

EGU24-16588, updated on 15 Oct 2024

<https://doi.org/10.5194/egusphere-egu24-16588>

EGU General Assembly 2024

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Ambient noise based seismic imaging of the Tuscan Magmatic Province, Italy

Konstantinos Michailos¹, Geneviève Savard¹, Elliot Amir Jiwani-Brown¹, Domenico Montanari², Michele d'Ambrosio³, Gilberto Saccorotti³, Davide Piccinini³, Nicola Piana Agostinetti⁴, Riccardo Minetto⁵, Marco Bonini², Chiara Del Ventisette⁶, Francisco Muñoz¹, Juan Porras¹, and Matteo Lupi¹

¹Department of Earth Sciences, University of Geneva, Geneva, Switzerland (konstantinos.michailos@unige.ch)

²Institute of Geosciences and Earth Resources, National Research Council of Italy (CNR), Via La Pira 4, Florence 50121, Italy

³Istituto Nazionale di Geofisica e Vulcanologia, Italy

⁴Department of Earth and Environmental Sciences, Università di Milano Bicocca, Italy

⁵Université de Strasbourg/CNRS, Institut Terre et Environnement de Strasbourg, UMR7063, 67084 Strasbourg Cedex, France

⁶Department of Earth Science, University of Florence, Italy

The Tuscan Magmatic Province (TMP) is the result of several geodynamic events associated with the formation of the Apennines orogen and the Tyrrhenian Basin. Previous studies highlighted different aspects of the TMP, characterised by a complex geology, a thin continental crust, low seismicity rates, and locally high heat flow rates (e.g., Larderello-Travale and Amiata geothermal fields). Despite numerous active and passive seismic investigations in the past, the knowledge of the crustal structure across the broader TMP region is limited, particularly when considering its spatial coverage. To tackle this problem, we use ambient noise tomography and waveform data from the TEMPEST temporary seismic network and permanent seismometers. The TEMPEST network operated from late 2020 to late 2021, comprising 30 broadband seismometers, augmenting the existing permanent seismometer network.

Here we analyse Rayleigh wave group-velocity dispersion data from all seismic stations of our composite seismic network of 62 seismometers and generate 2-D maps of group velocities at different periods. We observe relatively low group velocities that may represent possibly two plutonic bodies in the region (i.e., Larderello and Mt Amiata). To further constrain the volume of the plutonic bodies, we intend to perform a series of inversions to estimate the variation of shear-wave velocity with depth. Our approach showcases the effectiveness of ambient noise tomography in unravelling crustal structures in geologically complex regions such as the Tuscan Magmatic Province, Italy, and its implications for geodynamic and tectonophysics studies.