

Seismic Observations of Bolivia

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1. National Seismic Network

Figure 1 shows the national seismic network under the control of the Observatorio San Calixto. Figures 2(a), 2(b) and 2(c) show the detail of Figure 1.

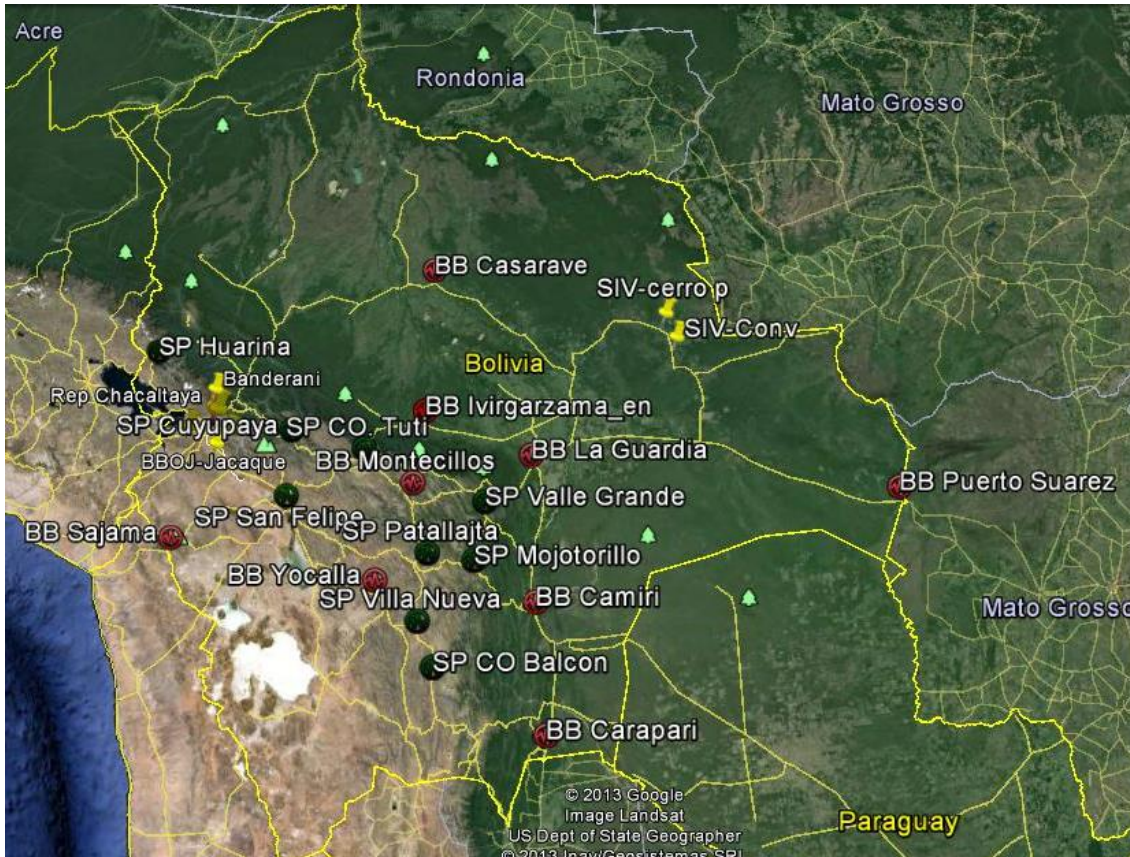


Figure 1. Seismic Network of Observatorio San Calixto.

- Red: Guralp 6TDE Broad Band Stations
- Dark Green: Sixaola Short Period Stations.
- Light Green: Infrasonic Array.
- Yellow: Analogic Short Period Stations
- Light Orange: Analogic Stations Repeaters



Figure 2(a). Seismic Network (detail).

