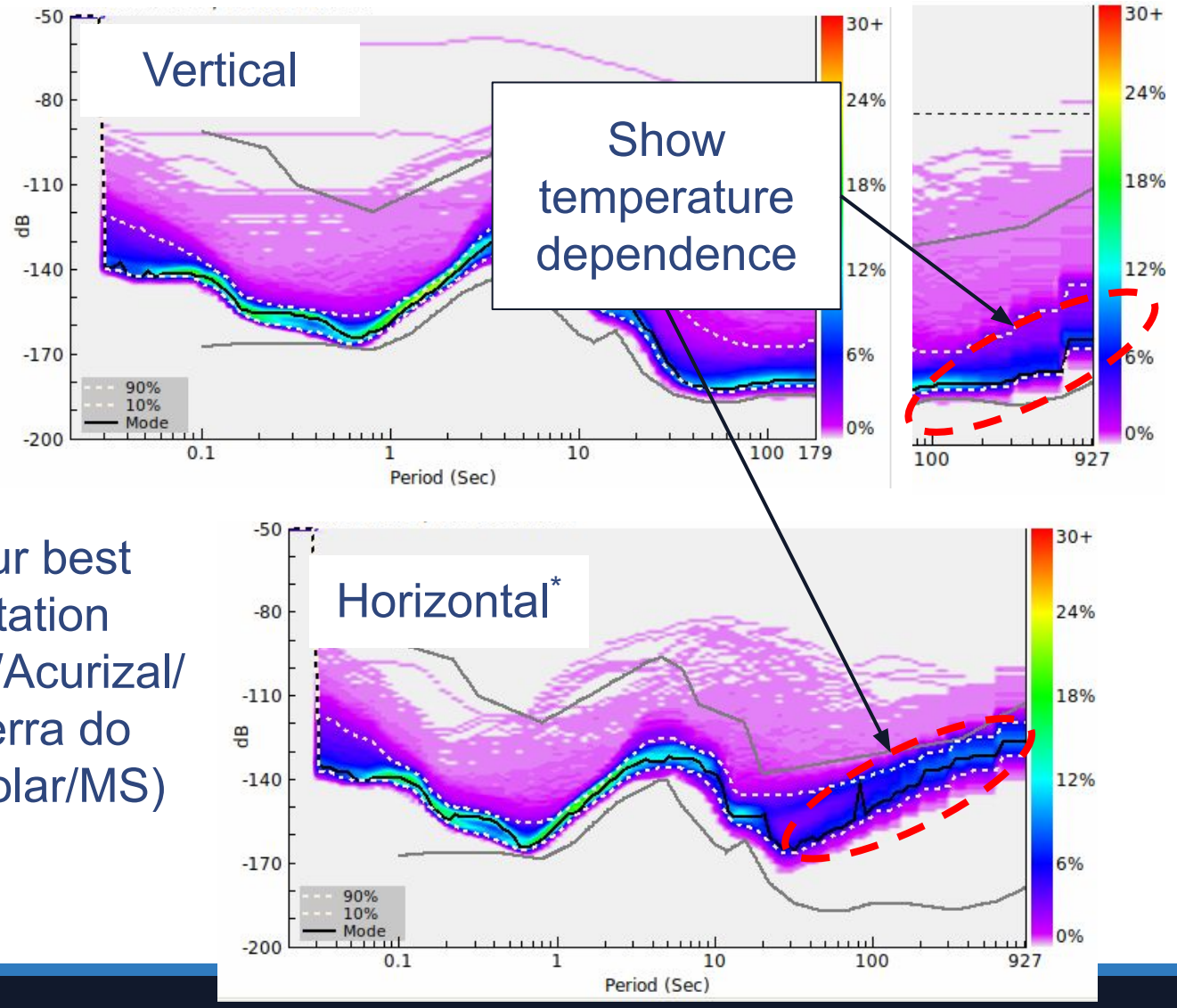
"Assessment of key design features of a new seismological station in the southwestern region of São Paulo state"

BL Network / RSBR



- Network BL is part of the RSBR;
- Covers most of the South, Southeast and part of the central part of Brazil;
- 33 stations 2 from partners (offline).
- Know Problems:
  - Show heterogeneity in station distribution.
  - Is completing +10 years and installation design vary from earlier to newer stations;
  - Even on rock outcrops we never achieved excellent long periods results;

BL Network / RSBR

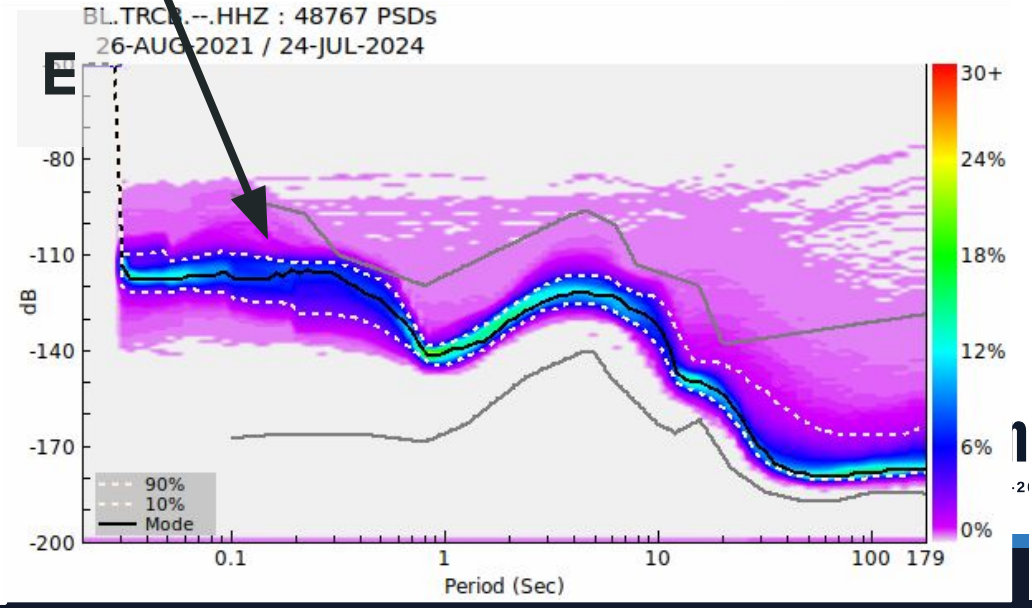


Our best station (IHP/Acurizal/ Serra do Amolar/MS)

- Network BL is part of the RSBR;
- Covers most of the South, Southeast and part of the central part of Brazil;
- 33 stations 2 from partners (offline).
- Know Problems:
  - Show heterogeneity in station distribution.
  - Is completing +10 years and installation design vary from earlier to newer stations;
  - **Even on rock outcrops we never achieved excellent long periods results;**

Terra Rica (TRCB) Station

fowl run effect?



