Continuation application: 1/2019-4/2019

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 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 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 hierarchy of model resolutions in the atmosphere and ocean to reduce biases. Computational efficiently 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 been benefited greatly from the computing resources at HLRN in our previous research activities. Below, we provide the research highlights for 2018 and describe our research strategy for 2019.

The progress report for 2018 provides results related to (1) Improving climate models: the equatorial Pacific cold sea surface temperature bias, (2) Control integrations with the FOCI, (3) Ensemble global warming simulations with idealized Antarctic meltwater input, (4) Sensitivity of the atmospheric circulation to model horizontal resolution in the OpenIFS atmosphere model, and (5) Coupling a new atmosphere model to the FOCI.

The proposal for 2019 includes ongoing research and new studies: (1) Atmosphere response to Southern Ocean Polynya, (2) Atmospheric circulation sensitivity to model resolutions in the OpenIFS, (3) FOCI development, and (4) FOCI with OpenIFS development.

To perform the outlined research, we request 740k NPL in 2019 as specified in detail in the full proposal.