SLAF implementation in HarmonEPS: First results

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Introduction

SLAF – Scaled Lagged Average Forecast

- Perturbations at boundaries is one main issue of LAM ensembles.
- Not many different methods have been examined in the literature.
- Due to small domains the influence of boundaries in mesoscale LAMs (and mesoscale LAM EPS) is moving quickly to the interest area of the domain.
- Downscaling lower resolution global ensembles is the most common method used.
Downscaling global EPS

- Global EPS don’t have spread enough in the short term.
- Lot of communication to get full model level data from the global EPS at home.
- Long delay to wait for Global EPS available for BCs.
Cheap method based in the deterministic global model.

Good representation of the errors of the day based in deviations of past operational runs.

Very few communication to get full model level data from the global deterministic model at home.

Less delay to wait for BCs (better availability).

Good possibility of several different global models for BCs (multiboundaries).
SLAF II

\[ SLAF = FC_{REF} \pm \sum_{HH} K_{HH} \cdot ( FC_{REF} - FC_{HH} ), \quad K_{HH} = \text{ctes} \]

- Testing different delays:
  - FCHH from 06, 12, 18, and 24
  - FCHH from 12, 24, 36, and 48

- Testing different values of K:
  - 0.25, 0.50, 0.75, and 1.00
  - 1.75, 1.50, 1.25, and 1.00
  - 1.50, 1.00, 0.75, and 0.50

- Tests Periods (Martin Leutbecher):
  - 2011102312 - 2011110718 — FCINT = 6 / LL = 36
  - 2012061000 - 2012062818 — FCINT = 6 / LL = 36

- Comparison with downscaling ECMWF EPS
Experiments

- Good implementation in HarmonEPS (thanks to Ulf)
- Domain IBERIA_2.5 - Physics AROME - 9 members (8 + control)
- Pure downscaling: ANAATMO=none - ANASURF=none

Experiments:

- **H2538H11** – Downscaling High Resolution ECMWF EPS (Det. Model resolution)
- **L2538H11** – Downscaling Low Resolution ECMWF EPS (Opr EPS resolution)
- **S2538H11** –
  - 'SLAFLAG' => [ 0, 6, 6, 12, 12, 18, 18, 24, 24],
  - 'SLAFK'  => ['0.0','0.25','-0.25','0.50','-0.50','0.75','-0.75','1.0','-1.0'],
- **S3538H11** -
  - 'SLAFLAG' => [ 0, 6, 6, 12, 12, 18, 18, 24, 24],
  - 'SLAFK'  => ['0.0','1.75','-1.75','1.50','-1.50','1.25','-1.25','1.0','-1.0'],
- **S4828H11** –
  - 'SLAFLAG' => [ 0, 12, 12, 24, 24, 36, 36, 48, 48],
  - 'SLAFK'  => ['0.0','1.5','-1.5','1.0','-1.0','0.75','-0.75','0.5','-0.5'],
Exercise goals

- Objective verification against observations:
  - To show the skill of the different members of each ensemble.
  - To compare with the skill of the downscaling ensembles.
    - Bias and RMSE surface and upper air

- Probabilistic verification against observations:
  - Rank Histograms.
  - Spread-skill of the ensemble.
  - Reliability diagrams.
Results Det - GPROF
Results Det – MSLP
Results Det – U10m

Selection: All using 160 stations
01:00h Period: 2011/02/29-2012/02/28
Hours: [00, 06, 12, 18]

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L25

H25

S35
Results Prob – Rank

Rank histogram: AccPcp12h
Lead Time: 36 hours
Verification Period: 2011102300-2011110718
Results Prob – Spread/Skill Upper Air
H+24

vertical profile
2011-10-23 / 2011-11-07 12:00 UTC
STEP=24h
NOBS=6

H+24

S25  S35  S48
Results Prob – Spread/Skill Upper Air
H+24
Results Prob – Brier Skill Score / Reliability – S10m
Results Prob – Spread/Skill – Surface - H+36 – Spring period
Results Prob – Canary or ALARO Physics

Spread & Skill (RMSE): Pmsl
Verification Period: 201102300-2011110718

Spread & Skill (RMSE): T2m
Verification Period: 201102300-2011110718

Reliability: S10m
Threshold: 5 m/s
Lead Time: 0 hours
Verification Period: 201102300-2011110718

Brier Skill Score: S10m
Verification Period: 201102300-2011110718
Conclusions

- SLAF is a technically cheap tool to generate perturbations at the boundaries for a LAM EPS.
- It simulates the errors of the day through the deviations of former runs of the deterministic numerical model.
- It has the advantage to get the highest possible resolution for boundaries.
- It can be mixed easily with different global models to make the EPS multiboundaries.
- The different members have a similar deterministic skill.
- Comparing with downscaling ECMWF EPS, at resolutions operational and deterministic, SLAF gives better probabilistic verification scores at surface and upper air.