SPECIAL PROJECT PROGRESS REPORT

Progress Reports should be 2 to 10 pages in length, depending on importance of the project. All the following mandatory information needs to be provided.

Reporting year ……2014……..……

Project Title: Sensitivity of multi-annual forecasts to model resolution ……..……

Computer Project Account: ……SPITCORT……

Principal Investigator(s): ……Susanna…Corti……

Affiliation: Institute of Atmospheric Science and Climate (ISAC) of the Italian National Research Council (CNR)

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

……..……

Start date of the project: ……01-01-2014……..……

Expected end date: ……31-12-2016……

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)	0	0	23 millions	~4 millions
Data storage capacity	(Gbytes)	0	0	50000 Gb	

Summary of project objectives

(10 lines max)

This is a three-year project, which aims to investigate the sensitivity of multi-year forecasts to model resolution. During the first project year it is planned to assess the sensitivity to the atmospheric model resolution. In the following project years, depending on the results of the experiments carried out during the first year, we will assess (or not) the sensitivity to the ocean model resolution. Such sensitivity will be assessed by a set of integrations with suitable versions of the ECMWF coupled system (including the Sea-Ice interactive module LIM2) where ocean resolution is kept at the standard ~1˚ or increased to ~0.25˚, while atmospheric resolution is increased from T255 (~80 km) to T511 (~40km).

Summary of problems encountered (if any)

(20 lines max)

Since the main objective of this project is to investigate the sensitivity of multi-year forecasts to model resolution, it is important to use the same ECMWF model cycle for all the integrations planned. During the year 2014 ECMWF has been changing its main super-computing platforms, passing from IBM Power7 technology to CRAY XC30 systems. This major computer change involves the migration of the model cycles to the new architecture. However, only few model cycles will be migrated: those used for the operational forecasts at ECMWF and some other model cycles in development. For this special project we cannot use an operational cycle because there is no operational cycle running in forecast mode with the Sea-Ice module LIM2. After discussions with staff in the Predictability Division, it was decided that the most suitable model cycle to carry out the proposed experiments that will be migrated in the CRAY platform is Cycle 40R1. The control integrations (T255-ORCA1) with the cycle 40R1 are currently running on the IBM platform. However, due to the difficulties encountered at ECMWF in the migration of the operational cycles to the CRAY system, it is now not clear yet whether Cycle 40R1 (in the coupled model configuration for extended seasonal integrations which is used for these experiments) will be supported in the CRAY computer. If this is not going to happen, we might need to repeat the on-going control integrations with a different cycle, which will be migrated on the CRAY (possibly 40R3). This eventuality should affect only marginally the computer time request for the project.

Summary of results of the current year (from July of previous year to June of current year)

The project start date is the 1st of January 2014.

During the first year project we planned to carry out three experiments:

1) The first experiment (CTL 10-3-5) consists of a control series of hindcasts with the atmospheric model integrated at T255 (~80km) with 91 levels in vertical (this is the current resolution of the ECMWF System4 coupled model for seasonal predictions). The ocean resolution is the standard NEMO-ORCA1 (~1˚). It was planned to consider 10 starting dates and perform 3-year long hindcasts with 5 ensemble members.

2) The set up of the second experiment is the same as the first one, but the atmospheric component of the coupled system is integrated at T511L91 (HRA 10-3-5)

3) In the third experiment we planned to consider a complete high-resolution coupled system. The atmospheric component is integrated at T511L91 and the resolution of the ocean model is

increased to the configuration ORCA025 (0.25˚). The number of vertical levels will be kept the same. In this configuration it was planned to repeat the same hindcasts as in 1) and 2), but, due to the considerable computer time required by coupled high resolution integrations, we will run only 1 ensemble member (HRCTL 10-3-1 experiment).

Experiment 1) has been set up and is running. Experiment 2) and 3) should run in the second half of the year.

For experiment 1) we used IFS cycle 40R1 (which should be also available in the new CRAY super-computer) integrated at T255 with 91 levels in vertical. The ocean resolution is the standard NEMO-ORCA1 (~1˚). We considered 10 starting dates and we are performing 3-year long hindcasts with 5 ensemble members. Specifically we chose to run the model every second year starting the 1st of November 1990 until the 1st of November 2008.

The model is initialised using the ECMWF NEMOVAR reanalysis dataset (Balmaseda et al. 2012). The ten starting dates have been chosen in the late period of the observed record (1990-2010) to investigate the ability of the model to reproduce the warming slow-down in the period 2000-2010 (Meehl et al. 2011, Guemas et al. 2013) and to take advantage of the ARGO observing system in the reanalysis.

These control integrations should be completed by the first week of July.

References

Balmaseda, M. A., Mogensen, K. S., Weaver, A. T., Evaluation of the ECMWF Ocean Reanalysis ORAS4. (2012) *Q. J. R. Meteorol. Soc.*, doi:10.1002/qj.2063 (2012).

Guemas Virginie, Francisco J. Doblas-Reyes1,3, Isabel Andreu-Burillo1, Muhammad Asif1 (2013) Retrospective prediction of the global warming slowdown in the last decade Nature Climate Change 3, doi:10.1038/nclimate1863

Meehl, G. A., Arblaster, J. M., Fasullo, J. Y., Hu, A., Trenberth, K. E., (2011) Model-based evidence of deep-ocean heat uptake during surface-temperature hiatus periods. *Nature Climate Change* **1,** 360-364, doi:10.1038/NCLIMATE1229

List of publications/reports from the project with complete references

None – The experiments are still running.

Summary of plans for the continuation of the project

(10 lines max)
We plan to run experiments 2) and 3) by the end of the year.