CT4: Summary of the discussions on microscale modelling
FAIRMODE Technical Meeting 2020

F. Martin (CIEMAT) & S. Janssen (VITO)

October 2st, 2020

2020 activities

- CT4 Microscale Modeling was endorsed in FAIRMODE Plenary Meeting, Berlin, Feb 2020.

- To advance some activities, a CT4 special session for the HARMO20 conference in Tartu (Estonia) in September was planed, but HARMO20 was postponed by COVID19.

- During 2020 summer, some preparations were done by sending a document to a wide number of groups, which showed interest in microscale modeling.

- The aim was to collect more detailed information about:

    - how the microscale modelers are dealing with the derivation of annual statistics (such as an annual average or percentiles) from microscale simulations.

    - the interest of intercomparison exercise among the different methodologies.

- We have received 8 responses from: *University of Aveiro, University of West Macedonia, Széchenyi István University (SZE), ENEA, RICARDO, CERC, VITO and CIEMAT*

Scope of this FAIRMODE CT4 session

- To discuss the computation of annual averages of concentrations (or other indicators) using microscale modeling

- To give the opportunity to the different groups to show their methodologies in more detail.

- To discuss the interest to carry out an intercomparison exercise (IE).

- In case of yes, how to design the IE

Presentations of the participants (1)

- 7 presentations from: *Aveiro University, University of West Macedonia (UOWM), Széchenyi István University (SZE), ENEA, RICARDO, VITO and CIEMAT.*

- Many are using CFD models (RANS mostly) but there are also other type of models (parametric, lagrangian, 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, which is mostly for the case of no CFD models but SZE university runs CFD models for one year.

- Mostly no chemistry (non-reactive pollutants) or simplified chemistry. Post-process correction is performed NO2/NOx in some cases.

Presentations of the participants (2)

- Spatial resolution ranging from 0.5 to 5 m.

- Urban domains ranging from less that 1x1 km^2 to few tens of km^2

- Emission data are from:
  - bottom-up methodologies using microscale emission models or inventories using real time data in some cases (traffic cameras identifying car plates, etc)
  - Proxies as traffic intensities
  - Normalized emissions and recalibrated by comparing model concentrations with observations.

- Mostly neutral atmospheric conditions assumed but some groups simulate unstable and stable conditions.

- Boundary conditions:
  - Wind profiles or data from meteorological stations or mesoscale models,
  - Background concentrations from AQ stations or from CTM models (some models coupled to CTM models)

- All the groups have made validation exercises of their models/methodologies

Questions for discussion

1. Do you use microscale modeling to estimate AQD indicators?

1. Do you use microscale modeling to estimate AQD indicators?

Yes   (21) 72%

No   (8) 28%

2. If yes, which AQD indicators do you estimate?

2. If yes, which AQD indicators do you estimate? (Multiple choice)

Annual mean   (25/29) 86%

Percentile / daily limit value   (18/29) 62%

Questions for discussion

- How should an inter-comparison exercise be organized?
- Are you interested in participating in the IE exercise?
- Should a common set of simulations be provided by a coordinating team? If so, how many?
- What would be needed for each group for simulations and to retrieve the annual statistic/indicator?
- How can we validate the approaches? How to separate uncertainties: modelling and time averaging method contributions?

Questions for discussion

- How should an inter-comparison exercise be organized?

Case/domain/city to be decided:

Two proposals

Case/domain/city?

