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Geothermal exploration with passive geophysical methods in the canton of Thurgau, Switzerland

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Geothermal resources represent a significant opportunity for clean baseload energy in Europe, yet their development remains largely untapped. A key barrier to expanding geothermal energy is the challenge of greenfield exploration, where traditional active seismic methods face high costs, complex logistics, and limited depth resolution, which elevate project risks. Recently, ambient noise tomography, a passive seismic imaging technique, has emerged as a promising alternative due to its affordability, scalability, and ease of deployment.

As part of the EU-funded GeoHEAT project, we aim to integrate passive geophysical imaging methods at both regional and reservoir scales into a comprehensive, cost-effective exploration workflow. This will ultimately produce a ranked list of the most promising drilling locations within a given region. The canton of Thurgau in Switzerland has been selected as a test site due to its interesting geological setting, strong local political support, and availability of existing geological and geophysical data. In March 2025, a network of roughly 300, 3-component nodal seismic sensors will be deployed to survey an area approximately 30 by 50 km^2. The primary geological targets of this survey include the topography of the crystalline basement and the identification of potential sedimentary troughs and deep fractured zones.

This presentation will outline our proposed passive seismic exploration workflow, emphasizing its simplicity and applicability. We will also present early results from the newly acquired dataset, including group velocity maps. By demonstrating the alignment of passive seismic 3D models with existing subsurface data and incorporating these models into a probabilistic framework that

quantifies subsurface uncertainties, we aim to accelerate the adoption of scalable, low-cost exploration techniques. This work is funded by the Swiss State Secretariat for Education, Research, and Innovation (SERI) and the European Union through the GeoHEAT project under Horizon 2020. GeoHEAT seeks to transform geothermal exploration by creating an innovative, low-cost, multi-scale workflow, spanning from regional to borehole levels. The project emphasizes a transparent and quantitative approach to effectively communicate risks to all stakeholders.