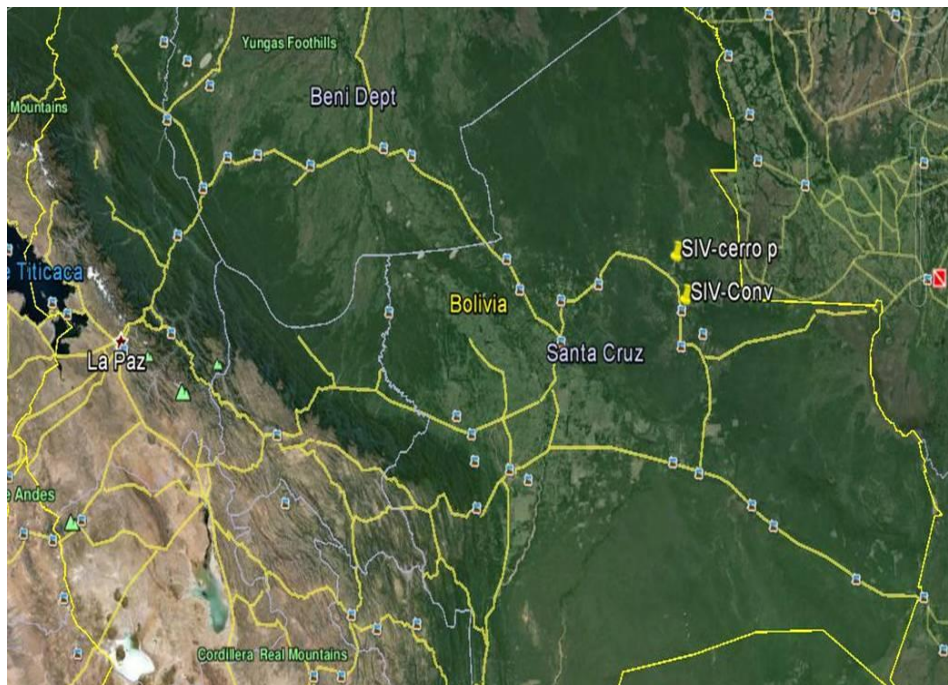


Figure 2(b). Seismic Network (detail).



Figure 2(c). Seismic Network (detail).

The Observatorio San Calixto has five seismic stations which were installed around La Paz before 2010. All of them are short period with one vertical component operated under the French cooperation. These stations are all analog with also telemetric analog transmission. Outside La Paz there are two stations, which are digital and composed by three short period sensors and three long period sensors. They belong also to the French cooperation and they are a part of the IMS as AS08 station. In La Paz we also installed one infrasonic array near to “Peñas” town; it is also a part of the IMS as IS08 station with the French cooperation. We have one station called PS06 near Milluni; it is a station with one short period and one broad band three component stations, which is also a part of IMS with the AFTAC cooperation.

After 2010, the Observatorio San Calixto improved the seismic network adding eighteen new stations all around Bolivia, eight broad band stations and ten short period stations; the broad band station are Guralp 6TDE and the short Period stations are Sixaola.

1.1 Analogical Seismic Network

The San Calixto analogical seismic network is composed of five seismic stations and all of them are short period sensors and only have one vertical component. They are located around La Paz-Bolivia and this network has the collaboration with CEA/DASE French cooperation.

1.2 Infrasonic Array

It is composed of four stations including the central facility station that is known by the code as IS08. The treatment is digital because the MB2000 micro barometer is linked directly to an AUBRAC 24 bits digitizer with the authentication function. The data is forwarded to the central facility through RF link, at 400Mhz, and the RF links do not exceed 1 Km. The infrasonic array IS08 uses the polling mode to get all the data in just one point (central facility), and the polling mode is also known as the master-slave topology in which the data is also forwarded through VSAT.

1.3 LPAZ Seismic Station

The LPAZ station has been nominated as one of the most important seismic stations in the world, because the data quality is over the required parameters, that is why both sensors (short period and broad band) are inside a borehole. The code for LPAZ is PS06, the treatment is also totally digital, and the seismic signals are digitized with a 24 bits digitizer called AIM24S. Then the authentication runs over the streams; after that the data is send to San Calixto Observatory through a RF link using the FREEWAVE radio on 900Mhz.

1.4 New Observatorio San Calixto Seismic network

Our new Seismic network has eighteen stations, eight broadband sensors and ten short periods sensor; the broadband sensors are Guralp 6TDE, the short period sensors are Sixaola geophones, and the data link is sponsored by ENTEL. We use their IP-MPLS network to get back the data in the Observatorio San Calixto, and we route all data to the main Entel backbone, from where we received the data in real time.

1.5 Accelerometers

To start the seismic hazard research in La Paz-Bolivia, the San Calixto Observatory installed one accelerometer inside the Public University (Electronic Career), as we need the data in real time to start the research and the secure protocols and politics are too closed inside the Public University. We started to develop a IP_Linux Tunnel through the Public University and the Observatorio San Calixto, it means, the data is “jumped” from the Public University firewalls and arrived to our NDC in real Time.