

Moad Chikh* (1), Rabah Bensalem (1), El Hadi Oubaiche (1), Mohand ou Abdellah Bounif(2), Bouziane Djilali (1)

(1)Centre National De Recherche Appliquée En Génie Parasismique (CGS), Algeria

(2) Université des sciences et de la technologie Houari-Boumediène, Algeria

* chmoad2001@hotmail.com

T4.1-P28



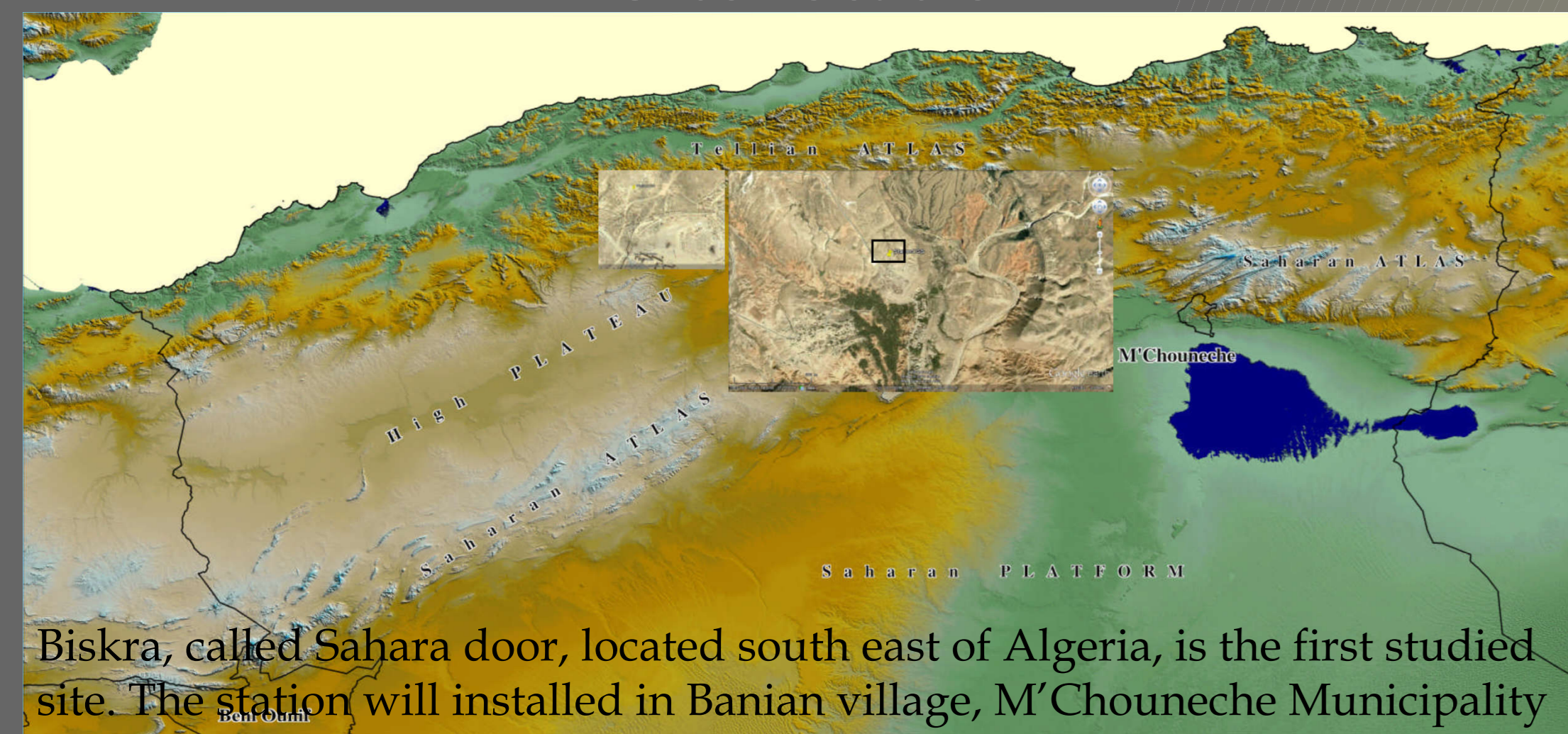
Centre National de Recherche Appliquée en Génie Parasismique (CGS)

INTRODUCTION

As part of its monitoring activities, the National Center of Applied Research in Earthquake Engineering Algeria (CGS) includes a National strong motion accelerometers network (335 stations), and a National Broadband seismic network (five stations) located in northern part of the country. In the effort to install the Broadband stations a methodology was adopted, inspired from the international standard and adopted with local needs.

As first step administrative contacts was made with the local authorities in concerned Wilaya (departments), then in sites visit and primary site selection, followed by geophysical field studies, then shelter building and final installation. Three sites was obtained and geophysical studies at each site was undertaken.

