Marine LAPORTE

Seismologist, Post-doc

https://Marine-Laporte.github.io/

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About

I am an early-career seismologist interested in developing innovative techniques for **seismicity analysis**, **seismotectonics** and **uncertainty assessment** in earthquake catalogs. I am a post-doctoral seismologist at the Claude Bernard University in Lyon. With a PhD in Earth Sciences obtained in 2022, my thesis focused on improving the estimation of earthquake depths from regional (<150 km) or global seismological networks, co-supervised by L. Bollinger, Research Director at CEA-DIF and J. Letort, Assistant Physicist at Paul Sabatier University in Toulouse. I am developing new **inverse and statistical methods** to exploit seismicity catalogues containing the location, time-origin and magnitude of earthquakes. I'm particularly interested in gaining a better understanding of and quantifying the uncertainties associated with these parameters, which characterize the **seismic source,** in order to obtain robust interpretations of the mechanisms behind the seismicity. Specifically, I worked on micro-seismicity in **far-Western Nepal**, on seismic swarms and mainshock-aftershock sequences such as the 2015 Gorkha earthquake. I published 6 (8) research articles in A-rated journals including 2(3) as first author (2 articles currently under review). I participated to 5 international conferences to present my work and I organized one short workshop in Nepal. I am a currently involved on several projects, 2 PhD theses and an ANR grant. I have given several outreach talks on seismology and Himalayan seismotectonics and taught a few courses at CEA and University.

Education

Ph.D of Earth Sciences *CEA, ENS - Paris* **[2022]**

Master Earth and Planetary Science *University of Lorraine - Nancy* **[2018]**

Engineering degree in Geology *Ecole Nationale Supérieure de Géologie - Nancy* **[2018]**

Research experience

- **MSCA Post-doctoral fellow** *Instituto de Ciencès del Mar - Barcelona* **[2025-Present]**

Funded by the European program of Marie-Sklodowska-Curie-Actions
Title: B- GRASP : Bayesian Gutenberg-Richter analysis for understanding Seismic Processes
In collaboration with : T. Bodin (ICM), Pierre Arroucau (EDF)

- **Post-doctoral Researcher** *University Claude Bernard Lyon 1- Lyon* **[2023-Present]**

Funded by the Laboratory of Excellence : Institute of Origins of Lyon (Labex-LIO)
Title: Deciphering temporal variations of the b-value parameter from the Gutenberg-Richter law in large seismic datasets using a Bayesian approach.
Supervisors: Stéphanie Durand (Univ. Lyon), Blandine Gardonio (Univ. Lyon).
In collaboration with : T. Bodin (Univ. Lyon), D. Marsan (Isterre, Chambery)

- **Ph.D., Geophysics** *CEA-DASE, ENS – Bruyères-le-Châtel* **[2019 –2022]**

Funded by the French Atomic Energy and Alternative Energies Commission (CEA)
and granted by Ecole Nationale Supérieure, Paris Sciences et Lettres (ENS-PSL).
Title: Contribution to the improvement of hypocentral depth estimations from regional and global networks.
Supervisors: Laurent Bollinger (CEA), Jean Letort (University Paul Sabatier, Toulouse).
Jury: Martin Vallée (IPGP), Alexandrine Gesret (Mines), Alessia Maggi (University of Strasbourg), Gyorgy Hetényi (University of Lausanne)

- **Research Assistant, Seismology** *ENS- Laboratory of Geology – Paris* **[2019]**

Project: Progress in exploiting data from the HiKNet temporary seismological network (Nepal)

Internships and voluntary work

- **Engineering school, Geology** *CEA-DASE, ENS - Bruyères-le-Châtel* **[2018]**

Project: Analysis of the seismicity of western Nepal revealed by the HiKNet network.
Supervisors: Laurent Bollinger (CEA), Hélène Lyon-Caen (ENS)

- **Master of Geosciences** *CRPG - Nancy* **[2018]**

Host: Centre de Recherches Pétrographiques et Géochimiques (CRPG).
Project: Study of deformation and exhumation within the foreland prism of an intercontinental collision chain. Thermochronology. Tectonics. Magnetostratigraphy.
Supervisors: Raphaël Pik (CRPG), Jerôme Lavé (CRPG), Julien Charreau (CRPG)

- **Voluntary work** *Himalaya-Solaire, Nyamdu Dro – Ladakh, India* **[2015, 2017]**

Project: Solar electrification of remote villages in Ladakh-Zanskar. 1 month (2015). 3 months (2017)
Teaching: Cultural exchanges between children from a primary school in Nancy and schools in Ladakh.

