Giacomo Mastella

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My research focuses on Earthquake Science. I use Artificial Intelligence techniques to deepen our understanding of fault behaviors. My work aims to bridge the gap between laboratory experiments and real observations from natural faults.

CURRENT POSITION

[November 2023 - Now]

Junior Fellow, La Sapienza University

November 2023 - Now

Machine Learning applied to Laboratory Earthquakes.

Supervisor: Marco Scuderi (La Sapienza University).

EDUCATION

[November 2020 - December 2023]

Ph.D. in Earth Sciences, Department of Science, Roma Tre University

Thesis title: *Decoding the Megathrust Seismic Cycle: from Laboratory Analog Models to the Natural Prototype through the Lens of Machine Learning*

Supervisors: Funiciello Francesca (Roma Tre University), Corbi Fabio (CNR-IGAG), Bedford Jonathan (Ruhr University of Bochum), Rosenau Matthias (GFZ Potsdam)

[September 2018 - September 2020]

M.Sc. in Earth Sciences, Department of Science, Roma Tre University (110/110 cum laude)

Thesis title: *The Postseismic Deformation in the Northern Apennines after the 2012 Emilia Seismic Sequence: Implications for the Dynamics of the Orogenic Wedge*

Supervisors: D'Agostino Nicola (INGV), Cammarano Fabio (Roma Tre University)

[September 2015 - September 2018]

B.Sc. in Geology, Department of Geology and Physics, University of Ferrara (110/110 cum laude)

Thesis title: *"Interpretation of seismic profiles for the reconstruction of a 3D geological model of the subsurface of the city of Ferrara."*

Supervisors: Riccardo Caputo (University of Ferrara).

RESEARCH PUBLICATIONS

Journal Articles

[2022]

1. **Mastella G.**, Corbi F., Funiciello F., Rosenau M., (2022): *Foamquake a novel analog model mimicking megathrust seismic cycles;* Journal of Geophysical Research: Solid Earth, https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021JB022789.

[2022]

2. **Mastella, G.**, Corbi, F., Bedford, J., Funiciello, F., & Rosenau, M. (2022). *Forecasting surface velocity fields associated with laboratory seismic cycles using Deep Learning*. Geophysical Research Letters, 49,e2022GL099632. https://doi.org/10.1029/2022GL099632.

[2023]

3. Corbi F., **Mastella G.**, Tinti E., Rosenau M., Sandri L., Pardo S., Funiciello F., (2023). *Asperity size and neighboring segments can change the frictional response and fault slip behavior: insights from laboratory experiments and numerical simulations. Journal of Geophysical Research: Solid Earth*, 129, e2023JB026594. https://doi.org/10.1029/2023JB026594.

In Preparation

[2024]

1. **Mastella G.**, Bedford J., Corbi F., Funiciello F. (2024). *Towards a Near-Real-Time Tracking of Transients in GNSS Daily Displacement Time-Series: a Single-Station Denoising Method Based On Deep Learning*. To be submitted to Journal of Geophysical Research - Solid Earth.

[2024]

2. Corbi F., Gualandi A., **Mastella G.**, Funiciello F. (2024). *Scaled seismotectonic models through the lens of dynamical system theory.* To be submitted to Seismica

Data Repositories

[2021]

1. **Mastella G.**, Corbi F., Funiciello F., M. Rosenau (2021): *Particle image correlation data from Foamquake: a novel seismotectonic analog model mimicking the megathrust* seismic cycle. GFZ Data Services. https://doi.org/10.5880/fidgeo.2021.046.

[2021]

1. **Mastella, G.**, Corbi, F ., Funiciello, F ., Rosenau, M., Rudolf, M., & Kosari, E. (2021). *Properties of rock analogue materials used for foamquake: A novel seismotectonic analog model mimicking the megathrust seismic cycle at RomaTre university (Italy).* GFZ data Services. https://doi.org/10.5880/fidgeo.2021.047.

Conference Abstracts

[2021]

1. Willingshofer, E., Funiciello, F., Rosenau, M., Schreurs, G., Zwaan, F., Buiter, S., ter Maat, G., Lange, O., Elger, K., Faccenna, C., Acocella, V., Reitano, R., **Mastella, G.**, Guillaume, B., and Corbi, F. and the EPOS TCS MSL analogue modelling team: *Sharing experimental data and facilities in EPOS: Updates on services for the analogue modelling community in the TCS Multi-scale Laboratories,* EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-16301, https://doi.org/10.5194/egusphere-egu21-16301, 2021.

