CT4 – Microscale modelling
Hackathon 2022

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Agenda

- 09:30 –09:40 Status of the intercomparison exercise
- 09:40 –09:50 New CT4 Tool (Kees Cuvelier)
- 09:50 –10:30 Step 1. Results discussion
- 10:30 –11:15 Step 2.1. Results discussion
- 11:15 –12:00 Step 2.2. Results discussion
- 12:00 –12:30 Step 3. Results discussion
- 12:30 –13:00 Wrap-up & next steps.

Status of the intercomparison exercise

CT4 Intercomparison exercise

- **The aim is to compare methodologies for deriving annual statistics (using microscale modelling) to identify best practices.**
- Participant groups:

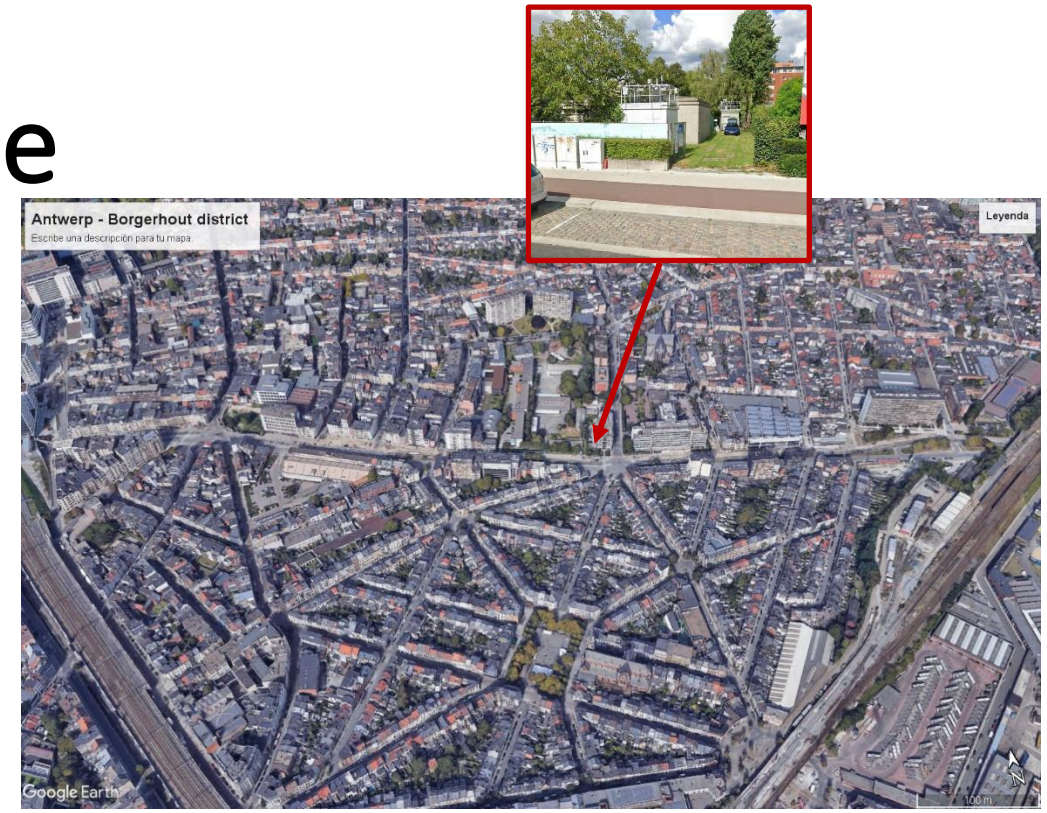
  ENEA, VITO, NILU, RICARDO, CERC, University of West Macedonia (UOWM), Széchenyi István University (SZE), UPM and CIEMAT.
- Designed during second half of 2020
- Started in March 2021
- Delivery of modelling results by September 2021
- Processing and analysis of the results November 2021/February 2022

CT4 Intercomparison exercise

Models and methodologies:

