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The feeding system of the Lusi eruption revealed by ambient noise tomography

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Lusi is a clastic dominated geysering system located in the northeastern Java backarc basin in Indonesia. Based on fluid geochemistry it has been described as a newborn sedimentary-hosted hydrothermal system. The present study provides a 3D model of shear wave velocity anomaly beneath Lusi and the neighboring Arjuno-Welirang volcanic complex and aims to better understand the subsurface structures as well as the Lusi plumbing system.
To date, our data represent the first image of a hydrothermal plume in the upper crust seen with geophysical methods. We use 10 months of ambient noise data recorded by 31 temporary seismic stations and use ambient noise tomography methods to obtain the shear wave velocity model. The obtained tomographic images reveal the presence of a low velocity zone that connects the Arjuno-Welirang volcanic complex at about 5 km depth and ultimately emerging at the Lusi eruption site. Magmatic reservoirs beneath volcanic systems are also identified. Low shear wave anomalies representing magmatic reservoirs are less pronounced for the Arjuno-Welirang volcanic complex (the oldest system investigated in this study), intermediate beneath the Penanggungan volcano and result much more pronounced beneath the newborn Lusi.
The results obtained in this study are consistent with a scenario envisaging a magmatic intrusion at depth and/or hydrothermal fluids migrating from the volcanic complex and extending towards the sedimentary basin.