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	2016
Project Title:	Improving Stochastic Parametrisation of Convection through the use of Data Assimilation
Computer Project Account:	spgbtpps
Principal Investigator(s):	Prof Tim Palmer Dr Hannah Christensen Dr Aneesh Subramanian
Affiliation:	University of Oxford
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Dr Antje Weisheimer Dr Mark Rodwell Dr Sarah-Jane Lock
Start date of the project:	Jan 2016
Expected end date:	Dec 2018

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)			750,000	801,745
Data storage capacity	(Gbytes)			1,200	

Summary of project objectives
(10 lines max)

Our central objective is the development and assessment of new stochastic convection parametrisation schemes. We will achieve this through the development of a new methodology to evaluate ensemble forecasts. By studying systematic errors and reliability during the DA window, errors due to misrepresentation of convective processes are isolated: by focusing on convective areas at very short lead times, remote errors cannot infect the forecast. Throughout, a key focus is using the DA diagnostic suite to identify systematic errors in existing convection parametrisations.

Summary of problems encountered (if any)
(20 lines max)

N/A

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

We have started by developing a new stochastic parametrisation scheme to improve the representation of uncertainty in convection in the IFS, in collaboration with Sarah-Jane Lock. The scheme is a generalisation to the operational Stochastically Perturbed Parametrisation Tendencies (SPPT) scheme. Whereas in SPPT the sum of the parametrised physics tendencies are perturbed with a single random pattern, in the new "independent SPPT" (iSPPT) scheme, each of the physics parametrisations is perturbed with an independent random pattern. Whereas SPPT assumes that the errors in the different parametrisation schemes are perfectly correlated with each other, iSPPT assumes that the errors are uncorrelated. We have tested the scheme in medium range forecasts, where it has a beneficial impact on spread of the forecasts. The positive impact is largest in the tropics, whereas in the extra-tropics the scheme can lead to slightly over-dispersive ensembles. Considering regions in the tropics with significant or little convective activity separately reveals that the scheme has the largest impact in tropical regions with significant convection that were previously under-dispersive. An alternative version of the scheme is also under consideration, whereby the 'moist' and 'dry' parametrised processes are grouped and perturbed independently (i.e. two independent patterns are used). This scheme also performs well in the tropics but has improved spread in the extra tropics (see Fig 1).

List of publications/reports from the project with complete references

SAC Topic Paper on Model Uncertainty: authors include **Christensen, Subramanian, Weisheimer**

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

Having established that the iSPPT scheme is beneficial in medium range forecasts, we will use the EDA verification package developed by Mark Rodwell to focus on the performance of the iSPPT and SPPT schemes in very short forecasts made during the DA window. Firstly, focusing on the location and spatial structure of the bias component will help isolate and identify systematic sources of error in the convection scheme, such as errors due to timing or dynamical adjustment. Secondly, comparing the random error component with the ensemble spread in convective regions will isolate and rigorously test the performance of the two stochastic approaches. iSPPT is the first new scheme we will test in this framework: we anticipate testing a wider variety of schemes as the project progresses. We also plan to diagnose model biases and errors in model variability for tropical phenomena such as the Madden Julian Oscillation and the South Asian monsoon.

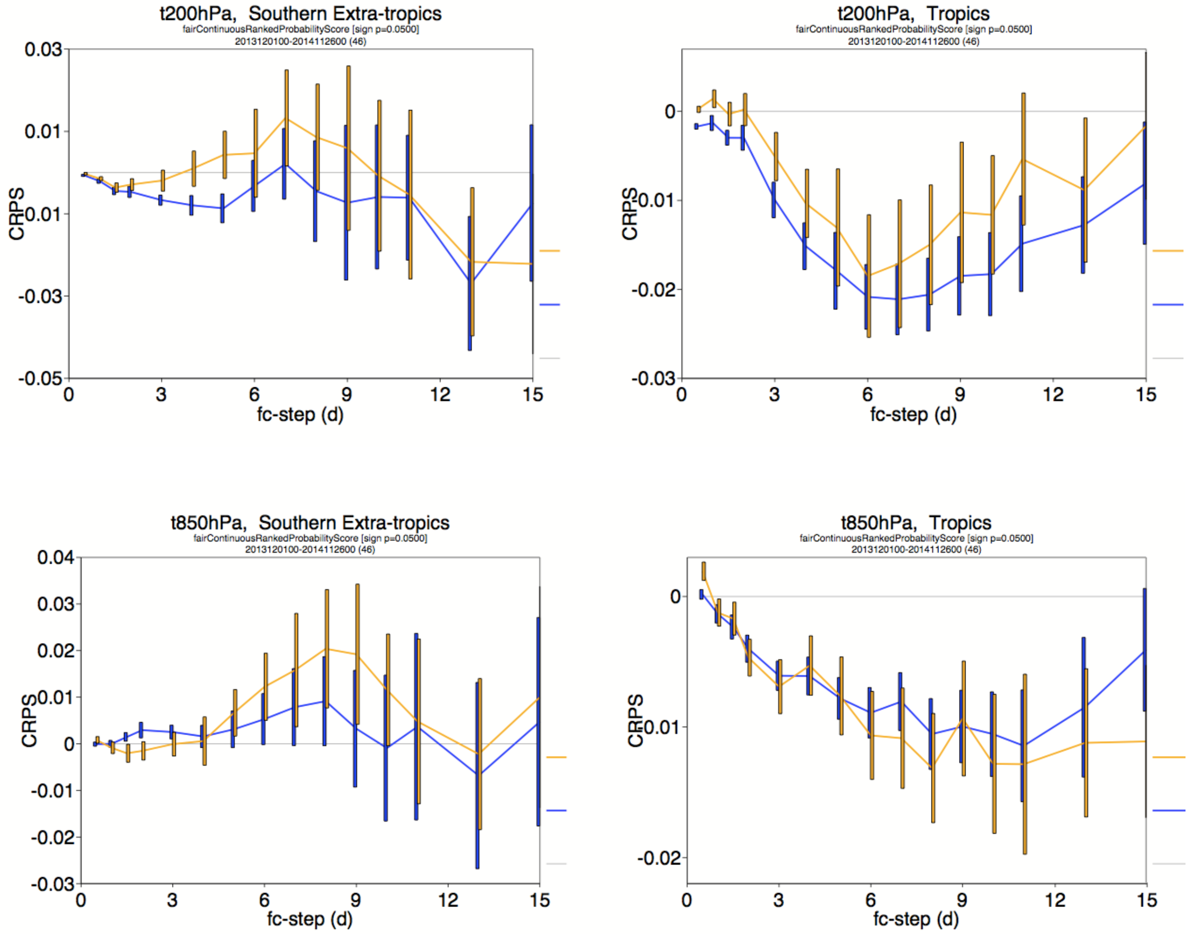

Fig 1: Impact of iSPPT on medium range forecasts. CRPS of iSPPT minus CRPS of SPPT. Yellow: fully independent SPPT. Blue: partially independent SPPT. Negative values indicate an improvement over SPPT.