

High Meadows Environmental Institute  
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# Nicolò Scapin

## Curriculum Vitae

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### Education

- 3/2018–6/2022 **Ph.D. in Fluid Mechanics**, *Royal Institute of Technology (KTH)*, Stockholm, SE,  
**Advisor:** Prof. Luca Brandt  
**Thesis title:** *Phase-changing flows: numerical methods and fully resolved simulations*  
Defended on June 15th, 2022 (PhD thesis available [here](#))
- 9/2014–4/2017 **MSc in Energy Engineering**, *Politecnico di Milano*, Milan, IT
- 9/2011–7/2014 **BSc in Energy Engineering**, *Politecnico di Milano*, Milan, IT

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### Research experience

- 1/2023–Present **Postdoctoral Research Fellow**, *High Meadows Environmental Institute (HMEI) and Department of Mechanical and Aerospace Engineering*, Princeton University, Princeton, NJ  
**Mentors:** Prof. Luc Deike and Prof. Gabriel Vecchi  
**Main activities:**
  - Research topics: air-sea interaction, wind waves, breaking waves, sea sprays
  - Mentorship a graduate student working on ocean waves
  - Write scientific proposals in order to access high-performance computing facilities funded by NSF (ACCESS)
- 3/2018–12/2022 **Graduate Research Assistant**, *Department of Engineering Mechanics*, Royal Institute of Technology (KTH), Stockholm, SE  
**Main activities:**
  - *FluTAS* project: development of an open source, modular and multi-physics code able to run on hybrid architectures CPU/GPU ([GitHub repository](#))
  - Mentorship: co-supervision of three younger Ph.D. students working in multiphase flows
  - EUROfusion project: development of numerical algorithms for liquid metal-plasma interaction
  - Write scientific proposals in order to access high-performance computing facilities in Sweden, Norway, Italy and US

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### Teaching experience

- 2/2024–Present **Lecturer and Teaching Assistant for the Course *ENV330/MAE330 Ocean Waves***, *High Meadows Environmental Institute*, Princeton University, Princeton, NJ

### Main activities:

- Delivered frontal lectures about the physics of ocean waves to 20+ undergraduate students (40 hours per semester)
- Facilitated hands-on activities, enhancing students' understanding of theoretical concepts through practical application (15 hours per semester)
- Assessed student performance by grading assignments and the final exam

9/2018–12/2021 **Teaching Assistant in the several undergraduate courses in Solid and Fluid Mechanics**, *Department of Engineering Mechanics*, Royal Institute of Technology (KTH), Stockholm, SE

### Main activities:

- Performed hands-on activities, enhancing students' understanding of theoretical concepts through practical application (20 hours per semester)
- Assessed student performance by grading assignments and the final exam

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## Industrial experience

6/2017–2/2018 **Research Engineer**, *ENI S.p.A.*, Milan, IT

### Main activities:

- Development of two and three-phase Eulerian solvers to model the transport of hydrocarbons in complex geometries
- Development of genetic algorithms for production optimization

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## Funding acquisition

- 2023 **HMEI Fellowship** to support the research at **Princeton University** (\$300k over three years)
- 2023 **International Postdoctoral Grant** awarded from the **Swedish Research Council - Vetenskapsrådet** to support the research at **Princeton University** (3.10 MKr/\$290k over three years). Note: renounced due to incompatibility with HMEI Fellowship

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## Awards & International Projects

- 2024 **Seal of Excellence** awarded from the **European Commission** on the Marie Curie Postdoctoral Fellowship (**Evaluation mark:** 96.80%)
- 2023 **Seal of Excellence** awarded from the **European Commission** on the Marie Curie Postdoctoral Fellowship (**Evaluation mark:** 91.40%)
- 2024 Co-PI of the **INCITE project on scalar transport in turbulent bubbly flows** with Dr. Parisa Mirbor (PI). Awarded allocation: 50000 node hours of computing time in Polaris
- 2022 **ERCOTAC Da Vinci Competition finalist**: among the top 5 Ph.D. theses in fundamental and applied Fluid Mechanics among European Universities. **Read the interview [here](#)**
- 2022 **Fellowship (\$5k) for the 17th Summer Program** at Center for Turbulence Research, Stanford (CA, USA)
- 2021 Participation of the **PRACE project Multiphase Rayleigh–Bénard convection** with Luca Brandt (PI). Awarded allocation: 50 million core hours of computing time in Marconi-100 (CINECA, Italy)

