

# **Continuation application: 1/2021-4/2021**

## **Simulation and predictability of Present-day climate**

**Project No.: shk00018**

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The aim of this project is to improve our understanding of present-day climate variability and predictability and to enhance simulation with climate models. This will reduce uncertainty in projections of the future climate.

The climate during the 20<sup>th</sup> and early 21<sup>st</sup> 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 emissions, and of natural variability, e.g. El Niño/Southern Oscillation (ENSO), are keys to detect and project 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. Extensive efforts have

been undertaken to improve the performance of climate models during the last decades, and large progress has been made in this respect. However, significant biases remain. We use different hierarchies of model resolutions in the atmosphere and ocean to reduce biases. Computational efficiency will be also considered in this context. This includes use of different atmosphere models favorable to higher resolution and grid refinement in the ocean.

We have benefited greatly from the computing resources at HLRN in our previous research activities. Below, we provide the research highlights for 2020 and describe our research strategy for 2021.

The progress report for 2020 provides results related to (1) Atmosphere response to Southern Ocean Polynya, (2) Atmospheric sensitivity to model resolutions in the OpenIFS, (3) FOCI development, and (4) FOCI-OpenIFS simulations.

The proposal for 2021 includes ongoing research and new studies: (1) Atmosphere response simulations to Southern Ocean Polynya with OpenIFS, (2) Evaluation and production 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.

To perform the outlined research, we request 875k NPL in 2021 as specified in detail in the full proposal.