Site location



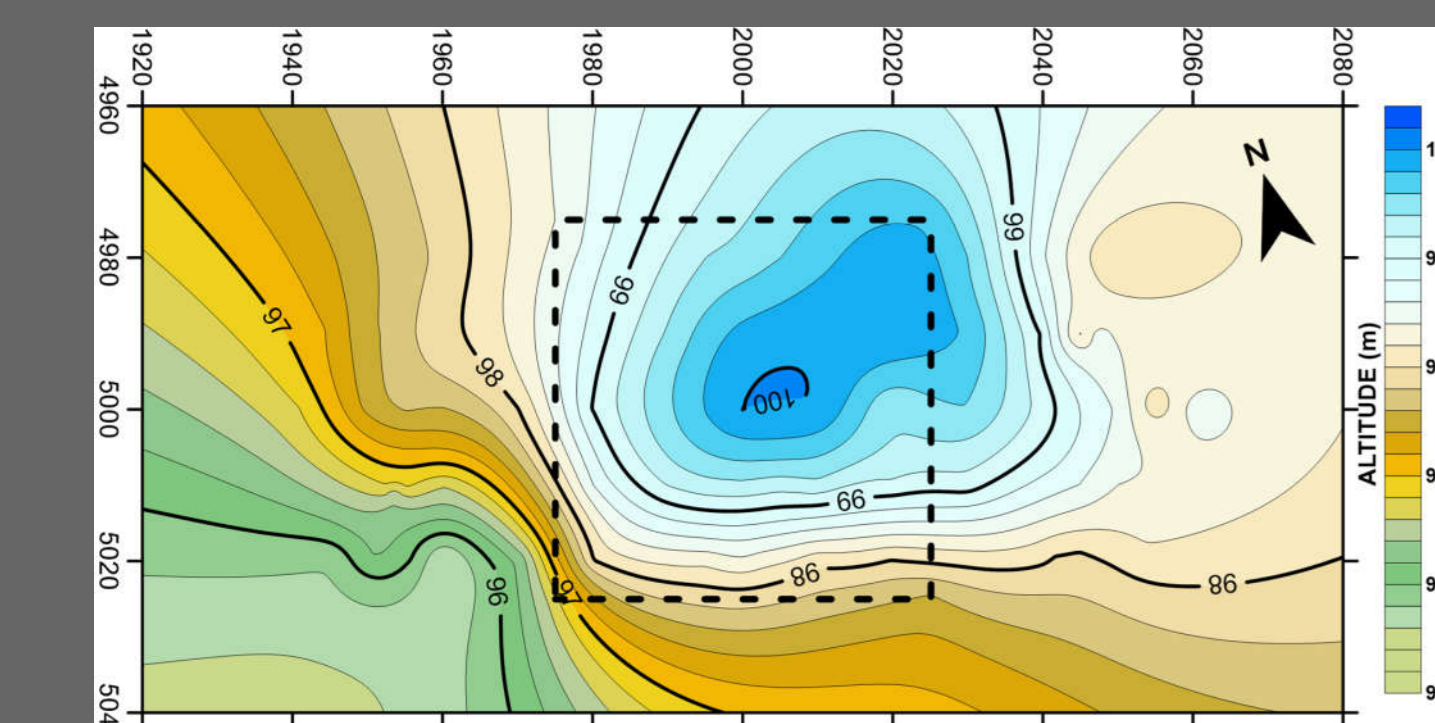
Biskra, called Sahara door, located south east of Algeria, is the first studied site. The station will be installed in Banian village, M'Chouneche Municipality

Two broad band seismological stations for continuous recording during four weeks was installed in M'Choneche Biskra selected site, enabled us to calculate daily PSD for each station and signal to noise ratio (SNR) using local and regional seismic event recorded by the stations.