A. Overview

B. Vault

C. Sensor

D. Datalogger

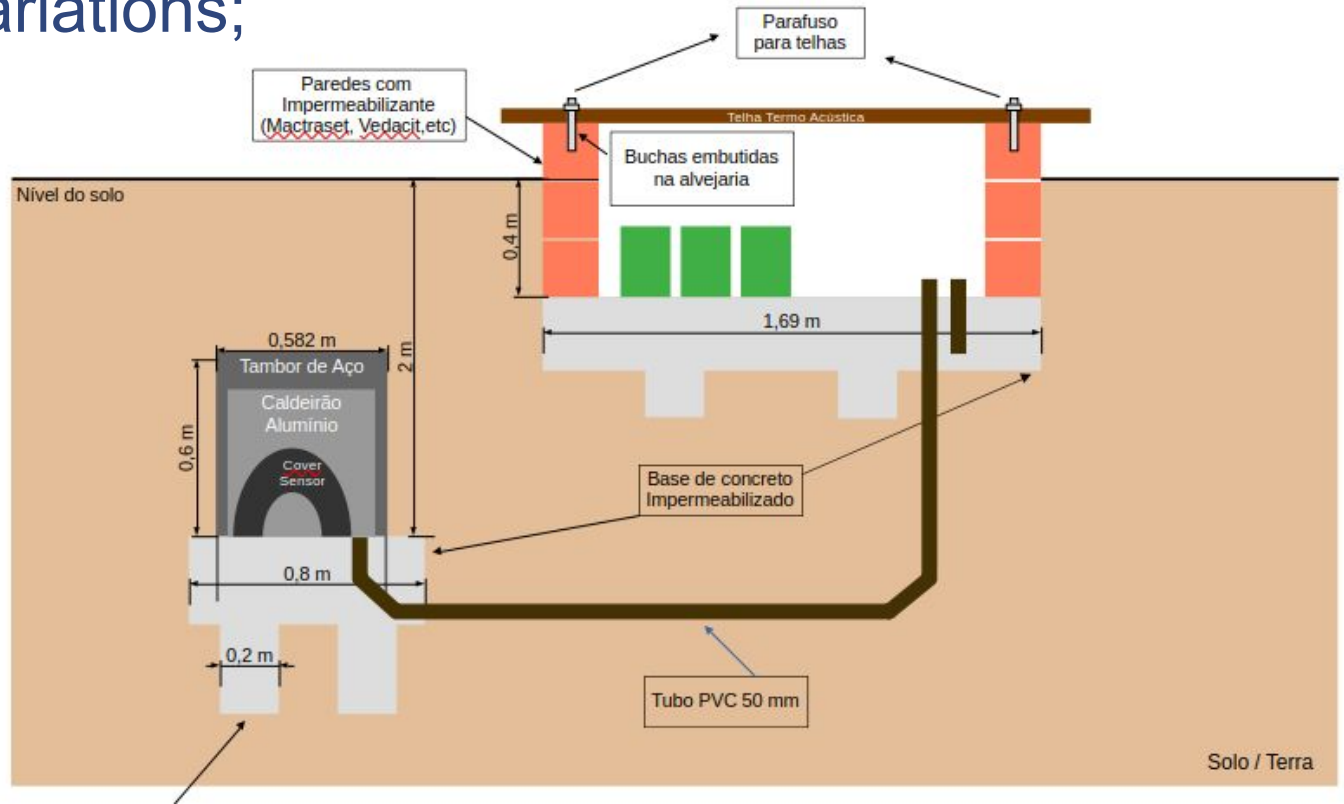
E. PDF

Study Area

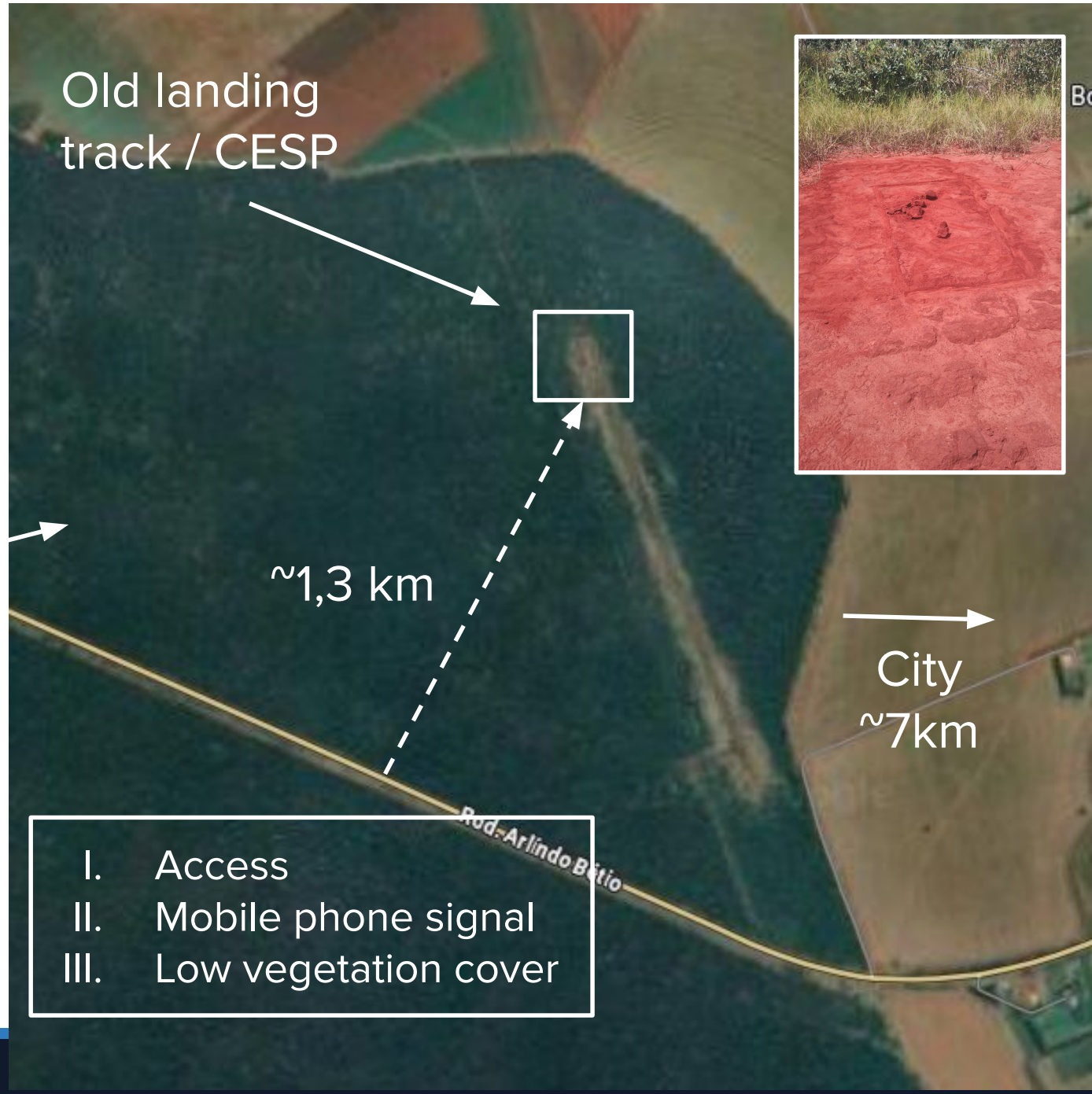
- ➔ No rock outcrops are easily accessible in the whole region;
- ➔ Instrument housing was not safe designed for maintenance.

Installation proposal

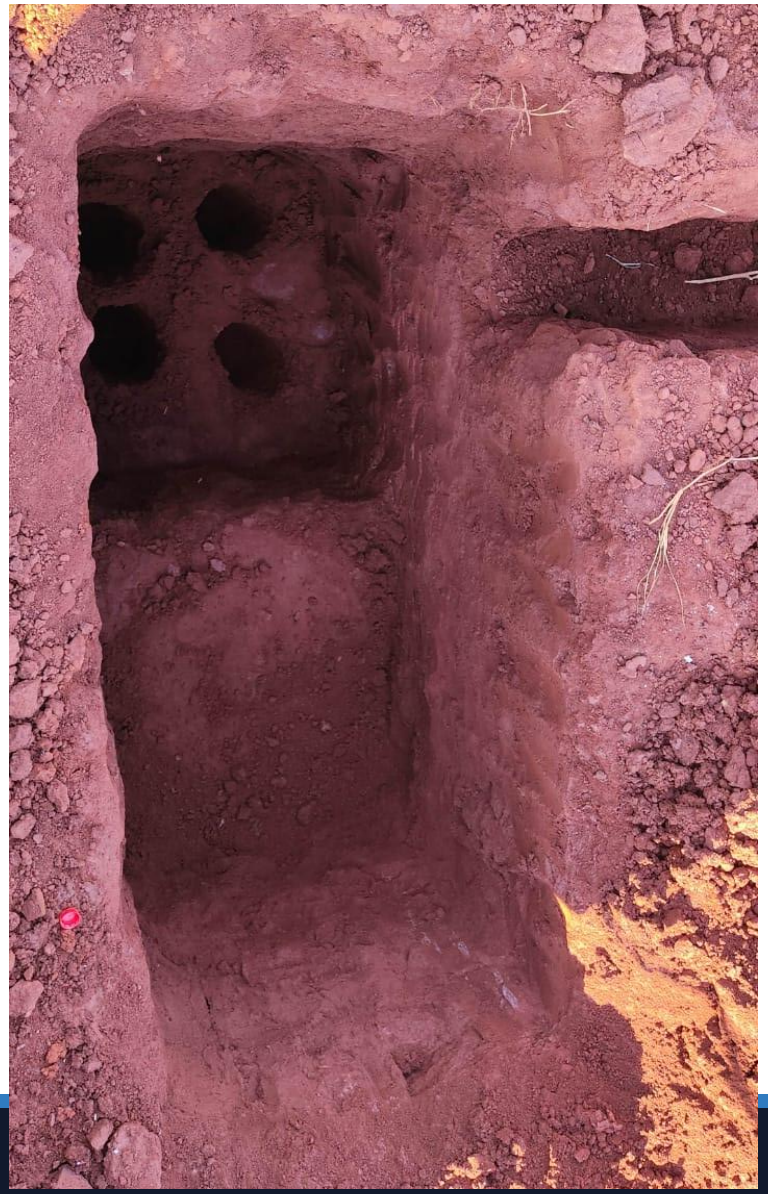
- Propose a standard installation method for soil stations;
- Minimize the surface footprint of the station;
- Isolate from surface temperature variations;
- Ensure a low humidity level;
- Move noise sources as far away as possible from the installation;
- Use a Raspberry Pi with temperature, pressure, and relative humidity sensors to monitor installation.



