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 2019

Project Title: EC-Earth high resolution simulations

Computer Project Account: SPNLHAAR

Principal Investigator(s): Dr. R. J. Haarsma, Dr. Ph. Le Sager, Dr. G. van den Oord

Affiliation: Royal Netherlands Meteorological Institute (KNMI)

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

Start date of the project: January 1th 2017

Expected end date: January 1th 2020

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)	50,000,000	50,000,00 (0%)	50,000,000	55854926.40 (111%)
Data storage capacity	(Gbytes)				

Summary of project objectives (10 lines max)

In this special project we perform simulations with the high resolution versions of EC-Earth. Runs as outlined in the HighResMIP protocol will be performed with the T511/ORCA025 resolution. They will contribute to the HighResMIP simulations done within the European H2020 PRIMAVERA project. In addition we will perform simulations with the T1279/ORCA0125 resolution. At this resolution small scale atmospheric and oceanic phenomena, like tropical cyclones, air-sea interaction over SST fronts, and deepwater formation are expected to be significantly better simulated. This enables a better understanding of the physical mechanisms and will be beneficial for the quality of the climate simulations and seasonal to decadal forecasts. Analysis of the runs will be done in collaboration with the other partners of PRIMAVERA and EC-Earth.

Summary of problems encountered (10 lines max)

The simulations with the T1279/ORCA0125 appeared to be numerically unstable and the simulations crashed. Until now this is not solved yet. T255ORCA1

The standard resolution of the model T255ORCA1 had a very low unrealistic AMOC. Because the focus of HighResMIP is to evaluate the impact of enhanced resolution it was decided to retune the T255ORCA1 so that it has a realistic AMOC and rerun the T1279/ORCA0125 with the new parameters.

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

Because of the problems with the T1279/ORCA0125 it was decided to use the resources mainly for the T511/ORCA025 simulations. The original plan was, due to limited computer resources, to produce only one HighResMIP member. Because with only one member the natural variability cannot be estimated correctly the EC-Earth consortium decided to increase the ensemble size to three. Together with the rerunning, after retuning, of the original member (see “Summary of problems encountered”), this resulted in the use of all the available resources of SPNLHAAR for 2019.

List of publications/reports from the project with complete references

Haarsma, R. J., Roberts, M. J., Vidale, P. L., Senior, C. A., Bellucci, A., Bao, Q., Chang, P., Corti, S., Fučkar, N. S., Guemas, V., von Hardenberg, J., Hazeleger, W., Kodama, C., Koenigk, T., Leung, L. R., Lu, J., Luo, J.-J., Mao, J., Mizielinski, M. S., Mizuta, R., Nobre, P., Satoh, M., Scoccimarro, E., Semmler, T., Small, J., and von Storch, J.-S.: High Resolution Model Intercomparison Project (HighResMIP v1.0) for CMIP6, Geosci. Model Dev., 9, 4185-4208, doi:10.5194/gmd-9-4185-2016, 2016

Haarsma et al. *HighResMIP versions of EC-Earth: EC-Earth3P and EC-Earth3P-HR. Description, model performance, data handling and validation.* In preparation.

Summary of results

All the planned simulations of T511/ORCA025 are finished. KNMI contributed to one extra ensemble member of HighResMIP (Tier 1-3). These simulations are performed with the standard (T255ORCA1) and high resolution (T511ORCA0.25). For details see Haarsma et al. (2016).

A schematic representation of the HighResMIP simulations is given in Figure 1.

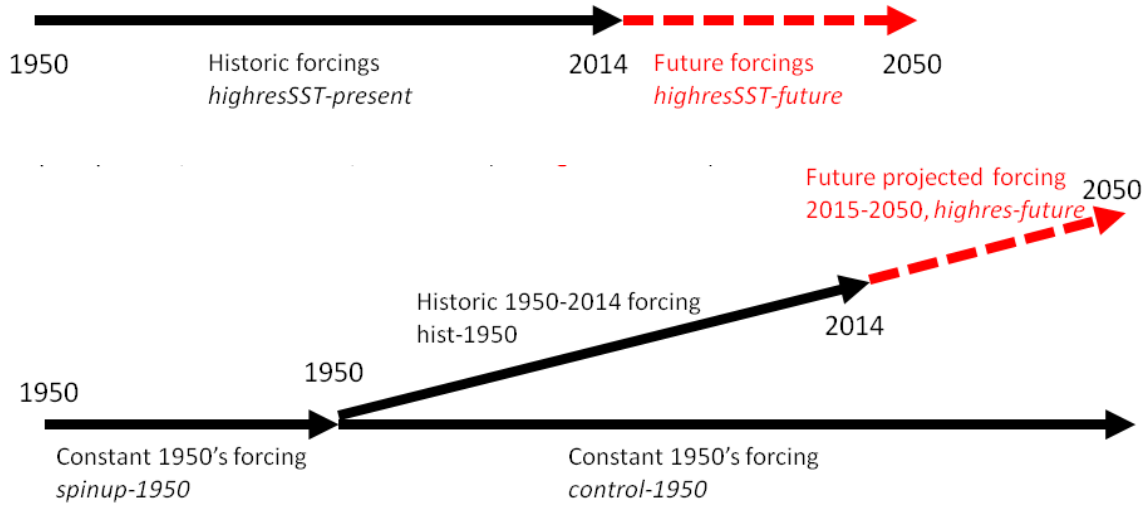

Figure 1. Schematic representation of the HighResMIP simulations.

The results are CMORIZED and are presently being uploaded to the JASMIN server. This will be finished before autumn. Thanks to SPNLHAAR the EC-Earth model has increased the ensemble size of its HighResMIP simulations to three. Within the PRIMAVERA project these simulations are now being analysed. In the following link the PRIMAVERA simulations of highresSST-present are summarized http://cerfacs.fr/giec6/CVDP/CMIP6_PRIMAVERA_HighResMIP-highresSST-present_JASMIN/. For the other HighResMIP this will appear in the autumn of 2019. The runs will also become available on the ESGF nodes. This allows the data to be analysed by other research groups and provide input for the upcoming AR6 IPCC report.

Within the PRIMAVERA project already studies have appeared that have used the EC-Earth HighResMIP simulations. For a list of publications of PRIMAVERA see https://www.primavera-h2020.eu/output/scientific-papers

References

Haarsma, R. J., Roberts, M. J., Vidale, P. L., Senior, C. A., Bellucci, A., Bao, Q., Chang, P., Corti, S., Fučkar, N. S., Guemas, V., von Hardenberg, J., Hazeleger, W., Kodama, C., Koenigk, T., Leung, L. R., Lu, J., Luo, J.-J., Mao, J., Mizielinski, M. S., Mizuta, R., Nobre, P., Satoh, M., Scoccimarro, E., Semmler, T., Small, J., and von Storch, J.-S.: High Resolution Model Intercomparison Project (HighResMIP v1.0) for CMIP6, Geosci. Model Dev., 9, 4185-4208, doi:10.5194/gmd-9-4185-2016, 2016