



DWD plans on COSMO-DE-EPS

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Long-term goal

- Unified ensemble data assimilation and prediction system
 - Consistent methods in assimilation and forecast mode
 - Use of LETKF IC perturbation
 - Use of ICON EPS boundary data
 - Physics perturbations that optimally describe model uncertainty from 0 to hh_end hours (fixed and/or stochastic PP)

- Challenges / Questions
 - Does a unified approach work satisfactorily in ass and fc mode?
 - What are the optimal methods/configuration of the respective perturbation approaches?
 - How to proceed with the development of COSMO-DE-EPS?



Current state

- Operational COSMO-DE-EPS
 - Pragmatic approaches for IC and physics perturbations, multi-model BC-EPS
 - Already pretty good quality regarding summery precipitation forecasts. Problems with air mass convection, inconsistency between successive runs
 - Weaknesses in t2m, cloud cover, and wind forecasts (under-dispersiveness, systematic errors, -..)
 - Work in progress to improve the system





Short term goals (2012/2013)

- Extension up to 40 members (use of COSMO LEPS BC)
- Extension / revision of physics perturbation setup (fixed PP)
- Revision of the multi model IC perturbation method
- Calibration of products
- Generation of products based on COSMO-DE-EPS LAF





Accompanying projects (2012-2016)

- SESAR: superensemble mesoscale forecast of convection (DWD, MF, UKMetoff)
- EWELINE & ORKA: Improvement of wind and photovoltaic power forecasts with deterministic and probabilistic forecast systems
- SFP: Stochastic physics (physics section)
- EMF: Calibration of EPS forecasts (Uni Heidelberg, Uni Bonn)
- HERZ: Ensemble data assimilation (Uni München) (DA section)





How to proceed to include alternative approaches for IC, BC, PP in COSMO-DE-EPS?

- Revision of IC, BC Ph perturbation methods in a **step by step process**.
- COSMO-DE-EPS to be used as benchmark!
- Each step to replace a perturbation method includes
 - Implementation of the method. Adaptations of scripts for providing the data needed. Preparing tools for evaluation using feedback files, ..
 - Running ensemble forecast experiments for at least 2 month for summer and winter period, 00 and 12 UTC runs
 - Evaluation of forecast quality by deterministic and probabilistic verification.
 - Surface weather parameters: precip. T2m, wind 10m, (cloud cover)
 - Boundary layer profiles of wind , temp, hum, .. (with view to energy projects)
 - Some upper level model variables



Medium term objectives

Step 1: Use of LETKF for COSMO-DE-EPS

Start: ~Q3 2013. As soon as a reasonably consolidated LETKF is ready to run continuously in an experimental data assimilation

Comparison LETKF IC vs. multi model IC perturbation (ope IC)

- a. Test IC perturbation only**, no BCP, no PP, no LHN
40 member LETKF IC vs. 8 member multi model IC
Evaluation: spatial scale of perturbation, perturbation growth, spread skill relations, ...
- b. If necessary:** test inflated LETKF ICP and/or combination of LETKF and multi model ICP
- c. Test IC + BC + Ph perturbations**
40 LETKF IC + BC (BC-EPS) +PP (ope) vs. ope 40 mem COSMO-DE-EPS

Goal: LETKF for COSMO-DE-EPS operational Q.4 2015:

Step 2: BC perturbation

Test single model BC vs. multi model BC

- a. **BC perturbations only.** BC (GME-EPS, later ICON-EPS) vs. multi-model BC-EPS
- b. **ICP + BCP + (PP)**
40 mem LETKF IC + BC (GME/ICON-EPS) (+ PP_ope) vs.
40 mem LETKF IC + BC-EPS + (PP_ope)

(in cooperation with ORKA project (similar objectives))

Step 3: Physics perturbation

Develop and test different Ph perturbation setups

- a) PP only, no ICP, no BCP
PP as in EDA vs. fixed PP (ope setup)
 - b) combination of both PP setups
 - c) Test updated PP together with ICP and BCP
 - d) Use of stochastic physics approaches;
development and testing of new methods suitable
for convection permitting models
- in cooperation
with EWELINE
und ORKA
- in cooperation with
SFP „stochastic
physics“

Other COSMO-DE model improvements

- Ongoing model improvements (physics, dynamics)
 - Increased number of vertical levels
 - Enlarged model domain
 - Smaller mesh size
 - Extended lead time
 - ...
- } With next HPC
in 2014/2015
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- **Basic idea:** keep COSMO-DE-EPS as close as possible to the deterministic model in order to maintain fully comparable deterministic and probabilistic forecast systems



Cooperation in COSMO

- Cooperation within COSMO worthwhile and helpful in all steps
- Development of stochastic physics schemes seems to be very complex and could be most important in EDA and forecast mode.
Maybe the most suitable subject for a new COSMO PP

