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 2011

Project Title: Use and value of ECMWF short-range and seasonal forecast products for developing countries in terms of end-user impact variables

Computer Project Account: SPITP4DC

Principal Investigator(s): Adrian Tompkins

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Affiliation: Abdus Salam International Institute for Theoretical Physics (ICTP)

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

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Start date of the project: 1 January 2010

Expected end date: 31 December 2013

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)	100,000	18854 (18%)	300,000 + 1,700,000	282483 (94% of 1st allocation)
Data storage capacity	(Gbytes)	n/a	n/a	100 Gb	

Summary of project objectives

(10 lines max)

The purpose of this product is to end ECMWF products to drive impacts models in distinct pilot projects focussing on developing countries in Africa, namely Ghana, Senegal, Ethiopia, Malawi, Rwanda, Uganda, Tanzania and Kenya. The science in each project focuses on the coupling of the ECMWF systems to end-user dynamical models for water resources, crop production and vector borne disease, and then test the predictability of these coupled system in tropical regions. The project will test CDF and EOF-based bias correction techniques developed at ICTP under the EU-FP WATCH project to join the medium range, monthly and seasonal models seamlessly to drive the end-user impacts models. A limited allocation of computing resources is requested to allow a small set of sensitivity experiments to be conducted for each subproject to investigate the predictability of the region concerned with sensitivity integrations conducted with the IFS or possibly also the EC_Earth system.

Summary of problems encountered (if any)

(20 lines max)

The regional model was less efficient on the ECMWF machines than originially estimated and thus the computer unit allocation was found to be inadequate for the planned experiments..

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

This section should comprise 1 to 8 pages and can be replaced by a short summary plus an existing scientific report on the project

The first period of the project developed in two main areas (1) the validation of the seasonal forecast system and the EC-EARTH model in seasonal forecast mode over the tropical areas of interest and (2) the initial testing of the impacts models using a mixture of observations and reanalysis data over the area of interest, which will then be forced using the validated and bias corrected forecast data.

Validation of forecast models.

This part of the project follows on from groundwork conducted with the PA account, which examined both bias and skill of the seasonal forecast system as well as aspects of its variability. The work has led to a publication by Tompkins and Feudale in Weather and Climate 2010. Part of the problem with predictability on monthly timescales is the continuing poor representation on the Madden Julian Oscillation in the monthly and seasonal forecast system, despite improvements in recent cycles. The project account was then used to conduct a series of sensitivity tests with the model, which have identified changes that lead to a much improved MJO. This work was written up in collaboration with ECMWF staff members but unfortunately the first version was declined for publication in GRL due to the length. A revised manuscript is now under construction for submission to Monthly Weather Review.

Downscaling of Seasonal Forecasts for two EU-projects on climate-health:

As part of two projects detailed for climate-health interactions, a series of downscaling experiments have been conducted to see if the higher resolution of a regional model can add value to the monthly/seasonal systems of ECMWF. An example of the ROC scores from the ECMWF system 3 contributing to the ENSEMBLES project and the downscaled forecasts using REGCM for the horn of Africa is given below. The summary of the work is that, while the regional model beats the short range forecasts made from ERA-Interim reanalysis, using seasonal forecast boundary conditions, with regional errors in the SST over the Western Indian ocean leads to biases the regional modelling system can not improve.

