TFMM: progress in EMEP activities in 2024 and future work

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12/09/2024, 10th joint session of the EMEP SB/ WGE, Geneve

Outline

- 25th TFMM annual meeting summary
- TFMM work plan items
- Intended contribution to GP
- Organizational aspects (communication and dissemination)
- Preparation to modelling exercise

25th TFMM Annual Meeting (Warsaw 6/7 May)

- Hybrid meeting was held in Warsaw 6-7 of May 2024
- 147 experts attended the meeting
- Thematic sessions:
  - Update from the Convention (MSC-W, MSC-E, CCC, WMO, TF HTAP, TFEiP)
  - Volatile Organic Compounds impact on ozone (related to IMP July 2022)
  - Ozone trends and source apportionment
  - General country update (Finland, Czech Republic, Spain, Poland)
  - Low-cost sensors (collaboration with FAIRMODE)
  - PM composition

25th TFMM Annual Meeting (Warsaw 6/7 May)

- Summary:
  - IMP September 2024 (CCC)
  - Modelling Exercise July 2022 (2024/2025)
  - PM composition (collaboration with TFEIP, MSC-W)
  - BaP (TFIAM, MSC-E, TFHealth, Ciemat leading EurodeltaBAP manuscript)
  - Report on CEC (CCC)
  - Report on LCS (WMO)
  - Discussion on activities for 2025
  - Potential items for the next biannual workplan

Work plan items lead by TFMM (6)

No	Workplan item	Status
1.1.1.1	Contribution of VOCs during high ozone pollution episodes	IMP 2024 – started Survey on models – completed Modelling exercise – will start 09/2024
1.1.1.3	Aerosol chemical speciation in different models	*2025 - in collaboration (next table)* *Lessons learned from other EU projects*
1.1.1.4	Representation of intermediate and semi-volatile condensable emissions	*2025 - in collaboration (next page)* *Restart of an ad-hoc group on condensables?*
1.1.1.8a	Finalise the Eurodelta-BaP model intercomparison	CIEMAT with ENEA, Ineris and FMI
1.1.1.8b	Assessment of the BaP related health effects	ARP will be made available for TFMM by the end of 2024
1.3.5	Low-Cost Sensor review of WMO report	Published in May 2024
1.1.1.2	Chemicals of emerging concern	Will be published soon (CCC)

Workplan items in collaboration

No	Workplan item	Leading TF/Centre
1.1.1.7	Long-term O3 projections in relation to CH4 mitigation	TF HTAP
1.1.3.2	O3 modelling of future scenarios	TF HTAP
1.1.4.2	Global and regional model simulations of historical trends and future scenarios with assessment of human health and vegetation impacts	TF HTAP
1.1.1.5	Review source-receptor methodologies: brute force and sensibilities (local fractions) and their applicability	MSC-W
1.1.1.32	Consolidate existing evidence on health outcomes of exposure to air pollution (related to 1.1.1.8b)	TF-Health with other groups (TFIAM, TFMM)
1.1.2.3	Develop guidance on estimating and Party's reporting of emissions of condensable component of PM (related to 1.1.1.3 and 1.1.1.4)	CEIP and TFEIP with MSC-W and TFMM
1.1.2.4	Develop guidance on estimating and Party's reporting of emissions of BC	TFEIP and CEIP with TFMM

Science questions for the 2024-2025 period (1)

1) How biogenic and anthropogenic VOCs contribute to ozone formation episodes across Europe;
   a) How well do models reproduce ozone variability and levels?
   b) How well do models reproduce VOC variability and levels?
   c) How to compare modelled and observed VOC species?
   d) How to deal with VOC emissions in the models?
   e) Common approach for ozone regime analysis

Feedback to decision makers:

How much can VOC mitigation impact the reduction of ozone episodes and background ozone levels

Science questions for the 2024-2025 period and beyond (2)

2) What is the contribution of secondary aerosol production as compared to primary;

a) To what extend do primary aerosol reproduce variability and pattern of the observed PM10/PM2.5?
b) What is the natural component in the background?
c) How does secondary aerosols production differ between the models?
d) Are available emission data sufficient to reproduce aerosol chemical composition?
e) How to compare observed and modelled chemical components (magic factors applied to BC and OC)

