REQUEST FOR ADDITIONAL RESOURCES IN THE CURRENT YEAR FOR AN EXISTING SPECIAL PROJECT

MEMBER STATE: ITALY……………..…………………………………..…

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Project title: Use and value of ECMWF shortrange and seasonal forecast…….

Products for developing countries in terms of end-user impact variables……….

Project account: **SPITP4DC**

Additional computer resources requested for	Current Year
High Performance Computing Facility (units)	1 800 000
Data storage capacity (total) (Gbytes)	0

Continue overleaf

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[1] The Principal Investigator is the contact person for this Special Project

Technical reasons and scientific justifications
why additional resources are needed

Prologue: The following application for additional resources was made in 2011. The proposal underwent external review with two reviewers and was granted additional resources of 1.8 million SDUs which were added to the project account in June 2011. Once the resources were allocated, ICTP proceeded with the groundwork necessary to install the REGCM model on the ECMWF facilities within the SMS framework, which took around 2 to 3 months, meaning that the experiments could only start in earnest in September 2011. Unfortunately this meant that the original allocation expired in December 2011, when only 22% of the units and project had been completed. We therefore hereby make a repeat request for an additional 1.8 million units in 2012 in order to be able to complete this project (the spitp4dc allocation for 2012 has already almost expired).

Original proposal:

Originally the SPITP4DC proposal envisaged using bias-corrected ECMWF output to direct drive impacts models, which is already underway.

Now ICTP and ECMWF are both funded partners of a new and closely related EUFP7 project QWeCI: Quantifying weather and climate impact on health in developing countries (ECMWF funded consultant is F. Di Giuseppe, who is working closely with ICTP scientists on the project). The project work envisages also downscaling monthly and seasonal ECMWF forecast products with the ICTP regional model to see if the resolution of the topography over the three pilot regions improves the final weather driven health impacts model.

In order to carry out these experiments, however, an additional one-off allocation of computing resources will be required beyond the original allocation made for 2010. The granting of these units to allow these experiments to be conducted at ECMWF would greatly help the collaboration since both ECMWF and ICTP scientists would have simple access to the output. Moreover, the technicalities involved in running consider ensembles of seasonal integration implies that the granting of these units would greatly benefit the efficiency of achieving this deliverable for the QWeCI project due to the available of the SMS software, which is not presently the case on alternative systems available to ICTP scientists. Details of the request breakdown are outlined below.

Computing request:

The allocation of computing resources to ICTP is to provide regional model seasonal forecast ensembles that are driven by seasonal forecasts for a three month lead time. The aim is to see if the resolving the complex topography in the target regions with the higher resolution of the regional model can add to the quality of the local forecasts in Southern and Western Africa, and if the use of a regional model is an effective method to produce seamless seasonal range forecasts, joining the discrete ECMWF systems.

Experiments 1 and 2 will conduct a suite of downscaling integrations, downscaling each member of the seasonal forecast to a resolution of approximately 25km. One integration is covers the project target regions in West Africa, Senegal and Ghana, and thus will downscale the ENSEMBLES (the ENSEMBLES integrations using system 3 are used as they have 6 hourly model level fields

archived to provide lateral boundary conditions) seasonal forecasts starting in May, and will examine a lead time of 4 months as the seasonal system is unlikely to have significant skill beyond this range, although it does mean that the tail-end of the rainy season will be missed. The second experiment instead targets Malawi, and will use the November start and run for 4 months as well.

The groundwork of setting up the REGCM model under the SMS suite has already been accomplished using the ENSEMBLES projects hindcast series under the SPITP4DC member state account.

As the dynamical downscaling technique relies on frequency archiving of model level data for boundary conditions, a third stream of experiments will examine the downscaling the forecasts with the novel approach of using a "tropical band model". The tropical band model of the REGCM4.1 represents a tropical strip around the equator thus with only the need to provide lateral period boundary conditions. Using the band model means that the availability of 12 hourly model level data for boundary conditions is less important for the diurnal cycle of the meteorology, since these are only applied at the north and southern edge and thus the lack of East-West boundaries implies that 12 hourly archiving is sufficient to model the diurnal cycle (this will be tested with smaller integrations using the ENSEMBLES runs). The band models 12 hourly boundary condition requirement means it can be used to downscale both monthly and seasonal forecasts.
The band model will thus be used to see if this method can effectively join the monthly EPS and seasonal forecast systems together "seamlessly" without a significant shock at the simulation "temporal" boundaries. These integrations are more expensive and will be conducted for a shorter period and only using month 2 of the seasonal forecast system.

Apart from the direct application to the QWeCI project, this work will also have wider implications for whole approach of climate dynamical downscaling, since, despite their wide-spread use as downscaling tools for climate, most validation of these systems are conducted in terms of the mean climate and the statistics of its variability. It is argued that if these modelling systems are unable to improve regional skill on monthly to seasonal timescales then it brings their value in climate regional downscaling into question.

Detailed request breakdown:

These estimates are based on smaller pilots runs conducted under the SPITP4DC member state account.

The initial experiment set up uses a 25km resolution for REGCM4.1 (although we hope to improve this if resources suffice), with a 288x160x18 point domain and a timestep of 100 seconds, which has a cost of 1500 cpu units for a month of integration time.

The computer units applied for are to run the following suite of experiments:

Two integrations of 11 years in length (1991-2001) using the ENSEMBLES hindcasts for the seasonal forecast boundary conditions for month 1-3.
Integration 1: May starts for West Africa
A total cost for each experiment of 1500*5*11= 49500 cpu units for one member over the 11 years, and thus for 9 ensembles it will be approximately 500,000 cpu units.

Integration 2: November starts for Malawi.

This form is available at:
http://www.ecmwf.int/about/computer_access_registration/forms/

A similar experimental setup will lead to the consumption of 500,000 cpu units.
<u>Integration 3: A single control run for the same period driven by ERA-Interim analysis</u>

2 regions*1500 units*12 months*11years= 396000 (although this could be shortened by missing out the months in each region, or resorting to using the already conducted

<u>Experiment 4</u>: Band model integrations to produce seamless forecasts
A series of band model integrations to be conducted at coarser resolution for economy (~60-80km) on a domain extending from 40S to 40N, that will use the monthly EPS for month 1 and then switch to the seasonal system for month 2. Various methods will be tested to attempt to merge the boundary conditions smoothly at the "temporal" interface at month 1 to reduce the "shock" to the forecast system.
COST?
Total units (including an allocation for setup test and contingency) = 2,000,000 computing units