- 2020 **Fellowship (\$5k) for the 16th Summer Program** at Center for Turbulence Research, Stanford (CA, USA). Suspended due to pandemic
- 2018 **PhD Research Scholarship** *Hybrid multiscale modelling of transport phenomena for energy efficient processes*, founded by the *Swedish Research Council* (VR) (Grant 2016-06119)
- 2014-2017 **Merit-based scholarship for excellent students (tuition waiver)**, founded by the *Ministry of Public Education* in Italy
- 2014 **Scholarship (\$6k)** founded by *ENI S.p.A.* for excellent students in the field of energy engineering

## Skills

*Operating systems:* Linux/Unix-based, Windows

*Programming languages and Softwares:* Fortran90, C, C++, Python, Matlab, LaTeX, Bash, Office Package

*Parallel Processing:* MPI, OpenMP, OpenACC, CUDA

## Languages

Italian (Native Language), English (Proficient), German (Basic), Swedish (Basic)

## Publications

### Manuscripts in preparation (P)

- P1. **N. Scapin**, J. Wu, J. Thomas Farrar, B. Chapron, S. Popinet, L. Deike. "Growth and dissipation of wind-forced breaking waves", *In preparation for Geophysical Research Letter*
- P2. C. Martin Blanco, **N. Scapin**, J. Wu, J. Thomas Farrar, B. Chapron, S. Popinet, L. Deike. "Kinematics of broad-banded gravity-capillary waves coupled with boundary layers", *In preparation for Geophysical Research Letter*

### Submitted manuscripts (S)

- S1. **N. Scapin**, J. Wu, J. Thomas Farrar, B. Chapron, S. Popinet, L. Deike. "Momentum fluxes in wind-forced breaking waves", *Submitted to the Journal of Fluid Mechanics*, Arxiv Link: <http://arxiv.org/abs/2411.03415>.

### Journal papers (J)

- J10. S. Z. Salimi, **N. Scapin**, E. R. Popescu, P. Costa, L. Brandt. "A Volume-of-Fluid method for multicomponent droplet evaporation with Robin boundary conditions", *Journal of Computational Physics*, 113211 (2024)
- J9. A. M. Bilondi, **N. Scapin**, L. Brandt, P. Mirbor. "Turbulent convection in emulsions: the Rayleigh-Bénard configuration", *Journal of Fluid Mechanics*, 999, (2024)
- J8. A. Demou, **N. Scapin**, M. C. Esposito, P. Costa, F. Spiga, L. Brandt. "Effects of Rayleigh and Weber numbers on two-layer turbulent Rayleigh-Bénard convection", *Journal of Fluid Mechanics*, 996 (2024)
- J7. V. Agrawal, A. Kulachenko, **N. Scapin**, O. Tammisola, L. Brandt. "An Efficient Isogeometric/Finite-Difference Immersed Boundary Method for the Fluid-Structure Interactions of Slender Flexible Structures", *Computer Methods in Applied Mechanics and Engineering*, 418 (2024)