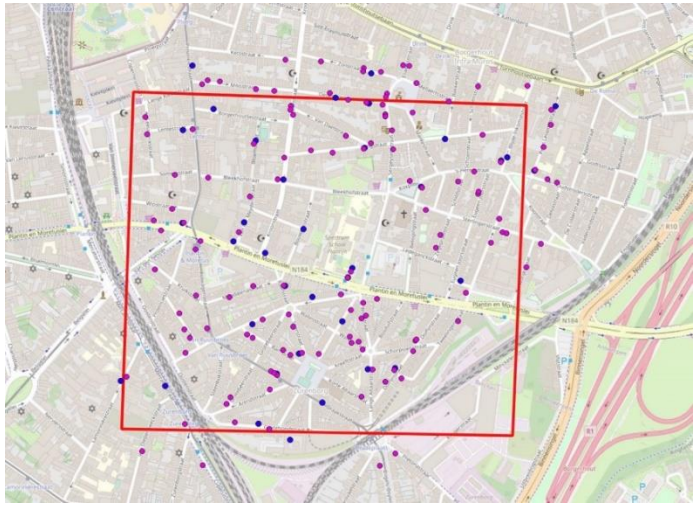
- Many are using CFD models (RANS mostly) but there are also other type of models (parametric, Lagrangian, Gaussian, etc).
- Different methods for computing annual indicators of pollutant concentrations.
  - Methods based on simulating a set of selected scenarios (wind scenarios and/or emission scenarios) and then a postprocessing (PDF of scenarios, rebuilding a entire year, etc) of model results for retrieving annual indicators.
  - Methods based on simulating the complete year or month, which is mostly for the case of non-CFD models but some of them run CFD models a complete year.

CT4 Intercomparison exercise



Exercise details:

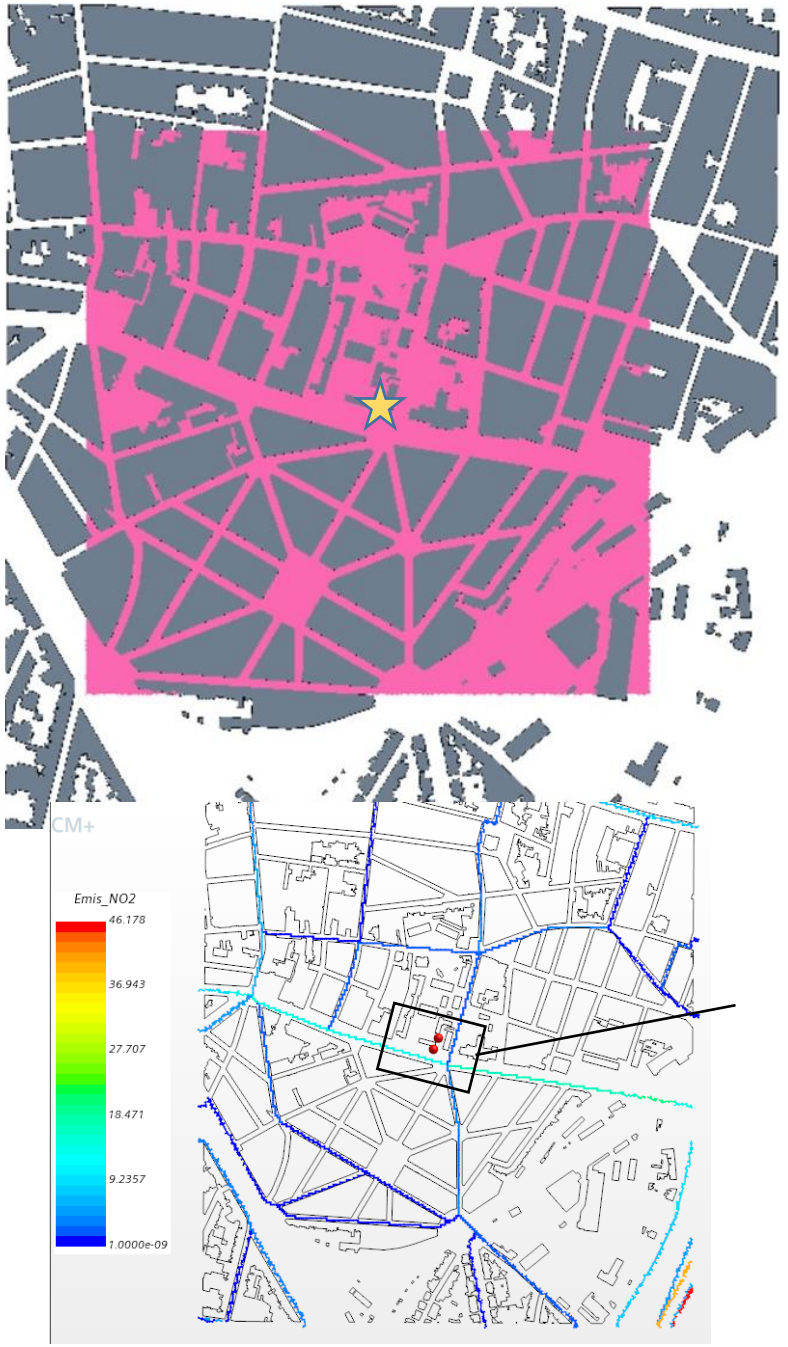
- Firstly focused on the **Antwerp (Belgium). NO_2**
  - Area around two air quality stations.
  - Used in a FAIRMODE spatial representativeness intercomparison exercise in 2016.
  - Urban morphology, emission data from traffic, meteorological data and air quality data (two stations and passive NO_2 samplers (VITO).
  - Campaign of 2016 (April 30 – May 28) selected.
  - Precomputed NO_2 and PM10 CFD simulations for 16 scenarios corresponding to 16 wind sectors (CIEMAT).
- Extension to other city as Gyor (Hungary) should be foreseen for 2022.
- Possible future extension to PM10 or PM2.5 as well.



