

Tom Beucler

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Research Interests

Atmospheric Physics, Climate Informatics, Clouds and Convection, Deep Learning, Downscaling, Environmental Data Science, Fluid Dynamics, Scientific Machine Learning, Tropical Meteorology, Weather and Climate Extremes.

Education

MIT Program in Atmospheres, Oceans, and Climate

Ph.D. in Atmospheric Science: Interaction between Water Vapor, Radiation and Convection

Thesis committee: K. Emanuel (co-advisor), T. Cronin (co-advisor), P. O’Gorman, Z. Kuang, C. Bretherton.

2014 – 2019

Cambridge, USA

École Polytechnique

Master of Science in Mechanics

Major in fluid dynamics and environmental science.

2013 – 2014

Palaiseau, France

École Polytechnique & Lycée Sainte-Geneviève

Bachelor of Engineering

Coursework in mechanics, physics, mathematics, chemistry and biology.

2009 – 2013

Versailles & Palaiseau, France

Academic Employment

University of Lausanne, Switzerland

Assistant Professor of Environmental Data Science (Tenure Track)

2021 – Present

Lausanne, Switzerland

University of California, Irvine

Assistant Project Scientist in Atmospheric Science: Machine Learning for Climate Science

Principal investigators: M. Pritchard and P. Gentine.

2019 – 2021

Irvine, USA

University of California, Irvine and Columbia University

Postdoctoral Scholar in Atmospheric Science: Deep Learning for Convection and Clouds

Co-advisors: P. Gentine and M. Pritchard.

2019

Irvine & NYC, USA

Awards and Visiting Positions

- (2021–Present) **Visiting scholar**, Earth System Science Department, UCI
- (2019–2023) **Visiting scholar**, Scripps Institution of Oceanography, UCSD
- (2023) **AGU 2022 Editor’s citation for excellence in refereeing**, Journal of Advances in Modeling Earth Systems
- (2022) **AGU 2021 Editor’s citation for excellence in refereeing**, Geophysical Research Letters
- (2021) **AGU 2020 Editor’s citation for excellence in refereeing**, Journal of Advances in Modeling Earth Systems
- (2019) **Rossby award for best doctoral thesis**, Program in Atmospheres, Oceans and Climate, MIT
- (2019) **Invited scholar**, Max Planck Institute for Meteorology
- (2019) **Summer fellow**, 2nd ICTP Summer School on Climate Dynamics and Convective Organization
- (2018) **Finalist of the “Climate Changed” @ MIT competition**, *Higher Grounds* at MIT
- (2018) **AGU 2017 Editor’s citation for excellence in refereeing**, Geophysical Research Letters
- (2018) **Best poster prize (Water & Society)**, *Preparing MIT for 2050 Floodwaters* at the MIT Water Night
- (2018) **Graduate research fellow**, Program on Math. and Stat. Methods for Climate & the Earth System at SIAM Institute
- (2017) **Summer fellow**, Les Houches Summer School on Fundamental Aspects of Turbulent Flows in Climate Dynamics
- (2015) **Geophysical fluid dynamics fellow**, Woods Hole Oceanographic Institution
- (2014–2015) **Rasmussen fellow**, MIT Department of Earth, Atmospheric and Planetary Sciences
- (2014) **Outstanding Master’s thesis**, École Polytechnique

Funding

- (2024–Present) **Lead PI, SNSF Project Funding**: *RobustSR: Improving the Robustness of Super-Resolution Algorithms to Climate Change and Extreme Events*. Estimated value of resources awarded to ∂^3 AWN: **CHF 584,989**
- (2024–Present) **Co-PI, Horizon Europe (CL5 Call)**: *AI4PEX: Artificial Intelligence and Machine Learning for Enhanced Representation of Processes and Extremes in Earth System Models*. Estimated value of resources awarded to ∂^3 AWN: **CHF 523,999**
- (2024–Present) **Lead PI, UNIL Teaching Innovation Fund (FIP)**: *Promoting the Teaching of Computational Sciences at the Faculty of Geosciences and Environment*. Estimated value of resources awarded: **CHF 54,000**

- (2021-Present) **Principal Investigator, Canton of Vaud funding for all IDYST professors:** ∂^3 AWN Lab at IDYST. Estimated value of awarded resources: **CHF 120,000/year** (2 PhD students)
- (2020-2021) **Principal Investigator, Columbia University subaward:** *Physics-Guided Deep Learning for Climate Predictions*. Estimated value of awarded resources: **\$51,986**
- (2020-2021) **Co-Investigator, XSEDE computational resources allocation:** *Simulating global climate with turbulence-permitting cloud superparameterization to train machine learning emulators and advance understanding of aerosol-cloud feedbacks*. Lead PI: Mike Pritchard. Estimated value of awarded resources: **\$2,025,427**

