

OPERATING CTBTO INSTRUMENTATION UNDER EXTREME CONDITIONS: An example from Costa Rica



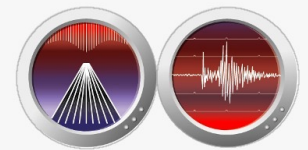
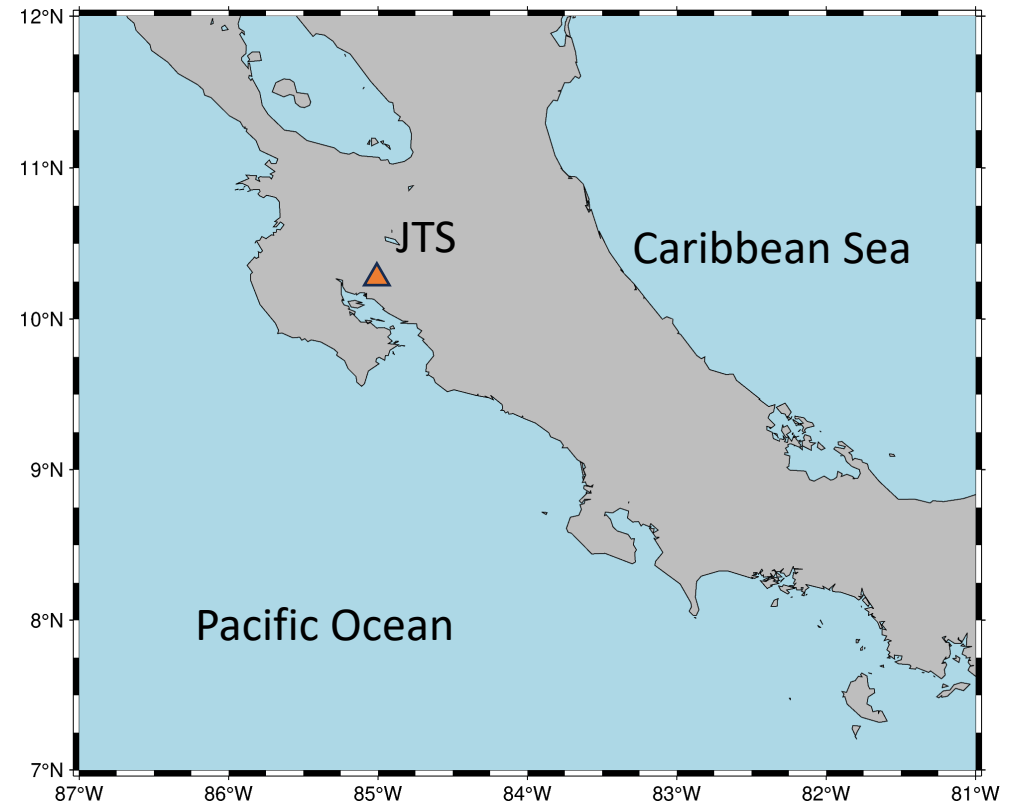


JTS Station: Location and background

- Installed since 1996
- Located in Central America, Guanacaste, Costa Rica
- Inside an old gold mine tunnel.



Location and background



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Weather conditions

Weather Condition	Average
Temperature	27 °C (min 21,4 °C ; max 32,6 °C)
Yearly precipitation	2281 mm
Solar radiation per day	15 to 24 MJ/m2
Dry Season / Rain season	November to March / May to October



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Effects of temperature in communication cable

Temperature's Effect on Ethernet Cable Length				
Worst case ambient temperature	Channel maximum length in meters		Permanent link maximum length in meters	
	Shielded	Unshielded	Shielded	Unshielded
Temperature (°C)				
21	100	100	90	90
27	98	97	88	87
36	97	95	87	85
36	96	93	87	84
38	96	92	86	83

