## Draft minutes of the COSMO GM CALMOMAX session, 03 September 2020 (8:45 – 17:30 UTC), videoconference

Participants: Jean-Marie Bettems (JMB), Antigoni Voudouri (AV), Euripides Avgoustoglou (EA), Eduoardo Bucchignani (EB), Izthak Carmona (IC), Yoav Levi (YL), Linda Schlemmer (LS), Jurgen Helmert (JH), Inna Rozinkina (IR)

Chair:Jean Marie BettemsInvited:Silje Soerland (SS), ETHZMinutes:Antigoni Voudouri

#### 1. Opening, agenda, minutes

JMB welcomed participants and presented the agenda. The main topics of the session were the progress of CALMO-MAX, collaboration with ETHZ on their new calibration project and preparation of a CALMO based follow-up PP.

#### 2. Presentations

AV summarized the status of work, including verification of calibration over the Swiss domain. Main findings are (a) a small improvement of the diurnal cycle of 2m temperature even for a well-tuned configuration as the one of MeteoSwiss, (b) variation of the optimum parameters on the time of the year and (c) the fact that these parameter fluctuations might reflect the dependency on the atmospheric flow or weather patterns. AV concluded that it is clear that the method is model independent, it can be applied to any NWP and suggested that the knowledge gained should be transferred for the calibration of ICON.

IC presented the progress on the meta-model (MM). The work is currently focused on minimizing the computational resources needed for the MM, mainly when calibrating a fine resolution model (COSMO-1) over a large domain. The methodologies tested for extracting yearly optimum where (a) dividing 365 days in 10 days intervals (decades) and extract the yearly optimum from the median of 36 decades (b) perform a cluster analysis (using 20 members) and calculate the optimum using corresponding (according to the number of days) weight to each member and (c) reducing the number of grid points (up to 80%) using selected ones where all observational data are available. The yearly optimum calculated using the different approaches does not coincide and needs to be further investigated. IC also informed that the MM code is translated in Octave and is available at ECMWF machines.

EA presented his work over the Mediterranean Sea Region. More specifically simulations have been performed over an extended domain covering eastern Mediterranean for five parameters (tkhmin/tkmmin, rat\_sea, c\_soil, rlam\_heat and tur\_len). Additional sensitivity tests to select the interaction terms have also been finalised. All simulations performed using HNMS computer resources at ECMWF. Model outputs are stored and available at ECMWF to be used for the calibration.

EB presented additional work performed within this COSMO year using COSMO-1, however due to lack of human resources calibration is still pending.

SS provided an overview of the calibration procedure taking place at ETHZ. The MM code developed by the group is available in <u>https://github.com/C2SM-RCM</u>. SS presented the new trCLIM project funded by SNF. The GPU-version of COSMO model will be used. Main tasks of the project include: (a) identification of the most sensitive semi-empirical parameters in a CRM modelling configuration over the subtropical and tropical Atlantic (b) investigate the extent in which the objective calibration method is sensitive to vertical and horizontal resolution and the definition of the performance score and (c) dependence of the tropical climate-change response upon the model parameter configurations.

Finally AV informed that currently there are no new developments on the MM from the group of Andreas Will (BTU Cottbus). They have started sensitivity experiments, on parameters of the turbulence parameterization, over the alpine and Brandesburg area using COSMO-1.

### 3. Discussion

LS commented on the stability of the optimum and suggested that the problem is associated with the incremental computation of the optimum. For example, in cases whether the convective scheme is not active the parameter associated with the scheme can have any value as it has no effect on the calibration. Thus, it is possible, a posteriori aggregation (within the 10-days interval) to be corrupted by this arbitrary value.

AV mentioned that the optimum instability might indicate that the parametrization scheme is not robust as it depends on the resolution and weather pattern.

JMB pointed out the need of having a well-documented list of the parameter values induced in parameterization schemes. LS also agreed on the importance of having a such a list of model parameters. LS has provided a preliminary list of the unconfined parameters included in ICON to CALMO team.

AV asked SS whether large monthly variations as the ones calculated during COSMO-1 calibration over MeteoSwiss domain have also be seen in the RCM calibration. SS responded that this check has not been done. The possibility to clarify whether this large flow dependency is also valid for ETH has been proposed by AV. SS replied that this could be included in the tasks of the Phd student working for trCliM

JMB asked to summarize the work pending for C-MAX by the end of the year from the groups of IMS and HNMS. It was agreed that HNMS will provide observations needed for selected stations over Greece and IMS will proceed with the calibration. Once optimum parameters are available verification of results for an independent year will be performed by HNMS. In addition, EB will work on the MM and proceed with the calibration using performed simulations using COSMO-1 over Italy. The public repository on Github of the MM is still missing and needs to be finalized. Final report has also to be provided by AV. In case of positive results, a manuscript on calibration over the Mediterranean will be written by CALMO team and submitted at a peer reviewed journal.

The submission of a follow-up proposal has also been discussed. All CALMO team members agreed that the knowledge gained should be consolidated and used within the consortium and in coordination with ETH. Possible tasks for the new project

include (a) the documentation of unconfined sensitive parameters in models used by the members of the consortium (COSMO and ICON) in terms of meaning, default value (proposed by model developer) and physical range (b) analyse and merge MM code used by CALMO team in NWP and ETH in RCM and provide a comprehensive user guide (c) define and implement a modular code structure, to properly separate observation import and processing, model import and processing, definition as well as MM fit, (d) consider open issues like screening of bad observations, strong flow dependency of optimum (e) work with other groups (BTU) on improving convergence aspects and (f) further investigate the stability issues of optimum parameter value. ...

# 4. Next PP meeting

The next teleconferences for the PP will be scheduled by JMB. Main topic of the meeting will be the coordination of the CALMO-MAX group work with the group of Christoph Schaer (ETH with 2 Phd students) working on their new project trCLiM. Main topics of the meeting will be the consolidation of the MM code, discuss on the possibility to get resources from C2SM (at least for code maintenance) and organize a hackaton to work on code consolidation (1 week).

### Any other business

Consider funding proposal for a project hosted at Cottbus (convergence aspects)

# 5. Closing the meeting

AV thanked all participants for their contributions and closed the meeting.