Morro do Diabo state park



Construction

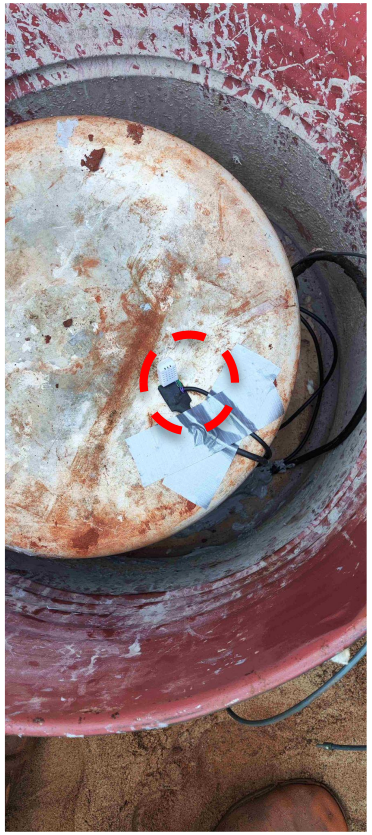


Sensor Installation

Drum

Sensor

Cover



Metal Pan

Coal

Drum Cover

Solar Panel and connections

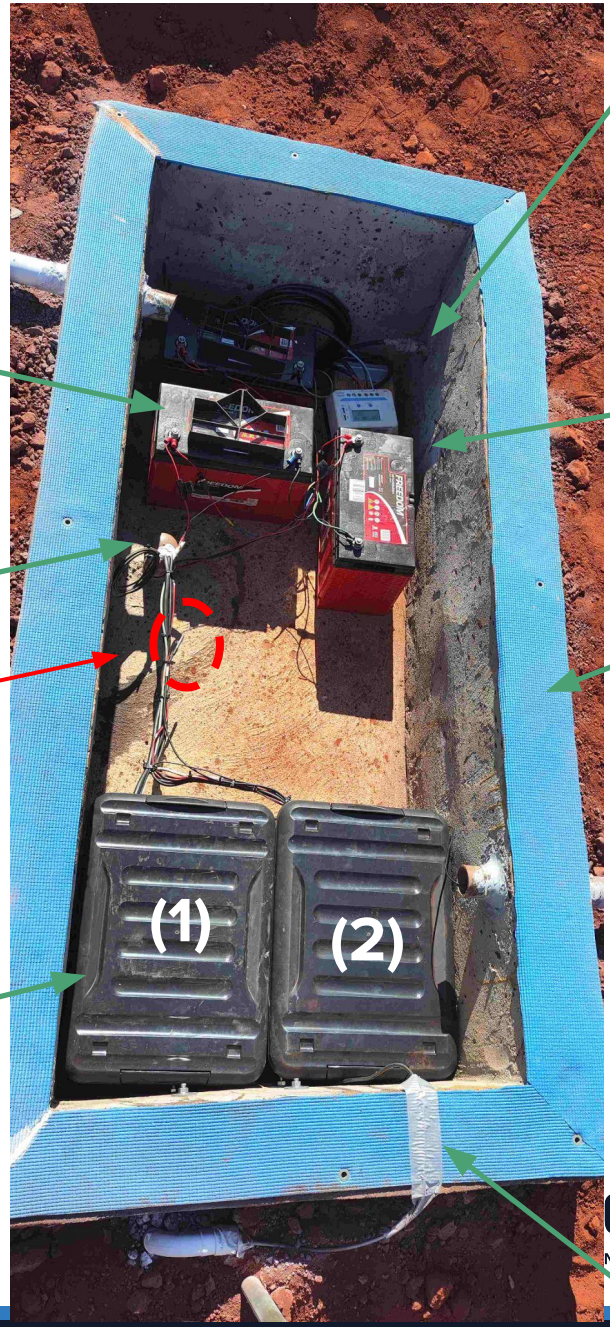
Ventilations

Stationary battery

Sensors cable

Temperature sensor

Digitizer (1); Modem and Raspberry Pi (2)



