

ESR 3.1: Evaluation of complex soil response and its variability in the urban environment

A Research PhD position in the URBASIS ITN funded by the EC

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Recent devastating earthquakes and induced seismicity near infrastructures must become the centrepiece of analysis in reducing risk and increasing resilience, facing up to global urban population growth in the coming decades and the concentration of wealth in cities. The prediction of seismic ground motion and response of structures are key issues in reduction of seismic urban risk. There is therefore a demand for highly trained scientists with a broad understanding of engineering seismology and earthquake engineering, skills being essential in academic research, in private companies with activities related to risk mitigation and energy facilities and for policy makers. The URBASIS-EU project aims to provide a multi-disciplinary training platform for young scientists in order to develop their individual project and to promote their entrepreneurship and their employability toward the academic, private and insurance or decision-making sector. High-quality supervision of the young scientists will be ensured through the international recognition of the URBASIS-EU partners. A comprehensive set of transferable skills will be developed through innovative and interdisciplinary joint research projects between academic and non-academic partners on the prediction of seismic hazard in urban areas considering low-probability/high-consequences events and induced seismicity related to the exploitation of energy resources; the seismic ground motion prediction within the non-free-field urban area; the coupling between ground motion and structures/infrastructures responses for natural and induced seismicity including time dependent vulnerability; and the systemic risk of interconnected urban systems. URBASIS-EU will create a lasting collaboration for the establishment of a European network of academic and non-academic experts, improving the interface with decision-makers.

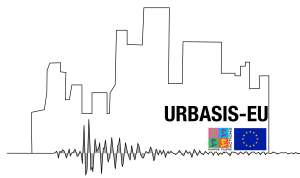
More information: <https://urbasis-eu.osug.fr/?lang=en>

Job description

Seismic waves are modified by the local geological conditions at the Earth surface. This so-called “site effect” can increase both amplitude and duration of earthquake ground motion. Therefore, it represents a major concern in seismic hazard assessment, especially in large urban settlements that are located on soft sedimentary basins where large amplifications and non-linear behaviour at high solicitation levels can be observed. Moreover, in such environments, the seismic wave-field is expected to interact with buildings and their foundations.

Understanding wave propagation in urban areas requires ad-hoc tools to identify and locate the strongest sources, to analyze wave fronts, to infer 2D/3D characteristics in the soil response, and to model propagation of inelastic diffuse wave-fields in complex media. Non-invasive active and passive seismic methods can provide information on the local geology and allow inferring the amplification and attenuation characteristic of the soil.

For this project, the linear site response at selected urban sites will be first evaluated through in-situ measurement of the weak ground motion associated to low-magnitude earthquakes or to the ambient seismic wave-field. For instance, array-processing techniques will be exploited to evaluate the spatial variability of the site response.



In a second step, the non-linear soil response will be modelled at different ground motion levels using state-of-the-art 2D and 3D non-linear wave propagators. Cities in alpine valleys will represent preferential targets. Calibration of the constitutive rheological models will be based on cone penetration test (CPT) measurements, eventually extending already existing databases where necessary. Validation of the modelling for small local earthquakes will be based on comparisons with observed ground motion and pore-pressure at vertical arrays. Highly monitored sites in alpine valleys constitute an unprecedented opportunity to study and quantify the role of surface waves excited by peculiar basin geometries in the soil liquefaction process. The candidate will take advantage of the high-performance computing facilities hosted at the Swiss National Supercomputing Center. After a review of the existing approaches, an original strategy will be proposed to determine and quantify the controlling factors of ground motion in urban areas

The URBASIS consortium is funded by European Commission's Innovative Training Network (ITN) program. This research project will take place at the Swiss Seismological Service (SED), ETH Zurich, Switzerland. The successful candidate is expected to spend several months at the partner institution IFSTTAR, Paris, France and with the private company Resonance in Geneva, Switzerland.

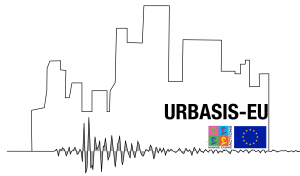
Requirements and Application

We are looking for a highly motivated candidate with a master degree in geophysics or related field. The applicant should have strong quantitative skills, interests in scientific programming, field measurements, and data analysis. English and German are working languages in the research group.

PhD stipends are allocated to individuals who hold a Master's degree. PhD stipends are normally for a period of 3 years (funded by the EU for 3 years though PhD studies at SED are normally for a period of 4 years). It is a prerequisite for allocation of the stipend that the successful candidate will be enrolled as a PhD student at ETH Zurich in accordance with the regulations of the PhD program at the Department of Earth Sciences and ETH Zurich (for more information see: <https://www.erdw.ethz.ch/en/doctorate.html>). According to the URBASIS-EU, the progress of the PhD student shall be assessed every 12 months. It is a prerequisite for continuation of salary payment that the previous progress is approved at the time of the evaluation.

The qualifications of the applicant will be assessed by the **Selection committee**. On the basis of the recommendation of the **Selection** committee, the Administration of ETHZ will make the final decision for allocating the stipend.

URBASIS-EU wishes to reflect the diversity of society and welcomes applications from all qualified candidates regardless of personal background or belief. We encourage applications from everyone irrespective of gender and ethnic group but, as women and members of ethnic minority groups are currently under-represented at this level of post, we would encourage applications from members of these groups. Appointment will be based on merit alone.



Application must be in a form of a single PDF file including a CV, a cover letter, academic transcripts, and the names and complete contact information and letter of two referees sent through :

- the consortium web-page <https://urbasis-eu.osug.fr/?lang=en>
- the EU EURAXESS portal <https://euraxess.ec.europa.eu/>

Vacancy number : URBASIS-EU ESR3.1 (to be reminded in the application form)

Deadline : February, 23rd 2019

Salary : According to the European Commission and local standards ; minimum gross wage is 3500 euros before local taxes

Contact Information

You may obtain further information from :

- **Philippe Guéguen**, URBASIS project coordinator : philippe.gueguen@univ-grenoble-alpes.fr (Earth Science Institute, Université Grenoble Alpes) for general questions regarding the URBASIS consortium or concerning the scientific and training aspects of the ITN program
- **Prof. Donat Fäh** : faeh@sed.ethz.ch (no applications) for specific questions regarding the position
- **Florence Cataye**, URBASIS project manager : florence.cataye@univ-grenoble-alpes.fr for administrative questions

For further information about the Swiss Seismological Service please visit our website (www.seismo.ethz.ch). Questions should be directed to.