Geo-INQUIRE Transnational Access Project Report

Joint TA and PT activity hosted at ETH Zurich

Geo-INQUIRE installation	EF-PSHA - Probabilistic Seismic Hazard Analysis (TA2-542-1) - Geo-INQUIRE
Project title	Open Ground Motion Greece
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Transnational access supporting team	Dr. Laurentiu Danciu (ETH Zurich, Switzerland)
Project acronym	OMG!
Project report ID	C1-TA2-542-1-1
Transnational access team	National Observatory of Athens - Dr. Olga-Joan Ktenidou; National Technical University of Athens - Mevlut Ziya Cekinmez; ETH Zurich / Swiss Seismological Service - Dr. Laurentiu Danciu
Date of visit	
Geo-INQUIRE Virtual Access	In preparation
Data/Products	Joint manuscript and hazard workflow products under development; broader data and metadata products remain under preparation
DOI	Not yet assigned

Project report

The Transnational Access project Open Ground Motion Greece was designed to improve the scientific usability of Greek seismic recordings by advancing waveform-based site characterization, improving metadata interpretation, and enabling better-constrained regional ground-motion modelling for future hazard applications in Greece. The original project aimed to capitalize on a large curated Greek dataset, integrate strong-motion and broadband perspectives, and create the conditions for more refined and eventually partially non-ergodic hazard applications.

During the access period, the TA activity of Dr. Olga-Joan Ktenidou was carried out in close integration with the Personal Training activity of Mevlut Ziya Cekinmez from NTUA. Both visitors worked together at ETH Zurich on a shared scientific programme focused on Greek seismic data, local GMPE calibration, site characterization, and implications for non-ergodic hazard assessment in the southern Aegean. Their collaboration developed around three scientific papers under joint preparation. At the present reporting stage, one common paper is sufficiently mature to be reported formally, while the other two remain under active development.

The first major common outcome is the completion of a manuscript entitled “A Three-Stage Framework for Local GMPE Calibration Using the 2025 Amorgos Offshore Earthquake Sequence: Implications for Non-Ergodic Hazard in Greece.” This study establishes a methodological workflow that combines Bayesian local calibration of a Greece-specific GMPE backbone, mixed-effects decomposition of aleatory variability, and HVSR-based site characterization using the 2025 Amorgos offshore sequence as a natural case study. The work demonstrates that site-to-site variability is a major component of total variability and that a substantial fraction of this variability can be predicted from waveform-derived site descriptors, thereby supporting future non-ergodic hazard applications in Greece.

The underlying dataset includes 2,880 three-component accelerometric recordings from 264 shallow normal-faulting earthquakes recorded at 17 strong-motion stations distributed across the Amorgos-Santorini region. Waveforms were processed consistently for RotD50 response spectra, and HVSR curves were computed following established practice. Ten scalar HVSR features were extracted to characterize site response and to evaluate their predictive value for the station term. The results indicate a reduction of total aleatory uncertainty of about 20 to 25% relative to uncalibrated reference models, while HVSR-based predictors explain a substantial part of the site-related variability, particularly at intermediate periods.

A second major outcome of the joint activity is the implementation of these findings in an OpenQuake-based probabilistic seismic hazard workflow for the Cyclades region. This hazard component has been completed and compares three alternative branches: the original rock model, a proxy site model, and a modified Bayesian rock model reflecting the local calibration results. The analysis provides a direct demonstration of how improved local site treatment and regional calibration can influence hazard estimates relative to standard regional assumptions.

In relation to the original TA work plan, the activities completed at ETH Zurich are well aligned with the scientific objectives of the access. While the broader vision also included enriched station and record metadata inventories, high-frequency usability assessment, stress-drop analysis, and wider data-harmonization products, the work achieved so far provides a strong methodological and application-oriented first phase. In particular, it advances the extraction and interpretation of waveform-derived site information, the analysis of residual structure, and the translation of those results into hazard-relevant computations.

Overall, the TA and PT activities should be understood as a strongly integrated common effort rather than two separate parallel visits. The collaboration has already produced one completed joint manuscript, one completed regional hazard workflow, and a clear basis for two additional publications currently in progress. The activity has therefore been scientifically successful and has created durable added value for the broader objectives of Open Ground Motion Greece.

Brief status of activities at M42

At M42, the joint TA and PT activity hosted at ETH Zurich has reached a productive and scientifically mature stage. One common manuscript has been completed and constitutes the main reportable scientific output of the collaboration at this stage. In parallel, the hazard-modelling component based on OpenQuake has been completed for the Cyclades case study and serves as a direct application of the methodological developments.

Two additional common papers were initiated and significantly advanced during the visit period, but they are not yet ready for formal reporting and will be documented in a later phase. The extension from hazard to seismic risk assessment is ongoing. The broader goals related to harmonized data products, improved metadata, and future virtual access remain relevant and are expected to continue beyond the present reporting period.

The M42 status can therefore be summarized as follows: the core scientific objectives for the present reporting period have been achieved, one major common publication output is ready, the associated hazard workflow has been completed, and the collaboration has established a solid foundation for the remaining joint outputs.