Peer-Reviewed Publications and Book Chapters

1. (2024) Eyring, V., W.D. Collins, P. Gentine, E.A. Barnes, M. Barreiro, **T. Beucler**, ... & L. Zanna: Pushing the frontiers in climate modeling and analysis with machine learning. *Nature Climate Change*.
2. (2024) Rampal, N., S. Hobeichi, P. B. Gibson, J. Baño-Medina, G. Abramowitz, **T. Beucler**, J. González-Abad, W. Chapman, P. Harder & José Manuel Gutiérrez: Enhancing Regional Climate Downscaling Through Advances in Machine Learning. *Artificial Intelligence for the Earth Systems*.
3. (2024) **Beucler, T.**, E. Koch, S. Kotlarski, D. Leutwyler, A. Michel & J. Koh: Next-Generation Earth System Models: Towards Reliable Hybrid Models for Weather and Climate Applications. *SATW Whitepaper on "AI for Climate Change Mitigation"*, 5.2.
4. (2024) Grundner, A., **T. Beucler**, P. Gentine & V. Eyring: Data-Driven Equation Discovery of a Cloud Cover Parameterization, *Journal of Advances in Modeling Earth Systems*, **16**, e2023MS003763.
5. (2024) Iglesias-Suarez, F., P. Gentine, B. Solino-Fernandez, **T. Beucler**, M. Pritchard, J. Runge & V. Eyring: Causally-informed deep learning to improve climate models and projections, *Journal of Geophysical Research: Atmospheres*, **129**, e2023JD039202.
6. (2024) Mooers, G., **T. Beucler**, M. Pritchard & S. Mandt: Understanding Precipitation Changes through Unsupervised Machine Learning, *Environmental Data Science*, **3**, e3.
7. (2024) **Beucler, T.**, P. Gentine, J. Yuval, A. Gupta, L. Peng, J. Lin, S. Yu, S. Rasp, F. Ahmed, P. O’Gorman, D. Neelin, N. Lutsko & M. Pritchard: Climate-Invariant Machine Learning, *Science Advances*, **10**, eadj7250.
8. (2023) **Beucler, T.**, I. Ebert-Uphoff, S. Rasp, M. Pritchard & P. Gentine: Machine Learning for Clouds and Climate, *Clouds and Their Climatic Impact: Radiation, Circulation, and Precipitation*, edited by: Sullivan, SC and Hoose, C., Wiley–American Geophysical Union: 327-346.
9. (2023) Mooers, G., M. Pritchard, **T. Beucler**, P. Srivastava, H. Mangipudi, L. Peng, P. Gentine & S. Mandt: Comparing Storm Resolving Models and Climates via Unsupervised Machine Learning, *Scientific Reports*.
10. (2023) Zanetta, F., D. Nerini, **T. Beucler** & M. Liniger: Physics-constrained deep learning postprocessing of temperature and humidity, *Artificial Intelligence for the Earth Systems*, **2**, e220089.
11. (2023) Ganesh S., S., **T. Beucler**, F. I. Tam, M. Gomez, J. Runge & A. Gerhardus: Selecting Robust Features for Machine Learning Applications using Multidata Causal Discovery, *Environmental Data Science*, **2**:e27.
12. (2022) Grundner, A., **T. Beucler**, P. Gentine, F. Iglesias-Suarez, M. Giorgetta & V. Eyring: Deep Learning Based Cloud Cover Parameterization for ICON, *Journal of Advances in Modeling Earth Systems*, e2021MS002959.
13. (2022) Wu, Z., **T. Beucler**, E. Székely, W. Ball & D. Domeisen: Modeling Stratospheric Polar Vortex Variation and Identifying Vortex Extremes Using Explainable Neural Networks. *Environmental Data Science 1*: e17.
14. (2022) Behrens, G., **T. Beucler**, P. Gentine, F. Iglesias-Suarez, M. Pritchard & V. Eyring: Non-Linear Dimensionality Reduction with a Variational Encoder Decoder to Understand Convective Processes in Climate Models. *Journal of Advances in Modeling Earth Systems*, e2022MS003130.
15. (2021) Gentine, P., V. Eyring & **T. Beucler**: Deep Learning for the Parametrisation of Subgrid Processes in Climate Models, *Deep learning for the Earth Sciences: With Applications and R, Second Edition*, **307-314**.
16. (2021) Mooers, G., M. Pritchard, **T. Beucler** et al.: Assessing the Potential of Deep Learning for Emulating Cloud Superparameterization in Climate Models with Real-Geography Boundary Conditions. *Journal of Advances in Modeling Earth Systems*, **13**, e2020MS002385.
17. (2021) **Beucler, T.**, M. Pritchard, S. Rasp, J. Ott, P. Baldi & P. Gentine: Enforcing Analytic Constraints in Neural-Networks Emulating Physical Systems, *Physical Review Letters*, **126.9**: 098302. **Editors’ Suggestion**.
18. (2020) Brenowitz, N., **T. Beucler**, M. Pritchard & C. Bretherton: Interpreting and Stabilizing Machine-Learning Parametrizations of Convection, *Journal of the Atmospheric Sciences*, **77.12**, 4357-4375.
19. (2020) **Beucler, T.**, D. Leutwyler & J. Windmiller: Quantifying Convective Aggregation Using the Tropical Moist Margin’s Length, *Journal of Advances in Modeling Earth Systems*, **12.10**, e2020MS002092.
20. (2020) Abbott, T., T. Cronin & **T. Beucler**: Convective Dynamics and the Response of Precipitation Extremes to Warming in Radiative–Convective Equilibrium, *Journal of the Atmospheric Sciences*, **77**, 1637-1660.
21. (2019) **Beucler, T.**, T. Abbott, T. Cronin & M. Pritchard: Comparing Convective Self-Aggregation in Idealized Models to Observed Moist Static Energy Variability Near the Equator, *Geophysical Research Letters*, **46**, 17-18.
22. (2019) **Beucler, T.**: Interaction between Water Vapor, Radiation and Convection in the Tropics, *Ph.D. Thesis in Atmospheric Science*.
23. (2018) **Beucler, T.** & T. Cronin: A Budget for the Size of Convective Self-Aggregation, *Quarterly Journal of the Royal Meteorological Society*, **145**, 947– 966.
24. (2018) **Beucler, T.**, T. Cronin & K. Emanuel: A Linear Response Framework for Radiative–Convective Instability, *Journal of Advances in Modeling Earth Systems*, **10**, 1924-1951.
25. (2016) **Beucler, T.** & T. Cronin: Moisture–Radiative Cooling Instability, *Journal of Advances in Modeling Earth Systems*, **8**, 1620–1640.