Grants and prices

- **Best poster price (2000€)** *1st meeting EPOS-France* **[2023]**
- **External collaborator on an ANR grant** **[2024]**
  J. Letort ANR-Young Researchers program : ShallowDepth- DL
- **MSCA grant (200.000€)** **[2025]**
  M.Laporte European Fellowship B-GRASP project

Skills/Expertise

- ✓ Language : French, English, Spanish
- ✓ Programing languages: Shell, Python, Matlab, Fortran
  bibliothèques : obspy, pyrocko, basemap, numpy, pandas, matplotlib, plotly (interactive plotting tools),SAlib
- ✓ Software and programme skills:
  - Seismological data processing software
  - Earthquake location algorithms
  - Other algorithms for seismology : SourceSpec (magnitudes), FPFIT (focal-mechanisms), Zmap
  - GIS software for creating maps: Generic Mapping Tools (GMT), Python-Basemap, QGis, Google Earth
- ✓ Seismotectonics, general seismology, seismic cycle, notions of palaeoseismology
- ✓ Signal processing in seismology: deconvolution, cepstral analysis, stacking techniques, etc.
- ✓ Statistical seismology : epidemic type aftershocks sequences (Etas), basics of Bayesian approaches
- ✓ Global sensitivity analysis: Sobol indexes, Morris screening

Publications (peer-reviewed journals)

- **Laporte, M.,** Durand, S., Bodin, T., Gardonio, B., & Marsan, D. **(2025)**. b-Bayesian: The Full Probabilistic Estimate of b-value Temporal Variations for Non-Truncated Catalogs. (access)
- **Laporte, M.,** Letort, J., Bertin, M., & Bollinger, L. **(2024)**. Understanding earthquake location uncertainties using global sensitivity analysis framework. Geophysical Journal International, 237(2), 1048-1060. (access)

- **Laporte, M.,** Bollinger, L., Lyon-Caen, H., Hoste-Colomer, R., Duverger, C., ...& Adhikari, L. B. **(2021)**. Seismicity in far western Nepal reveals flats and ramps along the Main Himalayan Thrust. Geophysical Journal International, 226(3), 1747-1763. (access)
- Gardonio, B., Bollinger, L., **Laporte, M**., Vergne, J., Lyon-Caen, H., & Adhikari, L. B. **(2025)**. Seismicity acceleration and clustering before the Mw7. 9 Gorkha earthquake, Nepal. (access)
- Koirala, B. P., **Laporte, M.,** Bollinger, L., Batteux, D., Letort, J., Guilhem Trilla, A., ... & Adhikari, L. B. **(2023)**. Tectonic significance of the 2021 Lamjung, Nepal, mid-crustal seismic cluster. Earth, Planets and Space, 75(1), 165. (access)
- Adhikari, L. B., **Laporte, M.,** Bollinger, L., Vergne, J., Lambotte, S., Koirala, B. P., ... & Perrier, F. **(2023).** Seismically active structures of the Main Himalayan Thrust revealed before, during and after the 2015 M w 7.9 Gorkha earthquake in Nepal. Geophysical Journal International, 232(1), 451-471. (access)
- Retailleau, L., Saurel, J. M., **Laporte, M.,** Lavayssière, A., Ferrazzini, V., Zhu, W., ... & OVPF Team. **(2022)**. Automatic detection for a comprehensive view of Mayotte seismicity. Comptes Rendus. Géoscience, 354(S2), 1-18. (access)
- Adhikari, L. B., Bollinger, L., Vergne, J., Lambotte, S., Chanard, K., **Laporte, M.,** ... & Perrier, F. **(2021)**. Orogenic collapse and stress adjustments revealed by an intense seismic swarm following the 2015 Gorkha earthquake in Nepal. Frontiers in Earth Science, 524. (access)

Other publications

- **Laporte, M.,** Ph.D manuscript. **(2022)**. Contribution à l'amélioration de l'estimation de la profondeur hypocentrale à partir de réseaux régionaux ou globaux. (French only)(access)
- **Laporte, M.,** Durand, S., Gardonio, B., Bodin, T., & Marsan, D. **(2023)**. Inversion-Variation temporelle de la b-value. Lettre d'information Epos-France, (1), 17-18. (French only)(access)

✓ Participation in the peer-review of research articles.