CT4 Intercomparison exercise

Exercise details:

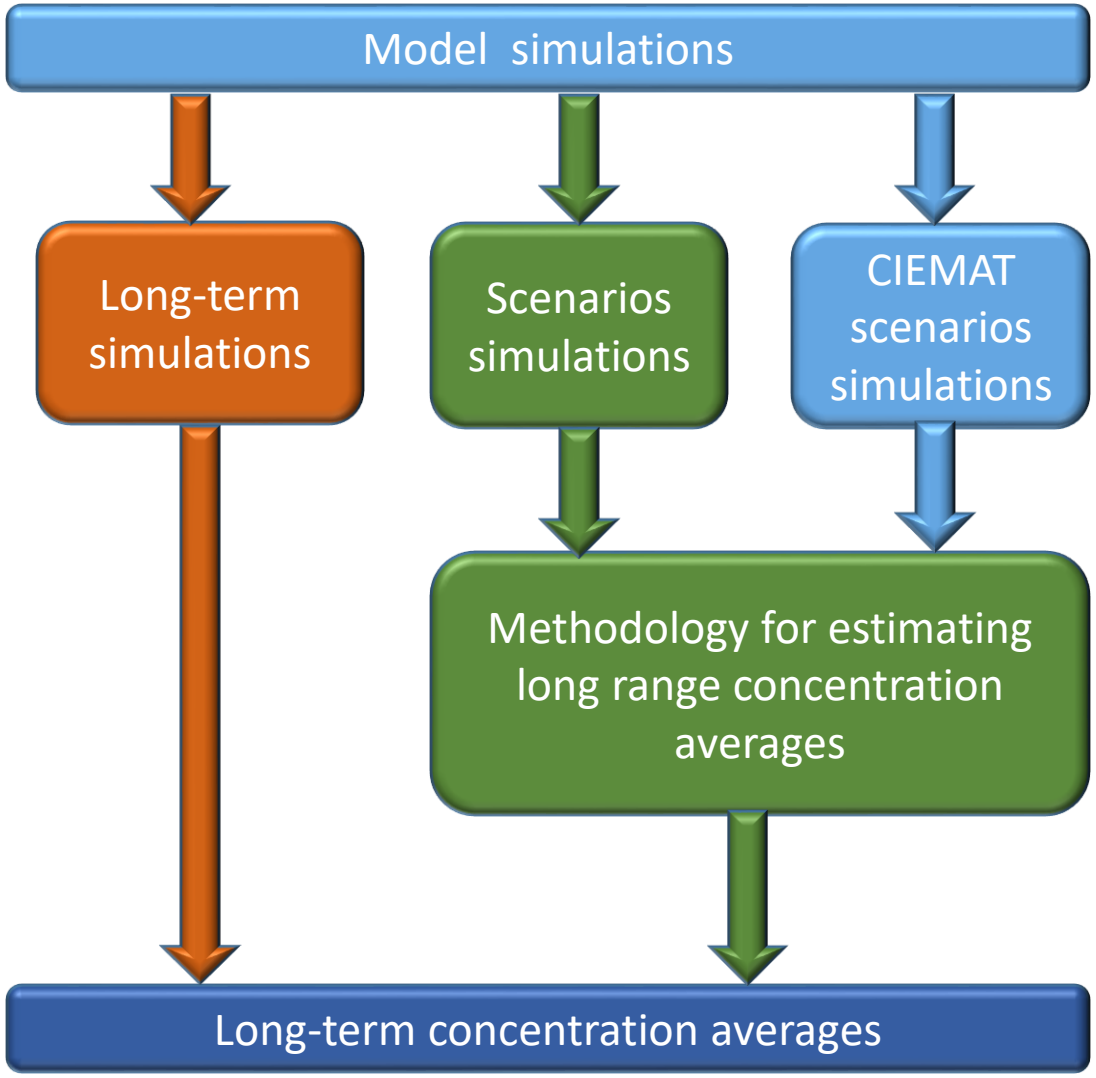
- A similar domain would be used for all the groups.
- Each group could decide the model domain and resolution of their simulations and computations.
- It should be good to finally give results in a common mesh for all, but not mandatory.
- The precomputed CIEMAT CFD simulations are for a domain of 800 m x 800 m (pink area) centered at the traffic AQ station (yellow star) with a resolution of 1m x 1m close to obstacles approx.
- Pollutant emission from traffic.