Solar Panel

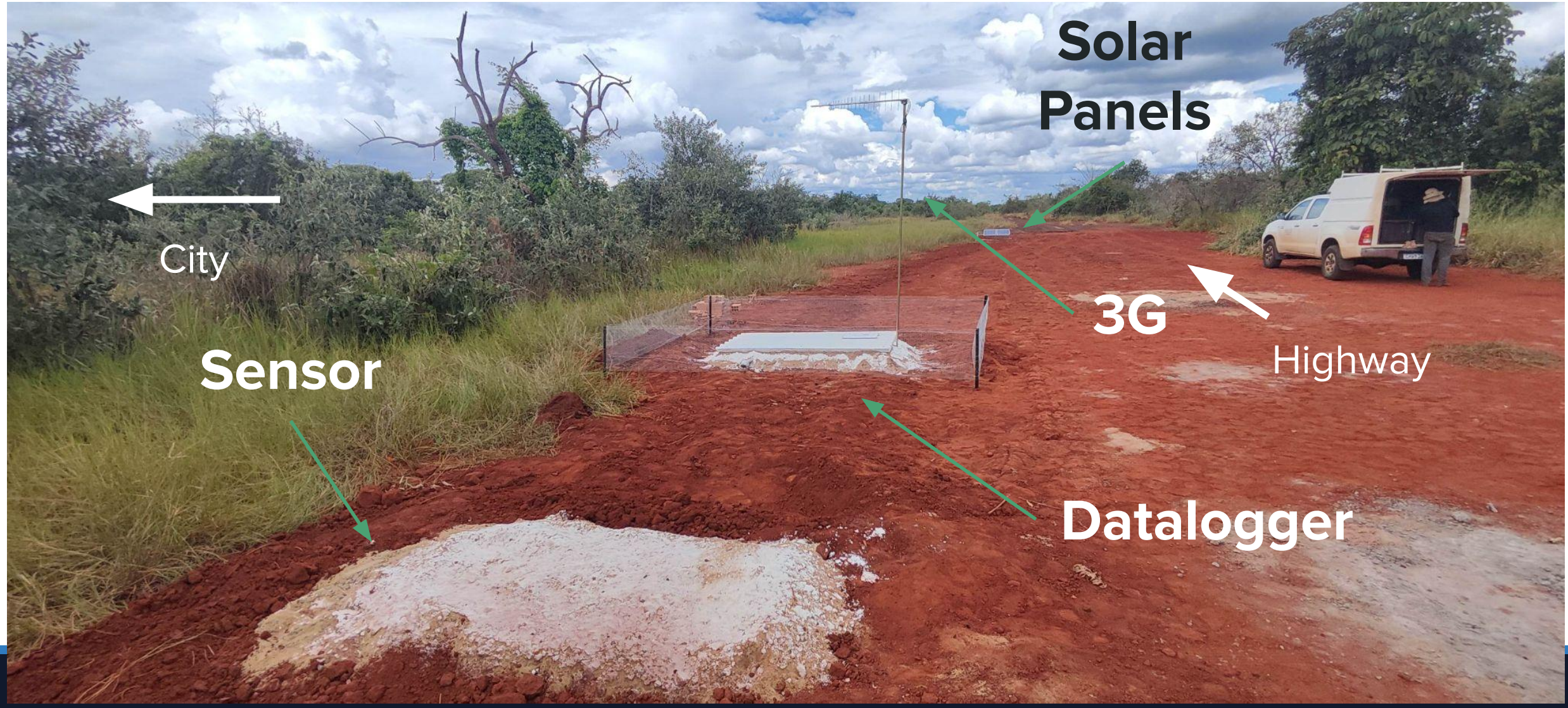
Solar charge controller

Tile seal

Ventilations

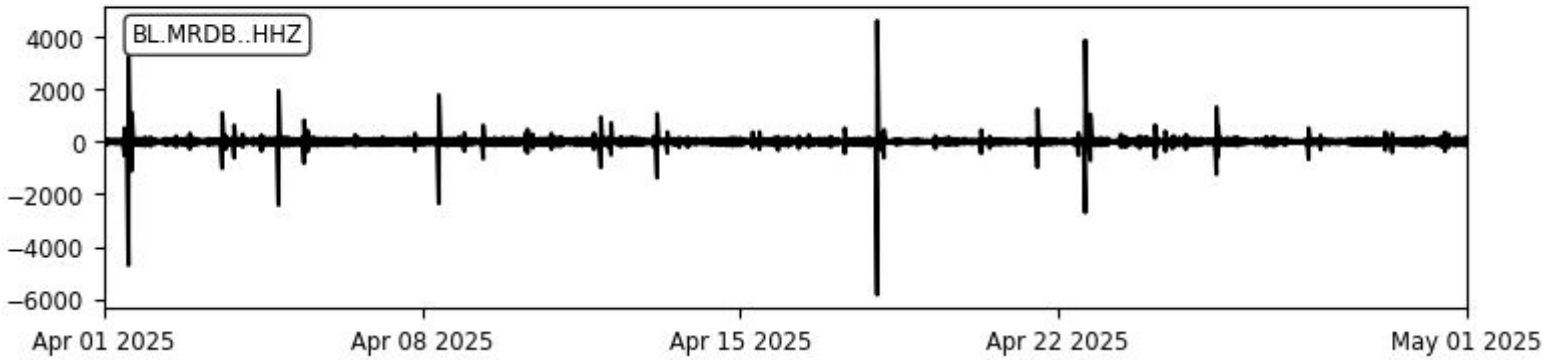
Cabo antena 3G

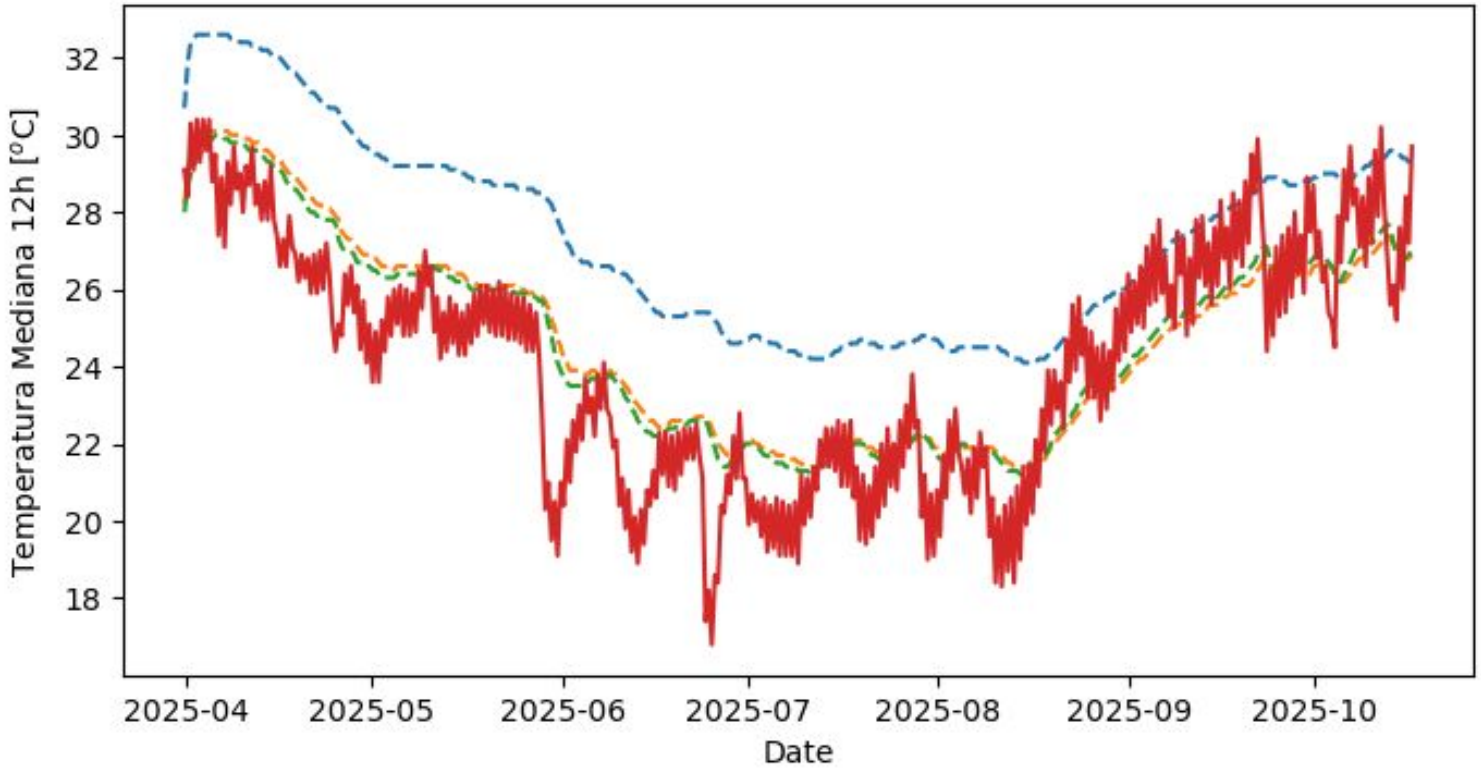
Results



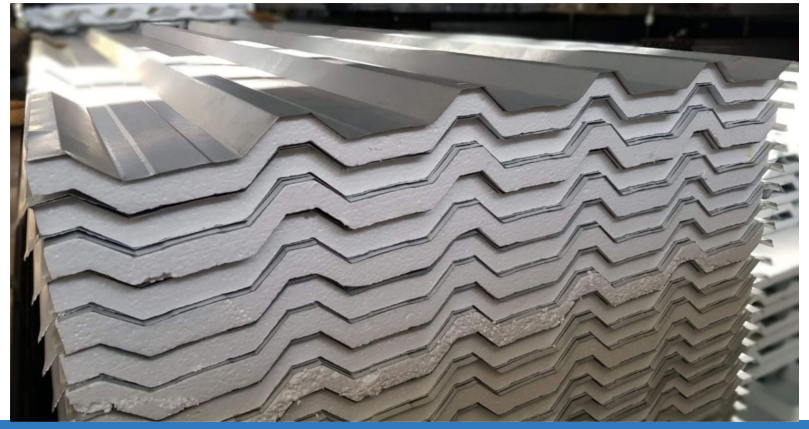
Collected Data

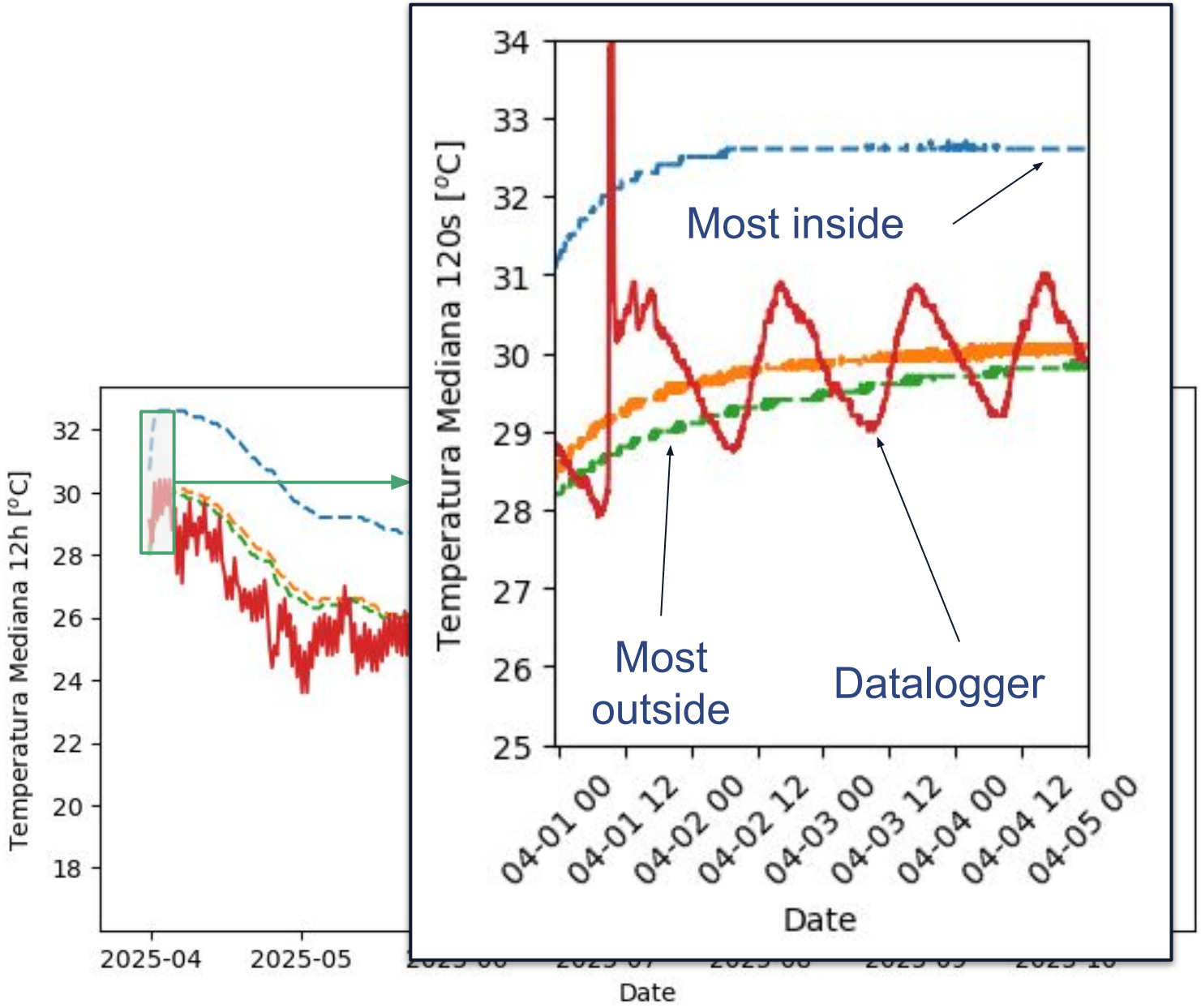
- Data transmitted to IAG:
  - Ground movement (Seedlink/NMX)
  - Environmental data, collected every minute, are transmitted via implemented web-push protocol.





