

Project: **1176**

Project title: **AIM**

Principal investigator: **Tobias Weigel**

Report period: **2025-07-01 to 2026-06-30**

Project 1176 (AIM) uses DKRZ resources to facilitate advanced ML applications in Earth and Environmental Sciences for scientific cases from users across the Helmholtz association. These are mostly formulated and managed as support project vouchers in the framework of Helmholtz AI. Out of all the voucher projects active in the report period, the following ones used substantial granted storage and/or compute resources on Levante.

Center	Activity	Start/End
Hereon	<b>ICON-AMIP: microphysics ML parameterization scheme</b> The microphysics scheme was optimized and now successfully runs in a realistic AMIP setting stable over 7 days, including in a 4K warmer climate. The resulting precipitation distribution exhibits a pattern indicating improvement of the simulation towards more physically plausible conditions compared to the standard two-moment scheme. We investigated robustness in several tests with different constraints and timesteps.	25/02 – ongoing
Hereon	<b>Accelerating Wave Model Predictions through AI-Based Emulation in SCHISM</b> In this voucher, an ML emulator for computationally expensive wind wave modelling is implemented, to be integrated with SCHISM. Several ML architectures incl. LSTMs and GNNs have been tested, with experiments still continuing as there is not yet a sufficiently capable architecture that meets all requirements (speed, accuracy, ease of integration with SCHISM).	25/10 – ongoing

#### Expired resources:

A substantial fraction of GPU compute resources requested for diffusion modelling expired as the related subproject (downscaling and bias correcting future ocean BGC, Tatiana Ilyina/Hongmei Li) decided on short notice to shift their compute needs to Juelich.

#### Tape archive usage:

Key data from older projects was archived and our /work space was cleaned up accordingly.

#### Publications:

The following publications originate from projects that made significant use of Levante resources. Some of these stem from efforts in previous allocation periods and due to length of publication cycles, got published only now:

- Karimpouli, Kwiatek, Martínez-Garzón, Caus, Wang, Dresen, Bohnhoff (2025). Forecasting induced seismicity in enhanced geothermal systems using machine learning: challenges and opportunities. Geophysics Journal International. <https://doi.org/10.1093/gji/ggaf155>
- Khan, T., Krebs, J., Gupta, S.K., Renkel, J., Arnold, C., Nölke, N. (2025). Validation

Challenges in Large-Scale Tree Crown Segmentations from Remote Sensing Imagery Using Deep Learning: A Case Study in Germany. In: Balke, WT., *et al.* New Trends in Theory and Practice of Digital Libraries. TPDL 2025. Communications in Computer and Information Science, vol 2694. Springer, Cham. [https://doi.org/10.1007/978-3-032-06136-2\\_30](https://doi.org/10.1007/978-3-032-06136-2_30) (Conference Paper, EcoDL workshop, Tampere, 2025)

- Meister, M., Keil, P. & Thomisch, K. Differences in acoustic presence and vocal behavior of Spitsbergen's bowhead whales under ice-covered and open-water conditions. *Sci Rep* **15**, 37752 (2025). <https://doi.org/10.1038/s41598-025-25360-2>