Site preparation

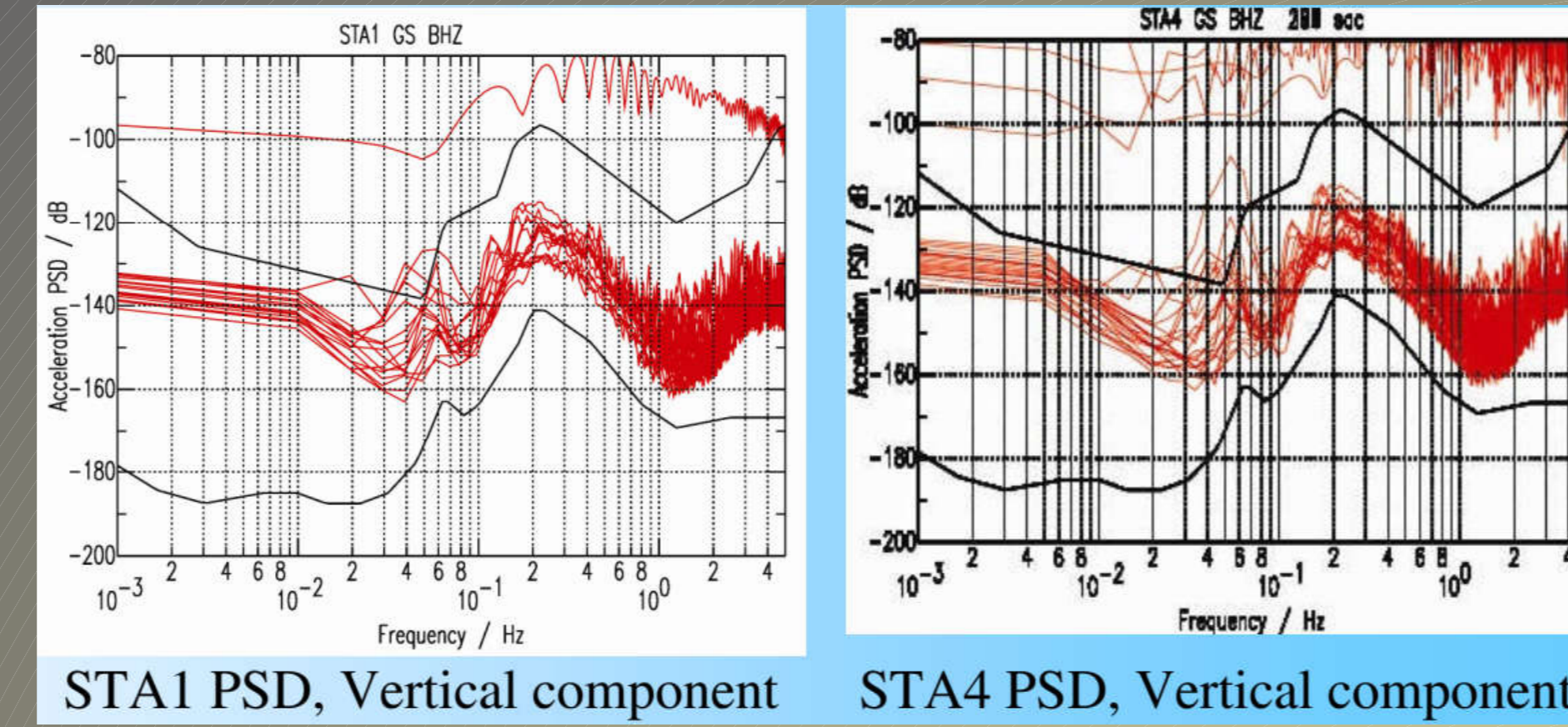


The two BB stations (STS2, Q330 & Baler) are installed under ground (50 cm depth) on a small seismic pier, with approximately 25m distance between both stations.



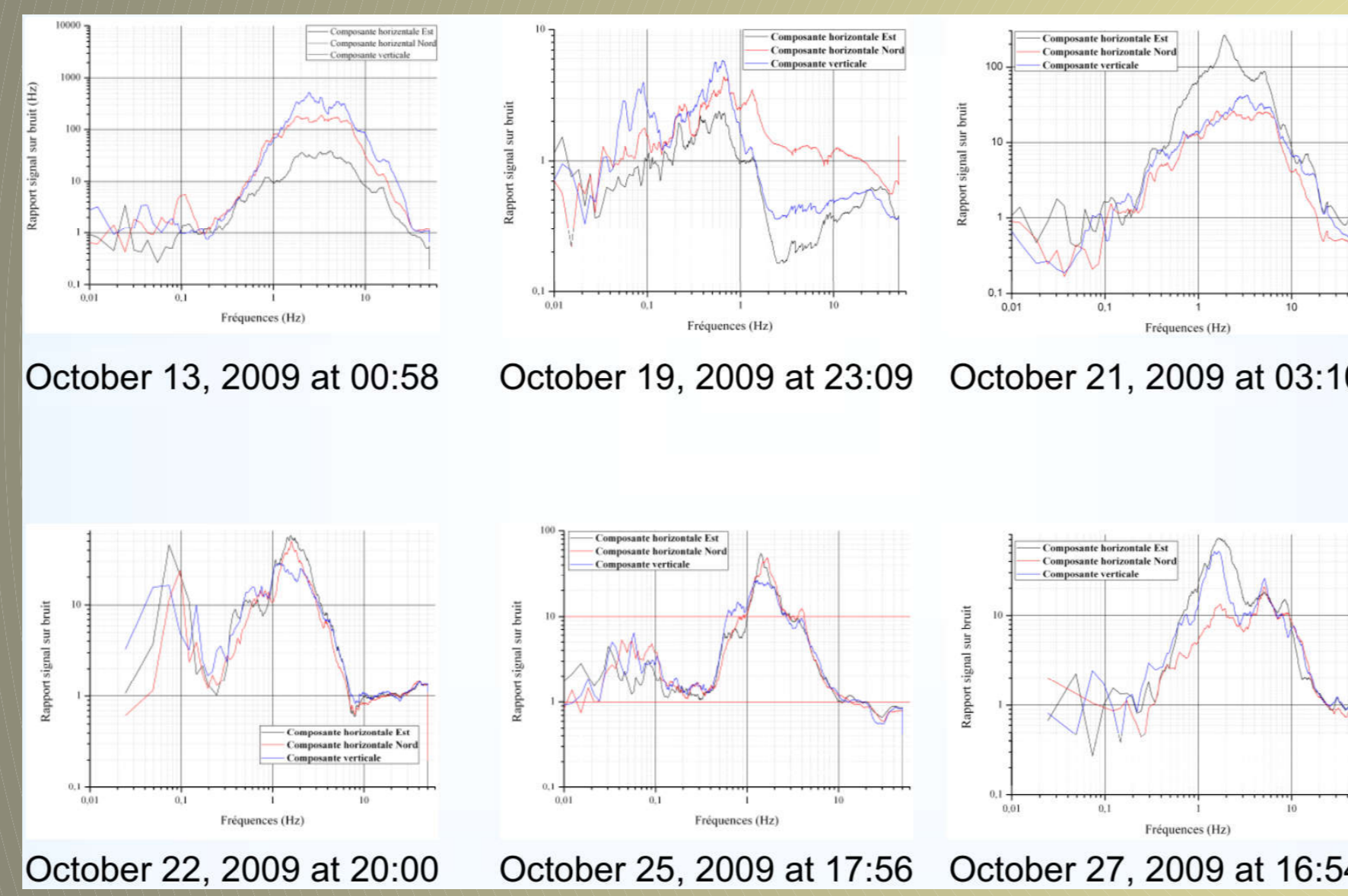
Topographic map for the studied site

Power spectral density estimation



The PSD shows a results similarity obtained at the two stations. It is observed that the curves are drawn inside the interval defined by the Peterson noise models

