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I am a physical scientist and research engineer specialized on all things scientific computing, with industry experience in scientific machine learning / AI, data engineering, and engineering leadership in a research setting.

I develop data-driven systems that help humans understand and navigate the physical world.

Education

Dec 2018 – **PhD in Physical Oceanography @ University of Copenhagen**

Apr 2022 Conducted at the Niels Bohr Institute (Prof. Markus Jochum). I inferred the relative importance of hypothesized causes of extreme ocean waves (“rogue waves”) in the real world. To this end, I analyzed over 1 Terabyte of observational data with data mining and probabilistic machine learning to extract robust, causal insights.

Sep 2021 – **Research visit @ University of Valencia**

Dec 2021 During my 3-month research visit to the Image Processing Lab (Prof. Gustau Camps-Valls) I investigated how machine learning can help humans to understand climate models.

Sep 2015 – **External Master’s thesis in Physical Oceanography @ University of Copenhagen**

Dec 2016 Working with state-of-the-art climate models, I learned how to process and analyze large quantities of data, and became familiar with geoscientific modeling and high-performance computing.

Sep 2011 – **BSc and MSc in Physics @ Heidelberg University**

Dec 2016 GPA of 1.3 and 1.2, respectively (“very good”). Exchange year at KTH Stockholm in 2014. Specialization on computational physics.

Academic Grants and Projects

Jan 2025 – **Co-PI, MADGOD @ University of Copenhagen**

Jun 2028 (3M DKK by Danish Council for Independent Research - Natural Sciences)

I am co-PI on the MADGOD project (supervising 1 PhD student), which aims to develop a new generation of machine learning algorithms for the prediction and understanding of dynamical processes in the Earth system.

Professional Experience

Apr 2022 – present **Staff Research Engineer — R&D lead @ Pasteur Labs**

I have been with Pasteur Labs since early on, and have had a hand in building the team, culture, vision, and technology stack from the ground up.

My team and I build efficient, scalable software for scientific advances in all areas of simulation intelligence (SI). This includes differentiable programming, fluid dynamics simulation, physics-infused machine learning, probabilistic methods, and causal machine learning.

As R&D lead, I guide the team in technical decision making, execution, and research-to-product transitions.

Sep 2017 – Dec 2018 **Software development specialist @ DHI GRAS**

At DHI GRAS, I built robust data pipelines at the Terabyte scale, powerful statistical / data science applications, and optimized remote sensing workflows.

Jun 2014 – Dec 2016 **Research assistant @ Institute of Environmental Physics**

Developing a numerical software suite for the simulation of soil water flow (discontinuous Galerkin PDE solver), in C++ and Python.

Software Projects

Veros — A high-performance ocean model in pure Python

I am the main developer and maintainer of Veros, a full-fledged ocean model capable of accurate, realistic simulations of the global ocean. Veros leverages the JAX library for state-of-the-art performance on CPU and GPU clusters. <https://github.com/team-ocean/veros>

mpi4jax — Zero-copy MPI communication of JAX arrays

mpi4jax enables zero-copy, multi-host communication of JAX arrays, even from compiled code and from GPU memory. <https://github.com/mpi4jax/mpi4jax>

(see all on **GitHub**)

Teaching

Courses 3 TA assignments in Physics MSc courses at the Niels Bohr Institute. Nominated for biannual TA prize in 2021.

Theses Formal co-advisor to 1 PhD student, 1 MSc student, 1 BSc student at Niels Bohr Institute. Closely involved in 5 MSc projects from other departments / universities.

Invited Talks

» (2022) “JAX of all trades — GPU-accelerated ocean modelling in Python”. Keynote presentation @ DRAKKAR ocean modelling workshop (virtual).

» (2022) “Painless science posters”. Presentation @ EGU webinar “Be ready to be a great conference presenter” (virtual).

Awards & Honors

- » (2022) Diploma of Excellence (top 10 PhD thesis of 2022) by Faculty of SCIENCE, University of Copenhagen.
- » (2021) Virtual Outstanding Student and PhD candidate Presentation (vOSPP) by European Geophysical Union.

Peer-reviewed Publications

- [1] **Häfner, D.**, Gemmrich, J., Jochum, M., “Machine-guided discovery of a real-world rogue wave model”. In: *Proceedings of the National Academy of Sciences* 120.48 (Nov. 2023). ISSN: 1091-6490. DOI: 10.1073/pnas.2306275120. URL: <http://dx.doi.org/10.1073/pnas.2306275120>.
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- [3] **Häfner, D.**, Vicentini, F., “mpi4jax: Zero-copy MPI communication of JAX arrays”. In: *Journal of Open Source Software* 6.65 (Sept. 2021), p. 3419. ISSN: 2475-9066. DOI: 10.21105/joss.03419. URL: <http://dx.doi.org/10.21105/joss.03419>.
- [4] **Häfner, D.**, Gemmrich, J., Jochum, M., “FOWD: A Free Ocean Wave Dataset for Data Mining and Machine Learning”. In: *Journal of Atmospheric and Oceanic Technology* (May 2021). ISSN: 1520-0426. DOI: 10.1175/jtech-d-20-0185.1. URL: <http://dx.doi.org/10.1175/JTECH-D-20-0185.1>.
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- [7] **Häfner, D.**, Jacobsen, R. L., Eden, C., Kristensen, M. R. B., Jochum, M., Nuterman, R., Vinter, B., “Veros v0.1 – a fast and versatile ocean simulator in pure Python”. In: *Geoscientific Model Development* 11.8 (Aug. 2018), pp. 3299–3312. ISSN: 1991-9603. DOI: 10.5194/gmd-11-3299-2018. URL: <http://dx.doi.org/10.5194/gmd-11-3299-2018>.

(see also [Google Scholar](#))

References

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