SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year 3rd……

Project Title: CMIP6 BSC contribution to HighResMIP (HighResMIP_BSC)…….

…….

Computer Project Account: spesiccf…….

Principal Investigator(s): Louis-Philippe Caron…….
…….

Affiliation: Barcelona Supercomputing Center - Earth Science Department……..…

Name of ECMWF scientist(s) collaborating to the project (if applicable) ……..…
…….

Start date of the project: January 1st, 2017…….

Expected end date: December 31st, 2019…….

Computer resources allocated/used for the current year and the previous one

(if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)	49.5M	44M	49.5M	60M
Data storage capacity	(Gbytes)	30K/user	55K	30K/user	55K

Summary of project objectives (10 lines max)

The simulations performed within the context of HighResMIP_BSC will represent BSC's contribution to the HighResMIP coordinated exercise, which is part of the Sixth Phase of the Coupled Model Intercomparison Project (CMIP6). This exercise offers a framework for increasing synergies and building a large multi-model ensemble of high resolution simulations with a standard resolution counterpart following a common experimental protocol, i.e. a common integration period, forcing and boundary conditions (50 year long spin-up simulation, followed by a 100-year control simulations as well as a 100-year historical+future climate simulation (1950-2050)). The primary goal is to determine which processes can be represented reliably at typical CMIP5 resolutions and what is the minimum resolution required for an adequate representation of other processes as well as what are the limitations of representing such processes in lower resolution models.

Summary of problems encountered (10 lines max)

We are not able to stick to the original timeline since there was major delays in the release of the future CMIP6 forcings (which are produced by a group external to this project). This delay impacted the climate community at large. The forcings became available in the fall and at which point we could complete the future part of the transient simulation.

Summary of plans for the continuation of the project (10 lines max)

Our simulations are completed and we will not run additional simulations on this account in 2019.

List of publications/reports from the project with complete references

1. Once the simulations are completed and made available, they will receive a persistent data identifiers (DOIs), which has already been reserved. The publication is currently underway.

2. Exarchou, E. and S. Drijfhout. The relationship between surface climate, and the ocean heat uptake arising from natural variability , and the impact of the resolution. In preparation for Climate Dynamics.

3. Levine, X. Extreme weather events in the Northern Hemisphere in EC-EARTH and their association with interannual variations in the seasonal-mean Arctic climate and sea ice cover. CL4.12: Climate Variability and Predictions in High Latitudes, EGU General Assembly, 8 April 2019, Vienna, Austria.

4. A manuscript detailing the EC-Earth model used to perform the simulations required by the HighResMIP protocol as well as some key results from the simulations is currently in preparation (lead author: Rein Haarsma, from KNMI):

   Rein Haarsma et al., The PRIMAVERA versions EC-Earth:EC-Earth3P and EC-Earth3P-HR. Description and validation. In preparation for Geoscientific Model Development

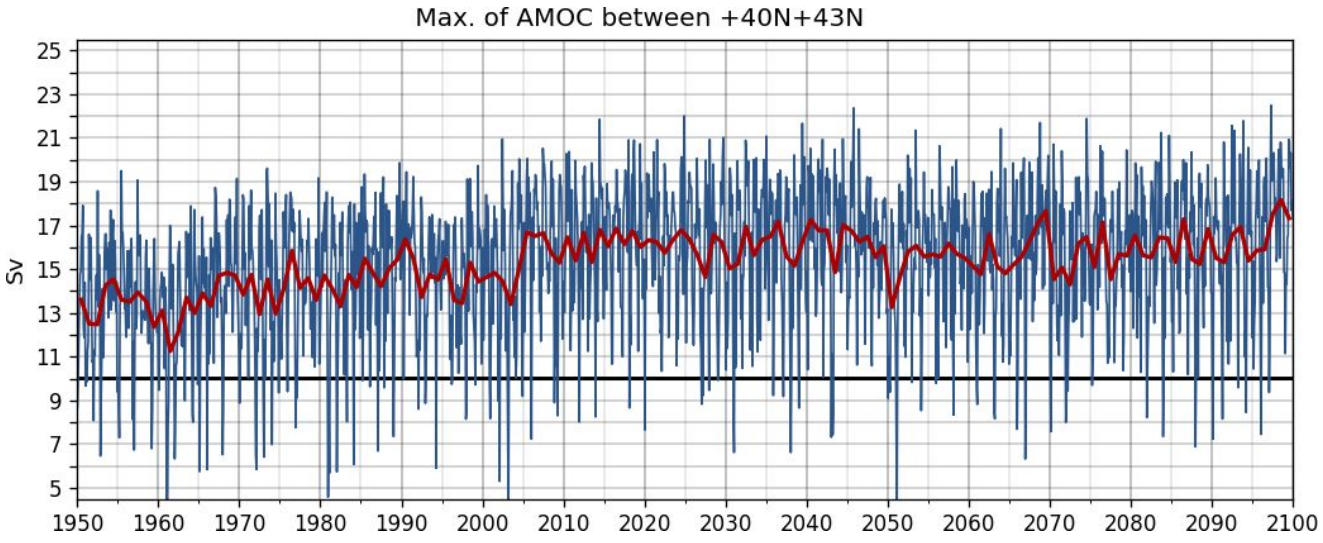
Summary of results

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

We have completed the entire HighResMIP protocol at both standard and high resolutions, including the period 2015-2050 (future scenario) once the future forcings became available. The data have been cmorized and most of it has been uploaded to JASMIN to share with other PRIMAVERA partners and later to the science community at large. The remaining data which are not currently on Jasmin are being uploaded now, upload which should be completed in early July and be made available to the wider scientific community through the ESGF node.

During the last year, we completed the future portion of the transient simulation and extended the transient and control simulations by an additional 50 years, thus covering 1950-2100. We plan to analyse these simulations in detail during the coming year, in particular in regard of the benefits of higher resolution in simulating extreme events.

Figure 1. AMOC for the ORCA025L75 – T511L91 control simulation



Finally, we used additional hours to test a new experimental setup, which is now part of a new special project proposal submitted in parallel to this report. In this new set of experiments, we aim to produce a twin set of experiments wherein the sea surface temperature over the Northern Atlantic is restored towards either Atlantic Multidecadal Variability (AMV) positive and negative anomalies. The AMV is a slow (~20-30 year), naturally occurring oscillation in Atlantic ocean temperature and has been shown to modulate the North American and European climate as well as hurricane variability, amongst others. Comparing the two sets of experiments will help understand the impact of the AMV on European climate and the pathway through which the responses are expressed throughout the ocean and the atmosphere. These simulations, which were also tested at high resolution, are also part of CMIP6 (DCPP-Component C).