PT-AEVUS

Analysis and Evaluation of TERRA-URB scheme

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Introduction

Goal: Testing the implementation of the TERRA-URB scheme

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- CIRA - Italian Aerospace Research Center
- RHM - HydroMet Center of Russia
- ARPA Piemonte - Italy
- KU Leuven - Belgium

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Advising and collaborations:
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PT AEVUS – Sub tasks

Sub task 0: Debugging of the COSMO climate version COSMO5.0-CLM9 including TERRA-URB (NEW TASK)

Sub task 1: Selection of case studies
Different regions of Italy, Moscow (Russia), and urban areas of Belgium will be considered.

Sub task 2: Simulation set-up and runs.
After the installation of COSMO v5.6, a simulation setup must be provided

Sub task 3: Calibration of the TERRA-URB scheme
SURY needs several input urban parameter fields. For this reason, it is necessary to investigate the model sensitivity performing a series of experiments.

Sub task 4: Evaluation and verification of the case studies
The verification is the key point of the work.

Sub task 5: Writing of the final report
The results must be summarized in a document useful for all the scientists of the Consortium.

PT AEVUS – Sub tasks

Sub task 0: Debugging of the COSMO climate version

Currently, the only version of COSMO model that includes TERRA_URB is the climate one (COSMO5.0 - CLM9), which is affected by some minor bugs. Considering that the release of the COSMO version to be used in this PT is not scheduled before September 2017 (???), a debugging of COSMO-CLM+TERRA_URB will be performed in the frame of this sub-task. Additional details are reported in the next slides.
The main aim of this task is to speed up the work in view of the next COSMO-Model release.

Sub task 1: Selection of case studies

- Urban area of Turin. The days will be selected in recent summer and winter periods (2015 and 2016).
- Moscow (about 35 km diameter of urban landscapes) with 50-80 km surrounding rural region, selecting period for summer, winter and spring in 2016 and/or 2017.
- Urban areas of Belgium, selecting summer and winter periods (from 2012 onwards)

Deliverable: A document with a set of test cases.

PT AEVUS – Sub tasks

Sub task 2: Simulation set-up and runs.

Initial and boundary conditions are provided by the ECMWF IFS global model, at resolution of about 10 km.
It should be investigated the structure of the chain in case of very high resolution runs (IFS→ COSMO1 or IFS→ COSMO2→ COSMO1), the use of data assimilation cycle (yes or not), the domain of COSMO-1 (compromise between CPU needs and lack of interference at the borders), tuning parameters, etc.

Deliverable : A complete set of namelists required for the simulation.

Sub task 3: Calibration of the TERRA-URB scheme

SURY needs input urban parameter fields, which are currently set to default values and hard-coded. For this reason, it is necessary to investigate the model sensitivity performing a series of experiments. Parameters to be considered: Impervious Surface Area (ISA), the annual-mean Anthropogenic Heat Flux (AHF), Surface Albedo, Surface Heat Conductivity, Surface Heat Capacity…

Deliverable: A document with guidelines for the users on the optimized setup of the parameters inside the scheme.

PT AEVUS – Sub tasks

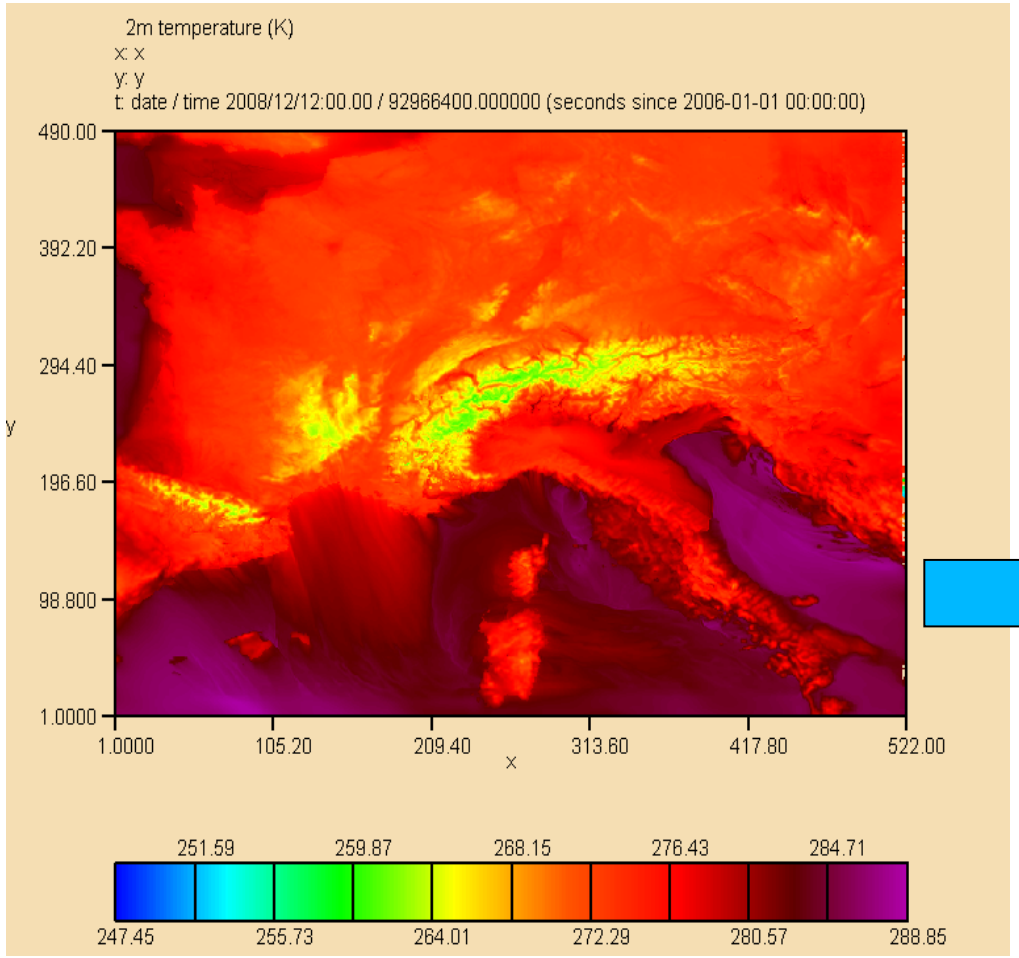
Sub task 4: Evaluation and verification of the case studies