- J6. **N. Scapin**, A. D. Demou, L. Brandt. "Evaporating Rayleigh-Bénard convection: prediction of interface temperature and global heat transfer modulation", *Journal of Fluid Mechanics*, 931 (2023)
- J5. M. Crialessi-Esposito, **N. Scapin**, A. D. Demou, M. E. Rosti, P. Costa, F. Spiga, L. Brandt (2023). "FluTAS: A GPU-accelerated finite difference code for multiphase flows", *Computer Physics Communication*, 452 (2023): 112314
- J4. **N. Scapin**, F. D. Barba, G. Lupo, M. E. Rosti, C. Duwig, and L. Brandt. "Finite-size evaporating droplets in weakly compressible homogeneous shear turbulence", *Journal of Fluid Mechanics*, 934 (2022): 110730
- J3. A. D. Demou, **N. Scapin**, M. Pelanti, and L. Brandt. "A pressure-based diffuse interface method for low-Mach multiphase flows with mass transfer", *Journal of Computational Physics*, 448 (2022): 110730
- J2. F. Dalla Barba, **N. Scapin**, A. D. Demou, M. E. Rosti, F. Picano, and L. Brandt. "An interface capturing method for liquid-gas flows at low-Mach number", *Computers & Fluids*, 216 (2021): 104789
- J1. **N. Scapin**, P. Costa, and L. Brandt, "A volume-of-fluid method for interface-resolved simulations of phase-changing two-fluid flows", *Journal of Computational Physics* 407 (2020): 109251

#### Peer-reviewed Proceedings (C)

- C1. **N. Scapin**, A. Shahmardi, W. H. R. Chan, S. S. Jain, S. Mirjalili, M. Pelanti and L. Brandt "A mass-conserving pressure-based method for two-phase flows with phase change", *Proceedings of the Summer Program, Center for Turbulence Research* (2022)

#### Book chapters (B)

- B1. W. Yang, M. Chung, L. Deike, T.-L. Hsieh, M. Igbinoba, E. Levin, S. Menemenlis, I. Mitevski, G. Rios, **N. Scapin**, G. A. Vecchi "Tropical cyclones and associated impacts: overview of tropical Cyclones and historical perspective", Elsevier, *In press* (2025)

#### Conference oral presentations (O)

- O19 **N. Scapin**, J. Wu, T. Farrar, B. Chapron, & L. Deike, *Momentum and energy fluxes in wind-forced breaking waves at high wind speeds*, **76th Annual Meeting of the APS Division of Fluid Dynamics**, November 2024, Salt Lake City, Utah.
- O18 C. Martin Blanco, **N. Scapin**, J. Wu, T. Farrar, B. Chapron, & L. Deike, *Direct numerical simulations of wind wave growth of a broad banded wave spectrum*, **76th Annual Meeting of the APS Division of Fluid Dynamics**, November 2024, Salt Lake City, Utah.
- O17 **N. Scapin**, J. Wu, S. Popinet, L. Deike, *Numerical simulations of wind-wave interaction at high wind speeds*, **Ocean Sciences Meeting**, February 2024, New Orleans, Louisiana, US.
- O16 **N. Scapin**, J. Wu, S. Popinet, L. Deike, *Direct numerical simulations of coupled turbulent wind-wave flow at high wind speed*, **75th Annual Meeting of the APS Division of Fluid Dynamics**, November 2023, Washington, DC.
- O15 A. M. Bilondi, **N. Scapin**, L. Brandt, P. Mirbor, *Heat transfer enhancement in turbulent Rayleigh Bénard convection with liquid-liquid emulsions*, **75th Annual Meeting of the APS Division of Fluid Dynamics**, November 2023, Washington, DC.
- O14 A. M. Bilondi, **N. Scapin**, L. Brandt, P. Mirbor, *Multiphase Turbulent Rayleigh-Bénard convection with Bubbles*, **75th Annual Meeting of the APS Division of Fluid Dynamics**, November 2022, Indianapolis, Indiana.

