

Mathieu RIGAL

Post-doctoral researcher in applied mathematics

— Contact details —

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Research interests

I am interested in the modelling and simulation of complex geophysical flows related to environmental challenges. My research focuses on open boundary conditions for dispersive wave models, as well as on the design, analysis, and implementation of efficient numerical schemes. In particular, my work enables the simulation of realistic wave fields in natural coastal environments.

During my thesis, I investigated the hyperbolic nonlinear shallow water system, with an emphasis on asymptotic-preserving implicit–explicit methods in the low Froude regime, alongside well-balanced implicit kinetic schemes satisfying a discrete entropy inequality.

Work experience

Post-doctoral researcher INSA Toulouse Teaching duty (10h completed plus 10h to come)	December 1 st 2025 – present
Post-doctoral researcher Institut de Mathématiques de Bordeaux Teaching duty (44h)	December 1 st 2022 – November 30 th 2025
Ph.D candidate Sorbonne Université, Paris Monitor mission (192h of teaching)	October 1 st 2019 – November 30 th 2022
Research internship Institut national de recherche en informatique et automatique, Paris	March 20 th 2019 – September 19 th 2019

Education

Laboratory Jacques-Louis Lions, Sorbonne Université, Paris, France Ph.D degree under the supervision of Nina Aguillon and Nathalie Ayi, and under the direction of Jacques Sainte-Marie (Sorbonne University, LJLL)	2019–2022
Sup Galilée, University Paris 13, Villetaneuse, France Engineering degree, equivalent to a master degree Major: Applied Mathematics and Scientific Computing	2016–2019
Technical University of Munich, Germany Exchange semester	winter semester 2018–2019

Publications

Published

- M. Rigal, D. Lannes and P. Bonneton. “Rigorous open boundary condition for Boussinesq-type models, applicable to complex wave fields”. *Ocean Modelling* 201 (2026), p. 102713. DOI : <https://doi.org/10.1016/j.ocemod.2026.102713>
- C. El Hassanieh, M. Rigal and J. Sainte-Marie. “Implicit kinetic scheme for the Saint-Venant system”. *ESAIM: M2AN* (2025), p. 1863–1908. DOI : <https://doi.org/10.1051/m2an/2025038>
- D. Lannes and M. Rigal. “General boundary conditions for a Boussinesq model with varying bathymetry”. In: *Studies in Applied Mathematics* 153.4 (2024), e12751. DOI : <https://doi.org/https://doi.org/10.1111/sapm.12751>
- D. Del Sarto, E. Deriaz, X. Lhebrard and M. Rigal. “Adaptive wavelet schemes and finite volumes”. *ESAIM: ProcS* 70 107-123 (2021), p. 107–123. DOI : <https://doi.org/10.1051/proc/202107007>

Submitted

- D. Aregba-Driollet, S. Brull and M. Rigal. “An entropy stable vectorial BGK scheme for the Saint-Venant system with hydrostatic reconstruction and adaptive time stepping”. URL : <https://hal.science/hal-05567719>

Software contributions

- Contributing to the `wavebox` code developed by Fabien Marche, which consists in discontinuous Galerkin methods for solving water waves problems, written in C++;
- `BA_waves`: numerical methods for the dispersive Boussinesq-Abbott model with a new treatment of general boundary conditions, written in vectorized Matlab ([Gitlab link](#));
- `swimpy`: a collection of finite volumes schemes for the shallow water system (including kinetic methods and implicit time integrators) written in vectorized Python ([Gitlab link](#));

Talks and presentations

Conferences and workshops

- Talence, July 18, 2025 - 5th Korea-France Conference in Mathematics
- Castro Urdiales, June 18, 2025 - CIEM workshop
- Nice, January 9, 2025 - Journées Jeunes EDPistes 2025
- Ile de Ré, May 31, 2024 - CANUM 2024
- Amiens, November 17, 2023 - GDR MathGeoPhy
- Bordeaux, November 14, 2023 - Workshop “Analysis, modeling and numerical methods for kinetic models”
- Ile d’Aix, October 4, 2023 - JMVPR workshop
- Bordeaux, June 29, 2023 - NumHyp23 conference
- Évian-les-Bains, June 15, 2022 - Congrès national d’Analyse NUMérique

Seminars

Grenoble, January 29, 2026 - AMAC seminar, LJK
Toulouse, January 13, 2026 - PDE team day
Marseille, January 6, 2026 - I2M seminar
Paris, March 5, 2025 - Stochastic parameterization half-day, LJLL
Bordeaux, March 21, 2024 - CSM seminar
Rennes, February 08, 2024 - IRMAR seminar
Bordeaux, February 05, 2024 - GT non permanents, Institut de Mathématiques de Bordeaux
Paris, January 12, 2024 - Team ANGE seminar, Inria Paris and LJLL
Paris, January 8, 2024 - Launch of the ANR Bourgeons, LJLL
Bordeaux, June 13, 2023 - Seminar of the team EDP et Physique mathématique at IMB
Amiens, October 10, 2022 - Seminar of the LAMFA laboratory
Paris, December 2, 2021 - Inria Paris, team ANGE seminar
Strasbourg, November 9, 2021 - Séminaire Equations aux dérivées partielles, IRMA team
Online, November 16, 2020 - MathInnov day
Online, June 16, 2020 - Inria Paris, team ANGE seminar
Paris, February 20, 2020 - Ph.D seminar of Laboratory Jacques-Louis Lions
Paris, November 18, 2019 - Inria Paris, team ANGE seminar

Poster session

Pornichet, March 10, 2022 - MoHyCon conference

Teaching (French)

Equations différentielles ordinaires (niveau L2)

travaux machine (2026, 10h00);

Introduction à l'analyse numérique (niveau L2)

travaux dirigés (2023, 14h40) et travaux machine (2023–2024, 2×14h40);

Analyse hilbertienne, intégration et topologie (niveau L3)

travaux dirigés (2019–2021, 3×36h00);

Analyse vectorielle (niveau L2)

révisions (2020, 18h00), cours (2020, 18h00), travaux dirigés (2019–2020, 2×18h00);

Introduction à Matlab (niveau L1)

travaux machine (2019–2021, 3×4h00);

Skills

Programming skills: Python, Matlab, C/C++

Software: Linux environment, Git, visualization with VTK, SLURM interface (notions)

Tongues: French (mother tongue), English