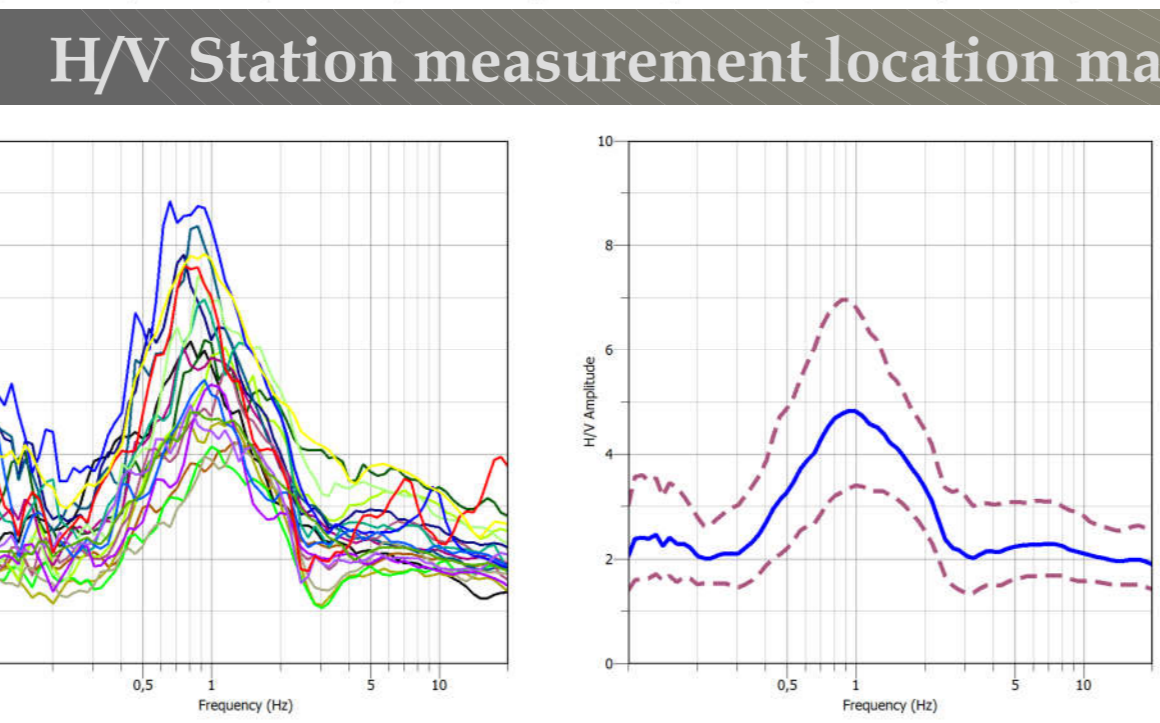
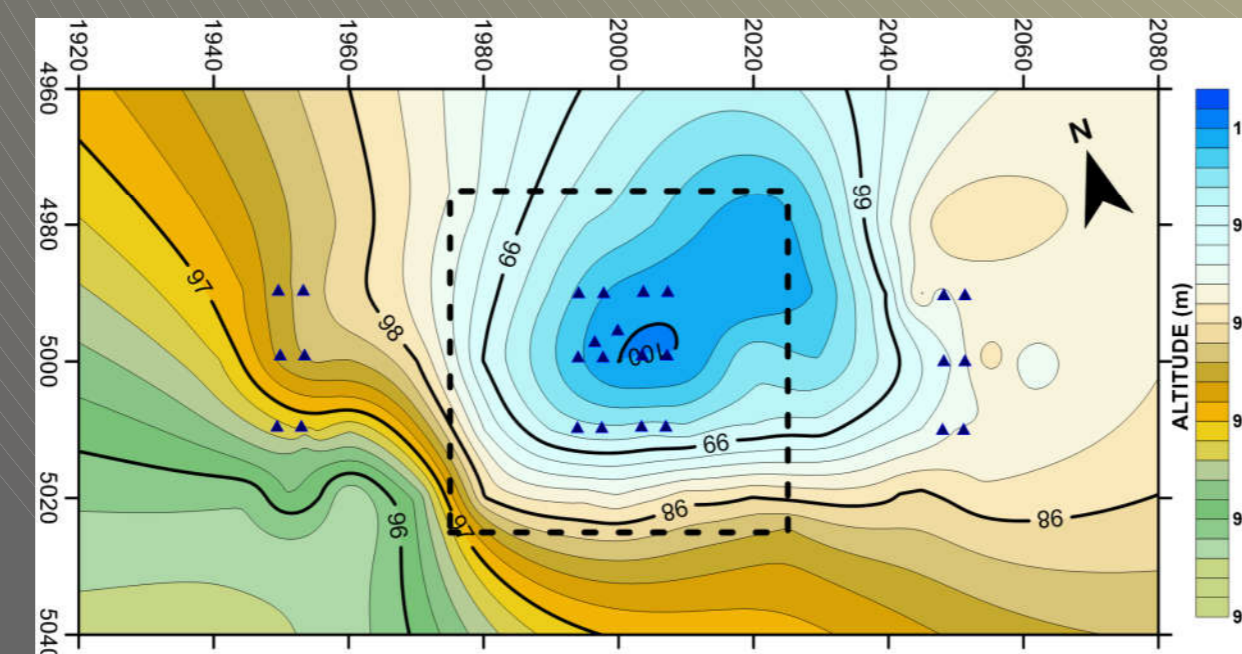
Signal-to-Noise Ratio (SNR)



The SNR ratio show a good results especially between frequencies 0,2Hz and 8Hz, except for very low seismic event recorded locally up for 40Km distance like the event recorded October 19, 2009 at 23H09.

H/V ambient vibration study

H/V Method consists in spectral amplitudes ratio esteemed between the horizontal and vertical component of the ambient noise measurements to consider the site's Eigen frequency.



