

COSMO PP CITTA' ICCARUS meeting

Minutes

Date: 10 Mar. 2022

Place: Web conference

Participants: Jan-Peter Schulz (JPS, host), Paola Mercogliano (PM), Carmela Apreda (CA), Francesca Bassani (FB), Jean-Marie Bettems (JMB), Edoardo Bucchignani (EB), Angelo Campanale (AC), Davide Cinquegrana (DC), Carmine De Lucia (CDL), Giusy Fedele (GF), Valeria Garbero (VG), Witold Interewicz (WI), Amalia Iriza-Burca (AIB), Adam Jaczewski (AJ), Chiara Marsigli (CM), Massimo Milelli (MM), Stefan Poll (SP), Alfredo Reder (AR), Roland Wirth (RW)

Minutes: Jan-Peter Schulz with contributions from all presenters

Agenda:

1. Introduction
2. New urban external parameters in EXTPAR
3. Implementation of TERRA_URB in ICON
4. Miscellaneous

1. Introduction

JPS and PM gave an introduction to the meeting. The main goal is to coordinate the work in the different tasks, in particular between the responsible persons, respectively.

2. New urban external parameters in EXTPAR

CA presented the results of the survey on land cover datasets to derive Impervious Surface Area (ISA). The study carried out a desk review of land cover datasets that are selected for the comparison according to the classes provided: urban areas, Local Climate Zones (LCZs) and impervious coverage. The datasets with an urban field are based on artificial classes that also include green urban areas such as gardens and parks, and they are not suitable to derive ISA. The datasets included in the study are Global Artificial Impervious Areas (GAIA), Global Annual Urban Dynamics (GAUD), Imperviousness Density provided by the Copernicus Land Monitoring Service (CLMS-IMD) and ECOCLIMAP-SG. The datasets have different spatial and temporal resolution and coverage and are based on different classification schemes. GAIA and GAUD, both available at 30 m spatial resolution, are based on binary information, with zero equal to non-impervious and values greater than zero equal to impervious pixels. These datasets consider impervious pixels as 100% sealed surfaces. CLMS-IMD (10 m spatial resolution) include the estimates of impermeable cover of soil (soil sealing) which is mapped as the degree of imperviousness from 0% to 100%. ECOCLIMAP-SG (300 m spatial resolution) includes the 10 urban LCZs with all associated information on thermal properties, geometry

and coverage that may be adopted as external parameters. The datasets are compared as follows:

- C1) by considering their original spatial resolution to verify their ability in representing urban heterogeneity and the differences between land cover classes;
- C2) by adopting a 2-km grid to verify the differences between datasets in terms of ISA. In order to compare CLMS-IMD and ECOCLIMAP-SG on a common grid, a new classification for ISA is proposed (ISA high=0.8, ISA medium=0.6, ISA low=0.3) and a new value is associated with each class of these two datasets. The values of the 10 urban LCZs included in ECOCLIMAP-SG are reclassified as follows: classes 24, 25, 26, 30, 31 (LCZs 1, 2, 3, 7, 8) = ISA high; classes 27, 28, 29, 33 (LCZs 4, 5, 6, 10) = ISA medium; class 32 (LCZ 9) = ISA low.

For each dataset, the latest version available is considered. The preliminary results of the comparison C1) carried out for Barcelona, Budapest, Milan and Naples show that ECOCLIMAP-SG includes parks and green areas in the urban LCZs in all cases and they are mainly identified as LCZ 9 = sparsely built (class 32). The comparison C2) at 2 km highlights the similarity between GAUD and GAIA and between IMD and ECOCLIMAP-SG.

The preliminary results of the study show the relevance of ECOCLIMAP-SG for the aim of the project. It could be a good dataset to derive ISA because it is global, and it includes natural as well as urban land use classes. However, further analyses on other cities are required to verify that urban green areas are included in LCZ 9.

AJ presented the preparation of a new look-up table for the ECOCLIMAP-SG land use classes. The look-up table gives a value of all variables for every class, and in the next step, it will be implemented in appropriate parts of the EXTPAR and ICON codes. Besides the natural land cover, the ECOCLIMAP-SG dataset also consists of 10 urban classes (Local Climate Zones, LCZs). As the first step, the GlobCover2009 natural land use classes were reclassified to ECOCLIMAP-SG to feed the latter with existing values. A survey of existing data sources was made to update the values according to the current state of the art. One suggestion is to update rooting depth following the values from the recent SURFEX model. The values of new variables describing morphological and thermal variables for LCZ classes were reviewed. As a result, a preliminary table of the values for natural and urban classes has been elaborated. The final look-up table will be agreed upon and the codes will be adjusted in the next step.

Finally, FB presented a preliminary evaluation of the ECOCLIMAP-SG 2018 dataset. She compared it with the dataset of the Local Climate Zones (LCZs) provided in WUDAPT (Demuzere et al. 2019, 2020), which was a result of COSMO PT AEVUS2. Albeit the former has a coarser resolution (ECOCLIMAP-SG, 300 m) than the latter (WUDAPT, 100 m), it turned out that the ECOCLIMAP-SG data are detailed and precise over the city of Turin. Actually, while the WUDAPT classification identifies only 3 LCZ classes in the most urbanized area, namely LCZ 2, 5 and 8, ECOCLIMAP-SG captures much more land covers, which agree well with the reality (i.e., Google Satellite). In order to associate each LCZ derived from the ECOCLIMAP-SG dataset with AHF and ISA values, look-up tables will be adopted.

3. Implementation of TERRA_URB in ICON

JPS presented the initial release of TERRA_URB in ICON v.2.6.4. It includes new namelist switches and new fields for urban canopy parameters with harmonised nomenclature. As a first component of TERRA_URB, the modifications of heat capacity and thermal conductivity in TERRA were implemented.

The new implementation compiles successfully, and all buildbot tests on CPU and also GPU platforms were successful. First tests of the new implementation were carried out, and they look reasonable. The next step of the implementation of TERRA_URB in ICON will address the modifications in the turbulence scheme.

CDL presented the CMCC activities in Task 1 of PP CITTA'. They mainly focus on the implementation of the urban scheme TERRA_URB from the COSMO to the ICON (v.2.6.4) model together with JPS. The adopted methodology briefly consists in researching the involved fields in TERRA_URB, finding the correspondences between the routines of COSMO and ICON, declare, allocate and initialize the variables into the routines in ICON, and then compiling and testing.

By switching the parameter "lterra_urb" to true and then to false, some preliminary tests have been conducted after the modification at the routine "sfc_terra.f90". The simulations refer to one day (the 17 September 2021) and are forced by IFS analysis at 6hr. For testing purposes, the assumption to set the impervious surface parameter "fr_paved" equal to the urban land use class (n°19) of GlobCover2009 was used. The preliminary results show that slight differences in 2-m temperature (less than 1°C) occur around urban areas that are more pronounced at nighttime than daytime. Some unexpected increases of temperature also appear over the Adriatic Sea and coast. Deep investigations will be performed in order to understand if some unexpected increases have advective nature or could be explained as stochastic occurrence. Next steps to complete the porting would be addressed through the modification of turbulence schemes and radiative routines accounting for urban effects.

4. Miscellaneous

The next meetings of PP CITTA' are planned in June 2022 and at the COSMO General Meeting 2022.