Project: **1349**

Project title: **EUREC4A-MIP**

Principal investigator: **Hauke Schulz**

Report period: **2025-11-01 to 2026-10-31**

Maximum of 2 pages including figures. 9 pt minimum font size.

Project summary

EUREC4A-MIP is the model intercomparison project accompanying the EUREC4A field campaign. It evaluates how well storm-resolving models (SRMs) and large-eddy models (LEMs) represent the mesoscale organisation of trade-wind shallow cumulus observed in January and February 2020, and how these clouds and their radiative effects respond to a +4 K pseudo-global-warming (PGW) perturbation. Project 1349 provides the DKRZ Swift object storage through which the common initial and boundary conditions are distributed to the modelling groups, and through which the output of all groups is collected and published as analysis-ready, cloud-optimised Zarr datasets. The data can be accessed without login by the international MIP team as well as by the interested public.

Progress in the reporting period

The project took longer than anticipated to gain traction, but all collaborators have remained invested after the end of the EU Horizon 2020 project CONSTRAIN, and this reporting period marks the transition from the setup phase to the analysis phase. The participating groups delivered their present-day simulations, which were converted to Zarr, uploaded to Swift, checked against the MIP data protocol and registered in the EUREC4A intake catalogue (https://github.com/eurec4a/eurec4a-intake/tree/master/Simulations/EUREC4A-MIP, released on 6 August 2026). Each catalogue entry documents the remaining deviations from the data protocol, so that the models can be compared consistently. The catalogue now provides uniform access to the following datasets:

- Present-day SRMs: HARMONIE-AROME at 2.5 km (reference, scale-aware convection scheme, and cloud droplet number concentration of 70 cm^{-3}), Met Office Unified Model at 2.2 km (control, and cloud droplet number concentrations of 150 and 70 cm^{-3}), AROME and WRF.
- Present-day LEMs with open boundaries: DALES at coarse and fine resolution, and ICON-LES with nested domains at 624, 312 and 156 m (control and high CCN), the latter linked from the existing ICON entries of the catalogue.
- Present-day periodic LEM: MicroHH at 200 m on a 1024 × 1024 grid.
- PGW +4 K: HARMONIE-AROME reference simulation.
- Setup: ERA5- and COSMO-based initial and boundary conditions for the present-day and PGW experiments, and the PGW warming deltas.

In total, 13 present-day simulations from seven models and the first PGW simulation are now openly available. The Swift account of project 1349 currently holds more than 16 TB of simulation output in more than 6.5 million objects, plus 5.5 TB of boundary conditions. The catalogue is tested weekly by continuous integration and was adapted this year to zarr-python 3, so that the datasets remain readable with current software.

Scientific outcomes and dissemination

These datasets form the basis of the first EUREC4A-MIP paper, which is in preparation. First results were presented at the EGU General Assembly 2026 and at the following meetings:

- Janssens et al. (2026) Is the hectometer needed for tropical climate? A perspective from intercomparing km-scale and hm-scale models of organised shallow convection. Poster,

Km-scale Modelling Summit 2026, Hamburg, Germany, 20–24 July 2026. https://owncloud.gwdg.de/index.php/s/7TdLYndffCG5GPZ

- Siebesma et al. (2026) Representation of marine cloud mesoscale organisation by models operating in the grey zone. Talk, 5th Workshop on Convective Organisation, São José dos Campos, Brazil, 9–12 March 2026. https://www.gov.br/inpe/en/events/wco5/program

Use of resources and outlook

The essential DKRZ resource of this project is the Swift object storage. It allows the international team and the interested public to stream the simulations directly into their analyses without downloading them, which is why the project relies on a continued allocation. As DKRZ has announced that the new S3 object storage, in production since July 2026, will replace Swift, we now request S3 storage to migrate our datasets. In the coming period, the remaining PGW simulations of the SRMs and LEMs are expected to be uploaded and catalogued, so that the cloud-radiative response to warming can be compared across models, and the first EUREC4A-MIP paper is planned to be submitted. Documentation and access examples are maintained at https://howto.eurec4a.eu/eurec4a_mip.html.