CALMO-MAX Meeting, HNMS, Athens, 8-10th January 2018

Monday, 8th

Attendees: Jean-Marie Bettems (JB)-MCH, Euripides Avgoustoglou (EA)-HNMS, Antigoni Voudouri (AV)-HNMS, Eduardo Bucchignani (EB)-CIRA, Omar Bellprat (OB)-ETHZ, Yoav Levi (YL)-IMS

General remarks

JB:
CALMO-MAX needs to convince the COSMO consortium and scientific community that the methodology is truly leading to an improvement of the forecast quality. Current results demonstrate that the methodology is working but a clear evidence for forecast improvement is missing.

EA:
A 2nd publication is under review. An additional sensitivity study using COSMO with 7km resolution and 11 parameters for 60 days has been performed.

AV:
Cost of the calibration methodology is currently the largest problem a strategy to reduce the costs of the methodology has to be developed.

OB:
Systematic knowledge about unconfined model parameters and their possible ranges is missing. A change in model development process should be proposed to document key tuning parameters and relevant uncertainty range.

OB:
GitHub repository with MM is now public.

Introduction to CALMO-MAX [AV]

- Current resources 400'000 GPU Hs for one year allocation period (end of September 2018).
- Calibration done at 1km MCH domain with spin-up (3yrs) TERRA simulation
- MCH runs soil freely, IMS uses analysis for ICON in the operational forecasts
- 7 parameters selected
- Different considerations about interaction terms for fitting MM
- Dissemination of information is fundamental for the projects both through TR and manuscripts submitted to peer review journals.

Listed tasks on CALMO-MAX page [JB]

- List of scientific questions in available on: http://www.cosmo-model.org/content/tasks/priorityProjects/calmoMax/default.htm
- Last part of the project to work on extreme events and special situations and different domains.

Update on performance and meta model [YL]

- Some of the parameters are **sensitive for CH but not Israel**: e.g. v0snow
- Sensitivity of optimal parameter have a strong **annual cycle**
- **Independent validation** of the optimal parameter set (different year) important
- Noise of monthly values an issue, **bootstrapping** of solution could give an estimation of model internal variability
- Avoid using cases during calibration where large discrepancies between model and observations exist (e.g. stratus clouds that strongly influence 2m temperature not forecasted by the model).
- Minimal number of simulation ([2N+N(N-1)/2])+ 1 for N parameters is sufficient: Additional interaction simulations do not impact the calibration result dramatically.
- Optimal model parameters depends on the **weather type.** IMS used different parameter settings and even different model versions depending on the synoptic situation for their operational model. This may lead to problems for forecasters.
- If soil memory is of no concern, running selected cases instead of a full year could be a good compromise to lower computer resources needed.

Update calibration done at ETH [OB]

- New calibration on COSMO-CLM5 using new ground water scheme (L. Schlemmer)
- Ground water scheme has large impact on European winter and summer climate
- Use of GPU version which allows to extend calibration runs, from 5-10 years
- New validation using top-of-the-atmosphere (TOA) fluxes instead of total cloud cover
- Developments of meta model planned to improve signal-to-noise ratio
- Meta-model code being merged now and made public to everyone so it can used for other models as well

Short summary on paper from Bejing collegues [JB]

A paper in BAMS has been published by Duan et al. (2017) which shows the benefits of parameter tuning on NWP over China. Same methodology is applied and very large improvements (30%). Good news for CALMO, however, analysis is focused on a specific type of event and using un-tuned WRF

Update from activities at CIRA [EB]

- High precipitation event during the beginning of November analysed over Italy using also RTTOV based validation in a 1 km COSMO.
- Optimal parameter values used from CALMO. Then different tests with min/max values of tkhmin and rlam_heat are done.
- CIRA will continue min/max simulations using all 5 parameters selected within CALMO-MAX, follow the methodology, provide output data to IMS for fitting the MM.

- The work will also be repeated for a non-extreme case.

Tuesday, 9th

Improvements in the experiment design [EA]

- Define a priority order of experiments to reduce computational costs
- Rank different model variables according to importance
- Carry out min and max simulation for each parameter
- Make a ranking for each variable and each parameter pair comparing the sensitivities with respect to default values. Proposed to check priorities for finding interaction terms to fit the MM.

Discussion on the experimental design: Decision has been taken to use only one interaction term for fitting the MM, to reduce the calibration cost. First the min/max values are simulated and the MM fitted without interaction terms to make a first guess. Next the interaction point closest to the first guess is simulated to sample the point closest to the likely optimum.

Proposed developments of MM [JB]

- Make a perturbed initial condition run to estimate the internal variability of the model to cope with the noise : screen out cases in the calibration where internal model variability is larger that parameter dependency.
- No seasonal dependency for the weight used in performance function will be considered: the calibration should be valid for different NWP applications.
- How to avoid spotty convection (has been observed in calibrated COSMO-2)? Include spatial verification (FSS)
- Consider diurnal convection cycle. Validate precipitation on a 6-hourly basis.
- Use radar composites? Would be demanding and slowing the development of the project too much at this stage.
- Considering surface humidity would allow to reduce the risk of over fitting the temperature. Gridded analysis is available from INCA nowcasting data and will be provided
- Include sunshine duration in the validation using Frei et al. (2015) km-scale gridded dataset.

Find a way to optimize the computational cost of the method [ALL]

- Run a default simulation on a smaller (1/2) domain and high resolution to evaluate the feasibility of calibrating on a smaller domain.
- Run a default simulation with coarser resolution (2-km) to evaluate the feasibility of calibrating with different resolution.
- Calibration based on hindcasts instead of regular forecasts, performance gain 2-3x.

Additional decision
- Translate MM code to Octave to be compatible with ECMWF platform.

Wednesday, 10th

Attendees: Flora Gofa (FG) and Dimitra Boucouvala (DB)

Discussion with WG5

- Asked feedback on performance score used for the calibration.
- Feedback requested also on the verification of the optimal parameters

FG:
Suggested possible use of the ECMWF scores, or of the HIRLAM score.
Other possibility would be follow NWP guidelines or use common plots and VERSUS

Decision to use verification tools of MCH and selected test cases with the optimum sets for COSMO-1 in the framework of CALMO-MAX