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	2018
Project Title:	Parameter estimation (EPPES) in HarmonEPS
Computer Project Account:	SPFIOLLI
Principal Investigator(s):	Dr. Pirkka Ollinaho
Affiliation:	Finnish Meteorological Institute
Name of ECMWF scientist(s) collaborating to the project (if applicable)	……………………………………………………………….…… ……………………………………………………………….……
Start date of the project:	1.1.2018
Expected end date:	31.12.2020

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)	-	-	15 000 000	656 542
Data storage capacity	(Gbytes)	-	-	10000	0

Summary of project objectives
(10 lines max)

We apply the ensemble Prediction and Parameter Estimation System (EPPES; Laine, et al. 2012) to estimate uncertain parameters in HarmonEPS (Frogner et al. 2016). The first steps of the project consist of further improving the EPPES algorithm, and of finding a suitable set of closure parameters to be estimated from the HARMONIE-AROME model. The suitable parameters are searched via sensitivity tests, where the parameter values are simply changed by a static amount and used to run a set of forecasts. These forecasts are then thoroughly analysed in order to select the parameters that first of all have a noticeable effect on the forecast skill, and in constructing a suitable estimation target for the later EPPES optimisation task. EPPES provides, in addition to the optimal parameter value, an estimate of the parameter uncertainty. This information will furthermore be used in developing model uncertainty representations for HarmonEPS.

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

None

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 SBUs used so far have been mostly directed to algorithm improvement efforts. We have generated ensemble initial states with IFS following that what is done in the ECMWF operational ensemble. Two PhD-students from University of Helsinki (M.Sc. Lauri Tuppi and M.Sc. Madeleine Ekblom) are using these initial states with the OpenIFS-model to test out EPPES algorithm developments and new features, e.g. a multi-criteria target for constraining the estimation, and exploring the role of ensemble size in the estimation progress. Only the initial state generation for this task have been performed in the ECMWF system - the OpenIFS-runs have been conducted in the supercomputer of the Finnish IT center for science, CSC. We estimate that roughly 15-20% of this year's allocated SBUs will used to aid in the algorithm development work.

<figure>

nhem geop 50000Pa
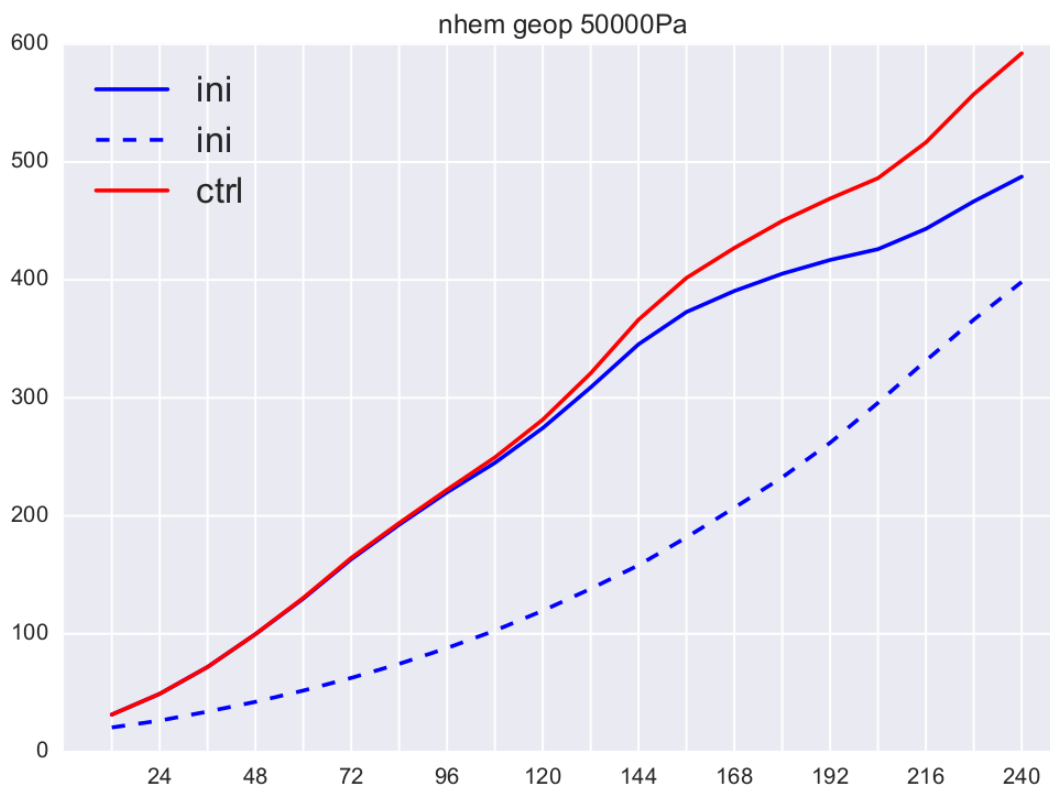
Legend:
— ini
- - ini
— ctrl

</figure>

Figure 1: OpenIFS ensemble skill for 500hPa geopotential at Northern hemisphere. Scores are shown for an experiment with 50-ensemble members using IFS ensemble initial states ("ini only") and an unperturbed control forecast ("ctrl"), both are averaged over 10 start dates and run with TL159 horizontal resolution. Ensemble mean and control forecast RMSE (solid), and standard deviation (dashed) as a function of forecast length up to forecast day 10.

