



## 2026 Helmholtz – OCPC – Programme for the involvement of postdocs in bilateral collaboration projects

### PART A

**Title of the project:**

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Cascading, compound, companion hazards and their early warning system

**Helmholtz Centre and/or institute:**

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GFZ Helmholtz Centre for Geosciences

**Project leader:**

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Dr. Hui Tang, Dr. Jens Turowski, Prof. Dr. Jean Braun

**Contact Information of Project Supervisor:** (Email, telephone)

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**Web-address:**

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<https://www.gfz.de/en/section/earth-surface-process-modelling/overview/>

[https://www.gfz.de/en/section/geomorphology/overview](https://www.gfz.de/en/section/geomorphology/overview/)

**Department:** (at the Helmholtz centre or Institute)

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Department of Geosystem

Section 4.7 Earth Surface Process Modelling

Section 4.6 Geomorphology

**Programme Coordinator** (Email, telephone and telefax)

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## **Description of the project (max. 1 page):**

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Europe faces various hazards, including flooding, earthquakes, landslides, storms, volcanoes, wildfires, droughts, and heatwaves. One of the biggest challenges in risk assessment and early warning of these events is understanding and studying the interactions among individual hazards within a multi-hazard framework. Compound/consecutive, cascading, and companion events are interconnected concepts used in multi-hazard research. Compound/consecutive events occur simultaneously or sequentially, while cascading events trigger chain reactions that amplify impacts. Companion event refers to associated hazards from the same trigger. Nonlinear dynamics and interaction between these hazards can be mathematically represented as a causal diagram acting on the probability distribution of all possible measurements in the nonlinear system. Meanwhile, all those hazards can be potential recorded by seismic methods. Therefore, in this project, we aim to

- (1) understand multi-hazards based on seismic signal or other field monitoring data;
- (2) develop a method to understand the relationships among various single hazards using the Bayesian causal inference framework (e.g., a Causal Bayesian Network).
- (3) provide a foundation for the early warning system of multi-hazards.

## **Description of existing or sought Chinese collaboration partner institute (max. half page):**

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We have existing collaborations with several institutions in China, including State Key Laboratory of Geohazard Prevention and Geoenvironmental Protection, Chengdu University of Technology, Institute of Mountain Hazards and Environment, CAS, Jilin University, Zhejiang University, Tsinghua University, Tianjing University and Southwest Jiaotong University. With this application, we also seek to bring together groups with unique expertise in earth surface processes. Postdocs of these and other organizations with a strong background in surface processes modelling, natural hazard, seismology are invited to apply.

## **Required qualification of the postdoc:**

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- PhD in Earth Sciences, Physics, or Mathematics, demonstrating excellence in guided research
- Research experience in multi-hazard assessment and early warning
- Research experience in machine learning, deep learning, and numerical model development
- Experience of working with PyTorch, TensorFlow, Keras, Pandas, and Xarray
- Ability to use programming languages, such as Python, MATLAB, C, C++, or Fortran
- Experience in developing scientific data pipelines
- Rich knowledge in natural hazards, seismology or geomorphology
- Capacity for publication as leading author in high impact journal
- Proficiency in spoken and written English
- We expect the Postdoc start at the end of 2026