[2022]

2. **Mastella G.**, Corbi F., Funiciello F., Bedford J.. *Foamquake: investigating the megathrust seismic cycle using a novel analog model.* ERC Workshop – The physics of earthquake faulting: machine learning to illuminate earthquake precursors and predict laboratory earthquakes – Rome 20/23 September 2021.

[2022]

3. Funiciello, F., Rosenau, M., Dominguez, S., Willingshofer, E., ter Maat, G., Zwaan, F., Corbi, F., Eisermann, J. O., Guillaume, B., Souloumiac, P., Brizzi, S**., Mastella, G.,** Reitano, R., Druguet, E., Schreurs, G., and Faccenna, C. and the EPOS Multi-Scale Laboratories Team: *Sharing data and facilities in the analogue modelling community: the EPOS Multi-Scale Laboratories Thematic Core Service,* EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-4212, https://doi.org/10.5194/egusphere-egu22-4212, 2022.

[2022]

4. **Mastella, G.,** Corbi, F., Bedford, J., Funiciello, F., and Rosenau, M.: *Forecasting earthquake rupture characteristics with deep learning: a proof of concept using analog laboratory foamquakes,* EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-2996, *https://doi.org/10.5194/egusphere-egu22-2996, 2022*.

[2023]

5. Rosenau, M., Corbi, F., Cubas, N., Funiciello, F., Kosari, E., Maillot, B., **Mastella, G.,** Oncken, O., Rudolf, M., Souloumiac, P., and Visage, S.*: Creep on seismogenic faults: Insights from analogue earthquake experiments,* EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-4533, https://doi.org/10.5194/egusphere-egu22-4533, 2022.

[2023]

6. **Mastella G.**, Corbi F., Bedford J., Rosenau M., Funiciello F.: *Forecasting megathrust earthquakes: what can we learn from the laboratory?* Gruppo Nazionale Geofisica della Terra Solida- GNGTS, 41° Convegno, Bologna 7-9 Febbraio, 2023.

[2023]

7. Corbi, F., **Mastella, G.**, Tinti, E., Rosenau, M., Sandri, L., Pardo, S., and Funiciello, F.: *How asperity size and neighboring segments can change the frictional response and fault slip behavior: insights from laboratory experiments and numerical models,* EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-5411, https://doi.org/10.5194/egusphere-egu23-5411, 2023.

[2023]

8. **Mastella, G.**, Bedford, J., Corbi, F., and Funiciello, F.: *A Deep-Neural-Network-Based Denoising Method For GNSS Displacement Time-Series,* EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-5560, https://doi.org/10.5194/egusphere-egu23-5560, 2023.

[2023]

9. Bedford, J., **Mastella, G.** (2023): *Separating seasonal oscillations from tectonic signals using advanced regression routines and denoised GNSS displacement time series,* XXVIII General Assembly of the International Union of Geodesy and Geophysics (IUGG) (Berlin 2023). https://doi.org/10.57757/IUGG23-4347.

[2023]

10. **Mastella G.**, Corbi F., Funiciello F., Bedford J., *Fresh Outlook of the Megathrust Seismic Cycle with Deep Learning: Insights from Analog Laboratory Models and Real-World Applications.* ERC Workshop – The physics of earthquake faulting: machine learning to illuminate earthquake precursors and predict laboratory earthquakes – Rome 18/23 September 2023.

Oral presentations and Posters:

[2021]

1. Oral presentation: *Foamquake: insights into the megathrust seismic cycle using a novel analog model.* **Mastella G.**, Corbi F., Funiciello F., Bedford J. Earthquakes: Nucleation, Triggering, and Relationships With Aseismic Process, Cargese Summer School, 30 September 2021.

[2022]

2. Oral presentation: *Can we forecast analog earthquakes in the laboratory? A proof of concept tested against foamquake.* **Mastella, G.,** Corbi, F., Bedford, J., Funiciello,

[2022]

F., and Rosenau, M.: GFZ Litosphere Dynamics Section Meeting - Invited talk – 16 March 2022.

3. Oral presentation: *Forecasting surface velocity fields associated with laboratory seismic cycles*. **Mastella, G.,** Corbi, F., Bedford, J., Funiciello, F., and Rosenau, M.: laboratory group workshop, 30 May – 1 June 2022 - Invited talk. TECTONIC: PSU-Roma Sapienza University.

