ENGLISH

Topic/Title

Reprocessing and Integration of Seismic Exploration Data for the Geological and Structural Characterization of the Campi Flegrei Caldera

Proposer (Tutor)

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Research proposal

This PhD project aims to reassess active seismic data acquired by Agip-ENI, OGS, and other public and private research institutions in past decades across the Campi Flegrei area and surrounding regions, both offshore and onshore. The main objective is to provide an updated geological and structural interpretation using modern seismic processing and interpretation techniques. The project seeks to identify new features and correlations to improve the understanding of the geodynamic processes linked to the Campi Flegrei volcanism. This research will offer valuable insights for volcanic risk management in this strategically important region, particularly relevant in light of the ongoing unrest in the Campi Flegrei area.

Research Plan

Year 1

- 1. **Data collection and organization:** digitization and inventory of legacy seismic datasets in pre-stack format; acquisition, vectorization, and cataloging of geophysical logs and well stratigraphy in the Gulf of Naples region.
- 2. **Analysis of acquisition parameters:** study of original acquisition geometries and parameters; assessment of technological limitations of legacy data.
- 3. **Pre-processing workflow:** development of customized workflows to improve signal-tonoise ratio; velocity analysis, static corrections, deconvolution, advanced marine multiple attenuation techniques; mapping of the usable frequency bandwidth for each dataset; application of classical NMO processing (CDP stack) to obtain an initial poststack image to be compared with legacy data.

Year 2

- 1. **Advanced processing:** application of CRS stack to produce zero-offset sections with high signal-to-noise ratio without requiring an accurate initial velocity model; construction of a P-wave velocity model; time and depth migration of post-stack data; evaluation of pre-stack time migration (PSTM) and pre-stack depth migration (PSDM), depending on data quality.
- 2. **Angle stacks (AVO):** generation of angle stacks on selected portions of the datasets with suitable geometries; qualitative analysis of amplitude variations with angle of incidence.

Year 3

- 1. **Acoustic impedance inversion:** application of deterministic or stochastic post-stack inversion algorithms; analysis of impedance variations as indicators of lithology, porosity, and fluid saturation.
- 2. Integration with well data: seismic-to-well tie through synthetic seismograms; correlation of seismic units with well stratigraphy; interpretation calibrated using geophysical logs (BHC, DLL, sonic, density); geological modeling consistent with seismic and well constraints.
- 3. **Integrated geological interpretation:** structural and stratigraphic interpretation at the regional scale of the entire Campi Flegrei Caldera.