Perturbation experiments with MetCoOp EPS (MEPS)

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MEPS

- HarmonEPS on the MetCoOp domain
- 2.5 km grid spacing, 64 levels
- 750 x 960 grid points
- 10 members
  - 1 Arome control, 1 Alaro control
  - 8 perturbed Arome members
- Pre-operational daily runs imminent
- Aim to be operational by autumn 2016
- See Ulf Andrae et al’s poster for more
Available perturbation strategies

- ICs and LBCs from IFS-ENS
  - First $N_{MEPS}$ members
  - Selection of $N_{MEPS}$ members from $N_{IFS-ENS}$ members
- ICs and LBCs from IFS-HIRES using SLAF
  - Scaled Lagged Average Forecast
  - $Y_{T+0} = X_{T+0} \pm k(X_{T+0} - (X-HH_i)_{T+HH_i}), \ (HH_i = 6,12,18,24...)$
- EDA
- Surface perturbations (currently being tested)
- Multiphysics (poster by Björn Stensen, SMHI)
- SPPT
Common HarmonEPS setup

- MetCoOp domain
- Harmonie-h1.1.beta.5
- 00:00 20 July 2015 - 06:00 10 August 2015
- 1 control + 8 perturbed members (all Arome)
- 3DVAR for control - conventional observations only
- Surface assimilation for all members
- 3-hour cycling for control
- 6-hour cycling for perturbed members
- 1 long-run to 36 hours each day for 06 cycle
First Experiments

- **SLAF_MetCoOp**
  - ICs + LBCs from weighted time lagged IFS HiRes taken from MARS.

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<th>0</th>
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- **ECLBC_MetCoOp**
  - ICs + LBCs from control + members 1-8 of IFS-ENS.
BUT….

- SLAF perturbations do not appear to be consistent between members
- Rescale SLAFK: SLAF_rescale

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- IFS-ENS perturbations smaller than those from SLAF
- Inflate ECLBC_SLAF perturbations by a factor of 1.4: ECLBC_K14_MetCoOp
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Individual members cluster together depending on the sign of the perturbation…

This is undesireable…
- leads to “gaps” in the ensemble forecast between clusters of members,
- in a stochastic system, individual members should have similar statistical properties.
6h SLAF perturbations

• Instead of computing perturbations relative to current analysis time, compute from differences relative to consecutive forecasts:

\[ Y_{T+0} = x_{T+0} \pm k( (X-HH)_i^{T+HH(i)} - (X-HH_{(i+1)})^{T+HH(i+1)} ) \]

SLAF_6hpert
Summary

• SLAF gives superior verification scores
  - Requires both rescaling and using consecutive forecasts to compute perturbations

• Inflation of IFS-ENS LBCs improves spread with no adverse effects on skill.

• Open questions
  - Will member selection improve IFS-ENS IC + LBC perturbation scores?
  - How do SLAF and EPS boundary perturbation methods compare for individual forecasts, especially for extreme events?
  - Is better performance of SLAF simply due to resolution of boundary data?