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.
- 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.

SLAF experiment:

- SLAF: [0, 6, 6, 12, 12, 18, 18, 24, 24]
- SLAF-Flag: [0.0, 1.5, -1.25, 1.5, -1.25, -1.25, 1.0, -1.0]
- 3DVar on Control. Surface assimilation on all members.

Probabilistic verification

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

Physic settings for each member

The different physic settings were chosen in order to try out schemes from different areas in the physics.

- Mbr001: Arome ref.  
  Mbr002: LOCND = TRUE. Turbulence scheme based on the scheme in the RACMO model. (new mixing length, new stability functions)
  Mbr003: LOCND = FALSE. Switch off microphysics option for separate ice-phase representation (Ivarsson, 2010)
  Mbr004: EDKF. Eddy diffusion mass-flux scheme with (Kain-Fritsch) mass-flux formulation. ("Direct" cloud scheme)
  Mbr005: EDKF. Eddy diffusion mass-flux scheme with (Kain-Fritsch) mass-flux formulation. ("Direct" cloud scheme)
  Mbr006: EDKF. Eddy diffusion mass-flux scheme with (Kain-Fritsch) mass-flux formulation. ("Direct" cloud scheme)
  Mbr007: ACRANEB. ACRANEB radiation scheme in AROME.
  Mbr008: DEAR. Eddy diffusion mass-flux scheme in the CBR scheme (Deardorff (1977)).
  Mbr009: UPDRAFT. "Direct" cloud scheme coupled to the mass-flux in EDM (instead of the "natural" cloud scheme), and alternative mixing length in the CBR scheme (Deardorff (1977)).
  Mbr010: TRUE. Current approach to snow more efficiently in microphysics scheme, and more efficient precipitation from shallow convective cumulus in cold conditions.
  Mbr011: HARATU. "Direct" cloud scheme coupled to the mass-flux in EDM (instead of the "natural" cloud scheme), and alternative mixing length in the CBR scheme (Deardorff (1977)).
  Mbr012: TRUE. Current approach to snow more efficiently in microphysics scheme, and more efficient precipitation from shallow convective cumulus in cold conditions.

Deterministic verification

- 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.

Conclusions

- AROME reference (mbr000) best in the deterministic scores.
- 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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Figure 1: MetCoOp-domain used in the experiment.

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.

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

Figure 5: Continuous 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.