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Simulation and predictability of Present-day climate

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This project aims at improving our understanding of present-day climate variability and predictability, and enhancing simulations with climate models. This will reduce uncertainty in projections of the future climate.

The climate during the 20th and early 21st century shows a gradual increase in global mean surface temperature, with fluctuations on different timescales superimposing the warming trend. This indicates that understanding and simulating both the climate response to external forcing, e.g., anthropogenic greenhouse gas emission, and natural variability, e.g. El Niño/Southern Oscillation (ENSO), are key to detecting and projecting anthropogenic climate change.

Climate models are indispensable tools to simulate and predict natural climate variability and to project future climate change in response to external forcing. Efforts have been undertaken during the last decades to improve of climate model performance, and large progress has been made in this respect. However, significant model biases remain. We will use a variety of model resolutions, in the atmosphere and ocean, to reduce the biases. Computational efficiency plays a role in this context. This includes the use of different atmosphere models, allowing to efficiently enhancing resolution, and grid refinement in the ocean.

In our previous research activities, we have benefited greatly from the computing resources at HLRN. Below, we provide the research highlights for 2021 and describe our research strategy for 2022.

The progress report for 2021 provides results related to (1) Atmospheric response to Southern Ocean Polynya with OpenIFS, (2) Evaluation of simulations with OpenIFS 43r3, (3) HI-CAM simulations with ECHAM6, (4) FOCI development within the ESM-Tools environment, and (5) Southern Ocean nested simulations with the FOCI-OpenIFS.

The proposal for 2022 includes ongoing research and new studies: (1) Atmospheric response to Southern Ocean Polynya, (2) Evaluation of simulations with OpenIFS 43r3, (3) HI-CAM follow-up simulations with ECHAM6, (4) SOLCHECK simulations, (5) North Pacific nested simulations with the FOCI-NPAC10, and (6) Southern Ocean nested simulations with the FOCI-WG10.