8th International Symposium
on Andean Geodynamics
(ISAG)

# Imaging the Quito basin using ambient seismic noise

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Quito, the capital city of Ecuador, is located in a zone of high seismic activity: placed at approximately 200 km from the subduction zone and surrounded by crustal-faults prone to generate significant earthquakes. This city has been built on a piggyback basin, on the hanging wall of a system of active reverse faults [1]. The high population density (around 3 million inhabitants), together with the lack of planning in most of its buildings, make Quito a city with a high seismic risk.

Building damages due to earthquakes are mostly generated by the ground motions and depend on factors like earthquake source (the type of faulting, magnitude, etc.), and distance to the hypocenter. However in basins, how the superficial layers and the topography affect on the seismic waves propagation, called site effects, have an impact in ground motions. Local site effects can strongly amplify the incoming seismic waves by factors of more than 10 (like for example in Mexico city), and also increase the duration of ground motions.

In Quito, the filling of the basin has been described as volcano-sedimentary sequences consisting of lavas, tuffs, lahars; lacustrine, alluvial and pyroclastic deposits [1], however, the thickness of the in-fill material, its spatial arrangement, and the deep structure of the basin remain poorly known. Nevertheless, since [2] and [3], we know that in Quito the amplification due to site effects exists and can be strong in some areas at frequencies larger than 1 Hz. Besides, a low-frequency amplification around 0.3 Hz has been recently highlighted in the southern part of the basin [4], which points to a high contrast of velocities at depth (hundreds of meters below the surface).

In this context, the aim of our study is to obtain information on the geometry of the sedimentary layers, and the depth of the basement, which is crucial to increase the knowledge of the seismic risk. Between May 2016 and July 2017, 20 broad- and middle-band three-component seismological stations were deployed progressively throughout the city to record ambient seismic noise for a year or more. We present the first results of ambient noise cross-correlations of simultaneous operating seismic stations to retrieve inter-stations surface waves Green's functions. The dispersion curves of Rayleigh and Love waves were inverted to obtain velocities profiles along the city.

Our first main result obtained using phase velocity inversion, is that we find a clear difference in the structure of the basin between the northern and southern part.

[1] Alvarado, A., et al. (2014). Active tectonics in Quito, Ecuador, assessed by geomorphological studies, GPS data, and crustal seismicity, doi: 10.1002/2012TC003224.
[2] Chatelain, J. L., et al. (1996). Projet pilote de scénario sismique à Quito (Équateur): Méthode et résultats, Bull. IFEA 25, no. 3, 553–588.
[3] Guéguen, P., et al. (2000). An indication of the soil topmost layer response in Quito (Ecuador) using noise H/V spectral ratio, doi: 10.1016/S0267-7261(99)00035-4.
[4] Laurendeau, A., et al. (2017). Low-frequency seismic amplification in the Quito basin (Ecuador) revealed by accelerometric recordings of the RENAC network, doi: 10.1785/0120170134.