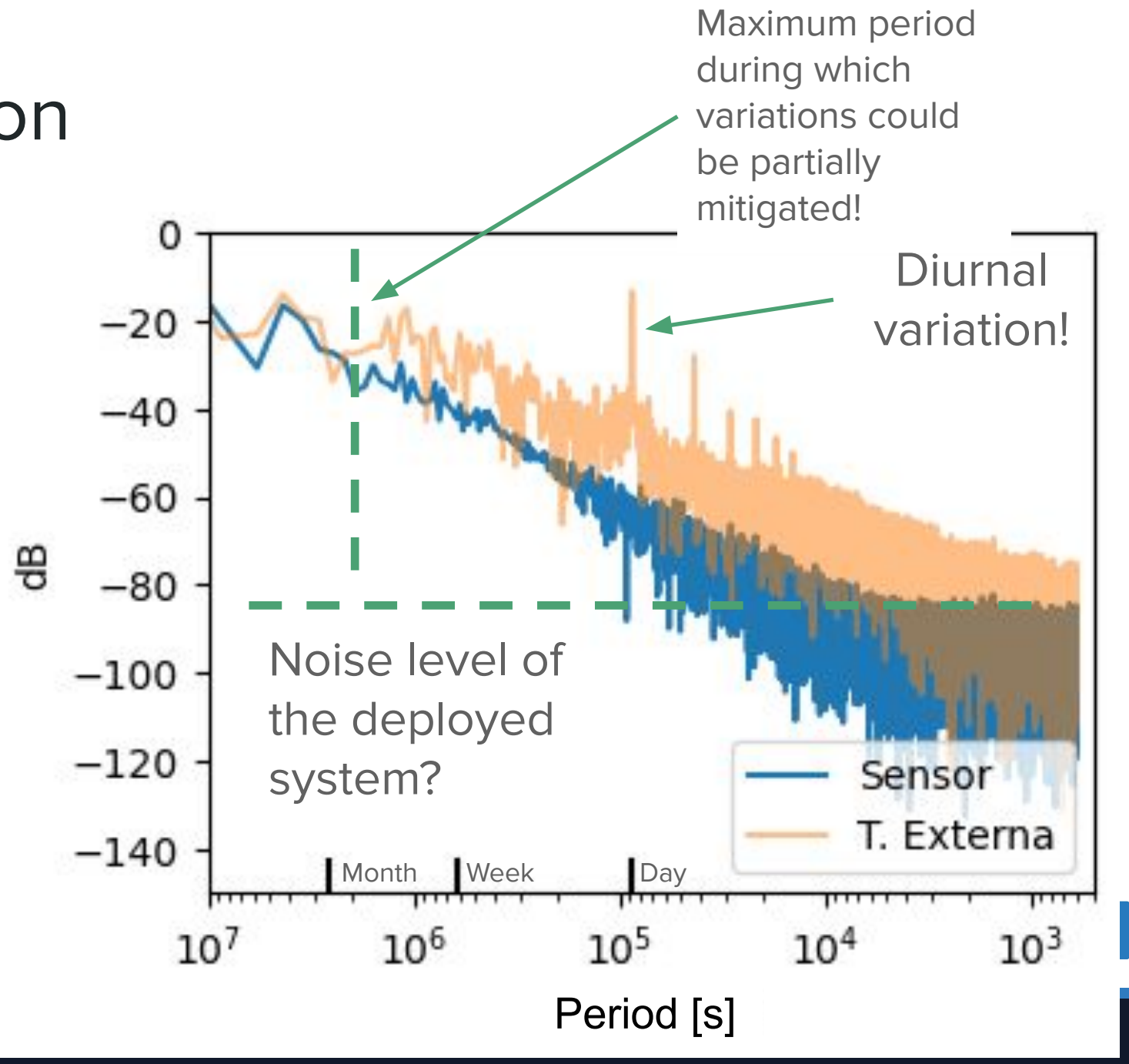
- The seismic sensor heats the "vault" by ~3°C;
- The sensor temperature is following the inter-monthly average;
- The diurnal variation with the "thermal cover" remains within the range of ±2°C (10 - 30°C).





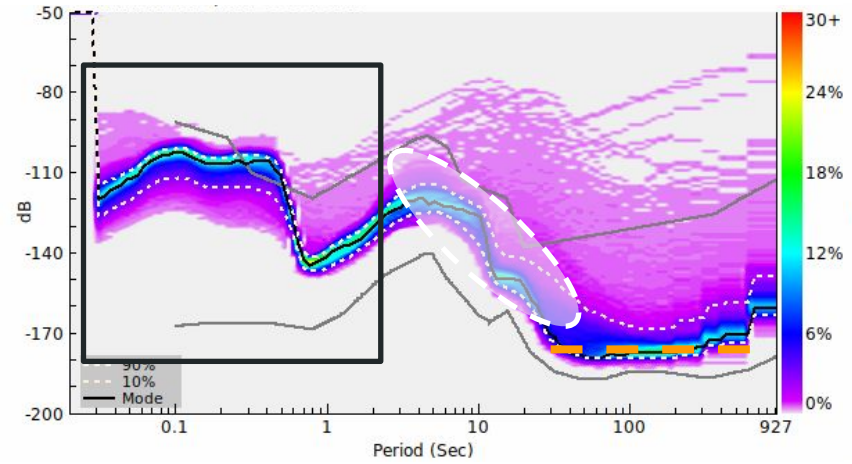
Temperature attenuation

- The FFT of the average temperature (dt = 300 s) shows attenuation of ~20dB for periods up to ~2E6 seconds (~23 days);
- The diurnal variation was suppressed, along its harmonics.

