JORDI BOLIBAR

Computational glaciologist/geoscientist

From: Barcelona, Catalonia (Spain) Born: 03/01/1989 Grenoble (France)

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EDUCATION

PhD

IGE, Univ. Grenoble Alpes

Oct 2017 – Oct 2020 Grenoble, France

Past and future evolution of French Alpine glaciers in a changing climate: a deep learning glacio-hydrological modelling approach

MSc in Physical Geography

Institute of Alpine Geography, University Grenoble Alpes

Sept 2016 – June 2017 Grenoble, France

Master in Geography, with a focus on mountain regions. *Best overall mark*.

MSc in Telecommunications Engineering

KTH Royal Institute of Technology

Aug 2010 – July 2012 Stockholm, Sweden

Double MSc degree between the KTH Royal Institute of Technology and the Polytechnic University of Catalonia.

BSc in Telecommunications Engineering

Polytechnic University of Catalonia

Sept 2007 – June 2010 Terrassa, Barcelona, Spain

BSc in image, audio and video signal processing engineering. *Top 10% mark*.

RESEARCH INTERESTS

Machine learning | Geoscientific modelling | Glaciers | Climate | Mountains | Geophysics | Cryosphere | Water cycle

LANGUAGES

English ●●●●○

Catalan ●●●●●

Spanish ●●●●●

French ●●●●○

EXPERIENCE

Research Scientist

CNRS, IGE, Univ. Grenoble Alpes

Jan 2025 – Grenoble, France

Permanent position. Research Scientist/Chargé de Recherche, CID 55 "Data Science".

Postdoc researcher

IGE, Univ. Grenoble Alpes

Apr 2024 – Oct 2026 Grenoble, France

Scientific machine learning for glacio-hydrological modelling.

Visiting researcher

UC Berkeley and University of Oslo

Spring/Summer 2022 Berkeley, USA and Oslo, Norway

Invited researcher at the Department of Statistics at UC Berkeley in the group of Fernando Pérez, and at the Department of Physics at the University of Oslo.

Postdoc researcher

IMAU, Utrecht University - TU Delft

Feb 2021 – Feb 2024 Utrecht/Delft, Netherlands

Physics-informed machine learning for large-scale glacier modelling.

Software Engineer

Amadeus IT Group

Feb 2013 – July 2016 Nice, France

Backend + Frontend software engineer working with word-wide travel passenger data.

FIELD EXPERIENCE

- **Glacier mass balance campaigns (GLACIOCLIM French National Observatory)**
- **Seismometer installation and maintenance in Argentière glacier: 2018**

Top publications

[1] **Jordi Bolibar**, Antoine Rabatel, Isabelle Gouttevin, Harry Zekollari, and Clovis Galiez. Nonlinear sensitivity of glacier mass balance to future climate change unveiled by deep learning. *Nature Communications*, 13(1):409, 2022.

[2] **Jordi Bolibar**, Facundo Sapienza, Fabien Maussion, Redouane Lguensat, Bert Wouters, and Fernando Pérez. Universal differential equations for glacier ice flow modelling. *Geoscientific Model Development*, 16(22):6671–6687, 2023.

Publications

[3] Lucille Gimenes, Romain Millan, Nicolas Champollion, and **Jordi Bolibar**. Brief communication: Sensitivity analysis of peak water to ice thickness and temperature: A case study in the Western Kunlun Mountains of the Tibetan Plateau. *The Cryosphere*, 20(1):171–182, January 2026.

[4] Kamilla Hauknes Sjursen, **Jordi Bolibar**, Marijn van der Meer, Liss Marie Andreassen, Julian Peter Biesheuvel, Thorben Dunse, Matthias Huss, Fabien Maussion, David R. Rounce, and Brandon Tober. Machine learning improves seasonal mass balance prediction for unmonitored glaciers. *EGUsphere*, pages 1–39, March 2025. Publisher: Copernicus GmbH.

[5] F. Sapienza, L. C. Gallo, **Jordi Bolibar**., F. Pérez, and J. Taylor. Spherical Path Regression Through Universal Differential Equations With Applications to Paleomagnetism. *Journal of Geophysical Research: Machine Learning and Computation*, 2(4):e2025JH000626, 2025. _eprint: https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2025JH000626.

