**Suitability of evolutionary open-source data analysis tools in geo-hazard research: a mini-review**

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**Abstract**

Early warning systems for geohazards (such as earthquakes, landslides, and volcanoes) require detailed investigations involving continuous monitoring of the system at high sample rates and adopting multi-parametric data recordings to understand better the nonlinearity of the factors involved. Such monitoring could be acquired through elastic wave propagation techniques where different stages of deformation are inferred (e.g. studying properties of the ambient noise wavefields and the rate of microseismic emissions). These approaches have gained popularity due to their affordability, flexibility, and ease of customization, leading to related algorithms development in recent years. This study presents a mini-review that provides important evolutionary highlights of the open source signals processing workflows and related algorithms over the past few decades. Along with considering the famous open-access tools, the review is also dedicated to analyzing the short-lived codes from the student thesis found in various GitHub repositories. The potential role of ChatGPT in data processing for geoscientists is also explained with examples using ambient noise data. Additionally, the pros and cons of digitization and their impacts on overall scientific growth in the subject are highlighted. Ultimately, the effects of the advancement in open science on teaching practices in geosciences in the developing world are described critically. In the end, the present study provides insight into the selection of tools for a specific research project and the implementing suitable algorithm freeware for geophysical research. The recommendations for adopting advanced teaching models to cope with these advancements in geoscience education are included.

**Keywords:** Ambient Noise; ChatGPT; Earthquakes; GitHub; Landslides; Microseismic; Volcanoes; Open Science