

# MACCBET

## Modelling atmospheric composition and climate for the Belgian territory

DURATION OF THE PROJECT  
15/12/2010 - 31/03/2015

BUDGET  
1.199.817€

### KEYWORDS

Climate modelling, atmospheric modelling, air quality

### CONTEXT

The consortium brings together four institutes in Belgium where regional climate modeling is performed namely KULeuven (Katholieke Universiteit Leuven), VITO (Flemish Institute for Technological Research), UCL (Université Catholique de Louvain) and RMI (Royal Meteorological Institute of Belgium). In 2007, KULeuven, VITO and UCL made the strategic decision to join a growing European research community around COSMO-CLM ([www.clm-community.eu](http://www.clm-community.eu)). By joining this community, both national and international collaboration could be strengthened substantially. It enabled an excellent connection to the European scientific community Valorisation within Belgium is ensured by the follow-up team of users (see below). International embedding (CORDEX activities and climate projections in neighbouring countries) is established by the scientific follow up community..

### INTERACTION BETWEEN THE DIFFERENT PARTNERS

As different teams with different strengths will work on the same topic, a frequent interaction between the different partners is foreseen. For example, both UCL and KULeuven will upgrade the model and this will be done in close collaboration. The RMI contribution is essential to assess whether a modification in the model is actually an improvement. Moreover, the atmospheric fields resulting from the climate simulations with the CCLM model (KULeuven task) will be employed to force the AURORA regional air quality model (VITO). Only by regular interaction between the partners it can be ensured that this is done adequately. In addition, regular meetings (2 per year) with the project partners and the members of the follow-up committee will be organised in order to discuss the progress and difficulties in case these arise.

### PROJECT DESCRIPTION

#### Objectives

The aim of the proposed research is to establish projections of future climate and air quality for Belgium, at an unprecedented spatial resolution, and using the latest insights and parameterizations of processes affecting regional climate and atmospheric composition.

#### Methodology

The project will be largely based on the "COSMO model in Climate Mode" (CCLM), a state-of-the-art regional climate model.

### EXPECTED RESULTS AND/OR PRODUCTS

- An improved and extended model. This will be done by upgrading the model schemes relevant for extreme precipitation events. Moreover, the CCLM model will be adapted so that contrails and their effect on the climate can be better assessed. We will also implement and test a new experimental scheme describing vegetation dynamics. With respect to air quality, the focus will be on establishing harmonized pollutant emissions for Belgium. Finally, we will explore ways of downscaling CCLM model output to high resolutions over cities, accounting for urban surface effects (including anthropogenic heating), aiming at a spatial resolution of several hundred of meters.



CLIMATE

# PREDANTAR

Understanding and predicting Antarctic sea ice variability at the decadal timescale

- Datasets containing present and future climate variables. The upgraded models will be employed to simulate present and future climate. The CCLM model will be run in nested mode, taking output fields from the EC-EARTH Global Climate Model to specify lateral boundary conditions, covering scales ranging from the European continent to the Belgian territory at resolutions of 25-7-3 km approximately. The coarsest (25-km) simulation will be done in transient mode, covering the period 2000-2069. The 7- and 3-km simulations will cover periods of ten years, considering current (2000-2009) as well as future (e.g., 2020-2029 and 2060-2069) periods. As a result, climate simulations will be performed for Belgium at a spatial resolution of 3 km, yielding a level of detail that has rarely ever been achieved in regional climate simulations. The advantage of this 3-km spatial resolution is that CCLM can then explicitly simulate deep convection, rather than having to use a sub-grid convection parameterization.

- Datasets containing present and future air quality variables in especially hourly fields of pollutant concentrations, focusing on species that are regulated and/or that have known adverse effects on human health (ozone, nitrogen dioxide, aerosol species including sulphates, nitrates, and elemental carbon...). As with the climate simulations, the air quality simulations will cover present and future periods. The air quality fields generated will allow constituting the most detailed air quality climatologies ever generated for Belgium. CCLM output will be downscaled to obtain high-resolution (scale of hundreds of meters) climate fields over the urban agglomeration of Brussels, focusing on the simulation of the urban heat island phenomenon.

- An improved understanding of the impact of climate change in Belgium on the studied processes, including heat-island effects, air quality, precipitation, and the interaction with vegetation. With respect to the hydrologic cycle, an investigation will be conducted regarding the projected changes in extreme precipitation events. Also, the effect of including the dynamic vegetation module on simulated climate will be explored, considering in particular feedback mechanisms involving vegetation growth and climate. Atmospheric concentration fields simulated by AURORA, in particular those of aerosols, will be evaluated regarding their climate effect. At smaller scales, the impact of climate change on the urban heat island intensity and frequency will be evaluated. In addition, the impact of enhanced greening scenarios for urban climate adaptation will be assessed.

## PARTNERS

### Activities

#### **Prof. Dr. Nicole van Lipzig**

Regional climate modelling, climate simulations, hydrological cycle, land use change and dynamical vegetation

#### **Dr. Koen de Ridder**

Climate and air quality simulations, urban heat island, emission modelling

#### **Prof. Dr. Jean-Pascal van Ypersele de Strihou**

Regional climate modeling, cloud and precipitation microphysics, contrail modelling

#### **Dr. Laurent Delobbe**

Radar meteorology, model evaluation

## CONTACT INFORMATION

### Coordinator

#### **Nicole van Lipzig**

K.U.Leuven - Katholieke Universiteit Leuven  
Aard- en Omgevingswetenschappen  
Celestijnenlaan 200e - bus 2409  
3001 Heverlee  
+32 16 326453 or +32 16 322980  
Fax +32 16 327800  
nicole.vanlipzig@ees.kuleuven.be  
www.kuleuven.be

### Partners

#### **Koen de Ridder**

VITO – Vlaamse Instelling voor Technologisch Onderzoek  
Boeretang 200  
2400 MOL  
+ 32 14 33 55 11  
+ 32 14 33 55 99  
koen.deridder@vito.be  
www.vito.be

#### **Jean-Pascal van YPERSELE de STRIHO**

UCL – Université Catholique de Louvain  
Earth & Climate (ELIC)  
Chemin du Cyclotron 2 bte L7.01.11  
1348 Louvain-la-Neuve  
+32 10 47 32 96  
+32 10 47 47 22  
jean-pascal.vanypersele@uclouvain.be  
www.uclouvain.be

#### **Laurent Delobbe**

RMI – Royal Meteorological Institute  
Belgium  
Avenue Circulaire 3  
1180 Uccle  
+322/373 05 62  
+32 2/375 12 69  
Laurent.Delobbe@meteo.be  
www.meteo.be

### Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting <http://www.belspo.be/fedra> or <http://www.belspo.be/ssd>