26. (2016) **Beucler, T.**: A Correlated Stochastic Model for the Large-Scale Advection, Condensation and Diffusion of Water Vapour. *Quarterly Journal of the Royal Meteorological Society*, **142**, 1721–1731.
27. (2014) **Beucler, T.**: Self-Aggregation Phenomenon in Cyclogenesis, *Master's Thesis in Fluid Mechanics*.

Peer-Reviewed Conference and Workshop Publications

1. (2023, NeurIPS Conference) Yu, S., W. Hannah, L. Peng, M. Bhourri, R. Gupta, J. Lin, B. Lütjens, J. Will, G. Behrens, J. Busecke, N. Loose, C. Stern, **T. Beucler** et al.: ClimSim: A large multi-scale dataset for hybrid physics-machine learning climate emulation. *Advances in Neural Information Processing Systems*. “**Outstanding Datasets and Benchmarks**” award.
2. (2023, NeurIPS Workshop) Lin, J., M. A. Bhourri, **T. Beucler**, S. Yu & M. Pritchard: Stress-testing the coupled behavior of hybrid physics-machine learning climate simulations on an unseen, warmer climate. *2023 Conference on Neural Information Processing Systems*.
3. (2021, NeurIPS Workshop) Mangipudi, H., G. Mooers, M. Pritchard, **T. Beucler** & S. Mandt: Analyzing High-Resolution Clouds and Convection using Multi-Channel VAEs. *2021 Conference on Neural Information Processing Systems*.
4. (2020, IGARSS) **Beucler, T.**, M. Pritchard, P. Gentine & S. Rasp: Towards Physically-Consistent, Data-Driven Models of Convection. *IEEE International Geoscience and Remote Sensing Symposium 2020*.
5. (2020, Climate Informatics) Mooers, G., J. Tuyls, S. Mandt, M. Pritchard & **T. Beucler**: Generative Modeling of Atmospheric Convection. *Proceedings of the 10th International Conference on Climate Informatics*, 98-105.
6. (2019, ICML Workshop) **Beucler, T.**, S. Rasp, M. Pritchard & P. Gentine: Achieving Conservation of Energy in Neural Network Emulators for Climate Modeling. *2019 International Conference on Machine Learning*.

Preprints and Submitted Manuscripts

1. **Beucler, T.**, A. Grundner, S. Shamekh, P. Ukkonen, M. Chantry, R. Lagerquist: Distilling Machine Learning's Added Value: Pareto Fronts in Atmospheric Applications. *arXiv:2408.02161*.
2. Feldmann, M., **T. Beucler**, M. Gomez & O. Martius: Lightning-Fast Thunderstorm Warnings: Predicting Severe Convective Environments with Global Neural Weather Models. *arXiv:2406.09474*.
3. Christopoulos, C., I. Lopez-Gomez, **T. Beucler**, Y. Cohen, C. Kawczynski, O. Dunbar & T. Schneider: Online Learning of Entrainment Closures in a Hybrid Machine Learning Parameterization.
4. Behrens, G., **T. Beucler**, F. Iglesias-Suarez, S. Yu, P. Gentine, M. Pritchard, M. Schwabe & V. Eyring: Improving Atmospheric Processes in Earth System Models with Deep Learning Ensembles and Stochastic Parameterizations. *arXiv:2402.03079*.
5. Tam, F. I, **T. Beucler** & J. Ruppert: Identifying Three-Dimensional Radiative Patterns Associated with Early Tropical Cyclone Intensification. *arXiv:2401.09493*.
6. Cache, T., M. Gomez, **T. Beucler**, J. Blagojevic, J. Leitao & N. Peleg: Enhancing generalizability of data-driven urban flood models by incorporating contextual information. *Hydrology and Earth System Sciences Discussions*.
7. Aarnink, J., **T. Beucler**, M. Vuaridel & V. Ruiz-Villanueva: Automatic detection of instream large wood in videos using deep learning. *EGU sphere*, doi. org/ 10. 5194/ egusphere-2024-792.
8. Yu, S., Z. Hu, A. Subramaniam, W. Hannah, L. Peng, J. Lin, M. Bhourri, R. Gupta, B. Lütjens, J. Will, G. Behrens, J. Busecke, N. Loose, C. Stern, **T. Beucler** et al.: ClimSim-Online: A Large Multi-scale Dataset and Framework for Hybrid ML-physics Climate Emulation. *arXiv:2306.08754*.
9. Gomez, M., & **T. Beucler**: Lessons Learned: Reproducibility, Replicability, and When to Stop. *arXiv:2401.03736*.
10. Lin, J., S. Yu, L. Peng, **T. Beucler**, E. Wong-Toi, Z. Hu, P. Gentine, M. Geleta & M. Pritchard: Sampling Hybrid Climate Simulation at Scale to Reliably Improve Machine Learning Parameterization. *arXiv:2309.16177*.