- O13 **N. Scapin**, A. Shahmardi, M. Pelanti, L. Brandt, *Contact-line treatment for phase-changing flows in a diffuse interface framework*, **International Conference of Numerical Methods in Multiphase Flows**, September 2022, Venice, Italy.
- O12 S. Zamani Salimi, **N. Scapin**, A. Gruber, L. Brandt, *A volume-of-fluid method for multicomponent evaporating two-phase flow*, **European Fluid Mechanics Conference**, September 2022, Athens, Greece.
- O11 L. Brandt, A. Demou, **N. Scapin**, A. Shahmardi, M. Pelanti, *Contact-line treatment for phase-changing flows in a diffuse interface framework*, **European Fluid Mechanics Conference**, September 2022, Athens, Greece.
- O10 N. Mastroianni, **N. Scapin**, L. Brandt, *An efficient pressure-correction method for the two-fluid model*, **European Fluid Mechanics Conference**, September 2022, Athens, Greece.
- O9 **N. Scapin**, A. Demou, L. Brandt, *Evaporating Rayleigh-Bénard convection: prediction of interface temperature and heat transfer modulation*, **European Fluid Mechanics Conference**, September 2022, Athens, Greece.
- O8 L. Brandt, **N. Scapin**, F. Picano, C. Duwig, *Simulations of finite-size evaporating droplets in weakly-compressible homogeneous shear turbulence*, **74th Annual Meeting of the APS Division of Fluid Dynamics**, November 2021, Phoenix AZ, United States.
- O7 **N. Scapin**, L. Brandt, *A robust low-Mach solver for phase-changing flows*, **74th Annual Meeting of the APS Division of Fluid Dynamics**, November 2021, Phoenix, AZ, USA.
- O6 A. Demou, **N. Scapin**, M. Pelanti, L. Brandt, *A pressure-based diffuse-interface method for two-phase flows with mass transfer*, **74th Annual Meeting of the APS Division of Fluid Dynamics**, November 2021, Phoenix, AZ, USA.
- O5 A. Demou, L. Brandt, P. Costa, M. Cialesi Esposito, **N. Scapin**, M. E. Rosti & F. Spiga, *FluTAS: a GPU-accelerated solver for multiphase flow applications*, **74th Annual Meeting of the APS Division of Fluid Dynamics**, November 2021, Phoenix, AZ, USA.
- O4 **N. Scapin**, F. Dalla Barba, G. Lupo, P. Costa, M. E. Rosti, C. Duwig & L. Brandt, *Finite-size evaporating droplets in homogeneous shear turbulence*, **EUROMECH Colloquium 621 "Transport and fluxes in dispersed turbulent flows"**, July 2021, Virtual Congress.
- O3 **N. Scapin**, G. Lupo, C. Duwig & L. Brandt, *Interface-resolved evaporating droplets in homogeneous shear turbulence*, **73rd Annual Meeting of the APS Division of Fluid Dynamics**, November 2020, Chicago IL, United States (Virtual Conference).
- O2 **N. Scapin**, E. Popescu, P. Costa, C. Duwig & L. Brandt, *A combined low-Mach number Volume of Fluid method for phase-changing two-phase flow*, **WCCM-ECCOMAS 2020**, January 2021, Virtual Congress.
- O1 **N. Scapin**, P. Costa & L. Brandt, *A volume of fluid method for interface-resolved simulations of evaporating flows*, **72nd Annual Meeting of the APS Division of Fluid Dynamics**, November 2019, Seattle WA, United States.

#### Invited presentations (I)

- I3. *Phase-changing flows: numerical methods and fully resolved simulations*, October 6, 2022, École Centrale de Lyon (Lyon, France). **Coordinator: ERCOFTAC Da Vinci Competition.**
- I2. *Weakly compressible simulations of evaporating droplets*, March 2, 2022, Department of Mechanical Engineering (virtual presentation). **Coordinator: Prof. R. Ni, Johns Hopkins University (Baltimore, US).**

11. *Weakly compressible simulations of evaporating droplets*, February 15, 2022, Complex Fluids and Flows Unit (virtual presentation). **Coordinator: Prof. M. E. Rosti, Okinawa Institute for Science and Technology (Okinawa, Japan).**

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## Service to the Research Community

11/2024–  
Present **Chair of APS-DFD Sessions**, See [here](#) for the link

07/2019–  
Present **Peer reviewer**, *Journal of Computational Physics* (2022: 2 assignments), *Computer and Fluids* (2019-2020-2021: 2 assignments per year), *Journal of Fluid Mechanics - Rapids*, (2023: 1 assignment), *European Journal of Fluid Mechanics/B* (2019-2023: 3 assignments per year), *Computer Physics Communication* (2024: 1 assignment), *Nature Computational Science* (2024: 1 assignment)

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## References

### **Prof. Luca Brandt**

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