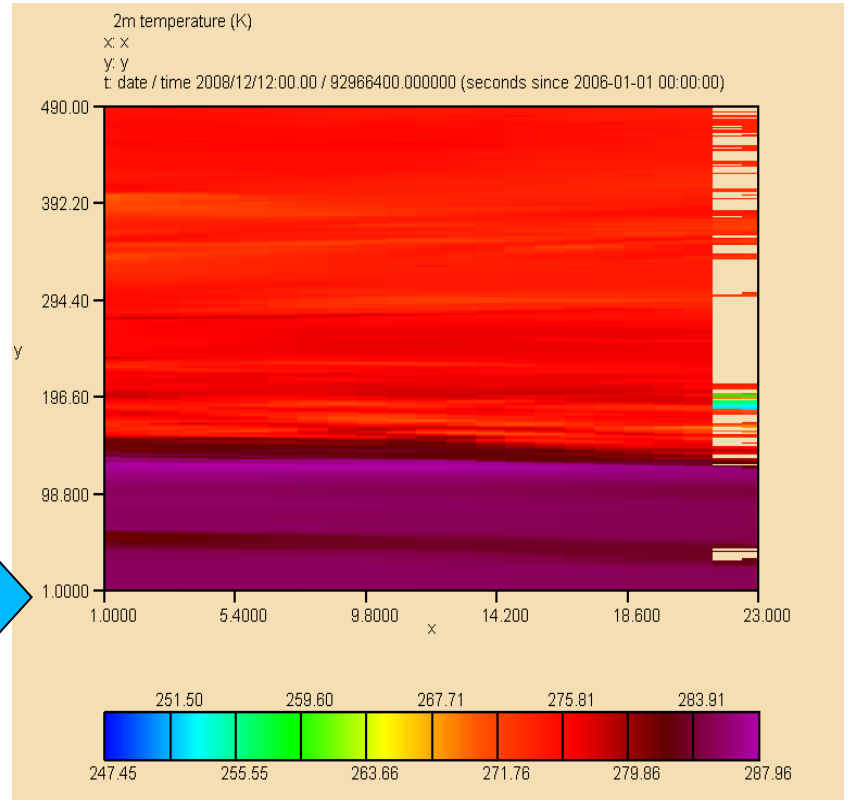
It is necessary to have a dense network of weather stations, to determine the performance of the model, both at the surface and in the atmosphere. The correct approach should be specified (which statistical index on which variable...). It would be also important to evaluate the behaviour of the heat fluxes, depending on the availability of the data. Moreover, some tests based profile measurements could be performed.

Deliverable: A reliable statistics on the behaviour of the model.

Sub task 5: Writing of the final report

PT AEVUS - Bug in TERRA-URB





This picture shows a T2m distribution obtained with COSMO-CLM including TERRA-URB over the Alpine space.
It is clearly evident that something wrong happens on the right boundary side (NaN). Problem of INT2LM ? It does not occur if TERRA_URB is switched off.

Gantt chart

	Time	09/17	10/17	11/17	12/17	01/18	02/18	03/18	04/18	05/18	06/18	07/18	08/18
Task													
0													
1													
2													
3													
4													
5													

Duration: 12 months
Start date: 09/2017
End date: 08/2018
A meeting is planned somewhere, somehow in … springtime

FTE summary

	Institution	CIRA	ARPA Piemonte	RHM	KU Leuven
Task					
0		0.01	0.01	xxx	0.03
1		0.01	0.01	0.06	0.01
2		0.1	0.1	0.07	0.04
3		0.2	0.01	0.1	0.05
4		0.05	0.1	0.1	0.04
5		0.03	0.02	0.02	0.01
Total FTEs		0.4	0.25	0.35	0.18

Total of : 1.00 FTE (COSMO) + 0.18 FTE (KU Leuven)

Thank you for your attention

Urban models in COSMO-CLM

Up to now, 3 urban land use parameterisations have been developed in COSMO-CLM:

CCLM-TEB: single layer urban canopy model

CCLM-DCEP: multilayer urban canopy model

CCLM-TERRA-URB: bulk parameterisation scheme with a prescribed anthropogenic heat flux.

The simple bulk-model CCLM-TERRA-URB parameterizes the effects of buildings on the air flow without resolving the energy budgets of the buildings themselves, but using the externally calculated anthropogenic heat flux (Q_F) The use of the previously estimated anthropogenic heat flux and modified thermal and radiative parameters provides the urban heat island with the correct diurnal phase. The magnitude of this flux can potentially be revised to fit the mean measured signal.

TERRA-URB uses a pre-calculated Q_F, which accounts for country-specific data of energy consumption, calculated based on the population density and the latitude dependent diurnal and seasonal distribution. Due to this simple representation of the urban land as a bulk, TERRA-URB is computationally inexpensive.

The latest version of TERRA-URB implements the Semi-empirical Urban canopy parameterization (SURY). It translates urban-canopy parameters (with 3D information) into bulk parameters.