Project: **1155**

Project title: **COPAT2 – Coordinated parameter testing of the COSMO6.0 version and ICON-CLM**

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Report period: **2024-11-01 to 2025-10-31**

COPAT2 – COSMO6.0

In 2023/2024 we were figuring out the best set up for the COSMO-CLM version 6.0 for Europe with the resources from bg1155. A paper draft (Determining an optimal configuration for the regional climate model COSMO-CLM 6.0 using a novel model evaluation metric) was submitted in the beginning of 2025 and the work on the reviews is ongoing. Therefore, the storage capacity from that effort is still in use. A link to the submitted document in overleaf can be provided via the Beratung.

COPAT2 – ICON

ICON-CLM 12 km

The optimized setup for the ICON release 2024.07 was defined in July 2024 and it was agreed on to be the recommended version for simulations over Europe on R13B05 grid at the Assembly of the CLM-community in October 2024. The optimized setup for the release 2024.07 is already in use for the CMIP6 downscaling by the CLM-community. A paper draft (Optimisation of ICON-CLM for the EURO-CORDEX domain: developments, sensitivities, tuning) was submitted in 09/2025. Until the final publication, the data produced in the tuning process are in use. A link to the submitted document in overleaf can be provided via the Beratung.

Figure 1 shows the strategy for a standard procedure of testing, tuning and evaluating new ICON releases for the regional climate application. The development of the LiMMo-Meta-Model (Petrov et al., 2025) during the COPAT2-ICON process allows for strong reduction of necessary test simulations.

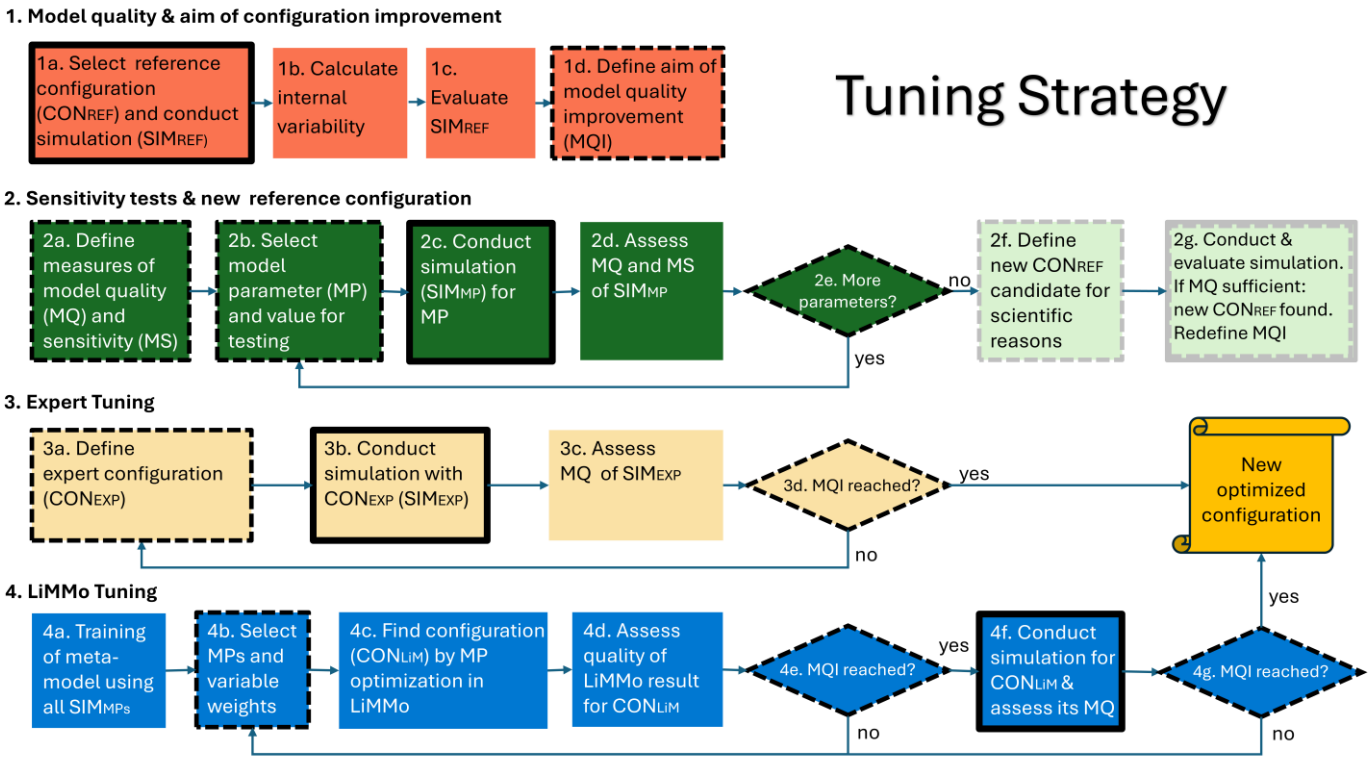

Figure 1: RCM tuning strategy framework. The four rows correspond to four stages. Rectangles correspond to activities, diamond-shaped polygons correspond to decisions. A thick solid frame (1a, 2c, 3b, and 4f) marks computationally intensive activities; a dashed frame (1d, 2a, 2b, 2e, 2f, 2g, 3a, 3d, 4b, 4e, and 4g) marks activities that require expert judgement. Light yellow and green colors indicate optional steps.

ICON-CLM 3 km

The reference configuration at convection resolving scale for Central Europe (Germany, Austria, Switzerland plus catchments of rivers that flow into the sea along the German coast) in 3 km resolution was agreed on at the CLM-Assembly 2025. It was found by applying the tuning strategy developed for the 12 km case beforehand (*Figure 1*). As the downscaling of CMIP6 to 3 km for Germany was a task within the UDAG project (Updating the Data Basis for Adaptation to Climate Change in Germany, (Früh, 2023), bg1364), this setup is already used in production runs. For the ICON release 2024.07 the setup was fixed to the usage of the one moment scheme of micro-physics (Doms, 2011) due to limited resources for production runs, which wouldn't allow for the two moment overhead. We optimized 60 parameter values of initial and boundary conditions, surface fluxes, turbulence, mixing, numerical diffusion, convection and microphysics including logical and/or integer parameters. The documentation is ongoing and the according manuscript in preparation. The slides of the talk at the CLM assembly can be mase available on request via the Beratung.

References:

Doms, G. and F. J. and H. E. and H. H. and M. D. and R. M. and R. T. and R. B. and S. R. and S. J. and others. (2011). *A description of the nonhydrostatic regional COSMO model. Part II: Physical Parameterization*. http://www.cosmo-model.org

Früh, B. (2023). *Aktualisierung der Datengrundlage für die Anpassung an den Klimawandel in Deutschland* . https://www.dwd.de/DE/forschung/projekte/udag/udag_node.htm

Petrov, S., Will, A., & Geyer, B. (2025). Linear Meta-Model optimization for regional climate models (LiMMo version 1.0). *Geoscientific Model Development*, *18*(18), 6177–6194. https://doi.org/10.5194/gmd-18-6177-2025