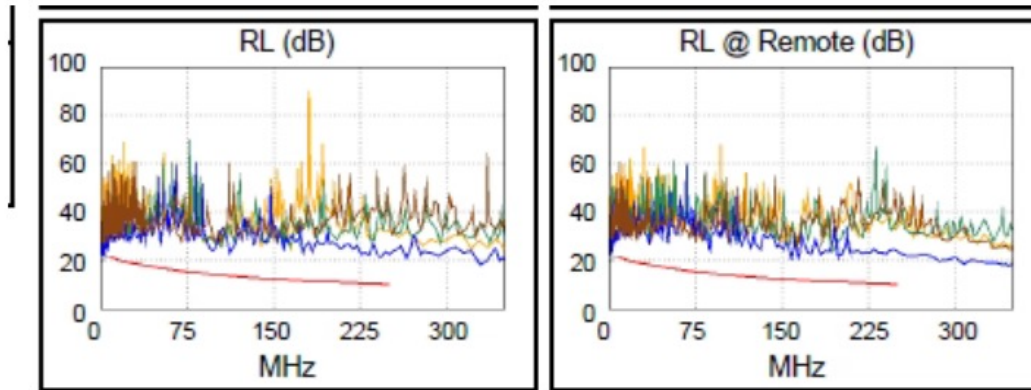


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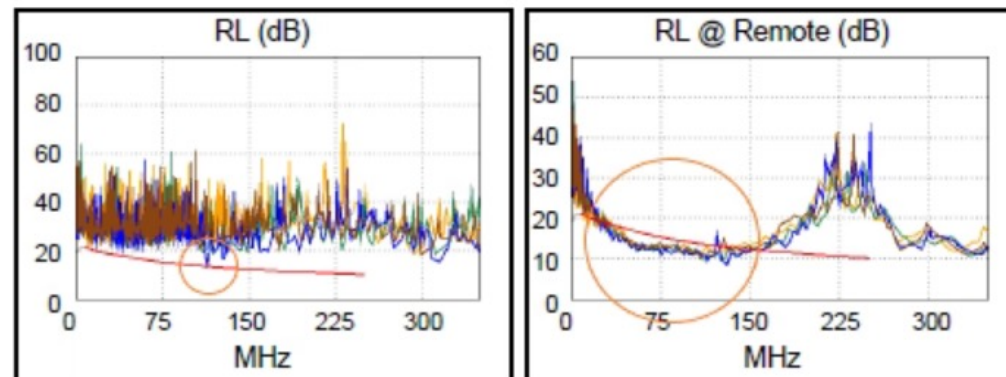
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Effects of humidity in communication cable

First, here is a **good** Return Loss graphic:



Here is a **bad** Return Loss graphic:



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REDUNDANT INFRASTRUCTURE

JTS station instrumentation

Seismic instruments

- 2 Seismic digitizers Q330HR
- 2 seismic broadband sensors (STS 2.5 and STS 6.0)

