# Gaspard Farge

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## Scientific statement

My research aims to describe the physical processes that generate and shape the activity of small-magnitude seismic phenomena. I am particularly interested in the interactions between the smallest seismic events in faults, glaciers and volcanoes. Using first-order physical models and statistical analysis methods, I attempt to describe the key aspects of stress transfer in geological systems that structure the interactions between seismic sources, and produce the spatio-temporal patterns of their activity. I try to make my science accessible for everyone, through open access scientific practices and perpetually learning how I can communicate it in compelling, entertaining ways.

## Education

2019–2022 **PhD** — Geophysics
Institut de Physique du Globe de Paris — Université Paris Cité

2014–2019 **ENS Graduate Degree** — Earth Sciences & Elective classes in: History, Physics, Linguistics...
École Normale Supérieure (Paris)

Spring 2018 **Graduate exchange scholar** — Graduate classes in: Data Sonification, Sociology, & History
Columbia University (New York, NY), Graduate School of Arts and Sciences

2015–2017 **M.Sc.** — Earth, Atmospheric and Planetary Sciences, majoring in Geophysics
École Normale Supérieure & Institut de Physique du Globe de Paris

2014–2015 **B.Sc.** — Earth and Planetary Sciences
École Normale Supérieure & Université Pierre et Marie Curie (Paris)

## Research positions

Mar 2023 — **Postdoc** — with *Emily Brodsky*
University of California, Santa Cruz — Seismological Laboratory
*> Statistical study of the interaction between regular and low-frequency earthquakes on the San Andreas fault*

Sep 2021–Mar 2022 **Fulbright Visiting Fellow** — with *William B. Frank*
Massachusetts Institute of Technology (Cambridge, MA), EAPS — Earthquake Science group
*> Development of statistical measures of temporal clustering and periodicity in seismicity catalogs*

2018–2022 **Graduate Research Assistant** — PhD research, with *Claude Jaupart* & *Nikolaï M. Shapiro*
Institut de Physique du Globe de Paris — Geological fluid dynamics group
*> Sounds of geological plumbing systems — How transient fluid circulation processes in faults and volcanoes shape sources and patterns of microseismicity*

Feb–Nov 2017 **Graduate Research Assistant** — research internship, with *Nikolaï M. Shapiro* & *William B. Frank*
Institut de Physique du Globe de Paris — Seismology group
*> Study of the source of low-frequency earthquakes in Guerrero, Mexico*

Mar–Aug 2016 **Graduate Research Assistant** — research internship, with *Roland Bürgmann*
University of California, Berkeley — Seismological Laboratory, Active tectonics group
*> Study of surface deformation in the complex junction of the Calaveras & Hayward faults*

Jun–Jul 2015 **Undergraduate Research Assistant** — B.Sc. research, with *Alexandre Schubnel*
Laboratoire de Géologie — École Normale Supérieure (Paris)
*> A global study of deep-focus seismicity: occurence, thermo-tectonic control and seasonality*

## Peer-reviewed publications

1. Journeau, C., Shapiro, N. M., Seydoux, L., Soubestre, J., Koulakov, I. Y., Jakovlev, A. V., Abkadyrov, I., Gordeev, E. I., Chebrov, D. V., Droznin, D. V., Sens-Schönfelder, C., Luehr, B. G., Tong, F., **Farge, G.**, & Jaupart, C. (2022). ***Seismic tremor reveals active trans-crustal magmatic system beneath Kamchatka volcanoes.*** Science Advances, 8(5)
2. Paté, A., **Farge, G.**, Holtzman, B. K., Barth, A. C., Poli, P., Boschi, L., & Karlström, L. (2021). ***Combining audio and visual displays to highlight temporal and spatial seismic patterns.*** Journal on Multimodal User Interfaces.
3. **Farge, G.**, Jaupart, C., & Shapiro, N. M. (2021). ***Episodicity and Migration of Low Frequency Earthquakes Modeled With Fast Fluid Pressure Transients in the Permeable Subduction Interface.*** Journal of Geophysical Research: Solid Earth
4. **Farge, G.**, Shapiro, N. M., & Frank, W. B. (2020). ***Moment-Duration Scaling of Low-Frequency Earthquakes in Guerrero, Mexico.*** Journal of Geophysical Research: Solid Earth, 125(8).

