



International Training Course on **Seismology, Seismic Data Analysis, Hazard Assessment and Risk Mitigation**

9 – 28 October, 2023
Podgorica, Montenegro

Organised and sponsored by

Helmholtz Centre Potsdam
GFZ German Research Centre for Geosciences

co-sponsored by

Federal Foreign Office of Germany (Berlin)

*European Plate Observing System (EPOS)
EPOS Thematic Core Service for Seismology
Observatories and Research Facilities for European Seismology
(ORFEUS)*

with the local support of

*Institute of Hydrometeorology and Seismology of Montenegro
University of Montenegro - Faculty of Civil Engineering*

1. OBJECTIVES AND PROGRAMME OF THE TRAINING COURSE

The disastrous consequences of destructive earthquakes place a heavy burden on many societies and their economies, particularly in developing countries. In order to avoid or at least to mitigate the negative effects of such events a thorough scientific knowledge of their geological and geophysical causes, their structural, kinematics and dynamic characteristics and destructive effects as well as a developed capability to monitor and to analyse them is indispensable. The vulnerability of human societies and related human and economic losses due to earthquakes are steadily growing as a consequence of rapid population growth and urbanization. Accordingly, improved risk assessment and effective disaster mitigation measures are prerequisites to ensure sustainable development in earthquake-prone countries.

The GFZ German Research Centre for Geosciences is running an annual international training course in the field of seismology and seismic hazard assessment. This training course is part of related programs of the United Nations (OCHA and UNESCO) aimed at promoting training and know-how transfer, especially to nationals from developing countries. The courses are a contribution to the Sendai Framework for Disaster Risk Reduction 2015-2030.

In 2023, the GFZ organizes and runs the course in Podgorica, Montenegro, in the time period 9 October to 28 October 2023 for the benefit of participants from earthquake-prone developing countries under the main topics:

"SEISMOLOGY, SEISMIC DATA ANALYSIS, HAZARD ASSESSMENT AND RISK MITIGATION".

The training course 2023 is chiefly sponsored by the Federal Foreign Office (FFO) of Germany (Berlin). It is also supported by the United Nations Educational, Scientific and Cultural Organization (UNESCO, Paris). Until 2019, more than 1200 participants from 119 countries, amongst them graduate students, university lecturers as well as senior staff and directors of reputed research institutes, have attended the seismology training courses organized and supported by the GFZ Potsdam. Since the foundation of the GFZ in 1992 these courses are, as an essentially new feature, held alternately every second year in Potsdam and as regional courses in a hosting country of Africa, Asia or Latin America. In the latter case, the course topics are specifically tailored to the needs and potentials of the respective region and integrate many local lecturers into the international team of instructors.

ORFEUS (Observatories and Research Facilities for European Seismology) is a non-profit foundation that promotes seismology in the Euro-Mediterranean area through the collection, archival and distribution of seismic waveform data, metadata, related services and products. The data and services are collected or developed at national level by more than 60 contributing Institutions in Pan-Europe. They are further developed, integrated, standardized, homogenized and promoted through ORFEUS. Goals of ORFEUS include the development and coordination of waveform data products, the coordination of a European data distribution system, the support for seismic networks in archiving and exchanging digital seismic waveform data, the encouragement of the adoption of best practices for seismic network operation, data quality control and data management and the promotion of open access to seismic waveform data, products and services for the broader Earth science community.



EPOS, the European Plate Observing System, is a multidisciplinary, distributed research infrastructure that facilitates the integrated use of data, data products, and facilities from the solid Earth science community in Europe. EPOS brings together Earth scientists, national research infrastructures, Information and Communication Technology experts, decision makers, and public to develop new concepts and tools for accurate, durable, and sustainable answers to societal questions concerning geo-hazards and those geodynamic phenomena relevant to the environment and human welfare.

For the first time GFZ, ORFEUS and the EPOS Thematic Core Service for Seismology (that comprises ORFEUS, EMSC and EFEHR) will team up for the organization of a joint event that will integrate the EPOS Seismology community workshop and the ITC. Among the aims of this synergy with ORFEUS and EPOS TCS Seismology is to facilitate open and FAIR data management, access and exchange in the region, along with open source seismological software towards the next generation of open science.

In line with the steadily growing demand by participants in former courses for mainly practice-oriented training and workshop discussions related to case studies, the current course programme comprises, besides introductory and state-of-the-art review lectures on the various subjects of earthquake seismology and risk assessment, extensive practical exercises, demonstrations, workshop discussions and scientific excursions. Generally, the course programme aims at developing interdisciplinary problem understanding, acquaintance with the theoretical fundamentals and basic features of modern instrumentation, commonly used models and algorithms as well as developing practical skills in data evaluation and analysis.