[6] Marijn van der Meer, Harry Zekollari, Matthias Huss, **Jordi Bolibar**, Kamilla Hauknes Sjursen, and Daniel Farinotti. A minimal machine-learning glacier mass balance model. *The Cryosphere*, 19(2):805–826, February 2025. Publisher: Copernicus GmbH.

[7] Sophie De Roda Husman, Zhongyang Hu, Maurice Van Tiggelen, Rebecca Dell, **Jordi Bolibar**, Stef Lhermitte, Bert Wouters, and Peter Kuipers Munneke. Physically-Informed Super-Resolution Downscaling of Antarctic Surface Melt. *Journal of Advances in Modeling Earth Systems*, 16(7):e2023MS004212, July 2024.

[8] Christian Torres, Deniz Bozkurt, Tomás Carrasco-Escaff, **Jordi Bolibar**, and Jorge Arigony-Neto. New insights on the interannual surface mass balance variability on the South Shetland Islands glaciers, northerly Antarctic Peninsula. *Global and Planetary Change*, 239:104506, August 2024.

[9] Sophie de Roda Husman, Stef Lhermitte, **Jordi Bolibar**, Maaike Izeboud, Zhongyang Hu, Shashwat Shukla, Marijn van der Meer, David Long, and Bert Wouters. A high-resolution record of surface melt on antarctic ice shelves using multi-source remote sensing data and deep learning. *Remote Sensing of Environment*, 301:113950, 2023.

[10] Suryanarayanan Balasubramanian, Martin Hoelzle, Michael Lehning, **Jordi Bolibar**, Sonam Wangchuk, Johannes Oerlemans, and Felix Keller. Influence of Meteorological Conditions on Artificial Ice Reservoir (Icestupa) Evolution. *Frontiers in Earth Science*, 9:771342, February 2022.

[11] **Jordi Bolibar**, Antoine Rabatel, Isabelle Gouttevin, and Clovis Galiez. A deep learning reconstruction of mass balance series for all glaciers in the French Alps: 1967–2015. *Earth System Science Data*, 12(3):1973–1983, September 2020.

[12] **Jordi Bolibar**, Antoine Rabatel, Isabelle Gouttevin, Clovis Galiez, Thomas Condom, and Eric Sauquet. Deep learning applied to glacier evolution modelling. *The Cryosphere*, 14(2):565–584, February 2020.

[13] Christian Vincent, Vincent Peyaud, Olivier Laarman, Delphine Six, Adrien Gilbert, Fabien Gillet-Chaulet, Étienne Berthier, Samuel Morin, Deborah Verfaillie, Antoine Rabatel, Bruno Jourdain, and **Jordi Bolibar**. Déclin des deux plus grands glaciers des Alpes françaises au cours du XXIe siècle : Argentière et Mer de Glace. *La Météorologie*, (106):49, 2019.

[14] **Jordi Bolibar** and Roberto Bresin. Sound feedback for the optimization of performance in running. *TMH-QPSR, KTH, Vol. 52(1)/2012*, 2012.

Submitted

[15] Facundo Sapienza, **Jordi Bolibar**, Frank Schäfer, Brian Groenke, Avik Pal, Victor Boussange, Patrick Heimbach, Giles Hooker, Fernando Pérez, Per-Olof Persson, and Christopher Rackauckas. Differentiable Programming for Differential Equations: A Review, June 2024. arXiv:2406.09699 [physics, stat].

In preparation

[16] Suryanarayanan Balasubramanian, Tom Matthews, and **Jordi Bolibar**. World-wide potential of artificial ice reservoirs to address water resource insecurity under climate change.