### *Manuscripts in preparation*

- **Farge G.**, Jaupart, C., Shapiro, N. M. and Frank, W. B. (2023?) ***Along-strike segmentation of tremor activity and its relationship with the hydraulic structure of the subduction fault zone.*** (*submitted to* Journal of Geophysical Research: Solid Earth)

*Participation in peer-review:* AGU Advances (1)

## Invited talks and seminars

- ***Sounds of the subduction plumbing system — How transient fluid circulation processes in the subduction shape sources and patterns of seismic tremor***

Avril 2023 UC Santa Cruz, Institute for Geophysics and Planetary Phisycs Seminar

- ***Tremor patterns & source synchronization in the subduction zone plumbing system***

Février 2023 Institut des Sciences de la Terre (Grenoble), Séminaire du groupe Tectonique (*Deeptrigger*, ERC)

- ***Noisy pipes: how intermittent fluid transport in faults could be responsible for swarm seismicity***

Dec 2021 Massachusetts Institute of Technology, Earth Resource Laboratory Seminar

- ***Migrations and episodicity of tremor as symptoms of the intermittence of permeable fluid transport systems***

Jun 2021 École Normale Supérieure (Paris), Geology Laboratory Seminar
Jun 2021 Institut de Physique du Globe de Paris, Geological Fluid Dynamics group Seminar
May 2021 Institut des Sciences de la Terre (Grenoble), Waves and Structure group Seminar
Jan 2020 Institut des Sciences de la Terre (Grenoble), SEISMAZE (ERC) project workshop

- ***Modeling LFE sources and their interaction in the framework of pore pressure transients diffusion***

Oct 2019 Institut des Sciences de la Terre (Grenoble), SEISMAZE (ERC) project kickoff meeting

- ***A(nother) moment-duration scaling for low-frequency earthquakes: insight in their apparent source processes***

Oct 2019 Institut des Sciences de la Terre (Grenoble), SEISMAZE (ERC) project kickoff meeting

## Selected conference proceedings

*(† talk, ǂ performance)*

1. **Farge, G.**, Jaupart, C., Shapiro, N. M. ***Clogging and un-clogging of the subduction plumbing system may generate tremor-like patterns.*** *EGU General Assembly, 2021 (virtual)* †
2. **Farge, G.**, Jaupart, C., Shapiro, N. M. ***Tectonic tremor without slip? Fast pore pressure transients in the subduction interface can generate tremor patterns.*** *AGU Fall Meeting, 2020 (virtual)*
3. Paté, A., Holtzman, B. K., Boschi, L., **Farge, G.**, Barth, A. C., Cluett, S. A., Pratt M., Candler, J., Repetto, D., Karlstrom, L., Crozier, J., Poli, P., Okamoto, K., & Nelson, J. ***Spatialized Seismic Soundscapes: Exploring Seismic Data in Virtual Reality***. *14th International Symposium on Computer Music Multidisciplinary Research, 2019* (Marseille, FR) ǂ
4. **Farge, G.**, Jaupart, C., Kaminski E., Shapiro, N.M. ***Sounds of the subduction piping system? How the dynamics of transient pore pressure diffusion in subduction zones could account for low-frequency earthquakes activity.*** *IPGP–ERI joint meeting, 2019 (Paris, FR)*

5. **Farge, G.**, Shapiro, N. M., Frank, W. B., Mercury, N., & Vilotte, J. P. ***Insights in low frequency earthquake source processes from observations of their size-duration scaling.*** *AGU Fall Meeting, 2017 (New Orleans, LA, USA)*

## Grants and awards

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| Sep 21 – Mar 22 | **Fulbright fellowship grant** — French-American Fulbright commission *(6-month funding $13,000)* |
| 2019 | **Best demo prize** for ***Spatialized seismic soundscapes: Exploring Seismic Data in Virtual Reality,*** at the 14th International Symposium on Computer Music Multidisciplinary Research |
| 2019–2022 | **Doctoral scholarship** — Ministry of higher education and research (France) & École Normale Supérieure *(3-year funding)* |
| 2018 | **Graduate exchange scholarship** — École Normale Supérieure & Columbia University *(1-semester funding)* |

## Teaching positions

*(* : class taught in English)*

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| 2020–2021 | Instructor in ***Thermodynamics*** — B.Sc. Earth Sc. at IPGP & Université Paris Cité (UP) |
| 2019–2021 | Instructor in ***Mathematics*** — B.Sc. Earth Sc. at IPGP & UP |
| 2019–2021 | Instructor in ***Data analysis in Python for Earth sciences*** — M.Sc. Earth Sc. at IPGP & UP |
| 2019–2020 | Instructor in ***Inverse problems in the Earth Sciences**** — M.Sc Earth Sc. at IPGP & UP |

## Outreach and Leadership

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| 2021 | **Head of organizing committee** — PhD student conference of IPGP Doctoral School *(post-2021-lockdown edition)* |
| 2020 | **Organizing committee** — PhD student conference of IPGP Doctoral School *(cancelled)* |

**Demonstrations of** ***Spatialized seismic soundscapes: Exploring Seismic Data in Virtual Reality***

- Open Lab Day Université Catholique de Lille (Oct 2018)
- Open Lab Day Lamont Doherty Earth Observatory (May 2018)

## Skills, tools and languages

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| High-performance scientific computing and data analysis | *using Python, Matlab, Fortran, MPI, bash* |
| Collaborative development, maintenance and publication of code packages | *using GitHub* |
| Visual and sonic representation of data | *using Python* |
| Animation and creative visual coding | *using matplotlib, JavaScript* |
| Basics of web development | *using HTML, CSS* |

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| French | *native* |
| English | *fluent* |
| Spanish | *basics* |
| Mandarin Chinese | *enthusiastic beginner* |