The scientific-technical background and work duties of the course participants are usually rather different. Nonetheless, there are generally two main groups of applicants:

- those mainly working in the field of seismic hazard and risk assessment, earthquake zonation and microzonation and/or earthquake engineering and disaster management;
- those responsible for the installation, maintenance, operation of and/or data analysis at seismic stations or network centres.

The detailed scientific programme of the course is annexed to this circular. The training course is planned as a 3-week course. The training is dedicated to fundamental lessons and exercises on Seismology, Microzonation, Strong Ground Motion, and Seismic Hazard Assessment and Risk Estimation. Additional topics are the use of InSAR and geodynamic modelling. Some sessions of the training course are dedicated to scientific-technical presentations by the course participants. Participants have also to report about own work. The scientific-technical presentations are planned as short talks to the other course participants and interested colleagues from the GFZ. In case a course participant wants to use his own data (seismic data, instrumental microzonation, earthquake catalogue, etc.) during the time of the Training Course a copy of the data should be sent to the GFZ before arrival for checking and quality control.

Since 2019 there is an important extension for further qualification available. Former course participants can apply for additional support from the International Training Course: in case you have an idea for a project, or an interest in gaining further qualifications, you can submit a short application (1 page). The proposed project should build upon the background gained as a course participant. We can provide (for a short period of time) a limited number of instruments, as well as software tools for data analysis. The aim should be to produce a common publication for submission to an international journal. Any acquired data will have to be made publically available in an electronic form. You will need

a partner (lecturer) from the training course. The time for the project should be “short” – we cannot support a full Master or PhD project (Note: there are other funding possibilities offered by DAAD or the Humboldt Foundation). However, we can support your visit to the GFZ or another institution with a travel grant and even a short-term scholarship. A board of lecturers will select the projects to be supported.

Throughout the course the completion of exercises by the participants as well as their contributions to workshop sessions and topical discussions are evaluated. **The successful participation in the course is acknowledged by a certificate at the end of the course.**

2. APPLICATION AND ADMISSION

2.1 Conditions for application and admission

The course is arranged for the benefit of participants from earthquake-prone countries. To make the training effective, the number of participants is limited to 25. Preference is given to female and young candidates engaged in seismology, seismic monitoring and zonation, earthquake data analysis, hazard, vulnerability and/or risk assessment. Applicants should have active interest and obligations in these fields. Engineers with background and duties in earthquake engineering and disaster management who want to deepen their understanding of seismological phenomena, methods and data products are also considered, as are researchers or university lecturers in geosciences who may act as conveyers of the knowledge acquired in the course (training of trainers). We aim at a minimum quota of 40% female participants for the course to foster participation and career development of female applicants.

Applicants must have a scientific degree (B.Sc. or M.Sc., diploma or higher) in geosciences, physics or engineering from a recognized university, a focus will be on PhD-students. Preferably applicants should have several years of professional experience in subjects covered by the course. Applicants must also have **a thorough knowledge of English** which is **the only working language of the course**.

It is also **mandatory** for admission to the course that applicants are able and willing to present a **paper (15 minutes + 5 minutes discussion) on their work**.

The travel and subsistence expenses of the successful applicants will be supported as specified in section 2.3.

An application is considered only when including:

- **two letters of recommendation**
- **applicant's explicit confirmation to have appropriate command of the English, if possible by adding copies of respective language certificates**
- **CV, including publications (if available)**
- **title and abstract of the applicant's scientific presentation**
- **sound motivation letter written by the applicant himself is submitted (½-1 page)**
- **applicant's confirmation that an international travel and health insurance will be concluded.**

Those who intend to present and discuss additionally in a special workshop session data, methods used or case studies from their country should indicate this separately in the registration form and submit an abstract giving details about the subject, method applied, kind of data available as well as of the open questions they want to thresh out.

Without such specifications and accompanying documents an application will not be considered!

All participants have to present themselves, at the social evening get-together (**cultural evening**). They are welcome to bring any suitable kind of material or food or

personal performances (dances, songs, instruments) which can convey to their fellow participants some impressions about geography, culture, customs, music and daily life. Such informal, short presentations should be limited to few minutes.

In the selection of participants **preference is given to those applicants**, who (as confirmed in the application forms and accompanying letters):

- are most in need of training in the subjects covered by the course;
- are concerned with the operation of seismic stations and/or data analysis and management at seismological data centres;
- are working with seismic hazard assessment or microzonation;
- are involved in vulnerability and risk assessment, engineering seismology, and/or disaster management and mitigation projects;
- can serve as multipliers in spreading the knowledge and skills acquired;
- can make an active contribution to the workshop sessions and discussions;
- had applied already earlier for the course, been found eligible/qualified but could not be accepted due to the limited number of fellowships available for each course;
- can pay their travel.