[2022]

4. Oral presentation: *Forecasting megathrust earthquakes generated in seismotectonic analog models. What can we learn from the laboratory?* **Mastella, G.,** Corbi, F., Bedford, J., Funiciello, F., and Rosenau, M.: : UTIG Discussion Hour, University of Texas Institute for Geophysics - Invited talk – 8 November 2022 - invited talk.

[2023]

5. Oral presentation: *Gaining Insight into the Megathrust Seismic Cycle Through Machine Learning: from Laboratory Analog Models to the Natural Prototype,* **Mastella G.**, Corbi F., Funiciello F., Bedford J.. Cargèse 2023 School on Subduction Zone Processes, 13 October 2023.

[2024]

6. Oral presentation: *Moving closer to real-time modeling of GNSS daily displacement time-series: a single-station Deep Learning-driven denoising technique*. **Mastella G.**, Bedford J., Corbi F., Funiciello F. Conference Machine Learning in Solid Earth Geoscience, Santa Fe, January 2024.

TEACHING

[2022 - 2023]

- **Co-Lecturer of Experimental Tectonics master course (Roma Tre University)**

[2022-2023]

- **Teaching Assistant Matlab course for PhD students (Roma Tre University)**

[2022-2023]

- **Introduction to the Laboratory of Experimental Tectonics (LET) for bachelor's student (Roma Tre University)**

OUTREACH AND OTHER ACTIVITIES

Outreach

[September 2020 - September 2023]

- **Hands-on activities during the European Researchers' Night (Roma Tre University)**

[September 2020 - September 2023]

- **Orientation activities in high schools: "Plate tectonics and earthquakes" (Roma Tre University)**

[2019 - 2020]

- **Seminar in high schools: ”Earthquakes: understanding the phenomenon and mitigating its risk: Ferrara its earthquakes and cultural heritage“ at Scuola Secondaria di I Grado di Baura (FE)**

[September 2018 - September 2019]

- **Collaborative fellowship at Biblioteca dell’area Scientifico-Tecnologica (Sezione Le Torri)- University of Roma Tre**

[October 2013 - June 2015]

- **Volunteering at FAI - Fondo Ambiente Italiano.** Cultural guides carried out on several occasions at the architectural and artistic heritage of the city of Ferrara, in light of the damage caused by historic earthquakes.

[2017-2019]

- **Geological field trips.**
  Dolomiti – Luglio 2017 – (University of Ferrara).
  Toscana – Giugno 2018 – (University of Ferrara).
  Calabria – Giugno 2019 – (Roma Tre University).
  Stromboli – Giugno 2019 – (Roma Tre University).
  Corsica– Giugno 2019 – (Roma Tre University).
  Dolomiti – Settembre 2019 – (Roma Tre University).

Other Activities

[June-July 2018]

- **Internship at GEplan Consulting:** the project involved the creation of a database of fields oil exploration in the Po Valley.

[July 2018]

- **CLARA Project, CALL MIUR "NATIONAL SMART CITIES"**
  Electrical resistivity tomographies beneath the city of Ferrara (Italy).

Summer Schools

[July 2021]

- **Earthquakes: Nucleation, Triggering, and Relationships With Aseismic Process, Cargese Summer School.**

[October 2023]

- **Subduction Zone Processes. Cargèse 2023 School.**

SKILLS

- **Languages:** Full professional proficiency in Italian (native) and English. Basic knowledge of French.
- **Operating Systems:** Unix (both Linux and Mac), Windows.

- **Programming Languages:** daily working proficiency with Python (Scipy, Pandas, Tensorflow, Pythorch), MatLab; basic working proficiency with C++, Bash.
- **Graphic Software:** Adobe Illustrator, Blender, Inskape, Photoshop.
- **Other Softwares:** Generic Mapping Tools, QGIS, Move, Daisy, Forc, Neuralog, Office (Excel).
- **Skills in the laboratory:** monitoring systems: high-speed cameras, laser scanner, MEMS accelerometers, piezoelectric sensors, image analysis techniques (e.g., PIV), arduino hardware. Basic experience with rock mechanics experiments (double-direct shear apparatus). Experience in the preparation of analog materials (e.g., foam rubber, gelatin, silicone, glucose syrup, sand) for lithospheric-scale models, especially analog experiments of the megathrust seismic cycle.

02/02/2024

Signature