First test with HarmonEPS in Multi-Physics Mode

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Background

- Later this year there will be collaboration with the ALADIN-LAEF team regarding multi-physics.
- Goal to implement multi-physics in HarmonEPS for AROME/ALARO-members.
- First test to get experience and to run HarmonEPS with different physic settings.

Experiment setup

- Version: Harmonie-40h1.1.beta.5.
- Domain: MetCoOp.
- $1 + 8$ members with different physics.
- Time period: 20150720-20150810.
- 6h assimilation.
- SLAF experiment as reference experiment.
- From reference experiment we create different physics for each member.
- SLAFLAG= $[0, 6, 6, 12, 12, 18, 18, 24, 24]$
- SLAFK = $[0.0, 1.75, -1.75, 1.5, -1.5, 1.25, -1.25, 1.0, -1.0]$
- 3DVar on Control. Surface assimilation on all members.

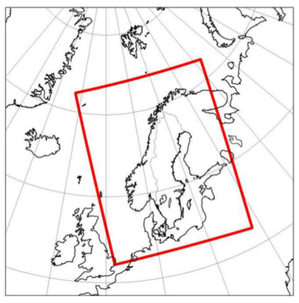

Figure 1: MetCoOp-domain used in the experiment.

Physic settings for each member

The different physic settings were chosen in order to try out schemes from different areas in the physics.
Mbr000: Arome ref.
Mbr001: $HARATU = TRUE$. Turbulence scheme based on the scheme in the RACMO model. (new mixing length, new stability functions)
Mbr002: $LOCND2 = FALSE$. Switch off microhysics option for separate ice-phase representation (Ivarsson, 2010).
Mbr003: $EDMF(CMF\_CLOUD = DIRE) + HTURBLEN = DEAR$. "Direct" cloud scheme coupled to the mass-flux in EDMF (instead of the "statistical" cloud scheme), and alternative mixing length in the CBR scheme (Deardorff (1977).
Mbr004: $EDKF(CMF\_UPDRAFT =' RAHA')$. Eddy diffusion mass-flux scheme with (Rio et al. 2008 and 2010) mass-flux formulation. ("Direct" cloud scheme)
Mbr005: $EDKF$. Eddy diffusion mass-flux scheme with (Kain-Fritsch) mass-flux formulation. ("Direct" cloud scheme)
Mbr006: $ACRANEB2$. ACRANEB2 radiation scheme in AROME.
Mbr007: $LGRSN = TRUE + LLCRIT = TRUE$. Convert graupel to snow more efficently in microphysics scheme, and more efficient precipitation from shallow convective cumulus in cold conditions.
Mbr008: $LOCND2 = FALSE + HARATU = TRUE$.

Deterministic verification

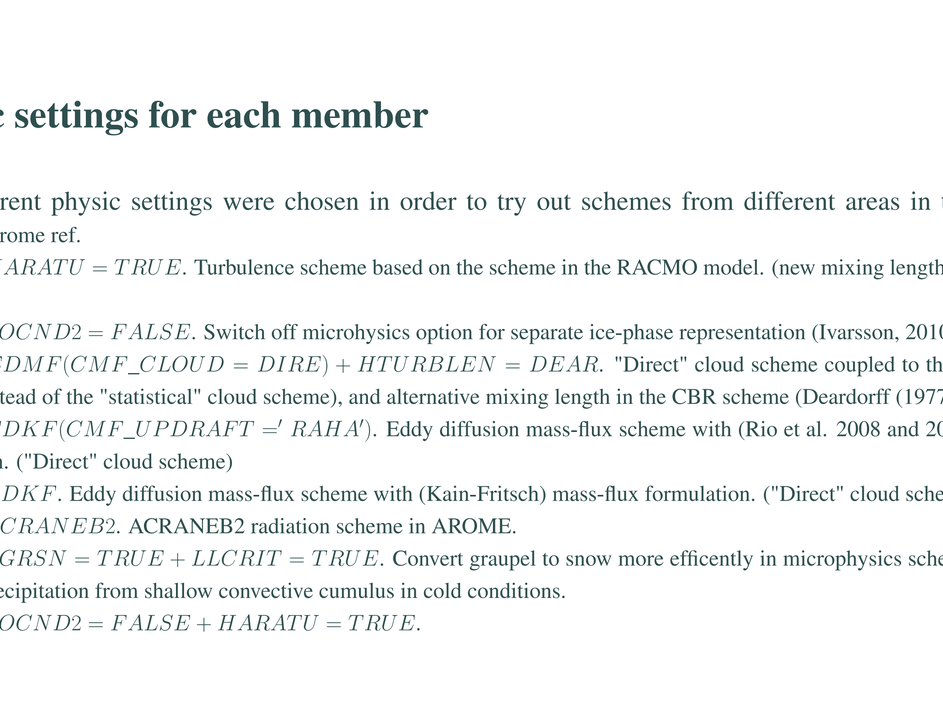

Figure 2: Deterministic scores from the experiment. Parameters are T2m, Pcp, MSLP and S10m. One can see a clustering of the members. AROME reference clearly the best member as one would expect. Mbr003 outlier in the S10m-figure.