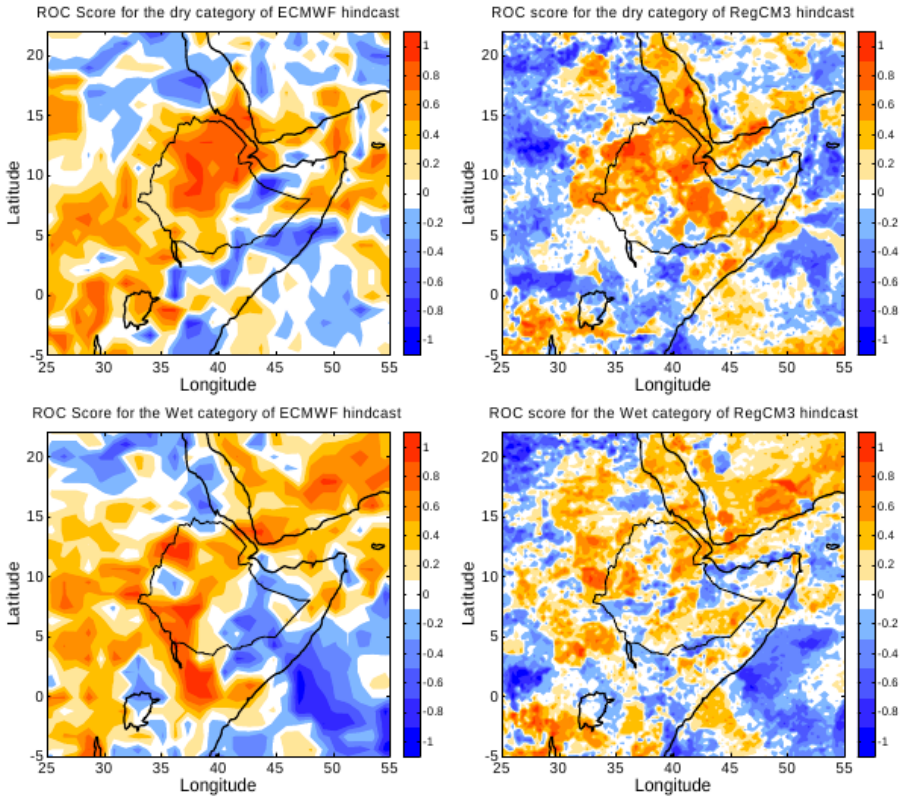

Figure 1: ROC scores for dry and wet events over the horn of Africa for the ECMWF sys3 and downscaled seasonal forecasts

Impact model studies

Crop forecasts

The initial impact model work has concentrated on the crop modelling aspect, although recourse to the operational products for health impact studies will be made soon for the project QWECI. The work has so far attempted to validate the crop model in Ethiopia, Ghana and China. An example integration is given in the figure below which shows crop yield predictions for three locations in Ethiopia made using observed rainfall (GPCP) and ERA-interim reanalysis products for temperature and radiation. The integrations show the problems of impacts research in that the impacts data is limited in length and often questionable in quality. Multiple cell distributed integrations will be used in a novel way to infer data quality before application to monthly and seasonal forecasting.

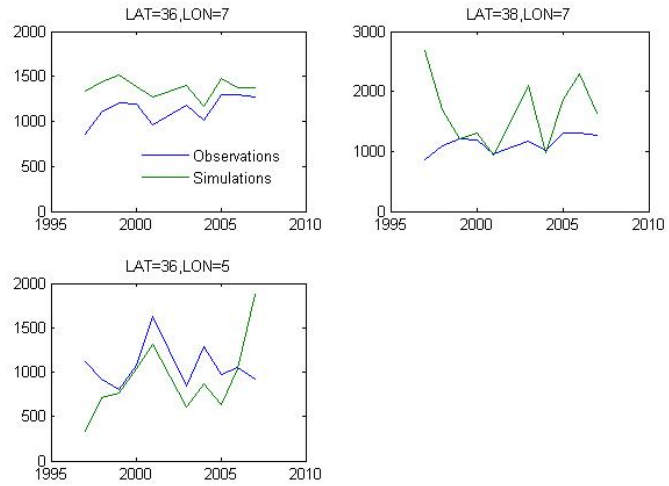

Figure 2: crop predictions driven with observations for rainfall and ECMWF reanalysis for temperature and radiation

Climate- health

As part of the EU projects on climate and health, ICTP has also developed a new dynamical malaria modelling system. This will be shortly coupled to the ECMWF monthly and seasonal forecasting systems in a prototype malaria forecast system, also taking advantage of a newly developed bias correction technique that is in the process of documentation, jointly developed with ICTP. More details of this system will be contained in the next progress report. The system will be rolled out in Malawi for prototype testing early in 2012.