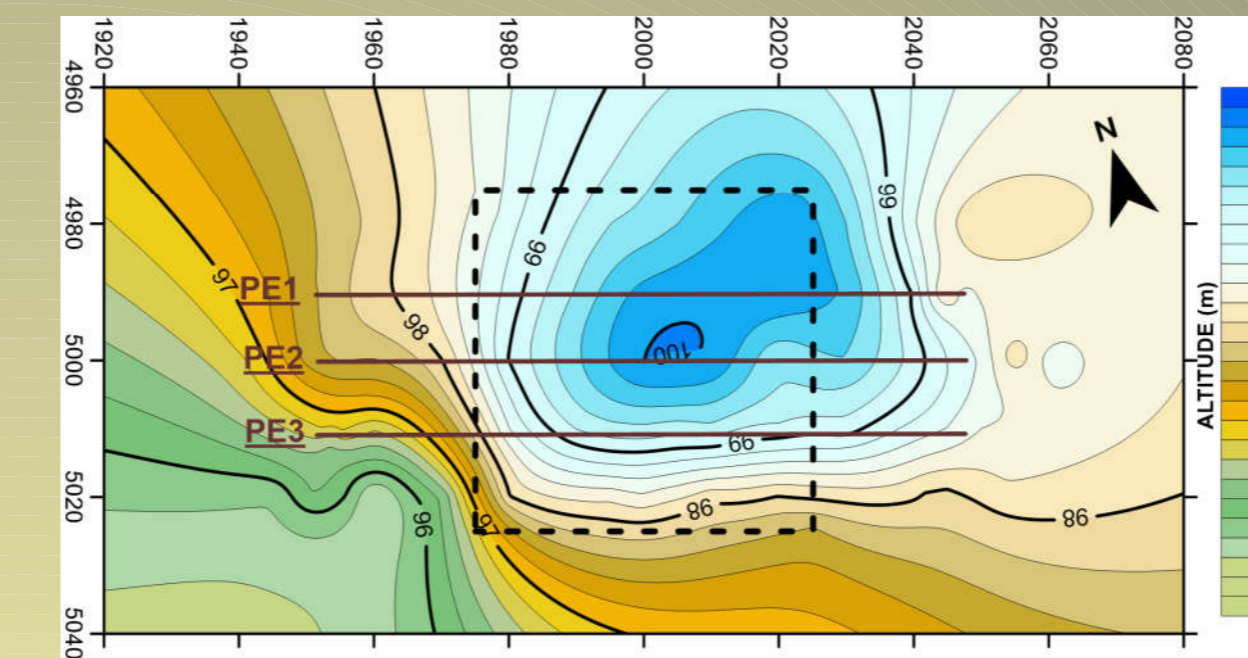
The analysis of H/V ratio shows three dominant frequency's, between 0,6-2Hz indicating amplification function, between 6-9,5Hz indicating deep velocity contrast, finally between 21 and 32Hz representing surface layer response.

Geophysical site study

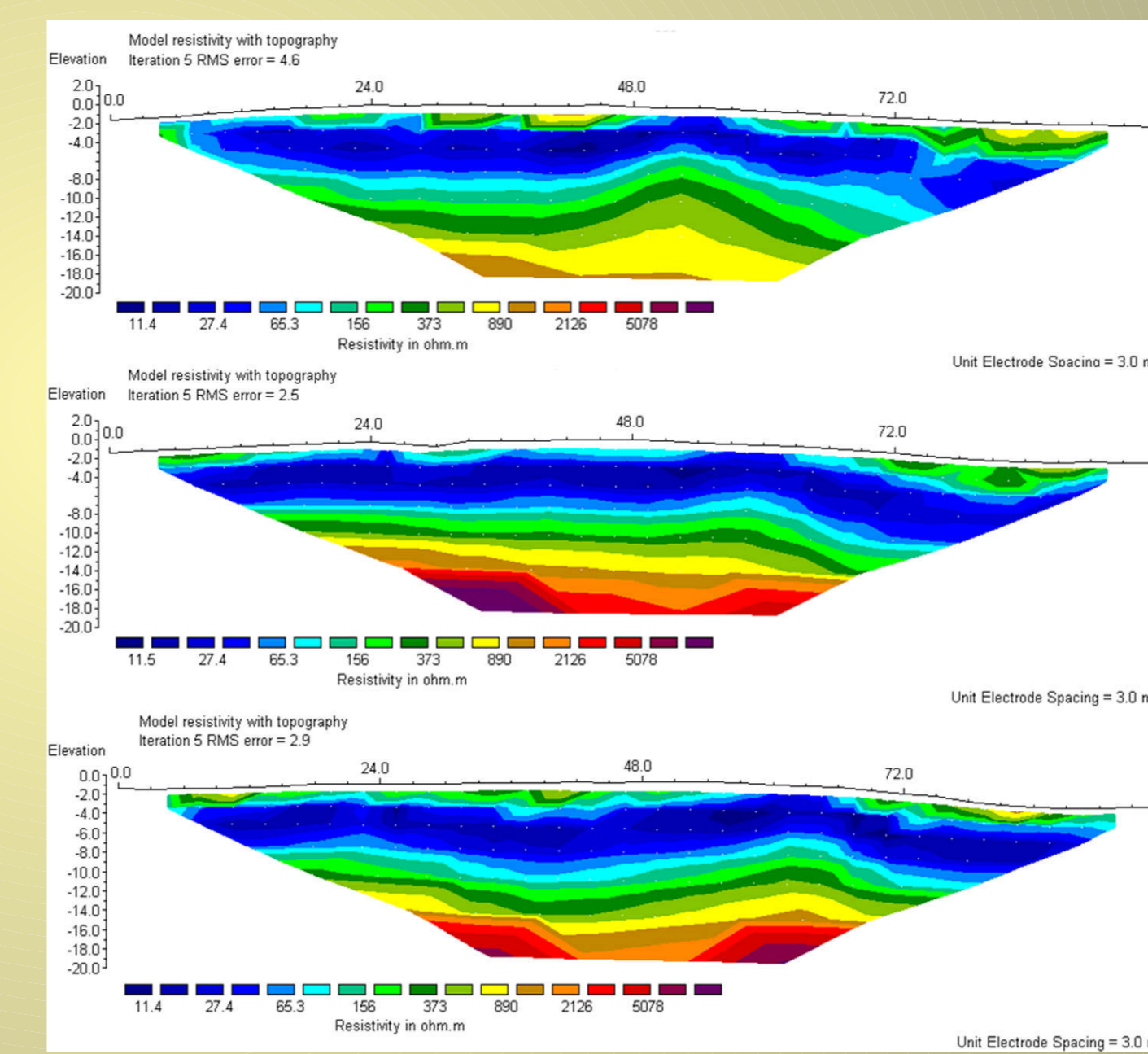
An electrical imaging and seismic refraction survey are performed to determine geological formations lithology and physical properties in the site reserved for seismic station installation. A microgravimetric survey was carried out, in order to verify the existence or not of geological anomalies. And finally, an H/V study (ambient noise) was conducted to function amplification and site frequencies determination.