The first sensitivity tests with HarmonEPS have also been conducted. We have so far restricted ourselves to a single test case to build up a more sophisticated tools for analysing large quantities of model data. We will ramp up running the sensitivity tests during the autumn.
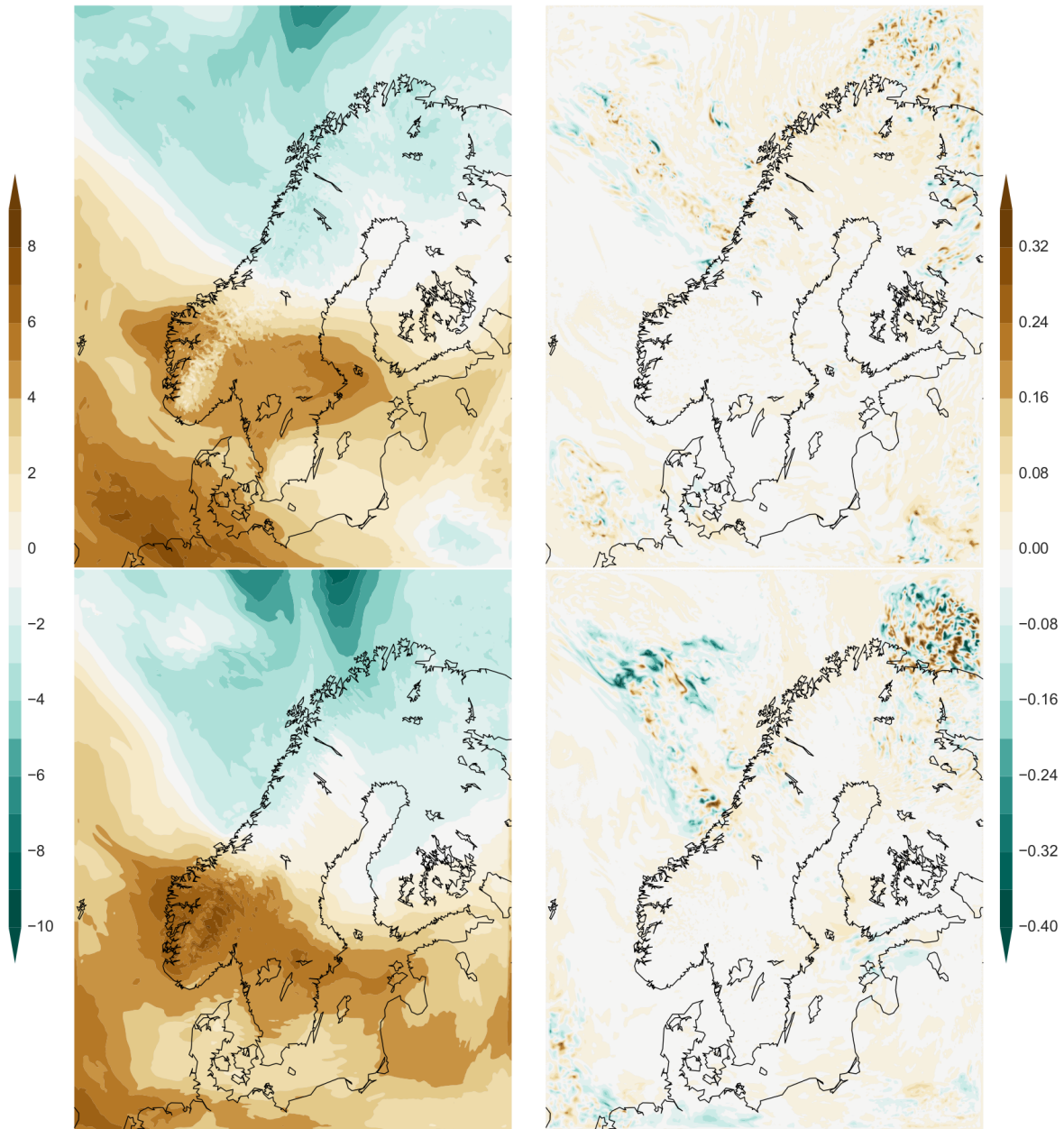
June 2018

Figure 2: HARMONIE-AROME model forecast for 925hPa temperature [°C] for forecast lengths of 12h (upper row) and 24h (lower row), initialised at 12UTC May 1st 2017. Left figures show control forecasts and right ones difference between control and a forecast run with halving the threshold for condensation at sub saturation conditions (VSIGQSAT).

June 2018

List of publications/reports from the project with complete references

None

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

We will generate IFS ensemble initial states for the OpenIFS-model for the whole year of 2017 with three different resolutions (TL159, TL399 and TL639). These will be used in the EPPES OpenIFS-implementation to find out answers to e.g. 1) how does using multiple target criterions in the estimation process help in finding universally skillful parameter values, and 2) how many parameters can we estimate concurrently with a limited ensemble size.

We will start running HarmonEPS sensitivity runs in larger scale for a number of closure parameters (so far there are 22 that will be investigated). We expect to fully use the dedicated SBUs by the end of the year.