Grants

- KLIMAFORSK - The Research Council of Norway, **PI**: **8K€**. Visiting researcher at the University of Oslo.
- Climate Action Program - TU Delft, **PI**: **30K€**. "Unravelling climate-glacier interactions with physics-informed machine learning".
- ERC Advanced Grant, **Collaborator** (PI: Regine Hock): **2.5M€**. "Past and Future High-resolution Global Glacier Mass Changes (GLACMASS)".
- IRGA MIAI Grant - Multidisciplinary Institute for Artificial Intelligence, **PI**: **120.5K€**. "$\partial P4ICE$: Differentiable programming for glacio-hydrological modelling".
- TRACCS - ANR, **PI**: **383K€**. "GLADAPT: "Glacio-hydrological modelling and Adaptation with Differential Programming"
- Institut des Mathématiques pour la Planète Terre, CNRS, **PI**: **114.2K€**. "Learning glacier flow laws with hybrid inverse modelling"

Scientific software

- **ODINN.jl**, *Julia*. Global glacier model based on Universal Differential Equations.
- **Huginn.jl**, *Julia*. Fast and flexible glacier ice flow models.
- **Muninn.jl**, *Julia*. Scientific machine learning glacier mass balance models.
- **Sleipnir.jl**, *Julia*. Core structures and tools for ODINN.jl.
- **MassBalanceMachine**, *Python*. Global machine learning surface mass balance model.
- **SphereUDE.jl**, *Julia*. A Julia package for regression in the sphere based on Universal Differential Equations.
- **ALPGM** (ALpine Parameterized Glacier Model), *Python*: 2017-2020. Regional glacier model using machine learning surface mass balance models.
- **Glaciers-to-J2K**, *Python*. Bringing glacier evolution into the J2K hydrological model.
- **J2000**, *Java*. Distributed hydrological model with glacier modelling coupling.

Scientific visits

- University of Oslo (Norway), Physics Department, **1.5 months**: 12/08/2022 - 26/09/2022.
- University of Washington, Seattle (USA), Earth sciences Department, **1 week**: 1/5/2022 - 9/5/2022.
- University of California, Berkeley (USA), Statistics Department, **2 months**: 5/4/2022 - 6/6/2022.

Invited talks

- Institut des Géosciences de l'Environnement (France), 15/12/2023: "Physics-informed Machine Learning for the Geosciences: an overview".
- The Alan Turing Institute (UK), 08/06/2023: "Universal Differential Equations for glacier ice flow modelling using ODINN.jl".
- University of Innsbruck, ACINN (Austria), 18/01/2023: "Towards the discovery of new emprirical laws of glacier physics using Universal Differential Equations".
- University of Oslo, Geosciences Department (Norway), 14/09/2022: "ODINN: scientific machine learning for glacier modelling".
- University of Washington, Earth and Space Sciences Department (USA), 03/05/2022: "Scientific machine learning for glacier modelling".
- University of California, Berkeley (USA), 27/04/2022: "Glaciers, climate, Julia and open science".
- University of Bristol (UK), 25/03/2022: "Scientific machine learning for glacier modelling".
- University of Oslo, Njord Center (Norway), 05/11/2021: "Towards interpretable, physics-based machine learning models for glacier evolution".
- TU Delft (Netherlands), 23/02/2021: "Glacier evolution modelling with deep learning: challenges and opportunities".
- ETH Zürich, VAW (Switzerland), 20/05/2020: "Glacier evolution modelling with deep learning: challenges and opportunities".

Supervision

Internal

Postdocs

- Alban Gossard, Université Grenoble Alpes (France); 2025-2026. "Inferring glacier ice dynamics governing laws with Universal Differential Equations".

MSc

- Lisa Girod, Université Grenoble Alpes (France); 2026 ."Transient glacier ice thickness inversions with ODINN.jl".
- Mathieu Le Séac'h, Université Grenoble Alpes (France); 2025 ."Data-driven inverse problems of glacier dynamics".
- Julian Biesheuvel, TU Delft (Netherlands); 2023 ."Machine Learning modelling of glacier surface mass balance".
- Lucille Gimenes, Université Grenoble Alpes (France); 2023 ."Coupling and speeding up ice flow models between ODINN.jl and OGGM".
- Francesco Moncada, Utrecht University (Netherlands); 2023 ."Modelling basal melt of Antarctic ice-shelves using machine learning".
- Vivek Gajadhar, TU Delft (Netherlands); 2023. "Glacier geophysical inversions using differentiable programming with ODINN.jl".