Feedback to decision makers:

Assessment of the contribution from the natural sources (no control) and secondary production (potentially nonlinear relation to the emission reduction)

TFMM contribution to GP (26/03/2024)

TFMM will focus its contribution to the GP review on **evaluating the reliability of modelling tools for accurately representing ozone formation and aerosol processes.**

This analysis will identify knowledge gaps and model deficiencies, which are crucial for future scenario analysis and inform **recommendations for improved emission reporting,** such as explicit reporting of black carbon (BC), organic carbon (OC), condensables, and detailed VOC profiles.

Furthermore, TFMM will **couple modelling results with health assessment tools to** establish best practices for integrating assessment process.

On the measurement side, TFMM will contribute valuable knowledge by **monitoring VOCs and Constituents of Emerging Concern** (CECs).

1.1.1	Assess contribution of VOCs on high O_3 pollution episodes using observations from intensive measurement period (summer 2022) and regular time series from EMEP network. Including model intercomparison exercise for intensive measurement week	EMEP reports (MSC-W) Peer-reviewed publication describing campaign and key results	2025
		Summary of model intercomparison exercise	2025
1.1.1.2	Investigate monitoring of chemicals of emerging concern. Follow up conclusions and guidelines from workshop in autumn 2023	Report from workshop	2024
1.1.1.3	Collect available information on aerosol chemical speciation from different models and how it can be matched with measurement to assess importance of different sources	Survey	2024
1.1.1.4	Consolidate representation of intermediate and semi-volatile condensable emissions in models and validation against existing observations of PM composition	Contribution to EMEP report (ad-hoc group?)	2025
1.1.1.8	Finalize Eurodelta-BaP model intercomparison.	Peer-reviewed publication on Eurodelta BaP	2024/2025
	Assess BaP-related health effects	Summary report	2025

TFMM organization and communication

- Dedicated e-mail address: tfmm@ios.edu.pl
- On-line briefs:
  - 1st TFMM online brief on 20/12/2023 (workplan overview, update from WMO, update on the campaigns)
  - 2nd TFMM online brief on 6/02/2024 (FAIRMODE, CEN/TC WG44)
  - 3rd TFMM online brief on 4/04/2024 (Mike Holland – ARP, MSC-E update)

- September 2024 - 1st TFMM newsletter (based on the outcome from the annual meeting)
- Planned briefs: end of September, mid December; thematic groups

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TFMM – dissemination in 2024

In 2024

- Participation in TFICAP
- Presentation at FAIRMODE General Assembly on 27/02 – synergies between TFMM and FAIRMODE
- Presentation at EGU2024 on 19/04: **TFMM: Advancing Air Quality Insights and Collaboration within the EMEP Framework,** PICO session Atmospheric composition variability and trends

Planned

- Participation/presentation at EPCAC meeting to develop regional-urban scale interaction

Question to EMEP SB: Should we include a TFMM acknowledgment statement for publications?

Next annual meeting

- Venue to be decided
- Time – preferably in the first full week of May (between 5 and 9/05) □ 3 days

