Stanford

Ettore Biondi

Assistant Professor of Geophysics

NIH Biosketch available Online Curriculum Vitae available Online

Bio

BIO

My research centers on leveraging fiber sensing technologies and dense seismic sensor networks for geophysical applications. By capturing vibrations from human activities and natural events such as ocean waves and earthquakes, my group develops methods to interpret the underlying mechanisms and subsurface structures driving these processes, including volcanic system dynamics and earthquake physics. With the rise of fiber sensing, we are exploring innovative approaches to create new environmental sensors that track both short- and long-term climate-related changes. I am also interested in using specialized sensor deployments in remote areas, such as glaciers and large volcanic systems, to investigate complex geophysical mechanisms. Additionally, our research aims to design advanced early warning systems for volcanoes, earthquakes, and tsunamis using long-term seismic arrays based on telecommunications fibers.

ACADEMIC APPOINTMENTS

- Assistant Professor, Geophysics

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Advisor and Board Member, Vortex Imaging (2024 - present)
- Advisor, Google X (2024 - present)

PROFESSIONAL EDUCATION

- PhD, Stanford University , Geophysics (2021)
- Diploma, Scuola Normale Superiore of Pisa , Computational Chemistry (2013)
- MSc, University of Pisa , Geophysics (2012)
- BSc, University of Genoa , Geology (2010)

PATENTS

- Jiaxuan Li, Ettore Biondi, Weiqiang Zhu, Zhongwen Zhan. "United States Patent 18/770,303 Inverting earthquake focal mechanisms with distributed acoustic sensing", California Institute of Technology, Jan 16, 2025
- Ettore Biondi, Jiaxuan Li, Weiqiang Zhu, Zhongwen Zhan. "United States Patent 18/752,231 Fiber-seismic tomography", California Institute of Technology, Dec 26, 2024

LINKS

- LinkedIn: https://www.linkedin.com/in/ettore-biondi/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Ettore Biondi's research focuses on advancing distributed fiber-optic sensing technologies for the study of Earth system phenomena. His interdisciplinary work bridges geophysics, environmental engineering, and data science, exploiting the unique capabilities of fiber-optic sensors—such as distributed acoustic sensing (DAS)—to provide continuous, high-resolution observations across extensive spatial domains. These sensors transform standard telecom fiber cables into large-scale arrays capable of detecting subtle changes in ground motion, temperature, and strain.

Dr. Biondi’s research encompasses a variety of applications, including monitoring seismic activity, mapping subsurface fluid movement, and assessing the impacts of environmental changes such as volcanic intrusions or groundwater flow. By collecting and analyzing massive datasets from fiber-optic arrays deployed in urban, natural, and engineered environments, he develops algorithms and modeling methods to extract information about processes that were previously challenging to observe with traditional point sensors.

This work directly impacts our ability to detect and respond to natural hazards, manage water resources, and understand long-term environmental trends. His novel approaches support early warning systems for earthquakes and infrastructure failures and enable more sustainable management of natural resources. Applying cutting-edge machine learning and signal processing, Dr. Biondi’s team refines interpretation of fiber-sensing data, revealing the nuanced interactions within the Earth’s subsurface and surface environments.

Collaboration is a central theme, with partnerships spanning academia, industry, and governmental agencies. His group develops open-source tools and datasets to facilitate broader adoption of fiber-optic sensing in Earth science research. Dr. Biondi frequently publishes and presents findings at international conferences, aiming to inspire innovation in the use of unconventional sensing networks for environmental monitoring.

Ultimately, the work seeks to transform our capacity to observe and understand complex, multiscale Earth system processes by making sensing more accessible, scalable, and informative. This next-generation approach to geophysical monitoring promises profound impacts on hazard mitigation, resource management, and environmental stewardship.

Teaching

COURSES

2025-26

- Computational Earth System Analysis: GEOPHYS 145, GEOPHYS 245 (Spr)
- Fiber Sensing: GEOPHYS 385F (Aut, Win, Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Oliver Pranis

Postdoctoral Faculty Sponsor

Regina Maass

Doctoral Dissertation Advisor (AC)

Alina Belyalova

Publications

PUBLICATIONS

- **Minute-scale dynamics of recurrent dike intrusions in Iceland with fiber-optic geodesy.** *Science (New York, N.Y.)*
  Li, J., Biondi, E., Heimisson, E. R., Puel, S., Zhai, Q., Zhang, S., Hjörleifsdóttir, V., Wei, X., Bird, E., Klesh, A., Kamalov, V., Gunnarsson, T., Geirsson, et al
  2025: eadu0225

- **Subsurface Monitoring and Imaging Based on DAS**
  Biondi, E., Li, J., Bird, E., Zhan, Z., IEEE
  IEEE.2025

- **Mid-Span Optically Powered Remote Sensor Module Using Residual Raman Pump Light**
  Lannone, P., Tran, C., Raybon, G., Straub, M., Huang, K., Burrows, E., Biondi, E., Mazur, M., IEEE
  IEEE.2025

- **Fiber-optic seismic sensing of vadose zone soil moisture dynamics.** *Nature communications*
  Shen, Z., Yang, Y., Fu, X., Adams, K. H., Biondi, E., Zhan, Z.
  2024; 15 (1): 6432

- **Seismic arrival-time picking on distributed acoustic sensing data using semi-supervised learning.** *Nature communications*
  Zhu, W., Biondi, E., Li, J., Yin, J., Ross, Z. E., Zhan, Z.
  2023; 14 (1): 8192

- **An upper-crust lid over the Long Valley magma chamber.** *Science advances*
  Biondi, E., Zhu, W., Li, J., Williams, E. F., Zhan, Z.
  2023; 9 (42): eadi9878

- **The break of earthquake asperities imaged by distributed acoustic sensing.** *Nature*
  Li, J., Kim, T., Lapusta, N., Biondi, E., Zhan, Z.
  2023; 620 (7975): 800-806

- **Earthquake focal mechanisms with distributed acoustic sensing.** *Nature communications*
  Li, J., Zhu, W., Biondi, E., Zhan, Z.
  2023; 14 (1): 4181

- **Properties of a deep seismic waveguide measured with an optical fiber** *PHYSICAL REVIEW RESEARCH*
  Lellouch, A., Biondi, E., Biondi, B. L., Luo, B., Jin, G., Meadows, M. A.
  2021; 3 (1)

- **ADAPTATION OF A RANGE-DOPPLER ALGORITHM TO MULTISTATIC SIGNALS FROM ULTRASOUND ARRAYS**
  Jakovljevic, M., Michaelides, R., Biondi, E., Herickhoff, C., Hyun, D., Zebker, H., Dahl, J., IEEE
  IEEE.2021: 3269-3272

- **Estimating Signal and Structured Noise in Ultrasound Data using Prediction-Error Filters**
  Jennings, J., Jakovljevic, M., Biondi, E., Dahl, J., Biondi, B.
  edited by Byram, B. C., Ruiter, N. V.
  SPIE-INT SOC OPTICAL ENGINEERING.2019

- **Nonstretch normal moveout through iterative partial correction and deconvolution.** *Geophysics*
  Biondi, E., Stucchi, E., Mazzotti, A.
  2014; 79 (4): V131-V141

- **Non-Stretch Fourth Order NMO through Iterative Partial Corrections and Deconvolution** *75th EAGE Conference & Exhibition incorporating SPE EUROPEC 2013*
  Biondi, E., Stucchi, E., Mazzotti, A.
  2013