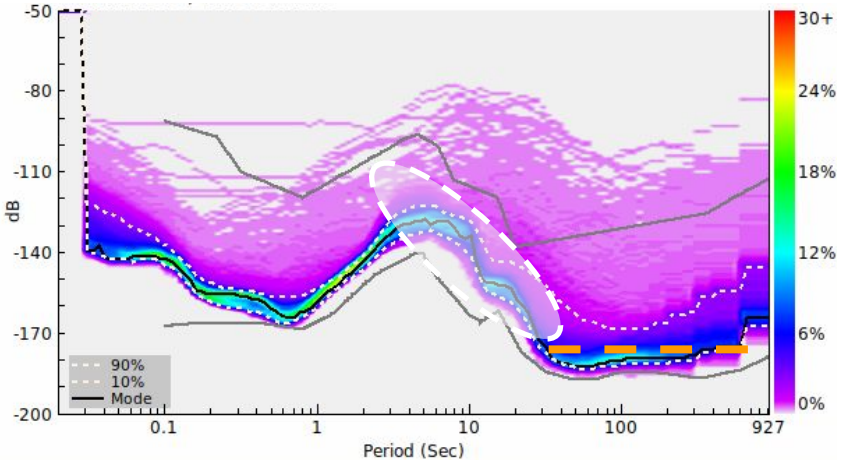


PDF

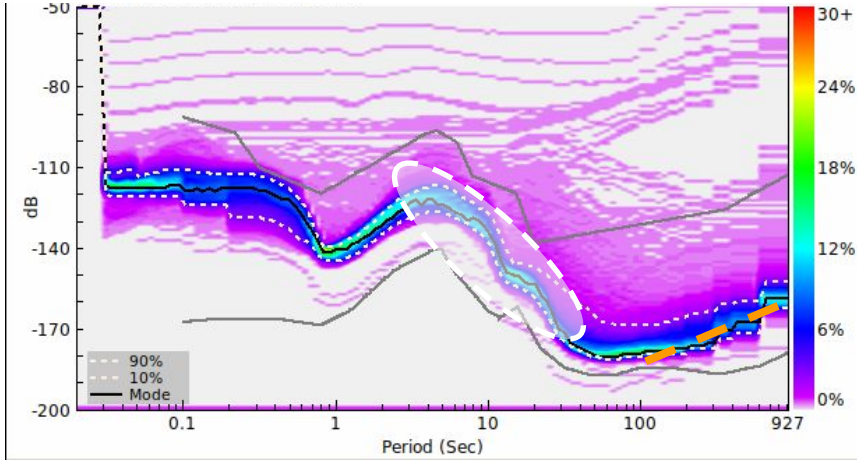
MRDB



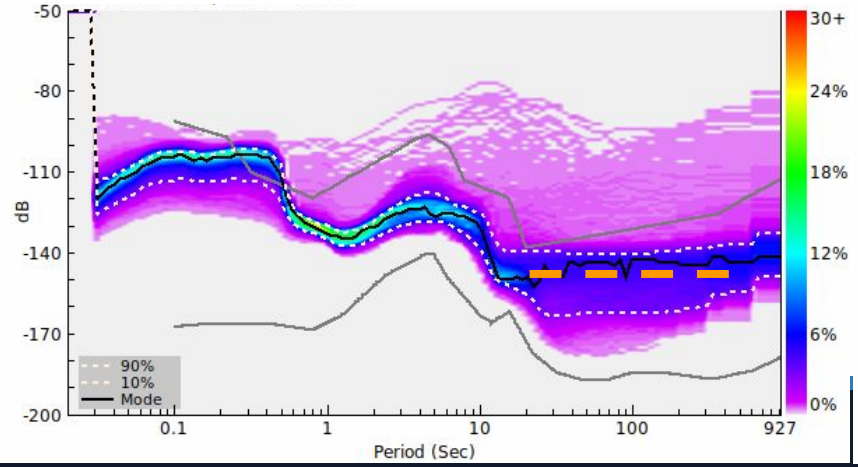
IHP

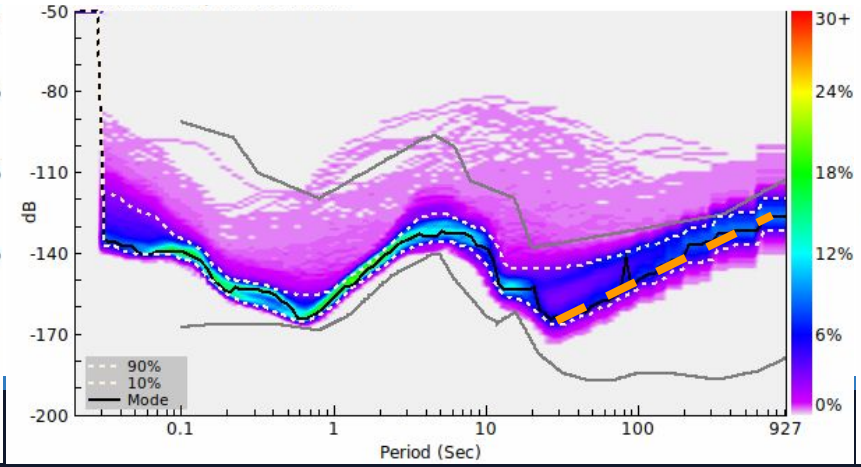


TRCB

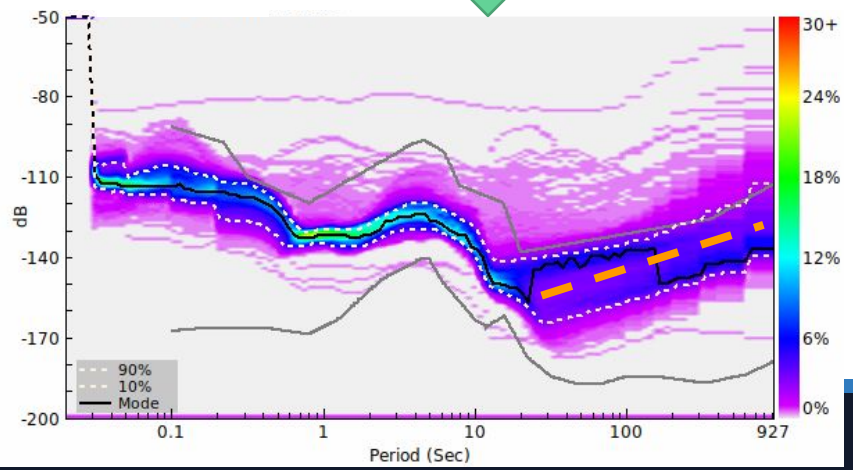


Vertical

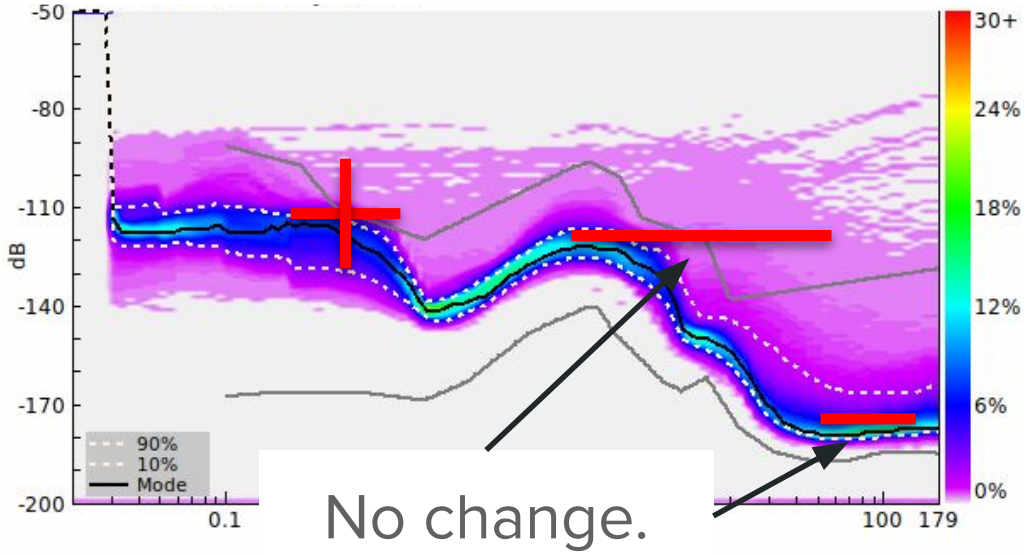




Horizontal

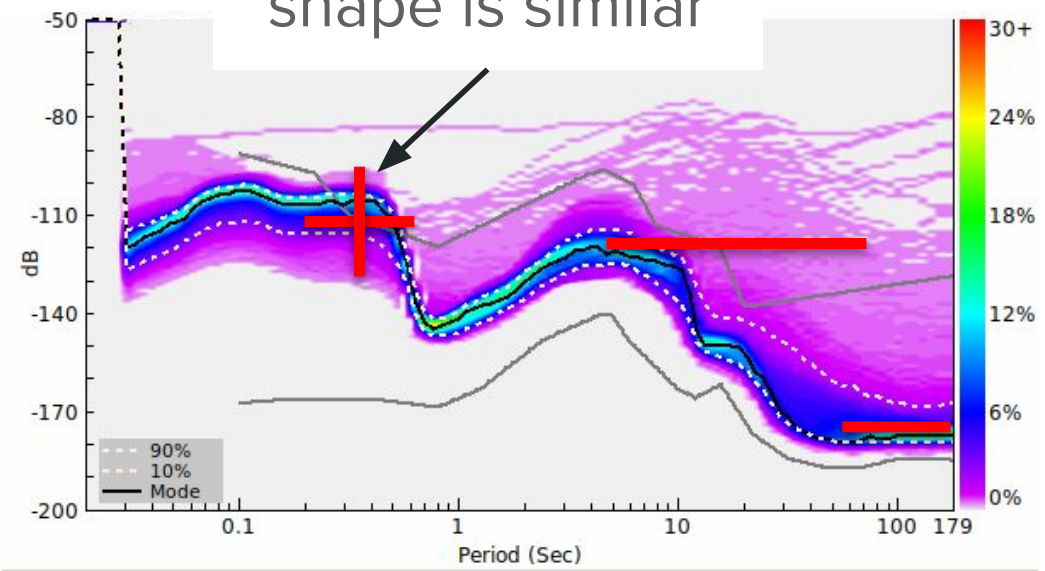


Comparing



No change.

worst?
shape is similar

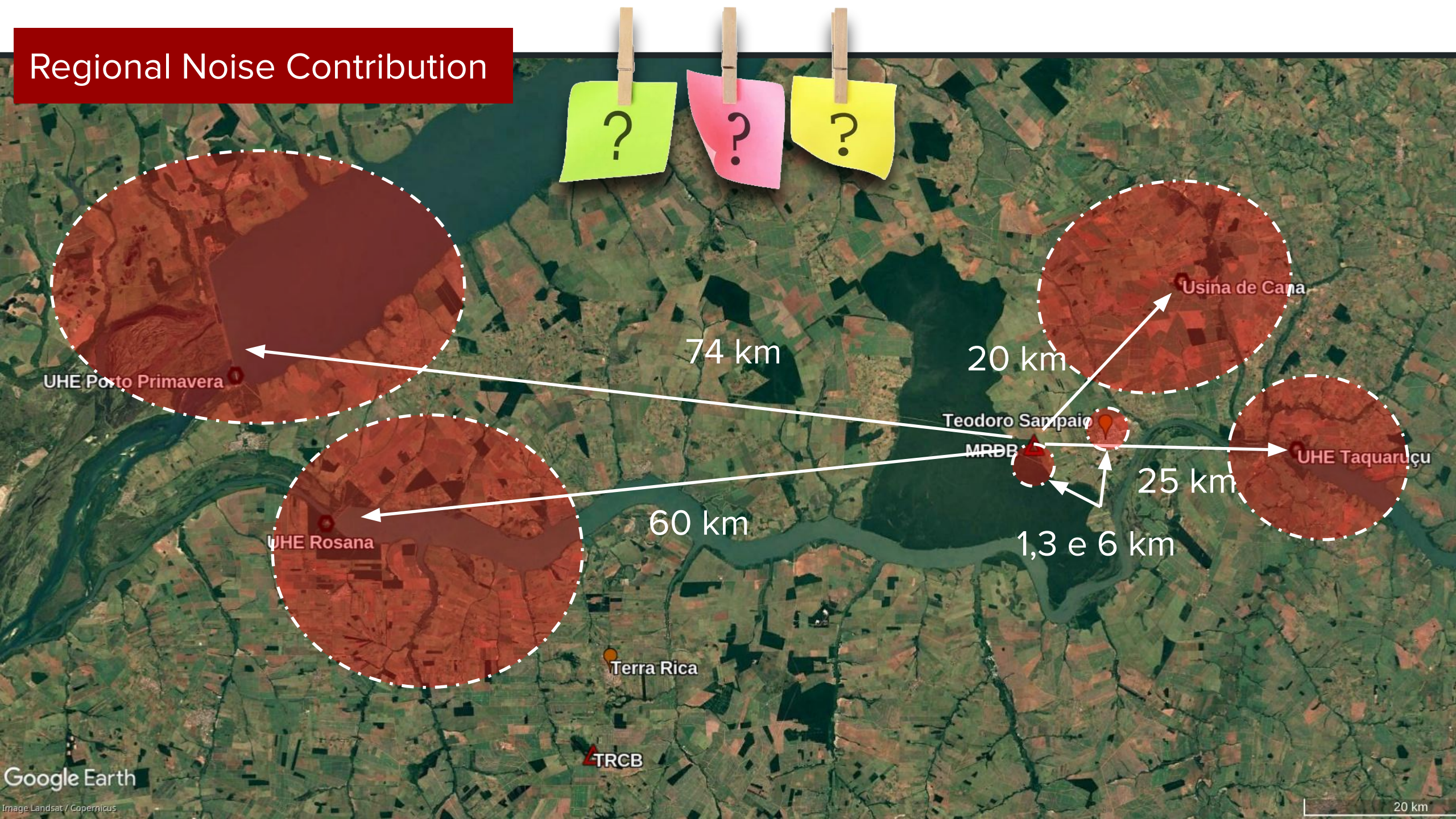


TRCB

MRDB

Not all the noise was coming from the farm!