Invited Seminars

1. (Jul 24) CleanCloud Monthly Seminar Series. *Data-Driven Parameterization of Cloud Processes: From Deep Learning to Equation Discovery*.
2. (Jun 24) TROPICAL Cyclones in ANthropocene: physics, simulations & Attribution (TROPICANA) seminar in Orsay, France. *AI for Tropical Meteorology: Challenges and Opportunities*.
3. (May 24) ETHZ Colloquium “Atmosphere and Climate”. *Distilling Machine Learning's Added Value: Pareto Fronts in Atmospheric Applications*.
4. (Apr 24) Data Science for the Sciences (DS4S) conference in Bern, Switzerland. *Atmospheric physics-guided machine learning for climate modeling and weather forecasting*.
5. (Mar 24) Joint CLIMACT-ECCE Seminar in Lausanne, Switzerland. *Tropical Precipitation in a Changing Climate*.
6. (Jan 24) US CLIVAR Predictability, Predictions, and Applications Interface (PPAI) Panel's Webinar. *Atmospheric physics-guided machine learning for climate modeling and weather forecasting*.
7. (Apr 23) UN's International Telecommunication Union (ITU) “AI for Good” Seminar Series. *AI for tropical meteorology: Challenges and opportunities*.
8. (Jan 24) Jeudis du climat, National Centre for Meteorological Research in Toulouse, France. *Atmospheric Physics-Guided Machine Learning for Climate Modeling and Weather Forecasting*.
9. (Oct 23) Joint Climate Impacts- ∂^3 AWN Group Meeting. *Demystifying Data-Driven Weather Forecasting*.
10. (Sep 23) Grenoble Alpes University's Institute of Environmental Geosciences Seminar in Grenoble, France. *Atmospheric*

Physics-Guided Machine Learning for Climate Modeling and Weather Forecasting.

11. (Jun 23) Caltech Climate Modeling Alliance (CliMA) Seminar. *Systematically Generating Hierarchies of Machine-Learning Models, from Equation Discovery to Deep Neural Networks.*
12. (Apr 23) ai4oac2023: Workshop on AI for Ocean, Atmosphere and Climate Dynamics in Brest, France. *Physically and Causally-Informed ML for Climate Modeling.*
13. (Jan 23) ETHZ Atmospheric Predictability Extended Group Meeting. *Atmospheric Physics-Guided Machine Learning.*
14. (Jan 23) CSSI-Gravity Wave journal club. *Systematically Generating Hierarchies of Machine-Learning Models, from Equation Discovery to Deep Neural Networks.*
15. (Jan 23) **Core Science Keynote** at the 103rd AMS Annual Meeting. *Systematically Generating Hierarchies of Machine-Learning Models, from Equation Discovery to Deep Neural Networks.*
16. (Nov 22) Institute for Mathematical and Statistical Innovation (iMSi) workshop on “ML for Climate and Weather Applications”. *Systematically Generating Hierarchies of Machine-Learning Models, from Equation Discovery to Deep Neural Networks.*
17. (Oct 22) ESIWACE2 Second Virtual Workshop on Emerging Technologies for Weather and Climate Modelling. *Atmospheric Physics-Guided Machine Learning.*
18. (Oct 22) UNIL “Machine Learning Café” seminar series. *Physically and Causally-Informed ML for Climate Modeling.*
19. (Sep 22) IPSL LSCE seminar on the Paris-Saclay university campus in France. *Climate-Invariant, Causally-Consistent Neural Networks as Robust Emulators of Subgrid Processes across Climates.*
20. (Sep 22) EPFL Environmental Engineering Seminar Series. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
21. (Sep 22) Royal Meteorological Society workshop on “Machine Learning for Atmospheric Sciences: Values and Controversies”. *Systematically Generating Hierarchies of Machine-Learning Models, from Equation Discovery to Deep Neural Networks.*
22. (Jun 22) NVIDIA Invited Webinar. *Climate-Invariant, Causally-Consistent Neural Networks as Robust Emulators of Subgrid Processes across Climates.*
23. (Jun 22) Aspen Global Change Institute workshop “Exploring the Frontiers in Earth System Modeling with Machine Learning and Big Data”. *Climate-Invariant Machine Learning.*
24. (Jun 22) CIRA/CSU Invited Seminar in Fort Collins, CO, USA. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
25. (May 22) EGU General Assembly 2022. *Climate-Invariant, Causally-Consistent Neural Networks as Robust Emulators of Subgrid Processes across Climates.*
26. (May 22) Climate Informatics 2022 Conference. *Climate-Invariant, Causally-Consistent Neural Networks as Robust Emulators of Subgrid Processes across Climates.*
27. (Apr 22) “Machine Learning and sampling methods for climate and physics” IXXI workshop at ENS Lyon in France. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
28. (Apr 22) Second workshop of the ELLIS Program ‘Machine Learning for Earth and Climate Sciences’. *Climate-Invariant Machine Learning.*
29. (Feb 22) “AI Super-Resolution Simulations: From Climate Science to Cosmology” CMU workshop. *Atmospheric Physics-Guided Machine Learning.*
30. (Feb 22) UCLA AOS 271 and Journal Club seminar. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
31. (Feb 22) Postdam Institute for Climate Impact Research invited seminar on “ML applications in climate science”. *Climate-Invariant, Causally-Consistent Neural Networks as Robust Emulators of Subgrid Processes across Climates.*
32. (Jan 22) AMS 102nd Annual Meeting. *Climate-Invariant, Causally Consistent Neural Networks as Robust Emulators of Subgrid Processes across Climates.*
33. (Jan 22) Caltech Climate Modeling Alliance (CliMA) Seminar. *Atmospheric Physics-Guided Machine Learning.*
34. (Nov 21) ESA-ECMWF Workshop 2021: Machine Learning for Earth System Observation and Prediction. *Atmospheric Physics-Guided Machine Learning.*
35. (Nov 21) MeteoSwiss APP Seminar in Locarno, Switzerland. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
36. (Nov 21) University of Bern’s Colloquium in Climatology, Climate Impact and Remote Sensing. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
37. (Jul 21) AI2ES NCAR Summer School on Trustworthy AI. *Invited Tutorial: Integrating Physics into Machine Learning.*
38. (May 21) Princeton Plasma Physics Laboratory (PPPL) Machine Learning Seminar. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
39. (May 21) MIT Sack Lunch Seminar Series (SLS) Seminar. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
40. (May 21) NCAR’s Climate and Global Dynamics (CGD) seminar series. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
41. (May 21) LANL’s Conference on Machine Learning in Solid Earth Geoscience. *Atmospheric Physics-Guided Machine Learning: Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
42. (Jan 21) AMS 101st Annual Meeting. *Climate-Invariant Nets: Using Physical Rescalings to Help Neural Networks Generalize to Out-of-Sample Climates.*
43. (Oct 20) UCI Earth System Science Departmental Seminar Series. *Towards Physically-Consistent, Data-Driven, and Interpretable Models of Convection.*
44. (Oct 20) UCSD SIO Machine Learners Group Meeting. *Towards Physically-Consistent, Data-Driven, and Interpretable Models of*