Electrical imaging

An automatic acquisition system was used with Sting R1 IP resistivity meter with Wenner configuration characterized by a good investigation depth and longitudinal resistivity variations sensitivity. Three parallel electrical imaging profiles east - west are used with 10 m line spacing, 96 meters length and an inter-electrode spacing of 3 meters.



Electric profile localisation map

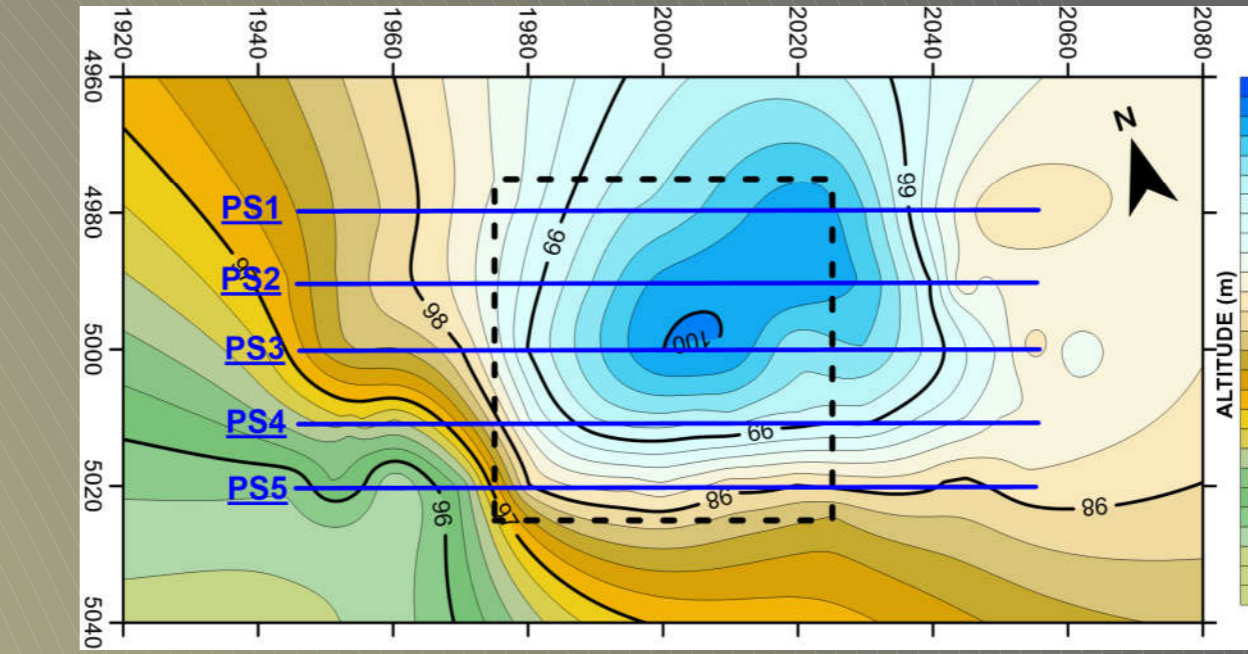


Resistivity cross-sections

The results show that the site consists of 3 layers reach more than 16 meter depth. The first layer develops until 2,5m depth with 100-900Ω m resistivity's, the second layer is 6 to 11m thickness with 10-65Ω m resistivity, the last layer reached 11-16m depth with 150-5000Ωm resistivity increase with depth.