External co-supervision

PhDs

- Marijn van der Meer, ETH Zürich (Switzerland); 2022-2026
- Kamilla Hauknes Sjursen, University of Western Norway (Norway); 2022-2025
- Facundo Sapienza: Department of Statistics, University of California, Berkeley (USA); 2021-2024.
- Suryanarayanan Balasubramanian: Department of Geosciences, University of Fribourg (Switzerland); 2021-2023

Workshops

Organizer and instructor

- 3rd Machine learning in Glaciology: September 2024, Finse research station (Norway).
- GAP2024: Grenoble Artificial Intelligence for Physical Sciences: 29-30 May 2024, Grenoble (France)
- Introduction to Julia for geoscience: April 2024, EGU General Assembly, Vienna (Austria)
- 2nd Machine learning in Glaciology: 16-21 April 2023, Finse research station (Norway).
- 1st Machine learning in Glaciology: 4-9 September 2022, Finse research station (Norway).

Atendee

- 9th OGGM workshop: 6-8 October 2025, Brussels (Belgium)
- Global glacier modelling workshop: 10-13 February 2025, Oslo (Norway)
- 6th OGGM workshop: 16-21 September 2022, Finse research station (Norway)
- NASA ICESat-2 Hackweek: 8-18 June 2020 (Virtual).
- 4th OGGM workshop: 17-21 June 2019, Saint-Martin-d'Uriage (France)
- Glaciology of the southern Andes: 6-12 August 2018, Mendoza (Argentina).
- Data science for geosciences: 15-19 January 2018, Grenoble (France).

Conferences

Convener

- JuliaCon 2024 (Eindhoven, Netherlands): Symposium "Earth and climate science in Julia: Power to the user"
- EGU General Meeting 2024 (Vienna, Austria): Session "Understanding cryospheric processes in the past, present and future using data assimilation and machine learning"
- EGU General Meeting 2023 (Vienna, Austria): Session "Advances in machine learning, data science and big data analytics for polar regions"
- IUGG General Assembly 2023 (Berlin, Germany): Session "Data driven cryospheric sciences: machine learning, data assimilation and inverse methods for the cryosphere"
- AGU Fall Meeting 2022 (Virtual, Chicago, IL): Session "A Data-Driven Cryosphere: Insights from Machine Learning and Other Statistical Methods"

Presenter

- JuliaCon 2024 (Eindhoven, Netherlands): "ODINN.jl: Multi-language Geoscientific Machine Learning".
- EGU General Meeting 2023 (Vienna): "Functional inversions of glacier rheology from ice velocities using ODINN.jl".
- Alpine Glaciological Meeting 2022 (Virtual): "Nonlinear sensitivity of glacier mass balance to climate change unveiled by deep learning".
- AGU Fall Meeting 2021 (Virtual): "Optimizing and discovering models of glacier processes with Neural Networks embedded in Differential Equations".
- EGU General Meeting 2020 (Virtual): "Glacier evolution modelling with deep learning: challenges and opportunities".
- AGU Fall Meeting 2019 (San Francisco, CA): "Deep learning applied to glacier surface mass balance reconstruction".
- AGU Fall Meeting 2018 (Washington, DC): "Towards the demise of French alpine glaciers: Parameterized modelling and perspectives on glacier evolution for the 1984-2100 period".

Reviewer

- Nature Communications: 1 paper
- Geophysical Research Letters: 1 paper
- The Cryosphere: 4 papers
- Journal of Open Source Software: 1 paper
- Journal of Geophysical Research: 2 papers
- Journal of Glaciology: 1 paper
- Water Resources Research: 1 paper
- Frontiers in Earth Science: 1 paper

PhD jury

- Matteo Guidicelli, University of Fribourg (Switzerland), 11/2023: "A data-fusion approach towards continuous spatio-temporal snow water equivalent in high-mountain regions".

PhD commitee

- Lucas Giboni, Université Grenoble Alpes (France), 2025-2028: "Aerosol-cloud interaction in a changing Arctic—integrating modeling and satellite approaches".