Convection.

45. (Oct 20) 2020 IEEE International Geoscience and Remote Sensing Symposium. *Towards Physically-Consistent, Data-Driven Models of Convection.*
46. (Aug 20) First Annual Workshop on Knowledge-Guided Machine Learning (UMN). *Towards Physically-Consistent, Data-Driven Models of Convection.*
47. (Jul 20) SIAM 2020 Conference on “Mathematics of Planet Earth”. *Climate-Invariant Nets: Physical Rescalings can Help Neural Networks Generalize to Out-of-sample Climates.*
48. (Jun 20) LANL’s “Machine Learning for Turbulence” webinar. *Towards Physically-Consistent, Data-driven, and Interpretable Parametrizations of Convection.*
49. (Apr 20) NOAA Satellite Applications and Research (STAR) Seminar Series. *Towards Physically-Consistent, Data-driven, and Interpretable Parametrizations of Convection.*
50. (Dec 19) AGU Fall Meeting 2019. *Building a Hierarchy of Hybrid, Neural-network Parametrizations of Convection.*
51. (Jul 19) Joint Max-Planck-Institute for Meteorology & University of Hamburg Seminar. *Physical Mechanisms of Convective Self-Aggregation in the Tropics.*
52. (Dec 18) Seminar in Geosciences, ENS Ulm in Paris, France. *Interaction between water vapor, radiation and convection in the Tropics.*
53. (Sep 18) MIT Sack Lunch Seminar Series (SLS) Seminar. *Interaction between water vapor, radiation and convection in the Tropics.*
54. (Oct 18) Yale AOCD Speaker Series in New Haven, CT, USA. *Interaction between water vapor, radiation and convection in the Tropics.*
55. (Aug 18) UCLA Atmospheric & Oceanic Sciences Department (Special Seminar). *Interaction between water vapor, radiation and convection in the Tropics.*
56. (Aug 18) UCI Earth System Science Department (Special Seminar). *Interaction between water vapor, radiation and convection in the Tropics.*
57. (Dec 17) Seminar in Geosciences, Université Pierre et Marie Curie in Paris, France. *A Spectral Budget for the Size of Convective Self-Aggregation.*
58. (Jan 17) Seminar in Geosciences, ENS Ulm in Paris, France. *Radiative-Convective Instability.*

Conference Oral Presentations

1. (May 24) AMS 36th Conference on Hurricanes and Tropical Meteorology. *Data-Driven Equation Discovery of a Parameterization for Tropical Precipitation.*
2. (Apr 23) 12th International Conference on Climate Informatics. *Systematically Generating Hierarchies of Machine-Learning Models, from Equation Discovery to Deep Neural Networks.*
3. (Jun 22) AMS 23rd Conference on Atmospheric and Oceanic Fluid Dynamics. *Systematically Generating Climate Model Hierarchies from Data using Machine Learning.*
4. (Mar 22) EPFL Applied Machine Learning Days (AMLD). *Atmospheric Physics-Guided Machine Learning.*
5. (Jan 20) AMS 100th Annual Meeting. *Building a Hierarchy of Hybrid, Neural Network Parameterizations of Convection.*
6. (Jun 19) Ninth Northeast Tropical Workshop in Dedham, MA, USA. *Towards Interpretable Neural-Network Parametrizations of Convection.*
7. (Feb 19) UCP 2019: “Understanding Clouds and Precipitation” in Berlin, Germany. *Understanding the Zonal Variability of Thermodynamic Feedbacks in the Tropics.*
8. (Apr 18) AMS 33rd Conference on Hurricanes and Tropical Meteorology. *A Spectral Budget for the Size of Convective Self-Aggregation.*
9. (Jul 17) AMS 17th Conference on Mesoscale Processes. *A Moist Static Energy Perspective on Atmospheric Rivers.*
10. (Jun 17) AMS 21st Conference on Atmospheric and Oceanic Fluid Dynamics. *The Vertical Structure of Radiative-Convective Instability.*
11. (Aug 16) 2016 International Atmospheric Rivers Conference in San Diego, CA, USA. *A Moist Static Energy Perspective on Atmospheric Rivers.*
12. (Apr 16) AMS 32nd Conference on Hurricanes and Tropical Meteorology. *Instabilities of Radiative Convective Equilibrium with an Interactive Surface.*