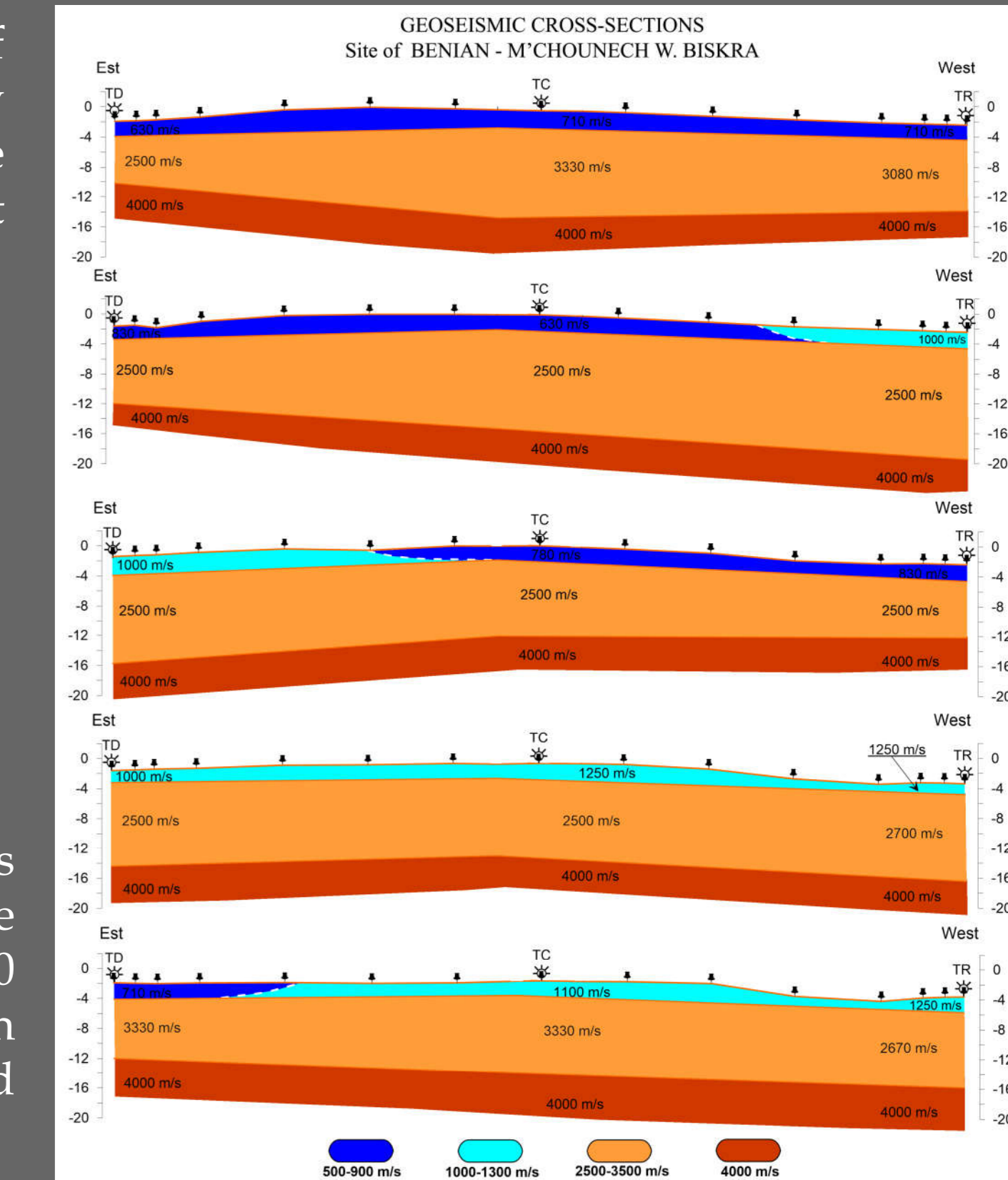
Seismic refraction measurement

Seismic refraction method allow definition of under ground layer's nature and geometry caused by a shock which gives vibratory wave rise which is propagated with different velocities in different geological formations.



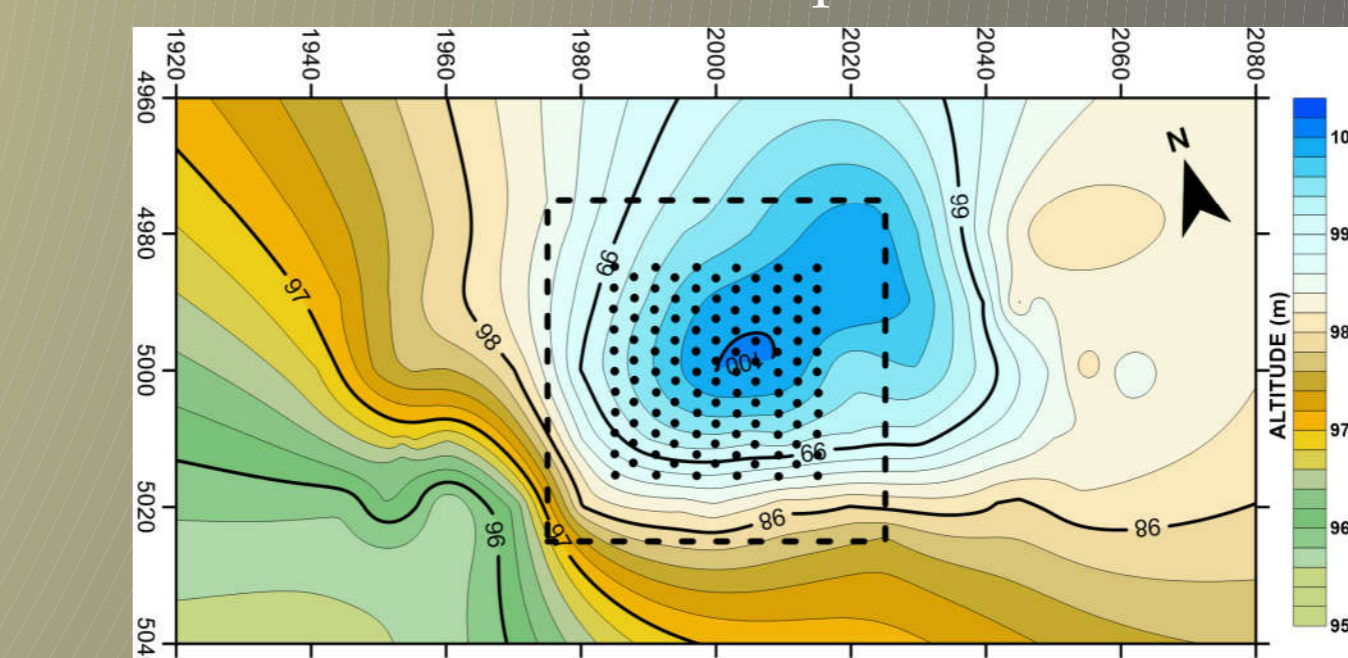
Seismic profile localization map

The seismic refraction show that the site consists of 3 layers reach more than 16 meter depth. The first layer develops until 2,5m depth with 300-1000 m/s, the second layer is 6 to 11m thickness with velocity 2700m/s average, the last layer reached 11-16m depth with 4000-5000 m/s velocity.



