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:	Probabilistic forecasts for short range in Europe
Computer Project Account	spnogeps
Principal Investigator(s):	Inger-Lise Frogner
Affiliation:	Norwegian Meteorological Institute P.O. Box 43, Blindern 0313 Oslo, Norway
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Martin Leutbecher
Start date of the project:	2015
Expected end date:	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)			20 000 000	10300000
Data storage capacity	(Gbytes)			10000	?

Summary of project objectives

(10 lines max)

The objectives are developing and maintaining probabilistic forecasts for short range in Europe, in the cooperation of two European consortia for short-range NWP: HIRLAM and ALADIN. It consists of two main activities: Activity 1: maintaining and developing The Grand Limited Area Modelling Ensemble Prediction System (GLAMEPS), which runs at ECMWF as Time-Critical facility Option 2 (TCF_2) and Activity 2: Experimenting scientifically and technically with ensembles of non-hydrostatic modelling with convection-permitting resolution (HarmonEPS) for the very short range in sub-European domains.

Summary of problems encountered (if any)

(20 lines max)

The working conditions at ECMWF are very good thanks to a helpful and collaborative staff at ECMWF.

Lack of disk space, both for operational GLAMEPS runs, and for running experiments, is sometimes a problem.

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

Only six months has passed since this project started, and so far the results are limited. Experiments with both GLAMEPS and HarmonEPS have been run, but so far they are not yet thoroughly investigated. Thus, this years report will be brief and more is expected to be reported next year.

Activity 1. GLAMEPS:
GLAMEPS version 2 became operational in 2014. GLAMEPSv2 is set up for producing a 52-member hydrostatic multi-model EPS on a pan-European integration domain for 54h forecasts with grid mesh width around 8 km. GLAMEPSv2 runs four times a day, at 00, 06, 12 and 18 UTC. GLAMEPSv2 utilises the lagging technique, meaning that only half the number of members is run at each forecast time and then combined with the members ran 6 hours before.

Model uncertainties are presently taken into account by using a small number of different models and versions, two versions of the HIRLAM model (HirEPS_S and HirEPS_K) and two versions of Alaro (Alo_I and Alo_S). Initial state uncertainties are taken into account in two ways: Ensemble perturbations are imported from the global ECMWF 51-member EPS. This system also provides perturbations at the lateral boundaries during the prediction period. Additional initial state perturbations are included by running two different assimilation cycles in parallel with different models and model versions. All LAM-members also run with a separate data-assimilation cycling for the ground surface, yielding a unique surface analysis per ensemble member.

GLAMEPS shows good scores as compared to IFS ENS. An example can be seen in figure 1 which shows the spread and skill for GLAMEPS and IFS ENS for T2m.

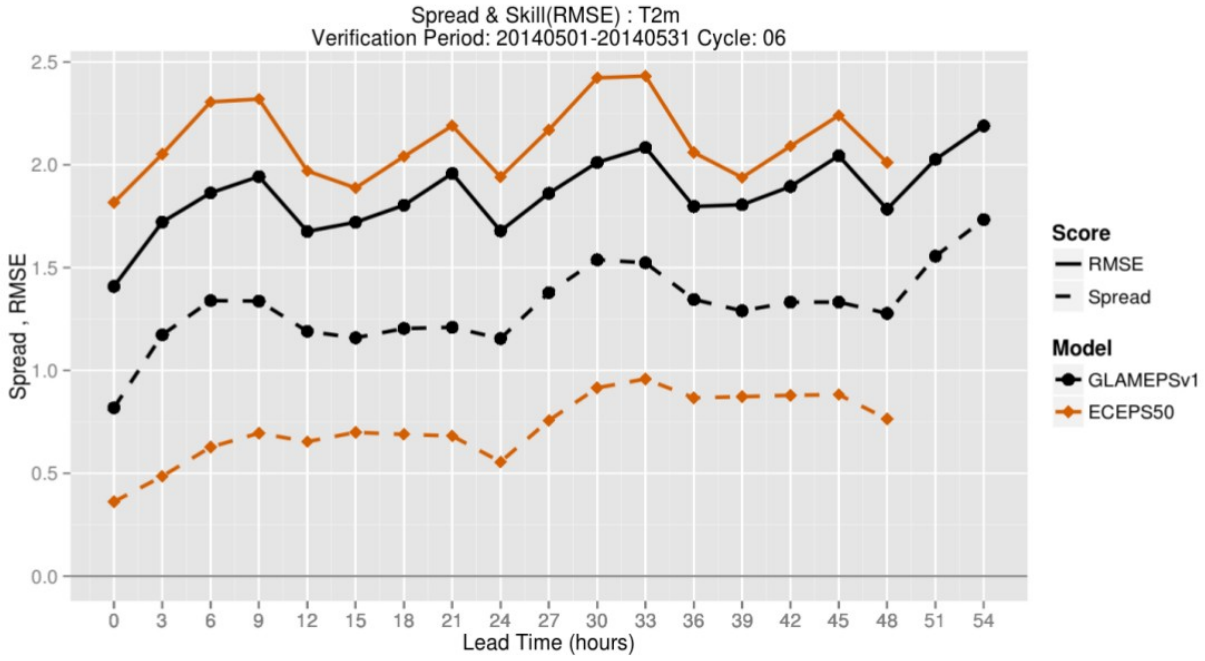

Figure 1: Spread (dashed line) and skill (solid line) for GLAMEPS (black) and IFS ENS (orange) for two meter temperature for May 2014.

