COSMO Priority Project CALMO-MAX:
CALMO Methodology Applied on eXtremes
Proposed Project Extension

Version 1, 17.06.2020

Project leader:	**A. Voudouri / HNMS**
Project extension:	**09.2020 – 12.2020**
Project resources:	**0.25 additional FTEs**

Contributing scientists:

Core tasks

A. Voudouri / HNMS	**2020: 0.1 FTE**
E. Avgoustoglou / HNMS	**2020: 0.1 FTE**
I. Carmona / IMS	**2020: 0.05 FTE**
E.Bucchignani–P. Mercogliano / CIRA	**2020:0 FTE**

Consulting

Y. Levi / IMS	**2020: 0 FTE**
JM. Bettems / MeteoSwiss	**2020: 0 FTE**

Additional support from University of Cottbus (Andreas Will) will be provided.

Rationale

The unprecedented conditions due to COVID-19 have caused delays that affected deliverables of CALMO-MAX. Although a considerable amount of effort has been devoted by contributing scientists, communication difficulties influencing work flow were unavoidable. Therefore, a three months extension is proposed.
The proposed extension is mainly required to achieve CALMO-MAX goals associated with the implementation of the methodology over Mediterranean, validation of the calibration platform established at ECMWF and the consolidation of the methodology. Based on the knowledge available at HNMS and at IMS, a permanent support of a CALMO based calibration, for the COSMO community could be achieved. Steps towards this direction are already on going through the establishment of cooperation with the University of Cottbus and ETHZ.

There are no new tasks added, only minor modifications on ongoing tasks 3 and 4 that need to be completed, but it is also necessary to define future steps beyond the end of the project. Therefore, a small amount of 0.25 FTE's (already secured by IMS and HNMS) is requested for the extension project. Besides lower efficiency due to the COVID, the FTEs requested stand for additional administrative work and documentation (0.1), extra simulations over Mediterranean (0.1) and for porting the MM to Octave and on ECMWF machines (0.05).

Main deliverable

- Provide a computationally reasonably cheap objective calibration methodology that can complement expert tuning for the calibrating of the COSMO model.
- Provide a demonstration framework at ECMWF to apply this methodology.
- Provide the associated technical and scientific documentation.

- Establish and maintain a documentation procedure on model parameters including “useful hints"

Description of individual tasks

Some of the following tasks are already finished (green colour), thus no additional FTEs for 2020 are needed, some of them are ongoing and are expected to finish by the end of this COSMO year with the existing FTEs (orange colour), while tasks where additional FTEs are needed are highlighted (red colour).

Task 0: Administration and support-This task is ongoing

This administrative task is significant due to the distributed nature of the project team. The necessary effort to keep a good information flow between all participants (e.g. by organizing regular phone or web conferences and workshops) is included in this task. The existing mailing list of the CALMO project (see http://mail.cosmo-model.org/mailman/listinfo/calmo) is used in order to support communication and information exchange within project participants.

Deliverables:

(1) Project coordination and regular web conference organization.

Additional resources (FTE):

A.Voudouri / HNMS: 2020:0.02

Task 1: Consolidation of CALMO outcome-This task has finished

The goal of this task was to establish the framework for the tasks 2 to 4. It was constituted by two sub tasks (Review of CALMO methodology and Preparation of the technical infrastructure) already finished.

Task 2: Optimization of the CALMO methodology - This task is on going

The goal here is to find a compromise between the forecast quality improvement brought by the calibration method, and the computational cost of the method.

2.1: Calibration of COSMO-1 for a full year - This task has finished

This calibration of the five parameters has finished, verification of results has been analysed and a short summary is provided in COSMO Newsletter, no 20.

2.2: Find a way to optimize the computational cost of the method-This task is on going

This sub-task aims at evaluating different options to reduce the computational cost of the method, without significantly degrading the quality of the calibration. As the methodology was computationally expensive in the yearly calibration over a fine resolution it is currently applied over a different the target area of interest for coarser horizontal and vertical resolution. In addition due to the fact that the new area is mainly marine the history of the soil is not a dominant factor for the considered calibration. That restricts the weather sampling from a full year to a set of representative periods.

