



de Physique du Globe de Strasbourg
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Seismological Study of the North-East of France: characterizing active structures and constraining seismic hazard.

Keywords:

Seismology, regional seismicity, active faults, anthropogenic and induced seismicity, crustal structure, local tomography, tectonics, seismic hazard.

Profile and competences

Strong background in seismology, signal processing and inverse problems.
Competent in computer programming (Linux, Python)
Intermediate to high level in English (knowledge of French not strictly required).

Objectives and Methods

Several moderate-magnitude earthquakes have affected the French Grand-Est (North-East) region over the last decades, notably in Alsace and in the Vosges. In addition to the few events that have caused quantifiable damage, seismic monitoring networks regularly detect low-level seismicity, not felt by the population. Few studies have analyzed this seismicity at regional scale, resulting in sparse information with which to identify the main active structures and their mechanisms. Over the past few years, the regional, national, and international networks that record this seismicity have been improved through a series of projects in which the seismology team of IPGS¹ and ObsNEF² have been involved. We note in particular the RESIF³ and EGS-Alsace⁴ projects and a vast European seismic experiment (AlpArray⁵ and AlpArray-FR⁶) during 2016-2018. The exceptional density of the current seismic network in the North-East of France together with recent analysis methods offer perspectives for new studies to optimize regional seismic monitoring and answer scientific questions that will lead to better seismic hazard estimates. After a precise determination of earthquake locations, the student will work on the rupture mechanisms, the evolution of the regional stress field, the geometry and kinematics of the active structures, and the mechanisms involved in the occurrence of anthropogenic seismicity. A local tomography will be performed in order to image the regional crustal structure and detect the presence of strong discontinuities or temperature/density anomalies.

1 Institut de Physique du Globe de Strasbourg (IPGS). eost.unistra.fr/recherche/ipgs/

2 Observatoire Sismologique du Nord-Est de la France (EOST). obsnef.unistra.fr

3 Réseau Sismologique et Géodésique Français: Nationale equipment of Excellence for the observation and the understanding of the internal Earth. www.resif.fr

4 The EGS-Alsace project is managed by Electricité de Strasbourg and EOST, co-funded by ADEME: help the industrialization of geothermy and help the development of innovative methods. <http://labex-geothermie.unistra.fr/article532.html>

5 AlpArray. European initiative for a geophysical 3D imagery of the structure and physical proprieties of the lithosphere and mantle. www.alparray.ethz.ch

6 AlpArray-Fr: project funded by ANR, managed by Isterre, IPGS and OGA (Nice).

7 Laboratory of Excellence G-Eau-Thermie Profonde. labex-geothermie.unistra.fr/

8 Réseau National de Surveillance Sismique. renass.unistra.fr/

Supervision

The student will work at the Institut de Physique du Globe de Strasbourg (University of Strasbourg), and will be a member of its seismology team. He/she will be advised by Professor Alessia Maggi, Cécile Doubre (Assoc. Prof. Seismology/Geodesy, ObsNEF) and Marc Grunberg (Research Ing., RéNaSS⁸). This work will be included in the framework of the AlpArray¹ and

Alparray-Fr⁶ (ANR) projects and the « Laboratory of Excellence » Labex G-Eau-Thermie Profonde⁷ of the Université de Strasbourg (co-funding Labex / Region Nord-Est or IPGS).

Working conditions

The student will have an office and computing equipment to conduct his/her studies, including access to high-performance computing facilities in case of large calculations. He/she will be able to travel for academic purposes (France and foreign countries) and be funded to attend meetings and to publish. He/she will benefit from all the facilities of the University of Strasbourg

Collaborations

There will be numerous interactions with the seismology team of l'IPGS, the national and European teams involved in AlpArray projects, the private partners within Labex, and the research centers dealing with seismic hazard (nuclear protection - IRSN, EDF, quarries and mines - BRGM...)

Applications are to be sent to Alessia Maggi: alessia.maggi@unistra.fr