Conference Posters

1. (Dec 20) AGU Fall Meeting 2020. *Climate-Invariant Nets: Using Physical Rescalings to Help Neural Networks Generalize to Out-of-Sample Climates.*
2. (Jan 20) AMS 100th Annual Meeting. *Comparing Convective Self-Aggregation in Idealized Models to Observed Moist Static Energy Variability near the Equator.*
3. (Dec 19) AGU Fall Meeting 2019. *Comparing Convective Self-Aggregation in Idealized Models to Observed Moist Static Energy Variability near the Equator.*
4. (Jun 19) International Conference on Machine Learning 2019’s workshop “Climate Change: How Can AI Help?”. *Achieving Conservation of Energy in Neural Network Emulators for Climate Modeling.*
5. (Dec 18) AGU Fall Meeting 2018. *A budget for the size of convective self-aggregation.*
6. (Jan 17) AMS 97th Annual Meeting. *Moisture-Radiative Cooling Instability.*

Teaching Experience

FGSE, University of Lausanne (4 occurrences: Fall 22+23+24 & Spring 22) <i>Main Instructor of "Machine Learning for Earth and Environmental Sciences" (5 ECTS, ≈25 students)</i> Design and delivery of yearly 12-week course open to all Master's and PhD students in Earth/env. sci. & geography.	Jan 2022 – Present Lausanne, Switzerland
FGSE, University of Lausanne (3 occurrences: Fall 22+23+24) <i>Main Instructor of "Introduction to Scientific Programming with Python" (2 ECTS, ≈50 students)</i> Design and delivery of yearly 4-week course open to all Master's and PhD students in Earth/env. sci. & geography.	Sep 2022 – Present Lausanne, Switzerland
FGSE, University of Lausanne (3 occurrences: Fall 22+23+24) <i>Main Instructor of "Géomatique et Systèmes d'Information Géographique" (3 ECTS, ≈100 students)</i> Design and delivery of yearly 12-week course open to all Bachelor students in Earth/env. sci. & geography.	Sep 2022 – Present Lausanne, Switzerland
FGSE, University of Lausanne (1 occurrence: Fall 24) <i>Main Instructor of "Géoinformatique I" (6 ECTS, ≈100 students)</i> Design and co-delivery of yearly 12-week course open to all Bachelor students in Earth/env. sci. & geography.	Sep 2024 – Present Lausanne, Switzerland
Institut Pascal & Université Paris-Saclay <i>Co-Instructor at the TROPICANA Program on Tropical Cyclones' Physics, Simulation, and Attribution</i> Co-designed and delivered a lecture followed by a tutorial on machine learning applied to tropical cyclones.	Jun 2024 Orsay, France
Foundation of Research and Technology-Hellas & University of Oxford <i>Main Instructor of the iMIRACLI 3rd Summer School on climate data science</i> Designed and delivered a one-day block course on physics-guided machine learning.	Sep 2023 Patras, Greece
European Centre for Medium-Range Weather Forecasts (MOOC) <i>Consultant, Reviewer, and Content Provider for "Machine Learning for Weather and Climate"</i> Main instructor for the "Physics-Guided ML" & "Parametrisation emulation" e-learning modules.	Mar 2022 – Mar 2023 Remote, Luxembourg
MIT Teaching and Learning Laboratory <i>Kaufman teaching certificate program</i> Program for MIT graduate students aimed at improving teaching skills.	Feb 2017 – May 2017 Cambridge, USA
PAOC, MIT <i>Teaching Assistant in 12.801, The General Circulation of the Ocean</i> Prof. Raffaele Ferrari.	Feb 2016 – May 2016 Cambridge, USA
PAOC, MIT <i>Teaching Assistant in 12.815, Atmospheric Radiation and Convection</i> Prof. Sara Seager and Prof. Kerry Emanuel.	Sep 2015 – Dec 2015 Cambridge, USA
Lycée Sainte-Geneviève <i>Teaching Assistant in physics</i> Undergraduate level: waves, electromagnetism, optics, newtonian, solid and fluid mechanics.	Sep 2012 – Mar 2014 Versailles, France