The applications and accompanying candidates' files will be carefully screened by the Academic Board and Selection Committee of the course. Members of the board are prominent geoscientists of the GFZ German Research Centre for Geosciences and representatives of the Foreign Office as the main sponsor of the course. Chairman is Prof. Dr. T. Dahm, head of section 2.1 "Physics of Earthquakes and Volcanoes" at the GFZ.

2.2 Application formalities / Invitation

Applications should be sent per e-mail, directed to Dr. Simone Cesca, at the following e-mail: course-un@gfz-potsdam.de.

Applications should include the following information:

- (1) CV, including (if available) a list of scientific publications; (if available)
- (2) Two letters of recommendation, which give details on the applicant's personality, duties, performance in seismic station operation, data analysis or scientific research;
- (3) Confirmation of appropriate command of English;
- (4) Title and one-page abstract of the proposed topic or case study to be presented or discussed in a special workshop session;
- (5) Letter of motivation;

The **deadline** for the submission of the application documents is **August 15, 2023**. **Candidates will be informed of the decision of the Academic Board by September, 2023** and, if accepted, will receive further instructions by the GFZ in a letter of acceptance.

Any additional question may be directed to the address above.

2.3 Services provided to selected participants

Fellowships granted to participants entitle them to the following services:

- Accommodation in single rooms, breakfast, lunch and tea-break refreshments within the facilities and arrangements provided by the organizers.
- Course software and material, which participants can take home;

- A small amount to cover dinner costs and incidental expenses; this amount will be provided by bank transfer to participants in the weeks following the training course, upon course attendance,
- Local transport in connection with the official programme and field excursions.

Travel grants to cover the cost of international travel might be available for only some of the participants. Every applicant is urged to look into available possibilities to cover travel expenses on his/her own with the support of his/her nominating or sponsoring institution and to make, an explicit statement to this effect in the application letter.

2.4 Costs borne by participants or nominating agencies

Participants or their nominating governments/agencies are required to bear the following:

- Cost of personal travel, accident, live and medical insurance;
- All expenses in the home country for travelling abroad, including passports, visa, medical examinations, inoculations, domestic travel, etc.;
- Salary and related allowance during the period of participation in the training course;
- Any expenses other than the travel grants for selected participants and the living and accommodation expenses at the seminar place including subsistence and incidental expenses during travel, any expenses incurred during stop-over en route and any additional costs for travel by other route than the one originally provided with the ticket;
- Any costs for excess luggage.

Neither the GFZ nor any other co-organiser or co-sponsor of the course will assume responsibility for the following expenditures or services:

- Costs incurred by participants with respect to travel insurance, medical bills and hospitals fees in connection with their attendance at the training course;
- Loss of or damage to property while attending the training course;
- Compensation in the event of death or disability of participants in connection their attendance at the training course;
- Any claim towards expenses incurred by participants other than those mentioned in section 2.4 above (e.g. for accommodation in hotels, food and drink orders or private trips of the participants own choice, shopping, excess luggage, etc.);
- Re-routing tickets or making visa arrangements other than those required for entering or leaving Germany on the shortest possible way.

By attending the International Training Course on Seismology, you grant the GFZ German Research Centre for Geosciences the right to use your name, photograph and biography in GFZ news, or promotional material, whether in print, electronic or other media, including the GFZ website.

By sending their application, all applicants and their nominating institutions accept these conditions irrevocably.

For more information please contact:

Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences
Section 2.1 "Physics of Earthquakes and Volcanoes"
Dr. S. Cesca and Dr. C. Milkereit
Telegrafenberg, D-14473 Potsdam, Germany
Phone: (+49 331) 288-1289, 288-28794 or 288-1201
E-mail: course-un@gfz-potsdam.de

3. GENERAL INFORMATION

3.1 Location of the course

The training course will be held at the Signum Hotel, Podgorica, Montenegro, where the course participants will be accommodated.

The Orfeus-EPOS meeting during the first days of the course will take place at the Sport Cultural Center. Podgorica, Montenegro.

3.2 Excursions

During the weekends, we plan to have two full-day excursions to Montenegro, with field destinations to be defined. Participants are recommended to bring appropriate shoes and waterproof clothes.

3.3 Climate and recommended dressing

Montenegro has a Mediterranean climate on the coast, with heavy rains from September to April. Climate is becoming progressively more continental in the inland, with colder winters, especially at high altitudes. Precipitation is plentiful, especially in the coastal region and in hilly and mountainous regions overlooking the sea. Rains are not very frequent, but intense. The proximity to the Adriatic Sea affects the climate of Podgorica – across the Bojana River valley and Lake Skadar. Under the influence of the surrounding mountains, the Mediterranean climate changes: summers in Podgorica are very dry, warm and hot, while winters are mild and rainy and with high air temperatures.

