Project: **1176**

Project title: **AIM**

Principal investigator: **Tobias Weigel**

Report period: **2024-05-01 to 2025-04-30**

Text: Maximum of two pages incuding figures. Reports for joint projects may be longer.

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
AWI	**Superresolution of aerial imagery from permafrost regions:** Training of diffusion models used substantial amount of GPU resources.	24/05 – ongoing
AWI	**Detection of bowhead whale vocalizations** Development of a pre-processing pipeline for spectrograms and training of a CNN/ResNet-based model consumed CPU and GPU resources.	23/09 – 24/08
Hereon	**ICON-AMIP: microphysics ML parameterization scheme** Initial development in preparation for the upcoming larger AMIP runs in the next allocation phase consumed a substantial fraction of CPU node hours.	25/02 – ongoing

Expired resources:

A substantial fraction of requested CPU compute resources expired as projects needed much less pre-processing capacities which are typically done on CPUs. In addition, several projects decided to host their main development and training efforts at Juwels.

Tape archive usage:

Storage consumption (/work) has been largely as planned and stable, with a main share of older projects being candidates for removal and/or archival now.

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, become available only now:

- Karimpouli, S., Caus, D., Grover, H., Martínez-Garzón, P., Bohnhoff, M., Beroza, G.C., Dresen, G., Goebel, T., Weigel, T. and Kwiatek, G., 2023. Explainable machine learning for labquake prediction using catalog-driven features. *Earth and Planetary Science Letters*, *622*, p.118383.

- Nalepa, ..., Albrecht, Arnold, ... et al.: Estimating Soil Parameters From Hyperspectral Images: A benchmark dataset and the outcome of the HYPERVIEW challenge. IEEE Geoscience and Remote Sensing Magazine (2024). https://doi.org/10.1109/MGRS.2024.3394040
- Bukas, Albrecht et al.: Robust deep learning based shrimp counting in an industrial farm setting. Journal of Cleaner Production (2024). https://doi.org/10.1016/j.jclepro.2024.143024
- Alrabayah, Caus, Watson, Schulten, Weigel, Rüpke, Al-Halbouni: Deep-Learning-Based Automatic Sinkhole Recognition: Application to the Eastern Dead Sea. Remote Sensing (2024), Special Issue on Artificial Intelligence for Natural Hazards. https://doi.org/10.3390/rs16132264
- Arnold, Sharma, Weigel, Greenberg: Efficient and stable coupling of the SuperdropNet deep-learning-based cloud microphysics (v0.1.0) with the ICON climate and weather model (v2.6.5). Geoscientific Model Development (2024). https://doi.org/10.5194/gmd-17-4017-2024