As seen in figure 1, GLAMEPS is under dispersive, although less so than IFS ENS. Experiments so far in 2015 have focused on adding an inflation factor to the initial perturbation in HIRLAM part of GLAMEPS, that comes from IFS ENS:

X (I)= X_(HIRLAM control-analysis) + X_(ECMWF EPS control forecast - ECMWF perturbed forecast nr J) * K

Where X is the model states, I stands for the "I"th perturbed HIRLAM member, J the "Jth" perturbed ECMWF ENS perturbed forecast, K the inflation factor (used to be 1). First try was with K=1.5. Results are largely as expected with a general improvement on scores, the biggest gain on spread, see figure 2.

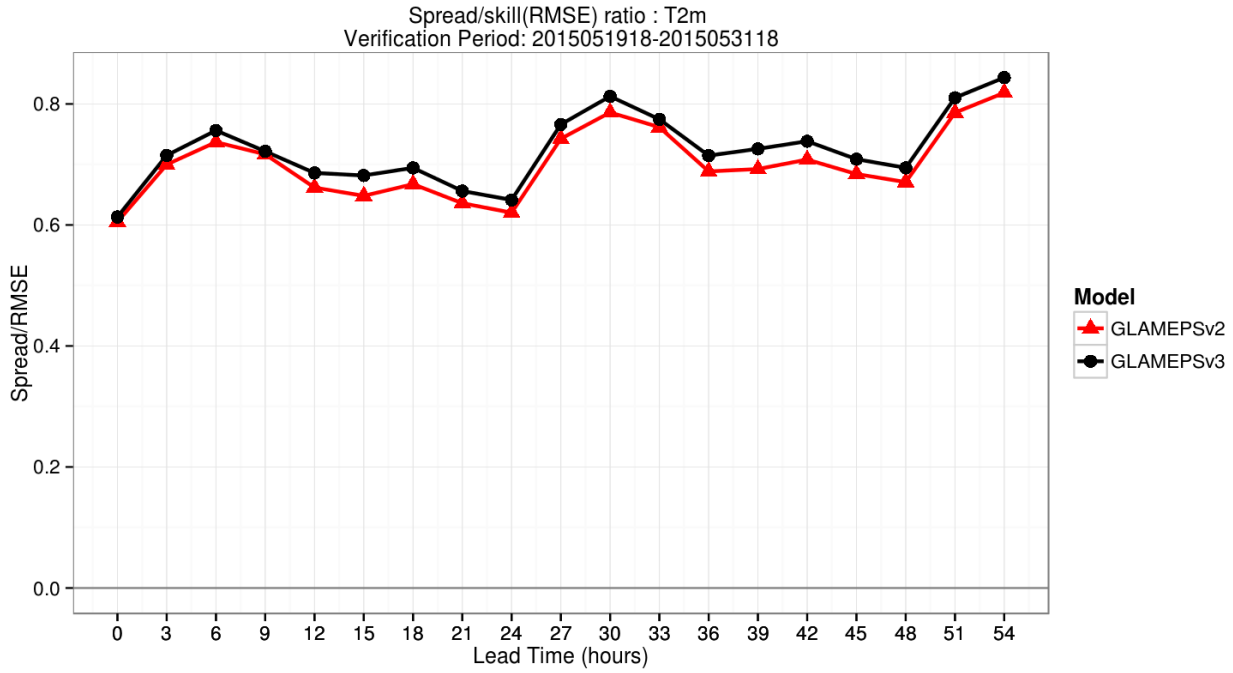

Figure 2: Spread-skill ratio for two meter temperature for 14 days in May 2015. GLAMEPSv2 is the current, operational GLAMEPS. GLAMEPSv3 is the same as v2, but with an inflation factor of 1.5 for the initial perturbations coming from IFS ENS.

Activity 2. HarmonEPS: Experimenting scientifically and technically with ensembles of non-hydrostatic modelling with convection-permitting resolution (HarmonEPS) for the very short range in sub-European domains.

HarmonEPS is the name of anensemble prediction systems for the very short range (<36h) on so-called convection-permitting scales. The basic model tool is the non-hydrostatic Harmonie with Alaro and/or Arome physics. The development towards a cloud-permitting, meso-scale model system (Harmonie) has had considerable progress, and a prototype system for HarmonEPS is developed.

So far in this special project period, that started in 2015, resources from spnogeps have been used for running EDA (ensemble data assimilation) experiments with HarmonEPS. A setup of 10 + 1 assimilation cycles with perturbed observations has been chosen. Two three week experiment periods have been run, one with perturbations from IFS ENS added (as explained in Activity 1, for GLAMEPS) and one without. This will be evaluated together, and also together with IFS ENS and a version of HarmonEPS without EDA. This is work in progress, and no plots are available so far. This will be reported in the next progress report.

List of publications/reports from the project with complete references

None so far.

Summary of plans for the continuation of the project

(10 lines max)

GLAMEPS: Work will continue to upgrade GLAMEPS to version 3:

1. start change of resolution
2. Implement perturbations about horizontal diffusion in Alaro-members

HarmonEPS:

Many experiments are planned for HarmonEPS, and they are listed in the application for this special project. We focus on developing a system that members states can adapt and run on their home computers. We design a system where we try to account for know uncertainties in all aspects, that is in initial conditions, model, surface and boundaries.

It remains to be seen which of the listed experiments will be performed using spnogeps, and which will be performed using national resources.