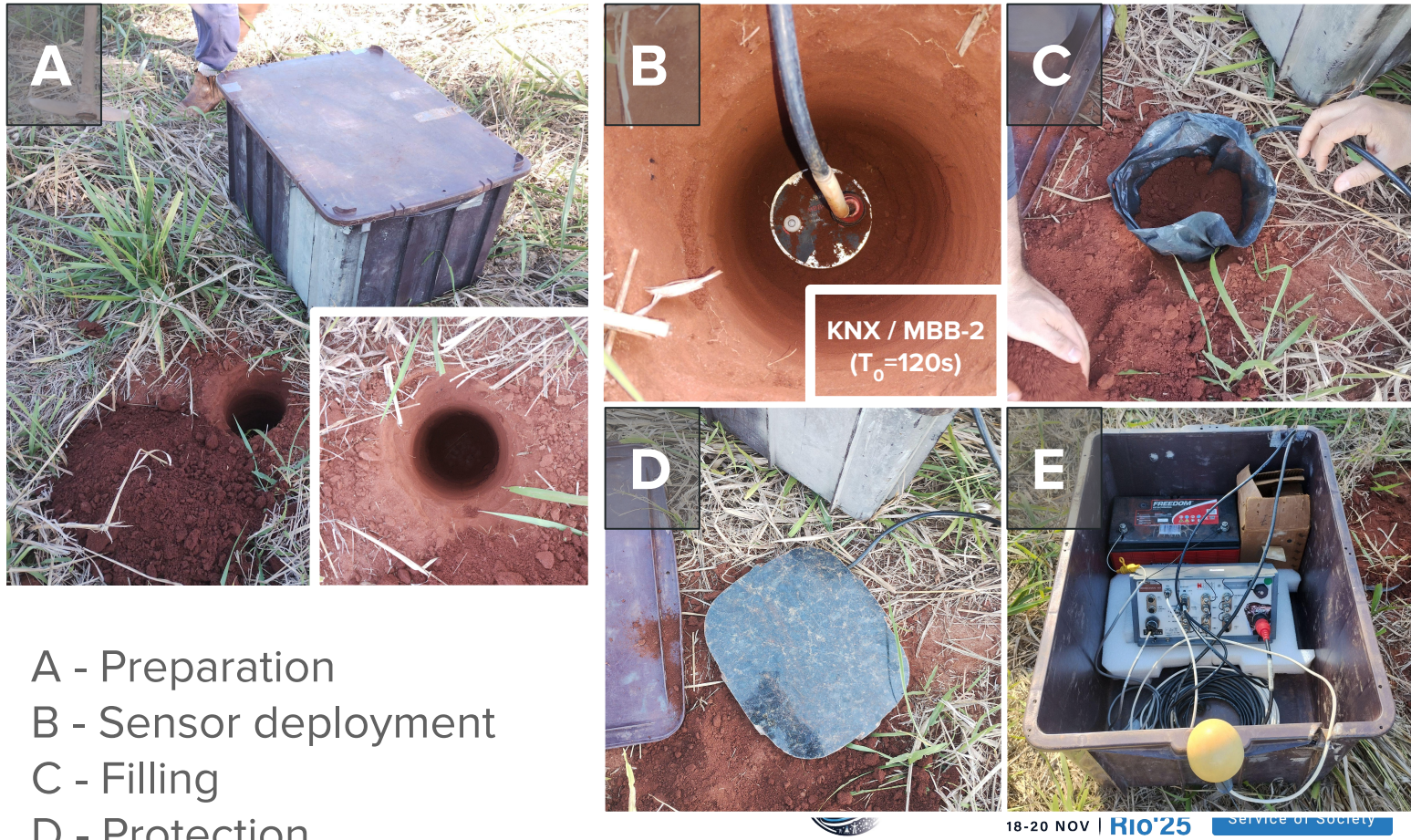
Regional Noise Contribution



Noise Evaluation: Another approach

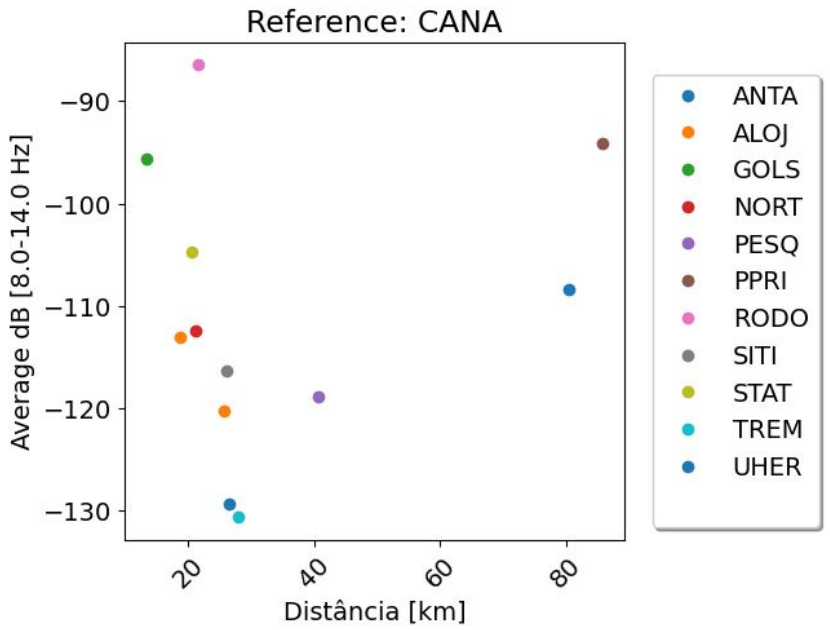
- Noise polarization [***presentation, Nov 19th, 14:00 - 17:40, Code P7-8***] (*Amaral, C., 2025*);
- Noise Amplitude:
  - Campaigns of 6 - 12 *hours* at fixed points;
  - Search for alternative relocation points;
  - Validation of **MRDB sensor**.

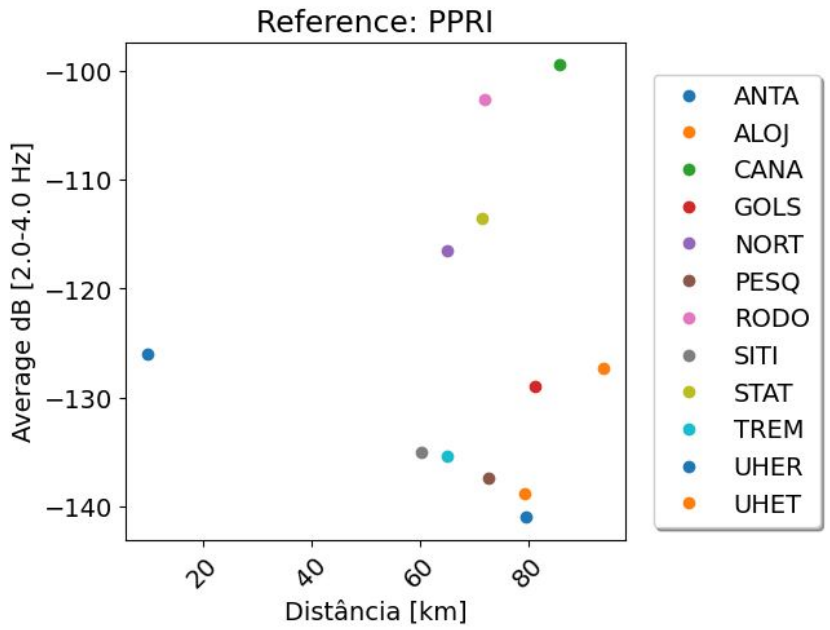
Field procedures

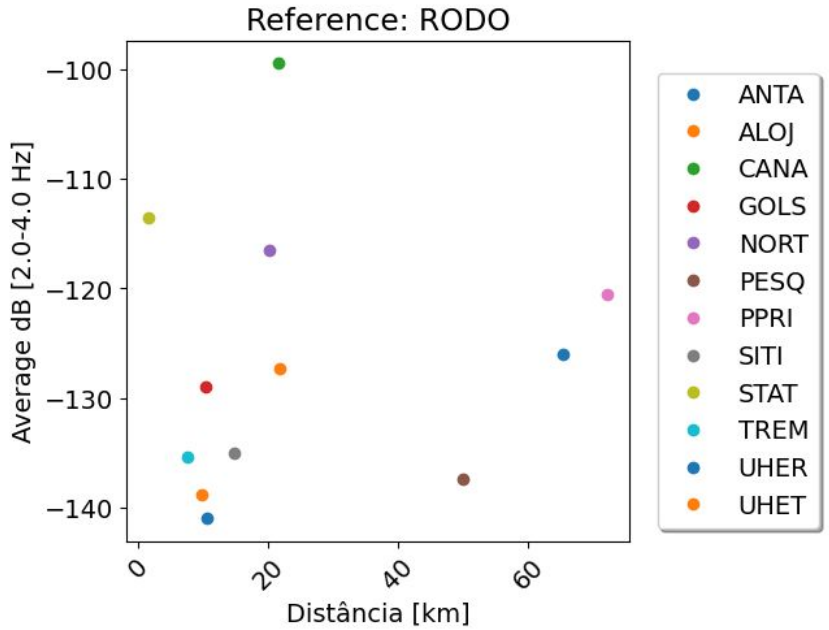


A - Preparation
B - Sensor deployment
C - Filling
D - Protection
E - Recording

Results (*Noise vs Distance*)







