

## Scientific Proposal

Multi-model assessment of [REDACTED] (ABC)

### Motivation

The role of the [REDACTED] is increasingly important with the rapid decline of the [REDACTED] (e.g. [REDACTED] 2015). Underneath the very fresh surface layer, large amounts of [REDACTED] are stored, and if available to the [REDACTED] within a few years ([REDACTED] 2015). Signs of structural changes in [REDACTED] have been observed in [REDACTED] ([REDACTED], 2017). It is therefore of utmost interest to estimate the current [REDACTED]. An ongoing project supported by the Research Council of [REDACTED]; [REDACTED] ([REDACTED] Experiment) will estimate the mean [REDACTED] over large areas in the central [REDACTED] ([https://\[REDACTED\]](https://[REDACTED])). In [REDACTED], there is also one work package that focus on [REDACTED] content in global climate models. The work package leader is the PI of this project ABC.

An important question is: What is the impact of model biases on climate prediction and projection? Would for instance an overestimated [REDACTED] result in a faster reduction of [REDACTED]? In order to support [REDACTED] and a more efficient multi-model assessment we propose ABC. In ABC we will investigate how well the new generation of global climate models (CMIP6 models) can simulate [REDACTED] and its variability (see Figure 1). A suite of CMIP6 models will be collected and compared with [REDACTED] ([REDACTED]) data for the period [REDACTED]. [REDACTED] employ a variety of [REDACTED] models and data assimilation schemes to synthesize a diverse network of available observations in order to arrive at a dynamically consistent estimate of the historical state ([REDACTED], 2015; [REDACTED], 2017).

### Project objectives

ABC will use both [REDACTED] data and acoustic derived mean [REDACTED] (from [REDACTED]) to benchmark the skill of global climate models:

- (1) Identify uncertainties of [REDACTED] in CMIP6 models in the period [REDACTED]
- (2) Evaluate decadal trends of [REDACTED] in CMIP6 models (historical+SSP [REDACTED] simulations).

### Work plan

CMIP6 historical simulations will be compared with [REDACTED] and [REDACTED] content from [REDACTED], and additionally with acoustically derived [REDACTED] using data from the central [REDACTED] (see Figure 1). Through the [REDACTED] [REDACTED] data sets are freely available online. The ESMValTool will be used to calculate the CMIP6 [REDACTED]. With this comparison between CMIP6 and [REDACTED] we will detect regions with large biases. We will furthermore assess the span of these model in representing the decadal trends in the [REDACTED] for the two periods [REDACTED] and [REDACTED]. [REDACTED] will provide an [REDACTED] estimate for 2019. Based on the [REDACTED] and the [REDACTED] estimate we can therefore estimate the change in the [REDACTED] for the [REDACTED] decade ([REDACTED]).

### Timeline

The PI proposes to complete the following tasks by the dates given below:

August: Selection of 10-20 CMIP6 historical simulations

September: Diagnose CMIP6 [REDACTED] using ESMValTool

October: Compare [REDACTED] in CMIP6 and [REDACTED] for the period [REDACTED]

November: Calculate decadal trends in CMIP6 [redacted]

December: Summaries CMIP6 main results in a paper to be submitted to [redacted] journal.

### **Required resources**

To perform this analysis the following data are needed: monthly ocean data (Omon) from large number of CMIP6 historical simulations and projections from CMIP6 ScenarioMIP (at first the SSP [redacted] scenarios will be analyzed). If time permits also monthly sea ice data will be analyzed. It will primarily be the PI of ABC that will perform the multi-model assessment of [redacted]. We ask for log-in account for two participants, in case the PI needs support from a colleague at [redacted] in the multi-model analysis. We have asked for 1000 CPU hours and storage space of 5TByte, although the PI expects this to be an upper limit of what the analysis will require. We would like to access the [redacted] provider since we will use the ESMValTool and the provider catalog shows the complete data collection we need.

### **Impacts**

Analysis of CMIP6 models in ABC provide a better understanding of the uncertainties and variability related to the [redacted]. This analysis will in particular provide input to the project [redacted] ([redacted]) and the [redacted] Center of Excellence project. ABC will provide important information to climate projections and predictions communities. Results will be presented at EGU XXX and in a peer-review journal.

### **References**

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Figure 1 (optional).