Telecommunication

- VSAT
- Cellular modem



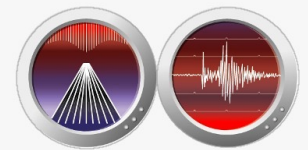
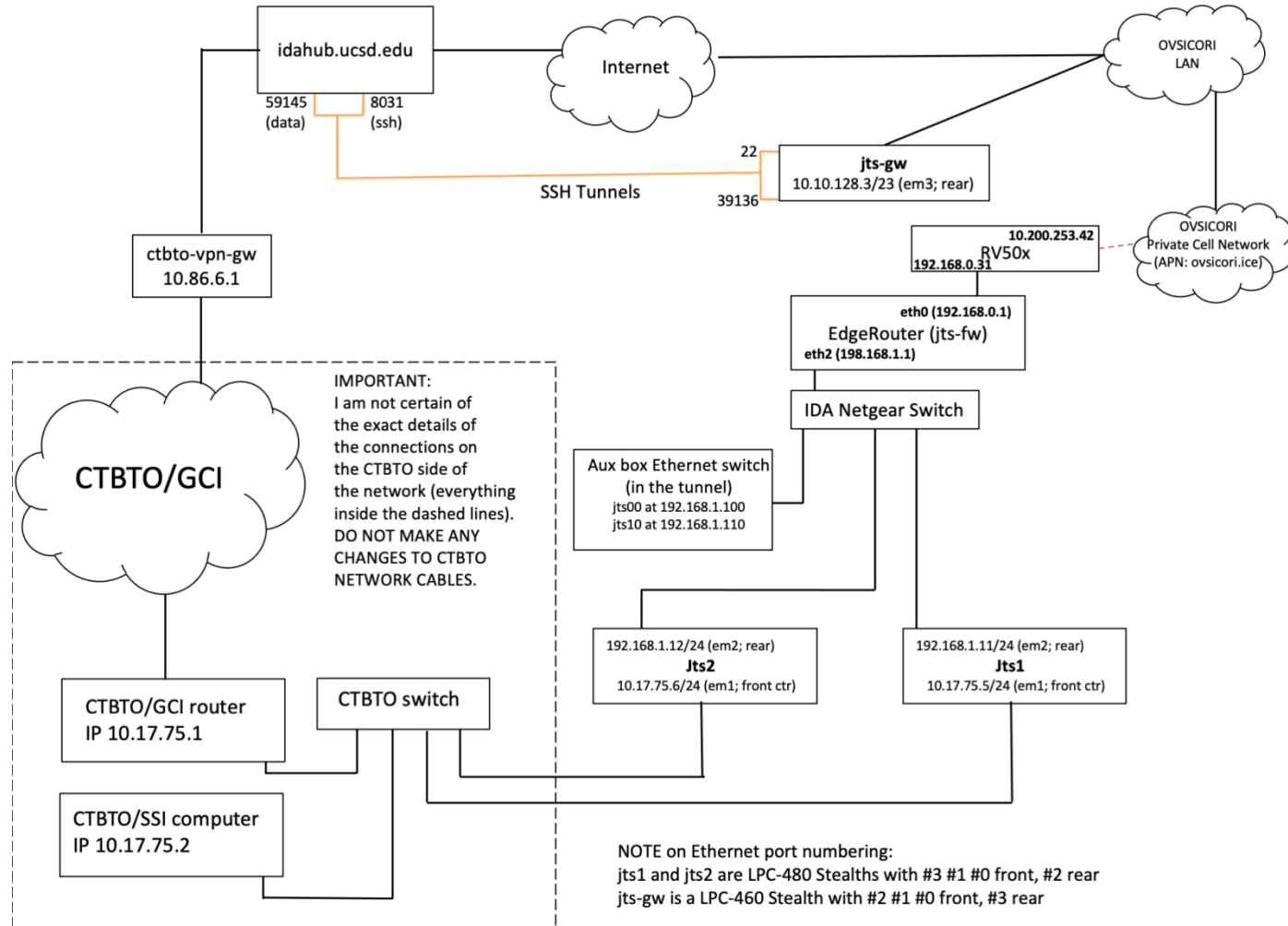
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JTS station network

JTS Seismic Station Network Configuration

Updated October 2022

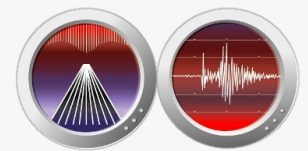


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Why is important the correct data acquisition?

- The continuous operation of CTBT geophysical instrumentation worldwide, has proven to be extremely important for characterizing source processes and atmospheric effects associated with nuclear and chemical tests, especially during complex political climates.
- These observatories have also strengthened the geophysical monitoring capabilities of solid-earth processes like large earthquakes and volcanic eruptions on earth, exponentially increasing CTBTO value nowadays.