Atvos
sugarcane
processing plant

(8 - 14 Hz)

Porto primavera
(hydroelectric)

(2 - 4.0 Hz)

Road

2 - 4 Hz

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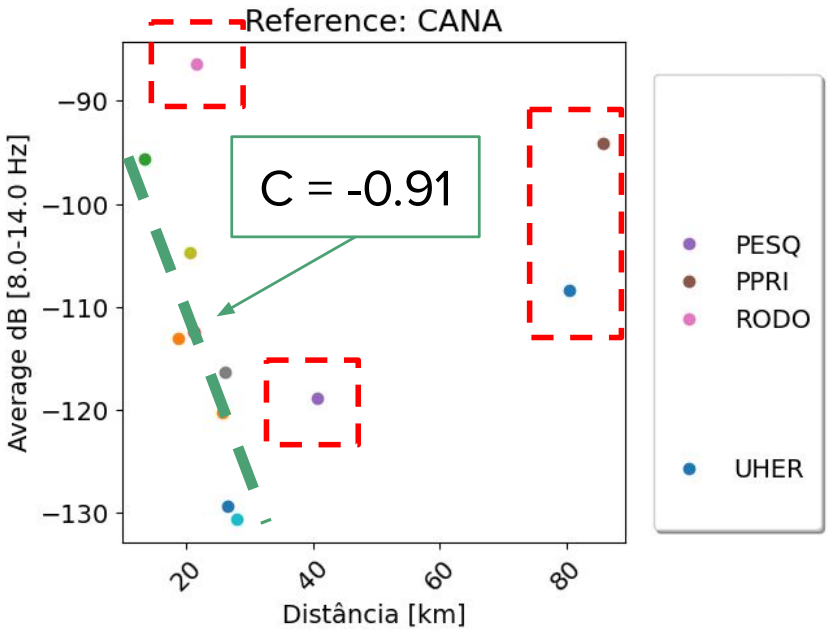
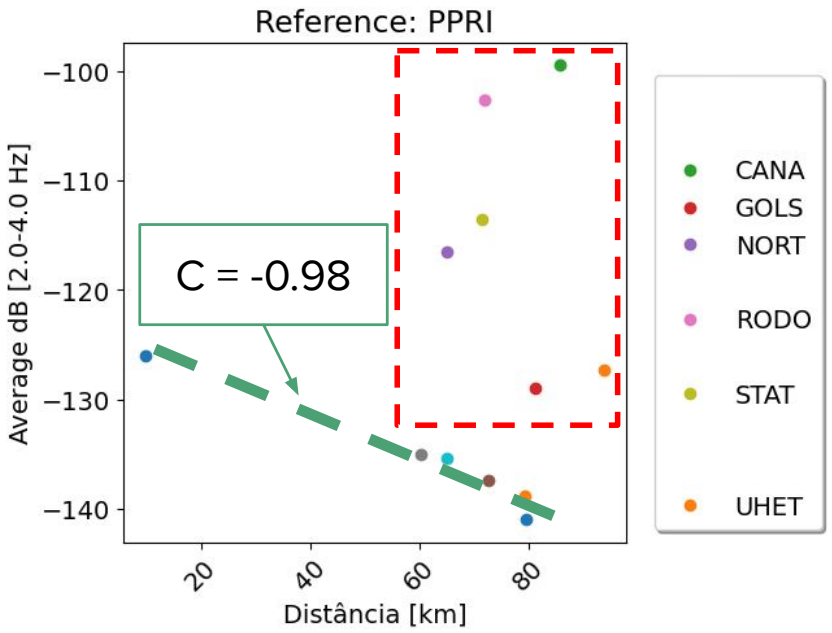
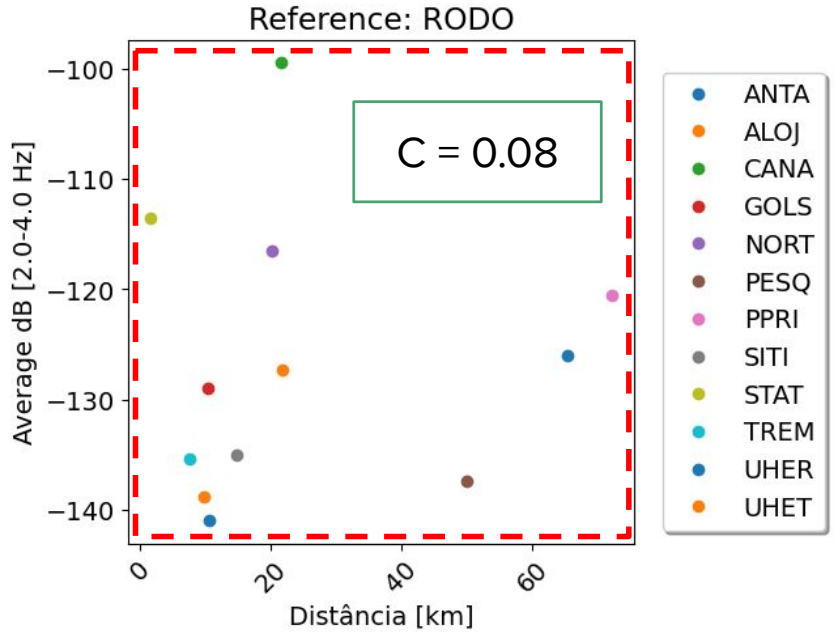
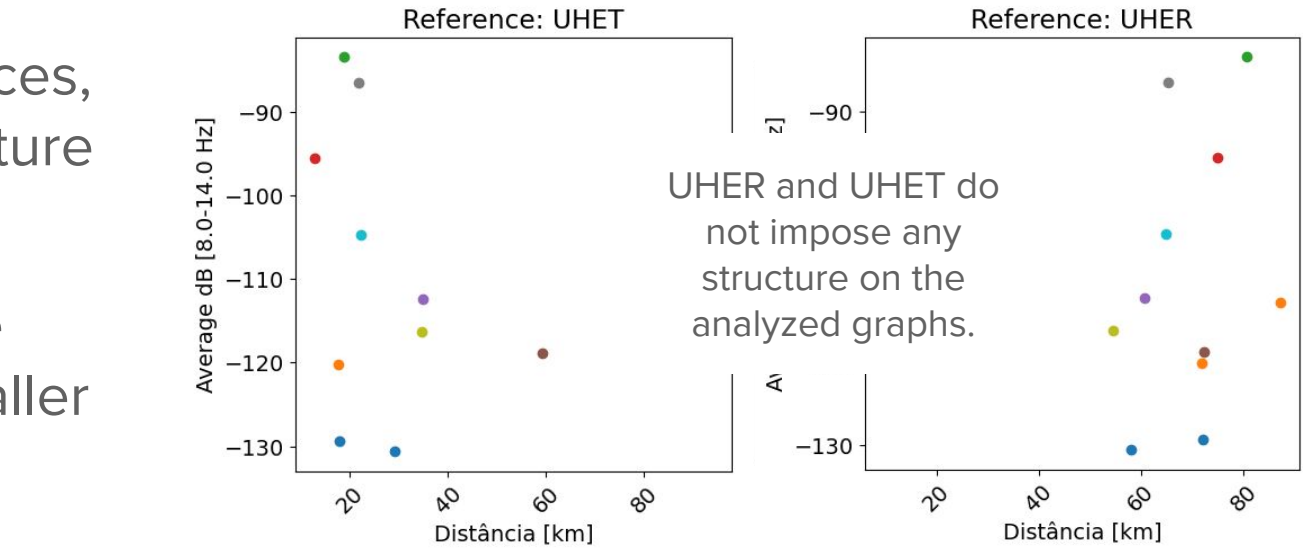






- Regionally, we have two clear sources, **CANA** and **PPRI**, which show structure on the noise by distance graphs.
- The highway apparently affects the MRDB station locally, but has a smaller amplitude than CANA!



UHER and UHET do not impose any structure on the analyzed graphs.

Conclusions

- A standard form of sitting instruments when no rocks are available was proposed.
- Using a Raspberry Pi set of sensors the efficiency of the temperature insulation could be evaluated along with long period signals.
- Regional noise sources plays an important role for stations at this specific region, specially from Porto Primavera Hydroelectric and ATVOS Sugar-cane plants.
- A rocky site would be the most reasonable manner to attenuate those signals.
- Future test at Morro do Diabo site would be advisable.

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Thank you

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