Application for computing time in 2013

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October 31, 2012

Project:	MiKlip Module A
Module:	Modini (A-34)
Project title:	Model initialisation by partially coupled spin-up
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Allocation period:	1.1.2013 - 31.12.2013

MiKlip–Modini Project overview

Modini will contribute to the decadal prediction system MiKlip through the development and investigation of a simple method to initialise coupled atmosphere–ocean–sea-ice models. We will implement and test the method for the *Max Planck Institute Earth System Model* (MPI-ESM), which is run in a partially coupled mode where the ocean–sea-ice component *Max Planck Institute Ocean Model* (MPIOM) is forced by time series of observed forcings, in particular ncep-, ecmwf-, and core-reanalysis data (*Kalnay et al.*, 1996; *Uppala et al.*, 2005; *Large and Yeager*, 2009). Our work will focus on the use of observed (reanalysed) wind stress and/or wind stress anomalies to drive the ocean component of the coupled model, although the use of other forcing variables (e.g. heat flux), computed from observations, will also be investigated. The application of partial coupling is expected to bring the coupled system sufficiently close to the observed state to provide an effective initial condition for decadal predictions, which are the focus of the whole MiKlip project. Experimental hindcasts and forecasts will be carried out with Max Planck Institute Earth System Model (MPI-ESM) to assess with respect to results of the corresponding CMIP5-historical simulations (*Meehl et al.*, 2009; *Taylor et al.*, 2011) to evaluate the success of the method.

The Modini-project funded by the *Bundesministerium für Bildung und Forschung* (BMBF) through grant 01LP1134A. For its success it is imperative to perform an adequate number of fully and partially coupled MPI-ESM runs on the DKRZ computer.

Estimation of required computer resources

During the set-up and testing phase of our project, we will use the default LR-resolution. After a successful implementation of the proposed method, we will switch to the eddy permitting MR-resolution. As control and reference experiment we will use the CMIP5-*historical* simulations. We will start our partially coupled spin-ups for the LR-resolution (MR-resolution) from 1950 onwards and will start a fore/hindcast every (fifth) year from 1980 onwards, resulting in 30 (7) forecasts. We regard a number of five realizations for each forecast run as the minimum to establish meaningful information about the potential predictability of the system. Defining the number of spin-up years as $n_{\mathrm{sp}} = 30$, the number of forecasts as $N_{\mathrm{f}}^{\mathrm{LR}} = 31$ and $N_{\mathrm{f}}^{\mathrm{MR}} = 7$, the increments of the forecast start years as $\Delta t_{\mathrm{f}}^{\mathrm{LR}} = 1\,\mathrm{yr}$ and $\Delta t_{\mathrm{f}}^{\mathrm{MR}} = 5\,\mathrm{yr}$, and the number of realisations $r = 5$, the total number of model years can be estimated as $n_{\mathrm{sp}} + \sum_{n=0}^{N_{\mathrm{f}}-1} n\Delta t_{\mathrm{f}} + N_{\mathrm{f}} \cdot 10\,\mathrm{yr} \cdot r$, where the summation in the second term indicates the starting year of each 10-year forecast and is 465 yr for the LR-resolution and 105 yr for the MR-resolution. Therefore, the total number of model years for each resolution is:

Resolution	Spin-up n_{sp}	Pre-forecast years $\sum_{n=0}^{N_{\mathrm{f}}-1} n\Delta t_{\mathrm{f}}$	Forecasts N_{f}	Realisations r	Total
LR	1950-1979		1980,1981,1982,...,2010		
	30 years	465	$31 \cdot 10$ years	5	2045 years
MR	1950-1979		1980,1985,1990,...,2010		
	30 years	105	$7 \cdot 10$ years	5	485 years

The MPI-ESM already runs on the DKRZ computer and is well tested. The existing experience there will help us to achieve the milestones of the Modini project. According to our information, the LR-(MR-)resolution needs 5.2 CPUh (24 CPUh) and 40 GB (65 GB) of storage per model year. We will use the standard CMIP5 configuration with 4 (10) nodes and 64 CPUs per node for the LR-(MR-)resolution. Therefore, the estimated computer resources for this project at the DKRZ are:

Resolution	Years	Estimated computational Time (CPUhs)		Storage (GB)		
		per year	total	per year	total	
LR	2045	5.2	10634	40	81800	
MR	485	24.0	11640	65	31525	
			22274		113325	(HPSS)
					150000	(GPFS)

Assuming, that all ensembles of all forecast are considered in intended publications, it is necessary to archive them all with respect to the guidelines for good scientific practice. Hence the estimated 113325 GB storage space refers to the HPSS–tape archive. With respect to the GPFS–disk storage, we anticipate an additional storage space of about 33%, resulting in 150 TB, which can be canceled three month after the MiKlip project ended.

Acronyms

AWI	Alfred Wegener Institute
BMBF	Bundesministerium für Bildung und Forschung
DKRZ	German Climate Computing Center (Deutsche Klimarechenzentrum)
CMIP5	Coupled Model Intercomparison Project Phase 5
MiKlip	Decadal Climate Predictions (Mittelfristige Klimaprognosen)
Modini	Model initialisation by partially coupled spin-up
MPI-ESM	Max Planck Institute Earth System Model
MPIOM	Max Planck Institute Ocean Model
ncep	National Centers for Environmental Prediction
ecmwf	European Centre for Medium-Range Weather Forecasts
core	Common Ocean-ice Reference Experiments
GEOMAR	Helmholtz Centre for Ocean Research, Kiel

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