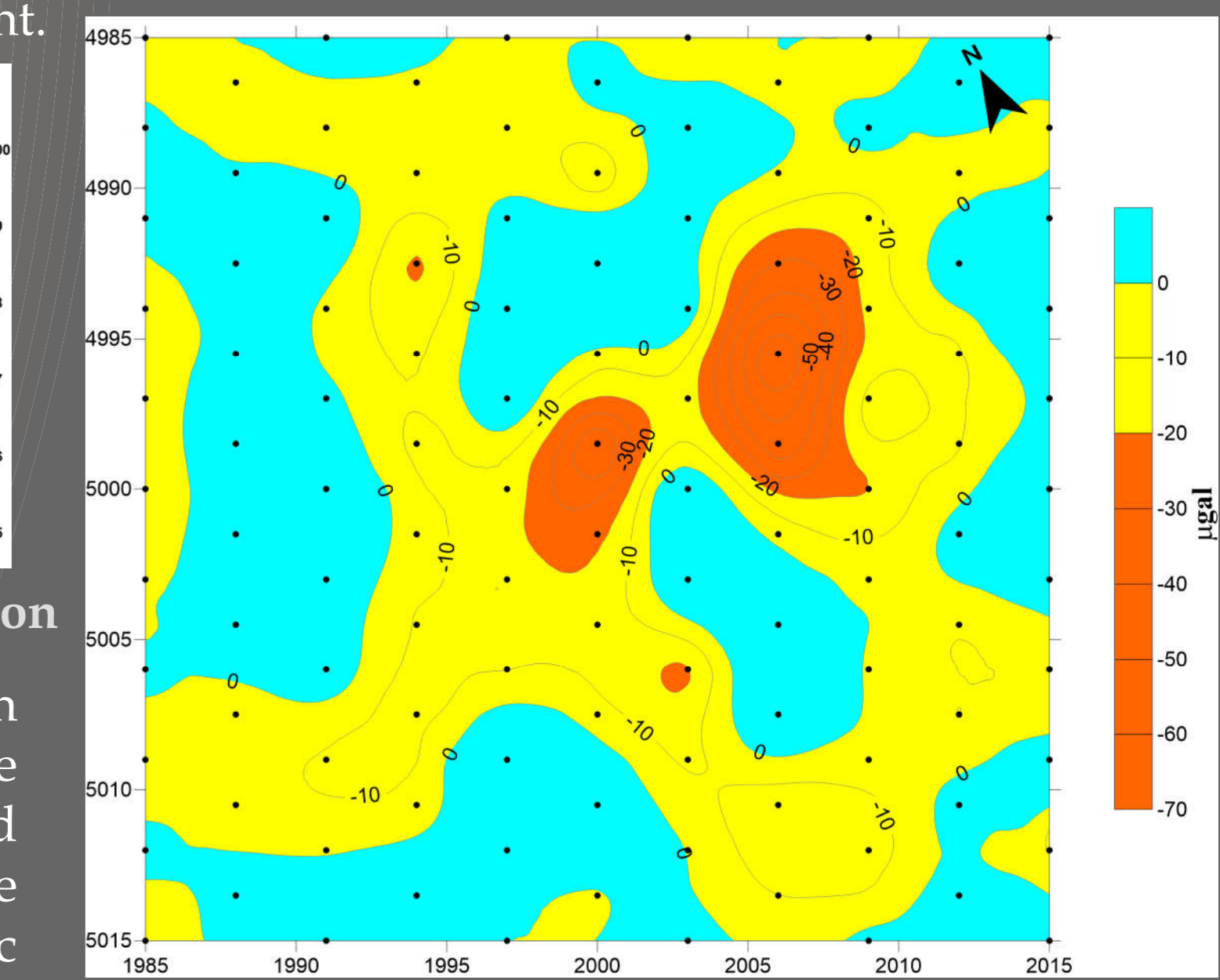
Gravimetry mesurment

The micro gravimetric measurements acquisition program, was defined on a regular grid with 03 meters separation between each measurement point. The surface measurements is localized in center of the site with a 116 total points measurement.



Measurements stations locations distribution

The residual anomaly estimated with gravimetry method shows two negative anomalies respectively about -20 μgal and -52 μgal which do not indicate cavity presence confirmed by electric method.



Residual gravity field anomaly map

The station shelter

The seismic shelter was built under four meters deep on a surface of 4 m² and divided in two levels, the bottom one host the broadband sensor and the electronics are installed on the top-level. The seismic pier was made with cyclopean concrete within 2,25m² surface and the shelter walls are in reinforced concrete surrounded with a stone wall to improve thermal isolation.



Data are collected manually at each regular visits to stations. Real-time data telemetry is in progress.

Conclusion

After the seismic noise study and a combined geophysical methods applied to the site study, it's appears that the site of Banian present a good condition to receive a permanent broadband station. This methodology was applied to the four other sites in north Algeria.