Grand Limited Area Model Ensemble Prediction System - GLAMEPS

Proposal by the HIRLAM(-ALADIN) planning meeting for HIRLAM predictability research and development,

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Participamts:

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The Major Challenge:

Can we beat ECMWF´s EPS system within a common area (Europe) over a common forecast range (60h)? And in particular: How can we cover extreme events with confidence?

The possible solution: A grand limited-area ensemble system: GLAMEPS

Intention: To establish a common distributed system in which each different country runs a LAM-EPS using its own unique "dialect" or version of the two common model codes, with results distributed in real time to all member countries.

- ~7 HIRLAM versions and ~10 ALADIN versions.
- The control run for each LAM-EPS will be based on analyses from each country's separate data-assimilation with its own model version.
- Around 200 or more ensemble members where uncertainties in initial data, open lateral boundary data, model physics formulations, and lower boundary conditions, are accounted for.

Questions and issues:

- **Each country / group should ideally run its model version with an ensemble based on initial and open lateral boundary perturbations. These perturbations need to be scaled to reflect actual uncertainties pertaining to initial and lateral boundary data. Each ensemble size should be at least 10.**
- **Grid resolution: Aim: 10km or finer established during HIRLAM-A. At present: 20km should be feasible**
- **Forecast range: at least to +60h, started daily from (preferably) 12 UTC.**
- **We need to use a common domain which addresses all countries' interest. To get started, a smaller, but still common, domain could be used in a preparatory phase. There is trade-off between domain-size, grid resolution, and the available computer power in each country.**

Questions and issues (cont.):

- **Which model parameters do we need to perturb and what should be the size of the perturbations? Can we possibly also use different physical parameterisation packages?**
- **The lower boundary conditions should be perturbed where European weather is sensitive. (1) SST and land-surface temperature, (2) Snow and sea-ice and (3) Soil humidity. Such perturbations could be regarded as different model versions.**
- **Concern: We need to calibrate each model-version in order to produce a "sensible" climatology. We need to get rid of ill-posed choices of model parameters.**

How to construct meso-scale initial perturbations?

- **Perturbations based the operational ECMWF model. (There is a need to produce and store TEPS/EPS data at ECMWF.)**
- **Can ECMWF calculate high-resolution SVs (say T500) targeted to Europe? Can they replace SVs calculated with the proper (LAM meso-scale) nested model?.**
- **Meso-scale initial perturbations within the integration domain, for example based on the (nested model) LAM, for the first part of the forecast range.**
- **Ensemble Transform Kalman Filter (ETKF) that performs a rescaling of ensemble forecast perturbations. ("extended breeding").**
- **Multi-analysis, i.e. ensemble assimilations based on, for example, observation perturbations.**

How to construct open lateral boundary perturbations?

- Relying on lateral boundary conditions from a global (host) EPS/TEPS system, (e.g. from ECMWF) taking the risk of inconsistencies between the host and the nested model perturbations.
- Generation of lateral boundary conditions consistent with spatial and temporal statistics of lateral boundary condition errors.

Some agreed upon actions:

- A prototype version of the proposed GLAMEPS will be implemented at the ECMWF computer system. An application will be made for a ECMWF Special Project.
- In order to get support for the proposal from the wider HIRLAM and ALADIN community, an extended document needs to be worked out in advance of the all staff meeting in May 2006. Responsible persons for this document are Nils, Trond, Jan, Andras and Martin. These persons could possibly continue to act as a steering group for the GLAMEPS project. (+Jose A.&Yong Wang)

Outcome of a short informal meeting 16 May 2006

- We will use 2006 for development of techniques and preparations.
- We will start with common experiments on a common large area but with moderate horizontal resolution (30 km).
- Norway, Sweden, Spain, Netherlands (and Denmark?) are interested to join during 2006-2007
- Austria and Hungary are interested to join during 2006-2007
- In case we will get a ECMWF Special project: The may be computer time for more ALADIN members to join.
- A more detailed project plan will be developed (coordination by NG)
- We will meet next time during the ALADIN-meeting 7-8 November 2006 in Vienna

Informally expressed areas of interest

- **Sweden:** EPS experiments with ETKF (0.5 person)
- **Hungary:** Downscaling ECMWF & ARPEGE, ALADIN singular vectors (1.0 person)
- **Norway**: Continue LAMEPS, combination targeted and non-targeted singular vectors, higher resolution singular vectors (1.0 person)
- **Austria:** Breeding, simplified ETKF, downscaling, blending of initial perturbations, participation in Beijing project
- **Netherlands**: HIRLAM singular vectors, comparison with ECMWF higher resolution singular vectors, forcing singular vectors, Bayesian model averagingand
- **Spain:** Make SREPS operational, BMA and ETKF (1.0 person)