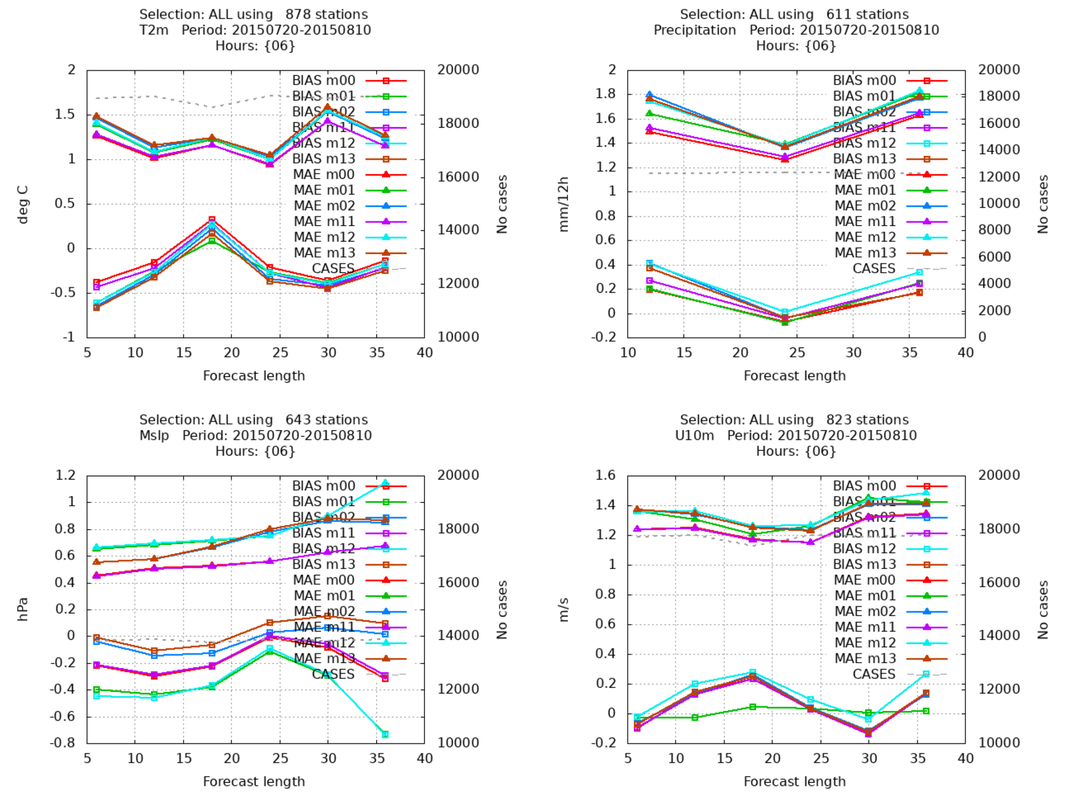

Figure 3: Deterministic scores from the multiphysics experiment **and** the SLAF reference experiment in the same plot. Parameters are T2m, Pcp, MSLP and S10m. First $1 + 2$ members are showed. No big difference between members from the two experiments.

