

Large N experiments and advancements in 4-D noise-based seismology

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Abstract

Noise-based seismology is proving to be complementary to active source or earthquake-based approaches for imaging and monitoring the Earth's interior. Until recently, noise-based imaging and monitoring relied mostly on the inversion of surface waves reconstructed from correlations of seismic noise recorded at individual seismic stations. It is well known that this approach is hampered by the non-uniform noise-source distribution. Also, these virtual reconstructed seismograms are in most cases dominated by surface waves and do not allow using direct or reflected body-waves that provide additional key information on the Earth's structure and temporal evolution.

The opportunity of deploying hundreds to thousands of short-period seismic sensors and moving from individual seismometers to arrays of sensors seems to be knocking down these barriers. In this presentation, we will review some of the latest advancements in using large-N seismic arrays for improving seismic interferometry. We will in particular focus on a recent seismic experiment on Piton de la Fournaise Volcano (La Réunion island) where we deployed 300 seismic sensors during one month. Our goal is to passively extract body-waves travelling directly through the active magma reservoir located at ~2.5 km depth below the summit crater using noise correlations between arrays of seismic sensors. We will show how using array processing techniques improves the quality of noise-based Green's function surface and body-wave reconstruction. The stability of these reconstructed waves over time is encouraging in the perspectives of high resolution monitoring of the volcano feeding system.

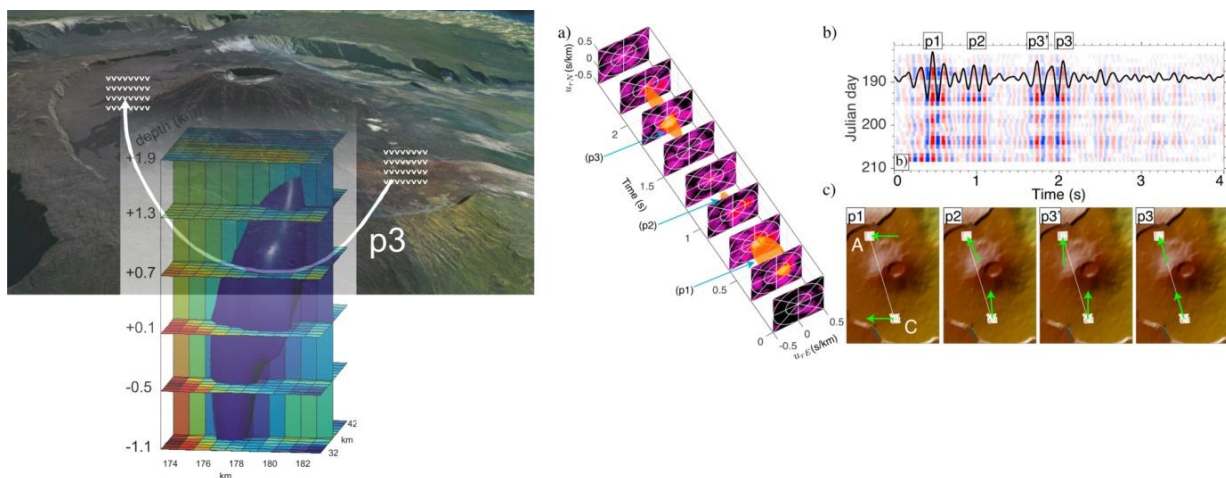


Figure caption: Left, sketch representing a virtual P-wave (p3) travelling through the vicinity of the magmatic reservoir of Piton de la Fournaise Volcano. Right, daily virtual seismograms associated with different wave packets p1 to p3 (Nakata et al. 2016).