Climate normal and extremes in Podgorica during the October are:

- The average daily temperature (measured over 24h) is 15.9°C,
- The average daily maximum is 21,7°C,
- The average daily minimum is 11,6°C.
- The average monthly precipitation in Podgorica is 164 mm
- The average number of sunny hours during an October is 201 h
- The average of rainy days 9
- The average humidity 68 %

3.4 Helmholtz Centre Potsdam, German Research Centre for Geosciences (GFZ)

The future can only be secured by those who understand the System Earth and its interactions with Man: We develop a profound understanding of systems and processes of the solid Earth together with strategies and options for action to address global change and its regional impacts, to understand natural hazards and to minimize associated risks, as well as to assess the human impact on System Earth.

The GFZ is Germany's national research center for the solid Earth Sciences. Our mission is to deepen the knowledge of the dynamics of the solid Earth, and to develop solutions for grand challenges facing society. These challenges include anticipating the hazards arising from the Earth's dynamic systems and mitigating the associated risks to society; securing our habitat under the pressure of global change; and supplying energy and mineral resources for a rapidly growing population in a sustainable manner and without harming the environment. These challenges are inextricably linked with the dynamics of planet Earth, not just the solid Earth and the surface on which we live, but also the hydrosphere, atmosphere, and biosphere, and the chemical, physical, and biological

processes that connect them. Hence, we view our planet as a system with interacting components. We investigate the structure and history of the Earth, its properties, and the dynamics of its interior and surface, and we use our fundamental understanding to develop solutions needed to maintain planet Earth as a safe and supportive habitat.

In pursuit of our mission, we have developed a comprehensive spectrum of expertise in geodesy, geophysics, geology, mineralogy, geochemistry, physics, geomorphology, geobiosciences, mathematics, and engineering. This is complemented by our deep methodological and technological knowhow and innovation. We are responsible for the long-term operation of expansive instrument networks, arrays and observatories, as well as data and analytical infrastructures. To accomplish our large-scale tasks, we have established MESI, the worldwide unique Modular Earth Science Infrastructure.

Our research is organized in a matrix structure, with disciplinary competences grouped in five scientific departments. The departments guarantee the development and continuity of disciplinary skills, methods, and infrastructures. This is an indispensable foundation for our ability to engage with evolving scientific insights, new technologies, and unexpected, pressing challenges of societal relevance.

Complementary to this, we at the GFZ are working on five topics in the joint programme of the seven Helmholtz Centres in the Research Field "Earth and Environment". Within the framework of this programme, "Changing Earth – Sustaining our Future", we will be researching the natural foundations of life –extending from the Earth's surface and the oceans to the remotest polar regions and from the deep interior of planet Earth to the atmosphere – in a systemic approach from the years 2021 to 2027.

The training course on "Seismology and Seismic Hazard Assessment" is part of the activities of the Geophysics Department. Disaster related topics of the Department are research on earthquakes and volcanic eruptions, multidisciplinary task force missions to be dispatched into areas, which are struck by devastating, geological events with the aim to collect first-hand data about damages, vulnerability, aftershocks or other post events activity, local underground effects, seismo-tectonic conditions.

More information is available from the GFZ home-page <http://www.gfz-potsdam.de/>.

Institute of Hydrometeorology and Seismology

Instrumental observations of seismicity in Montenegro began in 1960, with the establishment of the Podgorica seismic station. After the Montenegrin 1979 earthquake, the local seismic network has been established governed by Republic Seismological Institute (e.g. Montenegro Seismological Observatory).

In 2012, *Decree on the Government Administration's organization* accredited newly established Institute of Hydrometeorology and Seismology (IHMS) to monitor natural phenomena and processes – including seismicity. Nowadays IHMS is an administrative body organized under the Ministry of Ecology, Spatial Planning and Urbanism.

IHMS (Sector of Seismology) operates the Montenegrin Seismic network (<https://doi.org/10.7914/SN/ME>), with responsibilities to collect, archive and provide access to seismic data, analyse weak and strong motion waveform and parametric data, as well as geodetic ones. Sector analyses and evaluate seismic hazard, commend national seismic zonation - providing inputs for design and construction of buildings, spatial planning, etc. According to the License of the Ministry of Science, ZHMS performs scientific and research activities in the field of natural and mathematical sciences.

More information is available from the IHMS homepages <http://meteo.co.me> and <http://www.seismo.co.me>