Progress Report

Project: **1418**

Project title: Coming Decade - Decadal climate predictions for Europe

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

1 Global coupled Earth system model (UHH)

For the first phase of Coming Decade, we planned to use ICON-XPP at R2B5/R2B6 resolution (atmosphere / ocean) for the initialisation and simulation of a first decadal global hindcast set. In 2024 we have performed spin-up and assimilation runs with this configuration of ICON-XPP in mind, picking up almost half of the allocated total resources in the 2nd half of 2024. Due to the ongoing development on ICON-XPP in 2024, we adjusted our plan to work with the now state-of-the-art ICON-XPP R2B5/R2B7 ("target configuration"), which became available in November 2024. However, this adaptation came with a delay in time, and the ICON-XPP target configuration asks for double the resources we initially planned for with ICON-XPP R2B5/R2B6. In 2025, we therefore prepared and run spin-up, coupled assimilation tests (see Fig.1), and hindcasts tests with ICON-XPP R2B5/R2B7, the latter for allowing to test the downscaling and regionalisation (see 3). For this complex, we picked up close to the remaining half of the total allocated resources in the 1st half of 2025.

2 CODES (DKRZ)

The main focus of the first year of CODES was to implement and run the first version of the ForecastBackend plugin. The ForecastBackend plugin is based on other ones like terciles, LeadtimeSelect, ProblEMS, Recalibration and CVPrepare. We have successfully conducted first runs with the ForecastBackend plugin and tested some old set-ups from the Miklip project. Fig.2 presents the general plugin development activities done by different categories in the CODES project. All the plugins are hosted through CODES and are available to the whole Coming Decade community. Till March 2025 a total number of 1911 plugin runs were initiated, out of which 950 were finished successfully. This shows that we are still in the development phase. PROBLEMS is also used by other plugins like ForecastBackend and Recalibration. Therefore, it was the most used plugin till now. The refactoring involved substantial improvements across code structure, debugging, feature enhancements, continuous integration setups, and other development areas.

3 Downscaling and regionalisation (KIT)

In 2024, we performed initial tests with the coupled ICON-XPP including grid refinement over the North Atlantic. We used the output of the global hindcast tests with ICON-XPP in R2B5/R2B7 resolution (see 1) to further test the downscaling workflow, and developing a strategy to handle the expected data throughput of several PB when downscaling a full set of global decadal hindcasts.

4 Figures



-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1

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Figure 1: Analysis of a coupled assimilation with ICON-XPP R2B5/R2B7 from 1960-1994, correlation of detrended yearly mean near-surface air temperature (a) and mean sea level pressure (b) between coupled assimilation and ERA5 re-analysis. This assimilation test (35 years) performs well so that a full global coupled assimilation 1960-2024 can be run, from which global hindcasts can be initialized.



Figure 2: (a) Summary of GitLab commits presenting the implementation done in CODES, (b) successful runs per plugin.