CT4 Intercomparison exercise

Ways of participating in the exercise:

- Running your own model for the complete period.
- Running your own model for representative scenarios and then applying your own methodology for computing long term concentration indicators.
- Using the precomputed simulations of CIEMAT as starting point for applying a methodology for estimating long-term averages of pollutant concentration.



CT4 Intercomparison exercise

3 steps:

1. ***To simulate <u>one day</u> from the one-month passive sampler campaigns.***
   - ***May 6th, 2016 selected to simulate.***
   - ***The model results would be compared with AQ stations data***
   - ***Models results would be intercompared.***

2. ***To compute averages (concentration maps) for the <u>campaign period</u> (April 30 – May 28).***
   1. ***Comparison with passive samplers' data and AQ station data***
   2. ***Intercomparison among models results (2D maps).***

3. ***To compute averages (concentration maps) for <u>2016 year</u> applying the methodologies of each group.***
   - ***Intercompare results from every methodology (2D maps).***

Modelling results sent by the participants

GROUP	STEP1	STEP2.1	STEP2.2	STEP3	Model / Type	Methods for averaging
CIEMAT	X	XXX	XXX	XXX	STAR CCM+ / CFD RANS	3 techniques (16 wind direction/wind dir and speed / hourly maps)
CERC	X X	X X	X X	X X	ADMS-URBAN / Gaussian urban CIEMAT simulations / CFD RANS	Running model (all period) Processing CIEMAT CFD data (wind and emission cases + correction factors)
UOWM	X	X	X	X	ADREA HF / CFD RANS	Running model (32 wind direction + hourly maps)
ENEA	X	X	X	X	PMSS / Lagrangian urban	Running model (all period)
NILU	X	X	X	X	EPISODE / Gaussian	Running model + interpolation (all period)
SZE	XX X	X	X		OPENFOAM / CFD RANS ANSYS / CFD RANS	Running models (2 OPEN FOAM / 1 ANSYS) (all period)
UPM	X	X	X	X	PALM-4U / CFD-LES	Representative days
VITO	X X	X X	X X	 X	OPENFOAM / CFD RANS ATMO-Street model / Gaussian urban	Wind statistics + Averaging hourly maps Running model (all period)
RICARDO				X	RapidAir / Gaussian urban	Running model (all Antwerp)

IVL, Aarhus University, RIVM, U. Aveiro resigned to participate

WRAP UP Discussion of FTM October 2021

- Atmospheric stability by the models. Most considered neutral stability. Low correlation between stability and NO2 concentration.
- Some inconsistencies between concentration data of AQ stations and RIO background data.
  - Background station is not in fact background (affected by others sources (residential)?).
  - Use other background station as background data instead of RIO (difficult to selected other station, better to keep on using RIO)
- Some questions on wind speed data.
- **Agreement with the proposed methodology for analysis of the results, but several recommendations were done:**
  - **As there are no emission data in some small streets affecting to model outputs, better discard (or separated analysis) samplers of such streets for analysis of results.**
  - **Effect of a near highway (East) can affect the model results if it was not taken into account.**
  - **Make analysis by type of model/methodologies, by type of input data (wind direction, etc), use of chemistry or not in modelling, etc.**
  - **Not clear that use of thresholds could be useful in this case.**
  - **In the case of groups computing hourly concentrations along all 2016, good to compare percentiles of model concentrations with AQ stations data.**
  - **Use of variograms or semivariograms for the STEP 2.1 (only with samplers locations) is good idea, not for gridded data.**
  - **Good to compute spatial correlations when possible.**
  - **Good to use the Delta BM tool (Kees Cuvelier)**

Next steps (to be defined in next days)

- Are there questions pending?? Additional analysis??

- Submission of an abstract to HARMO21 (author list and affiliation for the HARMO abstract !!!)➔ February 2022!!
- Other hackathon on late March or April before the FAIRMODE Plenary Meeting??
- Presentation of results ➔ April 27/28, 2022 (FAIRMODE Plenary meeting)??
- Submission of paper to Journal ➔ Spring 2022??
- New exercise for Gyor Case. ➔ Mid 2022??