Deliverables:

(1) A strategy to define an optimal calibration process (document).

No additional resources (FTE):

Task 3: Establishment of a permanent CALMO platform-This task is on going

One important objective of this project is to provide a permanent infrastructure supporting the application of the calibration method, accessible to all COSMO members. Besides being used to run the calibration, this infrastructure could also serve as template for replication of the methodology on the user home HPC platform.

3.1: HPC framework-This task has finished

It was the aim of this sub-task to prepare a demonstrative technical framework. The installation of the latest version of COSMO model to perform simulations has finished and experimental tests are currently performed using HNMS available billing units.

3.2: Data thinning policy and applicationThis task has finished

3.3: Meta-model-This task is on going

The porting of MM to run on ECMWF machines requires additional effort than originally scheduled. This tasks aims on providing a unified, consolidated, portable (Octave instead of Matlab) and well documented (user guide) meta-model code, with the possibility to define any meaningful model performance score in an easy way. At the same time ideas and considerations about the optimization process of the MM code proposed at a BTU / Cottbus meeting beginning of 2020 will be tested.

3.4: Database of unconfined model parameters- This task is on going

Completion of this task requires an up-to-date and well-documented list of tunable model parameters, which supports a first screening of relevant parameters for the planned calibration.

3.5: Access to observations -This task has finished

Deliverables:

(1) An updated documentation of the tuning parameters in the COSMO model.

(2) A framework at ECMWF to apply the calibration methodology

(3) A protocol on model calibration.

Estimated resources (FTE):

E. Avgoustoglou / HNMS: 2020: 0.05

I. Carmona / IMS: 2020:0.025

Task 4: Adaptation of the methodology on Extremes - This task is on going

This task aims on applying the optimized calibration strategy developed in task 2 to tackle different open questions, using the platform prepared in task 3. In this process, different improvements of the meta-model will also be considered. This task will also serve as a demonstration vehicle on the application of CALMO methodology to ICON.

4.1: Support for extreme events - This task has finished

This sub-task is focused on preparing the necessary elements required for a calibration privileging extreme events. A set of specific dates has been selected, representing various weather types and model simulations have been performed.

4.2: Experiments using the meta-model (MM) This task is on going

This sub-task, deals with several open issues related to the MM, such as the use of sunshine duration, the definition of new regions etc. In addition, different global model performance scores will be evaluated, and the reliability of the meta-model will be evaluated. Further adjustments of the meta-model will be performed as necessary to consider extreme events.

4.3: Experimental set-up. This task has finished

The computation framework developed under task 3 is used as well as the latest version of the official COSMO code, namely COSMO 5.06

4.4: Compute experiments and analyse results-This task is on going

Although application of the calibration methodology over Mediterranean domain has started according to the PP, proposed changes in the parameters used for the calibration require additional simulation.

Additional Deliverables:

(1) An extended definition of the model performance score.

(2) An updated version of the meta-model.

(3) A scientific discussion of the results obtained.

Estimated resources (FTE):

A.Voudouri / HNMS: 2020:0.03

E. Avgoustoglou / HNMS: 2020:0.05

I.Carmona / IMS: 2020:0.025

Task 5: Documentation-This task is on going

The work performed within COSMO PPs has to be communicated, not only to COSMO members but also to the wider scientific community. A technical report has already been published (No 42) and a short summary on the performed work has been submitted to the forthcoming newsletter (no 20). The updated ‘cookbook’ to facilitate the usage of this method by other COSMO members and the final report proposed in the original project are pending, while in the extra time a peer reviewed manuscript will be prepared.

Additional Deliverables:

(1) Peer reviewed scientific papers.

Estimated resources (FTE):

A.Voudouri / HNMS:2020: 0.05

GANT Chart (09.2020 – 12.2020)

Task/Time	**9/20**	**12/20**
0		
1		
2		
3		
4		
5		