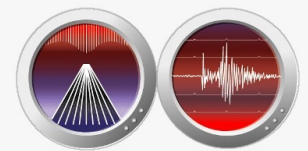


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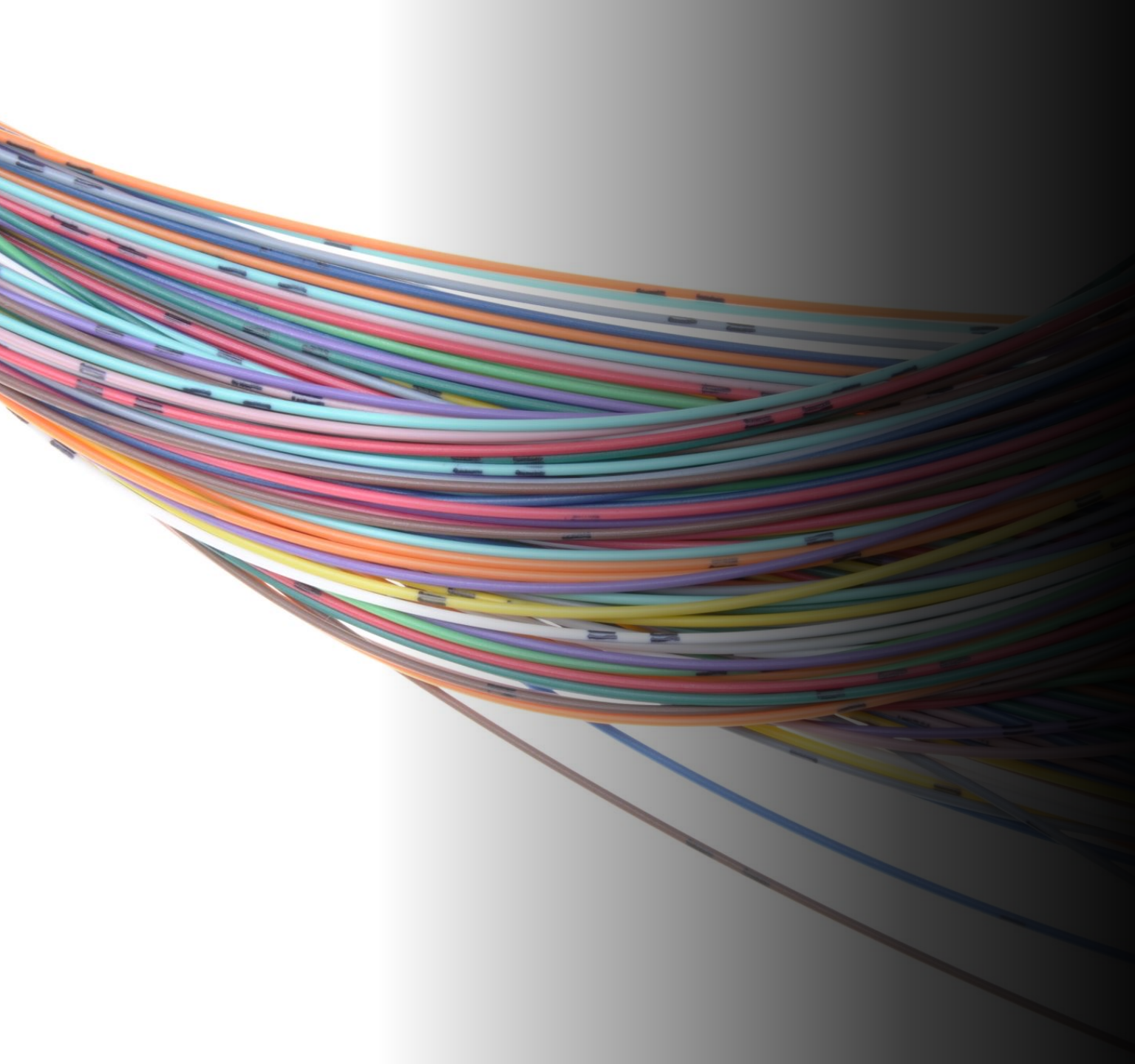
Challenges to keep the station running correctly

Assuring the correct functioning of this instrumentation is hard under the extreme conditions of temperature, humidity, flora coerture and complexity of the tropical forest.



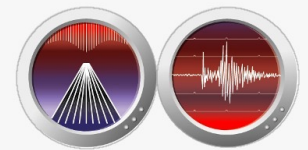
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The problem

Considering the aspects exposed at the beginning of the presentation, we show how under extreme conditions and current infrastructure, the use of UTP cables for data transmission can generate electronic noise of a long period that dramatically affects the quality of the data.



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The solution

- We replace UTP cables with fiber optics to reduce the effects of high temperatures and humidity in the tropical climate, taking advantage of the properties of fiber optics and the transmission of data on this material.