Conferences

- **European Geophysical Union - EGU 2025** *Vienna, Austria | Oral* **[2025]**
  Title: Exploring Temporal Variation of the b-value in Mainshock-Aftershock Sequences with the b-Bayesian Probabilistic Approach.
- **European Geophysical Union - EGU 2024** *Vienna, Austria | Poster* **[2024]**
  Title: A Bayesian transdimensional approach to estimate temporal changes in the b-value distribution without truncating catalogs.
- **American Geophysical Union - AGU 2023** *San Francisco, USA | Oral* **[2023]**
  Title: A Bayesian Transdimensional Framework to Recover Temporal Changes in the b-value Distribution of Non-truncated Seismic Catalog.
- **1st meeting EPOS-France** *Saint-Jean Cap Ferrat, France | Poster* **[2023]**
  Title: Modélisation Bayésienne des Variations Temporelles de la Distribution Fréquence-Magnitude des Séismes A Partir de Catalogues Non Tronqués. (Price of best poster : 2000€)
- **Visit from the High Commissioner for Atomic Energy** *CEA | Poster* **[2022]**
  Title: Improving teleseismic depth estimations in Nepal.
- **Science and Technology conference - SnT 2021** *Virtual | Oral* **[2021]**
  Title: Teleseismic depth determination, techniques and uncertainties : an Himalayan case study
- **Scientific evaluation of the committee of experts in geophysics** *CEA | Poster* **[2021]**
  Title: Seismological work in Nepal
- **American Geophysical - AGU 2019** *San Francisco, USA | Oral* **[2019]**
  Title: Seismicity in far western Nepal reveals flats and ramps along the Main Himalayan Thrust

Field missions

- **France | Low-noise underground laboratory** *2 weeks* **[2020]**
  Support for the deployment of nodes and DAS at the Low-Noise Underground Laboratory (LSBB)
  A project led by Amaury Vallage (CEA) and Olivier Sèbe (CEA)

- **Nepal | National Earthquake Monitoring Center** *1 month* **[2020]**
  Participation in a paleoseismology field led by Magali Riesner (CEA post-doctoral researcher) and Laurent Bollinger (CEA) to sample and date ancient earthquakes along the track of the great Himalayan thrust fault in south-eastern Nepal.

Public dissemination – Outreach activities

- **Course | TD Master 1** *Ecole Normale Supérieure – 12h* **[2025]**

Title : Inverse problems in Geosciences.
What is an inversion problem ? What are the hyperparameters ? Exercises include earthquake location problem, seismic tomography, Bayesian inversions and a personal project.

- **Course | Master 2** *Univ-Lyon 1 – 3h* **[2024]**

Title : Seismic cycle seen by seismology
Part of the UE–Seismic Cycle (Cecile Lasserre)

- **Workshop | Formation for seismic analysts** *NEMRC- Katmandu (Nepal) - 3 days* **[2022]**

Title : The earthquake location problem.
With seismologists of the Kathmandu seismology center. Course on location methods, presentation of the seismotectonic analysis of the Lamjung seismological crisis (2021). Installation of new localization software at the NEMRC (Hypo71, NonLinLoc, iLoc) and localization exercises using Seiscomp.

- **Course | Formation for seismic analysts** *CEA- Bruyères-le-Châtel- 2h* **[2021]**

Title : Seismotectonics of Nepal Himalaya. As part of the training
of an analyst from the National Tsunami Warning Centre (CENALT, France).

- **Outreach presentation | Secondary school** *Bruyères-le-Châtel – 2h* **[2021]**

Title : The basics of seismology

- **Outreach presentation | Secondary school** *University of Lyon - 1h* **[2024]**

Title : Understanding the Earth Structure.
Micro-conference organized by CNRS in secondary schools.
As a part of "Les échappées inattendues".

- **Outreach presentation | Primary school** *Bruyères-le-Châtel – 4h* **[2021]**

Title : Global tectonics - Understanding the formation of mountain ranges.
One-hour workshops for groups of 9/10 yo pupils.

- **Outreach presentation | Science local fair** *CEA- Bruyères-le-Châtel- 4h* **[2019]**

Title : Understanding the formation of mountain ranges.
30-minute workshops for primary schools.