39th GENERAL ASSEMBLY OF THE EUROPEAN SEISMOLOGICAL COMMISSION
ESC2024
22-27 September 2024
CORFU, GREECE

Session 07 & 15

Methodological advancements and their multidisciplinary applications in solid Earth science in general and single-station seismometry in particular

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In framework of multidisciplinary applications to Earth sciences and with the rapid advancements in data acquisition technologies and availability of relatively inexpensive computing resources, the last decades saw a revolution how scientists access and handle data. As a result, traditional boundaries between disciplines are fading, giving rise to a dynamic synergy between different fields of study and enabling new scientific use cases that are inter- and trans-disciplinary by design. This session is designed to focus on multi- and interdisciplinary contributions aiming to generate new knowledge and innovate novel approaches to problem-solving.
We intend to explore scientific use cases that rely on a data-first approach, combining data from different disciplines in solid Earth Sciences, and possibly related ones, with the objective of creating new knowledge or defining new ways to approach a problem. In building the EPOS infrastructure (https://www.epos-eu.org/dataportal) together with the scientific communities we experienced first-hand the growing need for this kind of approach, and believe it will have a pivotal role in shaping the future of the geoscientific disciplines and in tackling major scientific and societal problems.

We focus this session on single-station-based methods as they supported so far, many branches of seismology since those early studies on mantle attenuation or nuclear surveillance. Therefore, these methods well exemplify multi- and inter-disciplinary contributions in Erath science research topics. Specifically, in passive seismology, the single-station techniques imply a lower degree of labor intensity; they are economically advantageous and suitable for their applications in tough terrain conditions. Two of the methodologies that use the seismic ambient noise wavefield have been gaining great popularity in the past decades: the horizontal-to-vertical spectral ratio (HVSR) and the interferometry based on autocorrelation. The HVSR method was initially conceived to help in site response studies. However, since its emergence, the technique has undergone many improvements in all forms of acquisition, processing, and theory and is increasingly applied in diverse processes, hazards, and materials. The study of relative changes in ambient noise waveform inferred from ambient noise interferometry (single-station) created a complementary tool to investigate deformations (altered elastic and scattering properties) caused by mechanical processes (migration of pressurized magma, change in rigidity and rheology and environmental stressors), which tend to show spatial-temporal evolution. However, this technique is comparatively less adopted.

We welcome contributions that explore scientific use cases that prioritize a data-first approach, integrating data from various disciplines within solid Earth Sciences and potentially related fields, alongside showcasing the broad applications of single-station techniques across a range of Earth surface environments, including mass movement, hydrology, cryosphere, archaeo-geophysics, and beyond. We also encourage studies focused on the development of state-of-the-art methods to further enhance our understanding of Earth processes.