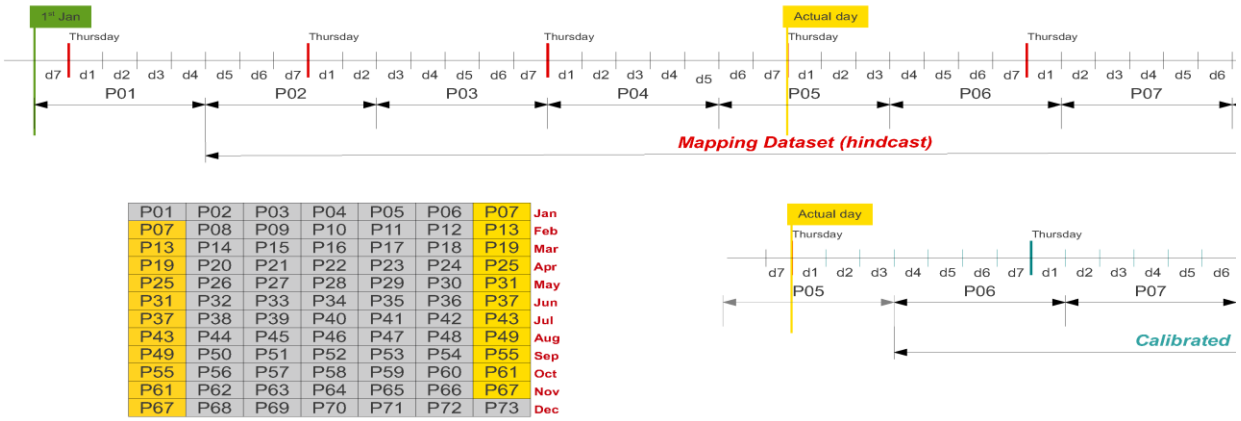

Figure 3: schematic of bias correction technique applied to monthlyforecasts which will be used to drive the |ICTP newly developed dynamical malaria model

Summary of achievement of objectives from previous report 2010:

The monthly forecasts will be evaluated in a systematic manner similar to determine the skill improvement on the 3-4 week timescale **– done with additional downscaling experiments conducted.**

The seasonal and monthly forecasts will be bias corrected and then used to drive the crop model in the target regions, possibly using the enhanced MJO version of the IFS currently being written up in Tompkins, Vitart and Jung. **– bias correction done but revisions required, crop forecasts delayed due to yield data quality issues.**

The Vector borne disease model of Trieste VECTRI will be completed and undergo evaluation in Africa using observations **– done, in process of writing up**

Sensitivity tests will be conducted with SYS3 to see what impact the crop surface attributes characteristics have on the local circulation **– not achieved due to lack of computing units**

List of publications/reports from the project with complete references

Adrian M. Tompkins and Laura Feudale
Seasonal Ensemble Predictions of West African Monsoon Precipitation in the ECMWF System 3 with a Focus on the AMMA Special Observing Period in 2006
Weather and Forecasting 2010; 25: 768-788

Sanai Li and Adrian Tompkins
The impact of using different temporal and spatial scale average weather data for forecasting of crop yield, to be submitted in August 2011.

Gulilat Tefera Diro, Adrian Tompkins and X. Bi: Dynamical downscaling of ECMWF Ensemble seasonal forecast over East Africa with RegCM3, to be submitted in August 2011

Summary of plans for the continuation of the project

(10 lines max)

Finalization of bias correction technique – used to drive VECTRI in prototype malaria prediction system over Malawi.

Further downscaling experiments to be conducted over Eastern Africa and Malawi for EU –projects to provide high resolution driving fields for impacts modeling.