1. **Antwerp (Belgium).** Area around a traffic station.
   - Used in a FAIRMODE spatial representativeness intercomparison exercise in 2016.
   - Urban morphology,
   - Emission data,
   - Meteorological data and air quality data including data from passive NO2 samplers from two citizen science campaigns (VITO),
   - NO2 and PM10 CFD simulations for 16 scenarios corresponding to 16 wind sectors (CIEMAT).
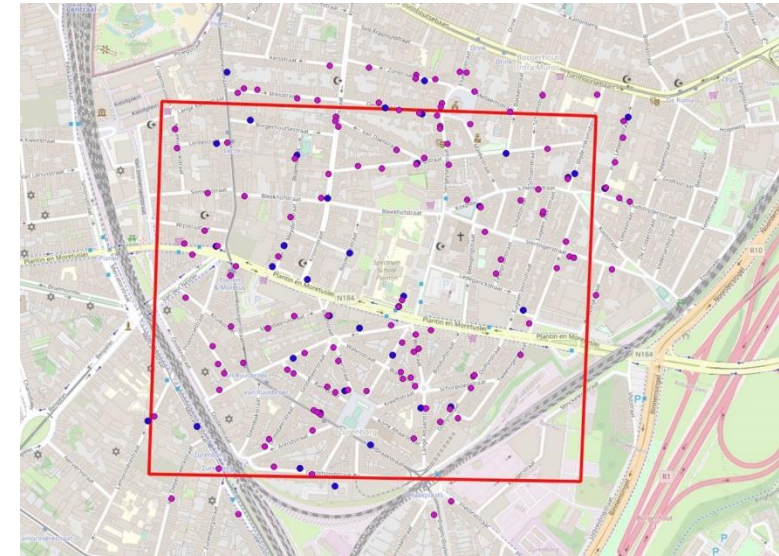
2. **Győr (Hungary)**
   - Proposed by Zoltán Horváth (SZE).
   - Data from meteorological stations, AQ microsensors and AQ stations
   - Real-time emission data for traffic.
   - CFD model simulations for the entire year (but need several months of computing)
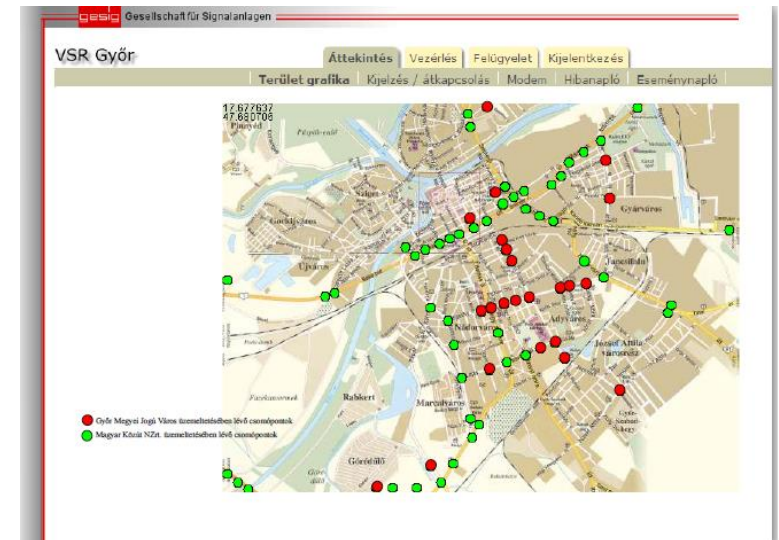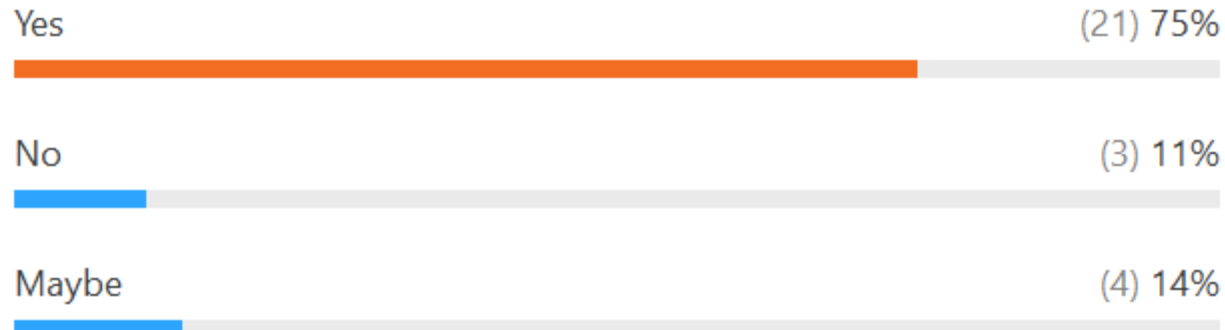
Questions for discussion

- Are you interested in participating in an intercomparison exercise?

Polling is closed   28 voted

1. Are you interested to participate in an intercomparison exercise?

Yes   (21) 75%

No   (3) 11%

Maybe   (4) 14%
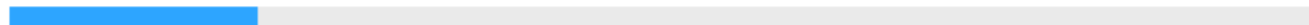
Questions for discussion

- How do you prefer to participate:
    - Running you own model or
    - using a precomputed set of simulations and focusing on the calculation of annual statistics

1. Do you want to participate?

I want to run my own model setup	(17) 81%

I want to make use of the precomputed results and only focus on the calculation of the annual statistics	(4) 19%

Questions for discussion

- What would be needed for each group for simulations and to retrieve the annual statistic/indicator?
- How can we validate the approaches? How to separate uncertainties: modelling and time averaging method contributions?

There was brief discussion.
I was decided that further details will be discuss in a hackathon (November).

Next steps

- **Hackathon (November) for IE preparation (only for participants).**
- To discuss and set up details for the exercise:
  - Select modelling domain.
  - Modelling period
  - Required input data.
  - Output formats.
  - Statistics for intercomparison of models and comparison with measurements (passive samplers, sensors, AQ stations)
  - How to separate uncertainties: modelling and time averaging method contributions?
  - Planning timeline
  - Others…