Public Engagement and Outreach

- (May 24) Climat, IA et lois physiques, un partenariat gagnant. *Co-author*
- (Mar 24) Modéliser la physique atmosphérique, prévoir la formation de cyclones tropicaux, et prédire le climat futur. *Co-author as part of the contribution to: "Évaluer les risques naturels, simuler le devenir des glaciers ou encore appréhender la complexité des réseaux urbains : les géosciences évoluent avec les progrès de l'intelligence artificielle."*
- (Feb 24) AI and Climate Science & Anticiper l'avenir climatique grâce à l'AI. *Co-author*
- (Jan 24) A la croisée de la physique et de l'intelligence artificielle : les nouveaux horizons de la modélisation. *UNIL Honorary and Retired Professors Ceremony. Speaker.*
- (Sep 23) L'intelligence artificielle au service des sciences du climat. *UNIL FGSE Academic Year Opening Ceremony*
- (Jun 23) CLIMACT Atmospheric Science Day 2023. *Author*
- (Dec 22) Intelligence artificielle : quels enjeux pour l'université ? *Contributor*
- (Mar 21) Teaching a Neural Network the Hard Way. *APS Physics 14*
- (Jun 20 – Jun 21) US CLIVAR Data Science Webinar Series. *Co-organizer and Moderator*
- (Nov 20) Modelling Clouds and Climate. *Communications of the ACM*
- (Aug 20) Outsourcing Sub-Grid Cloud Physics to Neural Networks. *E3SM Blog Post*
- (Jun 18) When the Wind Blows: Predicting how Hurricanes Change with Climate. *CaféSci Boston*
- (Jan 18) Higher Grounds. *MIT Climate Changed Ideas Competition*

Mentorship and Supervision

Direct Research Supervision (PhD students & Postdocs) <ul style="list-style-type: none">○ (Nov 2024 – Mar 2025) Incoming: 2 PhD students and 1 postdoctoral scholar at UNIL○ (Aug 2021 – Present) Milton Gomez (PhD student at UNIL)○ (Sep 2021 – Present) Frederick Iat-Hin Tam (PhD student at UNIL)○ (Aug 2021 – Dec 2023) Saranya Ganesh Sudheesh (Postdoctoral scholar at UNIL)	Aug 2021 – Present Lausanne, Switzerland
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Technical Advising (weekly to biweekly mentoring of early-career scientists)**Jul 2019 – Present**

- (Apr 2024 – Present) Helge Heuer (PhD student at the German Aerospace Center)
- (Sep 2021 – Present) Costa Christopoulos (PhD student at Caltech)
- (Sep 2022 – Aug 2024) Jingyan Yu (Postdoctoral fellow at UNIL)
- (Jan 2020 – Mar 2024) Arthur Grundner (Previously PhD student then postdoc at the German Aerospace Center)
- (Jul 2019 – Feb 2024) Gunnar Behrens (Previously PhD student then postdoc at the German Aerospace Center)
- (Apr 2019 – Dec 2023) Griffin Mooers (Previously PhD student at UC Irvine, then postdoc at MIT)
- (Feb 2022 – Nov 2023) Francesco Zanetta (PhD student at ETH/MeteoSwiss, Visiting student at UNIL)
- (Dec 2019 – Jul 2021) Andrea Jenney (Postdoctoral fellow at UC Irvine)

*Europe & USA***PhD Thesis Committee Member (annual meeting)****Jan 2020 – Present**

- (Feb 2024 – Present) Lucas Schmutz (UNIL)
- (Apr 2023 – Present) Kejdi Lleshi (UNIL)
- (Jan 2023 – Present) Tabea Cache (UNIL)
- (Jan 2022 – Present) Costa Christopoulos (Caltech)
- (Sep 2021 – Present) Janbert Aarnink (UNIL)
- (Sep 2022 – Aug 2024) Ségolène Crossouard (IPSL)
- (Jan 2020 – Apr 2023) Griffin Mooers: “Improving the Modeling and Analysis of Tropical Convection and Precipitation Through Machine Learning Methods”, *Earth System Science Department, UC Irvine*.

*Europe & USA***PhD Jury Member (only on final evaluation committee)****Oct 2022 – Present**

- (Jul 2024) Raghul Parthipan: “Machine learning for the weather: advancing the state-of-the-art in ML modelling for dynamical systems”, *Department of Computer Science and Technology, University of Cambridge*.
- (Jun 2024) Shahine Bouabid: “Transforming kernel-based learners to incorporate domain knowledge from climate science”, *Department of Statistics, University of Oxford*.
- (May 2024) Kai Jeggle: “Towards an improved understanding of cirrus clouds - Machine learning enabled insights from satellite data”, *Institute for Atmospheric and Climate Science, ETH Zürich*.
- (Oct 2022) Blanka Balogh (CNRM, Toulouse): “Towards Using Artificial Intelligence in Numerical Climate Models”, *Ocean/Atmosphere/Climate Program, CNRM, University of Toulouse*.

Direct Research Supervision (Bachelor & Master students)**Jul 2020 – Present**

- (Dec 2023 – Present) Alyssia Leclercq (Bachelor student at UNIL)
- (Nov 2022 – Present) Fabien Augsburg (Master’s student at UNIL)
- (Apr 2024 – Aug 2024) Mauricio Lima (Master’s student at Sorbonne University & ECCE intern)
- (Mar 2024 – Aug 2024) Louise Largeau (Master’s student at EPFL & ECCE intern)
- (Apr 2024 – Aug 2024) Antoine Leclerc (Master’s student at École Polytechnique & ECCE intern)
- (Sep 2023 – Apr 2024) Louis Poulain-Auzeau (Master’s student at EPFL)
- (Jun 2023 – Aug 2023) Aser Atawya (Bachelor fellow at UNIL)
- (May 2023 – Aug 2023) Marine Berthier (Master’s student at ENSTA & ECCE intern)
- (Apr 2023 – Aug 2023) Jo Lécuyer (Master’s student at École Polytechnique & UNIL intern)
- (May 2022 – Aug 2022) Léo Micollet (Master’s student at ENSTA & UNIL intern)
- (Mar 2022 – Jul 2022) Deborah Bassotto (Post-Master’s intern at UNIL)
- (Sep 2021 – Jun 2022) Meryam Cherqaoui (Bachelor student at UNIL)
- (Jul 2020 – Dec 2020) Ankitesh Gupta (Master’s student at UC Irvine)