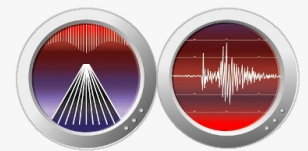


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Advantages of fiber optics

- Working with light
- Increase the distance

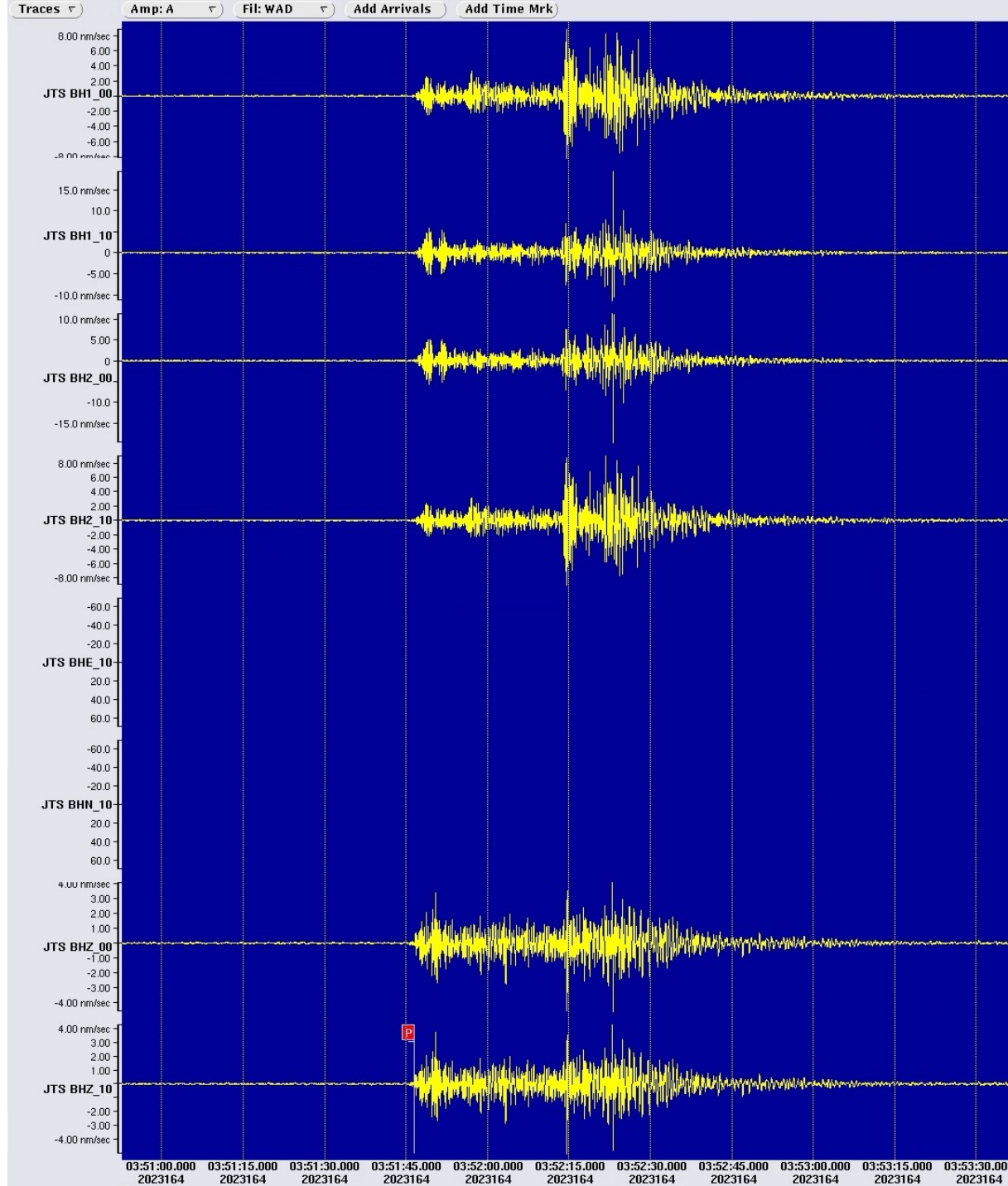


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Results

- No noise



Other improvements

- Furthermore, we show how the use of external antennas helped to stabilize data transmission since current bunker infrastructure decreased the power of cellular communication and transmission of seismological data.