Probabilistic verification

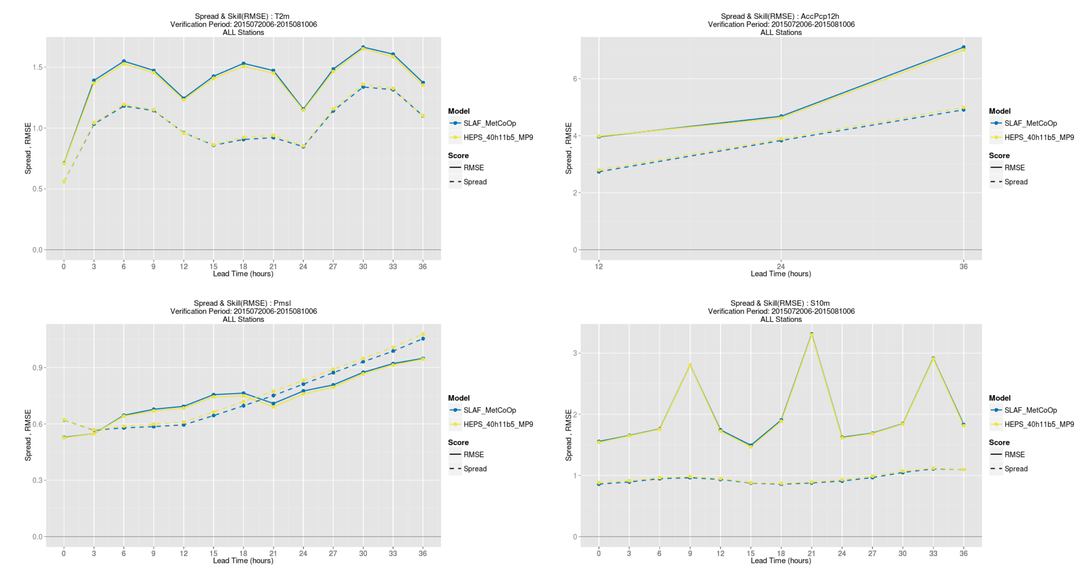

Figure 4: Spread/skill scores. Parameters are T2m, AccPcp12h, MSLP and S10m. Small difference between the experiments.

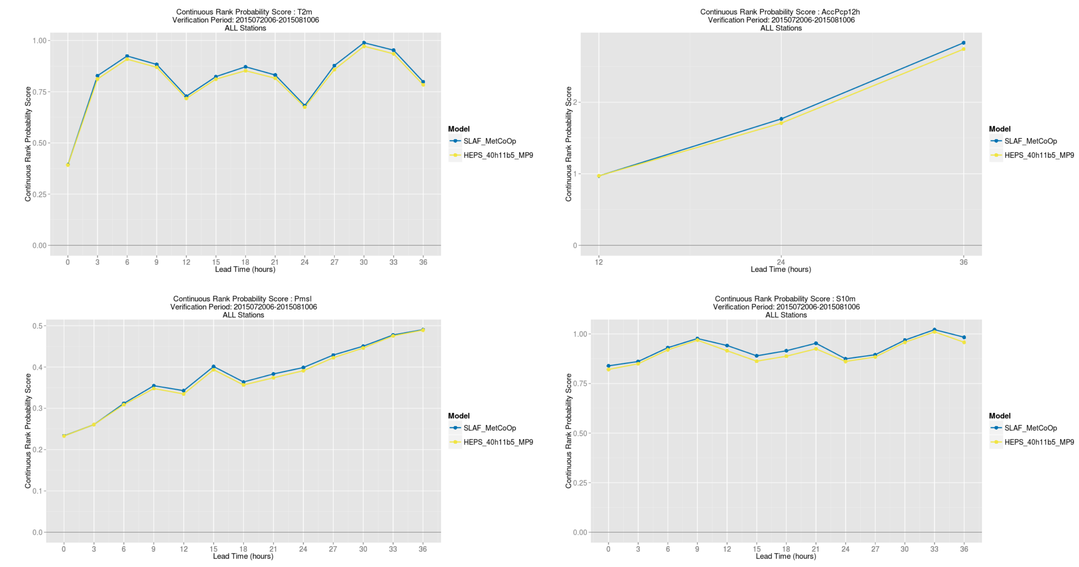

Figure 5: Continuos Rank Probability Score. Parameters are T2m, AccPcp12h, MSLP and S10m. Small difference between the experiments.

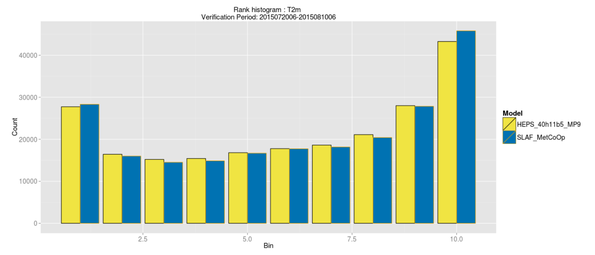

Figure 6: Rank histogram shows the under-dispersive pattern for both experiments.

Conclusions

- AROME reference (mbr000) best in the deterministic scores.
- Clustering of members in the deterministic plots.
- Slightly better scores for multi-physics in the probabilistic scores but no big impact.
- Outliers in the deterministic scores affect probabilistic scores?
- How large is the effect of the physic settings?

Forthcoming Research

Later this year in collaboration with the ALADIN-LAEF team implement more sophisticated multi-physics in HarmonEPS for AROME/ALARO-members.

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