Europe & USA

Service

Reviewer for Journals and Workshops (42 submissions, 66 rounds)**Nov 2016 – Present**

AGU Books, EDS, GMD, GRL, JAMES, JAS, JCLI, JGR, JHM, JMLR, MWR, Nat. Mach. Intell., NeurIPS, PLOS ONE, PNAS, PRL, QJRMS, RSE

Reviewer for Proposals (11 submissions)**Sep 2020 – Present**

American NSF, Belgian Science Policy Office, CLIMACT, Climate Change AI, German Aerospace Centre

EOCE: Expertise Center for Climate Extremes**Oct 2022 – Present**

Scientific Committee Member and Co-Founding Member

*Lausanne, Switzerland***Atmospheric Science Day in Lausanne (3 occurrences: Fall 22+23+24)****May 2022 – Present**

Founder and co-organizer of the annual one-day workshop bringing together EPFL & UNIL groups

*Lausanne, Switzerland***Artificial Intelligence Advisory Panel for UNIL****Mar 2024 – Present**

Committee Member

Lausanne, Switzerland

Swiss Geocomputing Centre <i>Scientific Committee Member</i>	Mar 2022 – Present Lausanne, Switzerland
UNIL FGSE's Faculty Council <i>Committee Member</i>	Sep 2023 – Present Lausanne, Switzerland
UNIL FGSE's Research Council <i>Committee Member</i>	Apr 2023 – Aug 2024 Lausanne, Switzerland
Professor Hiring committee at IGD, UNIL <i>Committee Member for the "Human Geography and/or Sustainable Urban/Regional Planning" position</i>	Sep 2023 – Apr 2024 Lausanne, Switzerland
UNIL Climate Physics Journal Club <i>Co-founder and faculty support for student-driven seminar series</i>	Dec 2021 – Jun 2023 Lausanne, Switzerland
PAT Hiring committees at UNIL <i>Committee Member for the position of "Computational Geoscientist" (IDYST/ISTE)</i>	Jul 2022 – Mar 2023 Lausanne, Switzerland
20th Edition of the Swiss Geoscience Meeting <i>Co-chair of the session: Spatial Data Science</i>	Feb 2022 – Sep 2022 Lausanne, Switzerland
AMS 21st Conference on AI for Environmental Science <i>Co-chair of the session: Applications of AI for Improved Estimation and Prediction of Weather and Climate</i>	Apr 2021 – Jan 2022 Houston, USA
CLIVAR Webinar: Emerging Data Science Tools for Climate Variability & Predictability <i>Invited Working Group Member: Co-organizer and moderator of the webinar</i>	May 2020 – July 2021 USA
NeurIPS 2020 Workshop: AI for Earth Sciences <i>Co-organizer: Meta-reviewer and organizer of the atmospheric science session</i>	Jun 2020 – Dec 2020 Vancouver, Canada
Editor-in-Chief Search Committee for JAMES (AGU) <i>Committee Member</i>	Apr 2020 – Sep 2020 USA
MIT Office of Sustainability <i>Graduate research assistant in the Climate Resiliency Committee</i>	Feb 2018 – Dec 2018 Cambridge, USA
Student and Post-doc Atmospheric Dynamics Lunch <i>Head of the organizing committee and founding member</i>	Sep 2016 – May 2018 Cambridge, USA
EAPS Graduate Student Advisory Council <i>Secretary</i>	Sep 2016 – May 2018 Cambridge, USA
Program in Atmospheres, Oceans and Climate Colloquium Series <i>Head of the organizing committee and founding member</i>	Sep 2016 – Dec 2017 Cambridge, USA
Program in Atmospheres, Oceans, and Climate 2015 and 2016 Retreats <i>Co-organized 2015/2016 PAOC retreats for the professors, post-docs and students of the program</i>	Jan 2015 – Oct 2016 Hancock and Brewster, USA
EAPS Social Hour <i>Organized the daily informal social gathering of the EAPS staff</i>	Dec 2015 – Apr 2016 Cambridge, USA
Graduate Climate Conference 2015 <i>Member of the organizational committee of the 2015 Graduate Climate Conference</i>	Jan 2015 – Nov 2015 Woods Hole, USA
EAPS Student Retreat 2015 <i>Co-organized the 2015 EAPS retreat for the students of the department</i>	Jul 2015 – Sep 2015 Lakeville, USA

Non-Academic Professional Experience

Cronite Castings Limited <i>Maintenance engineer</i> Engineering and operator internship in the Crewkerne foundry.	Jul 2013 – Aug 2013 Crewkerne, UK
French Air Force <i>Lieutenant</i> Leadership training as part of the engineering school's curriculum.	Sep 2011 – Apr 2012 Cazaux, France

Computer Skills

OS: Linux, Unix, Windows **Programming:** Python, Matlab, Fortran 77/90, VBA, Java **GIS:** QGIS, ArcGIS Pro

Language Skills

Native: French, **Fluent:** English, **Intermediate:** German, **Beginner:** Japanese (N5), Spanish.

Interests

Weather Forecasting, Weightlifting, Swimming, Jogging, Hiking, Video Games, Rescued two feral kittens (photo).