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	…2015
Project Title:	Boundary layer model errors in the AROME ensemble prediction system
Computer Project Account:	spfrbout
Principal Investigator(s):	Francois Bouttier
Affiliation:	CNRM, Meteo-France
Name of ECMWF scientist(s) collaborating to the project (if applicable)	n/a
Start date of the project:	January 2015
Expected end date:	December 2017

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)	6 MSBU	6 MSBU	7 MSBU	3.8 in June
Data storage capacity	(Gbytes)	5	4	5	4

Summary of project objectives

(10 lines max)

The objective is to research new parametrisations for the representation of low-level model error in ensemble prediction. The main intention is to test several strategies for stochastically perturbing parameters in the Bougeault-Lacarrere TKE-based vertical mixing scheme.

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)

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

Most of the work has been performed by the Hungarian Met Service (Mihaly Szucs in particular), which is registered in this project.

As a first step, improvements to the Arome SPPT stochastic physics scheme have been tested.

Current preoperational SPPT settings have a relatively high spread, which means that during any Arome-EPS run, SPPT clipping is active at many gridpoints. Active clipping means that physics tendencies are multiplied by zero or two, which seems a bit excessive from a physical standpoint. An SPPT version with reduced spread (standard error is divied by 5) has been tested in Arome-EPS on several cases, which somewhat reduces member forecast errors, but also reduces the ensemble spread, which is undesirable (the spread/skill relationship is degraded).

As a second step, multivariate versions of SPPT have been tested, in the hope that they can provide higher spread without degrading ensemble skill. 'Multivariate' means that the U,V,T,q variables are perturbed using independent stochastic noise. Ensemble spread is improved by this scheme (compared with a univariate SPPT with an equivalent tuning), particularly in the boundary layer, without an improved spread/skill relationship. Unfortunately, significant biases appear on upper-level fields (e.g. temperature, humidity, wind speed), which suggests that the univariate SPPT excites unphysical error structures.

As a third step, an improved multivariate version of SPPT, called 'elliptic' SPPT, introduces correlations between the perturbations of U,V,T,q variables, which aims to produce an intermediate configuration beween the univariate and multivariate SPPTs. As expected, the response is intermediate, too, with smaller (but still non-negligible) upper-level biases, and a weaker improvement of the spread/skill relationship in the PBL. Nevertheless, it seems to be a good tool for improving spread in the boundary layer, where multivariate relationships between forecast errors might not be as strong as in the upper tropopause.

List of publications/reports from the project with complete references

'Arome-EPS of the Hungarian Meteorological Service'. M. Szucs et al, 2016, presentation to the 2016 Eumetnet-EPS project workshop, Bologna, May 2016. available at http://www.arpae.it/dettaglio_evento.asp?id=2400&idlivello=1530

Summary of plans for the continuation of the project

(10 lines max)

The potential of the elliptic SPPT scheme will be further investigated by focusing more on the PBL response. It will be complemented by stochastic perturbations to parameters of the turbulence scheme, and specific perturbations of the low-level humidity field.