IOŚ-PIB
Institute of Environmental Protection
National Research Institute

WORLD
METEOROLOGICAL
ORGANIZATION

LRTAP
Long-range Transboundary Air Pollution

Preparation for Modelling exercise July 2022

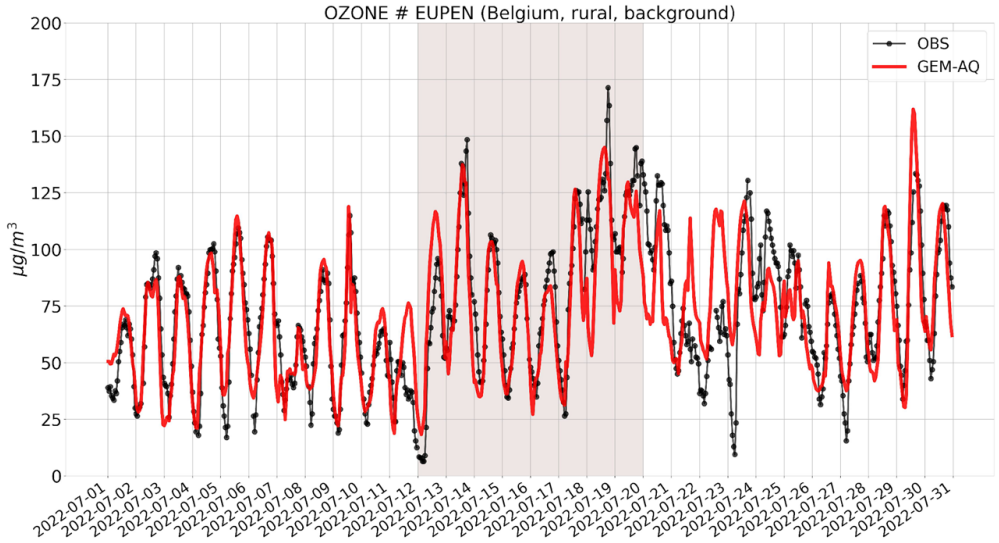
Motivation

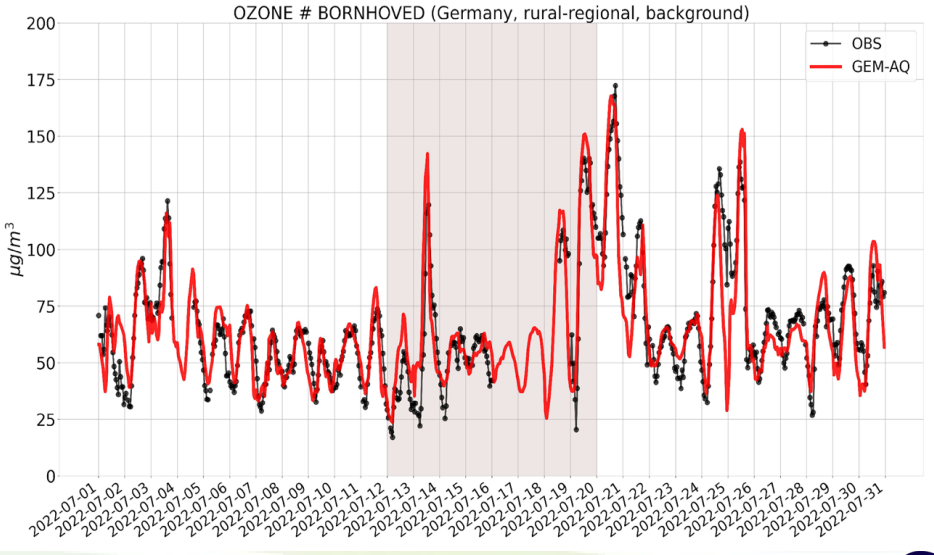
1) Follow up of the July 2022 campaign
2) Better understanding of:
   - VOC emission processing
   - Role of biogenic VOC
   - Models' ability to reproduce individual measured hydrocarbon species
   - Models' ability to reproduce O3 variability during heatwave episode
   - Chemical regimes during heatwave

Scope of the execise

1) Best model setup (BC and OA not framed)
2) Meteorological nesting – preferably every 1hour (very dynamic situation)
3) Emissions – anthropogenic EMEP 2022, biogenic – best available/used
4) Preferred European scale at 10km (subset of EMEP grid latlon) but regional simulation at 2.5km or 5km are also accepted
5) Output:
    - Emission
    - Meteo (1-hour) – surface : TT, wind, short wave radiation flux to the ground (optional meteo3D to analyse ABL and recirculation)
    - AQ (1-hour) - 3D: individual VOC, NO, NO2, O3
    - Netcdf format
    - **Hourly (GMT) – preferably July 2022, accepted 10 – 25 July**
    - Predefined grid (subset of the EMEP grid)

Preparation for modelling exercise – why longer period





Simulations planned

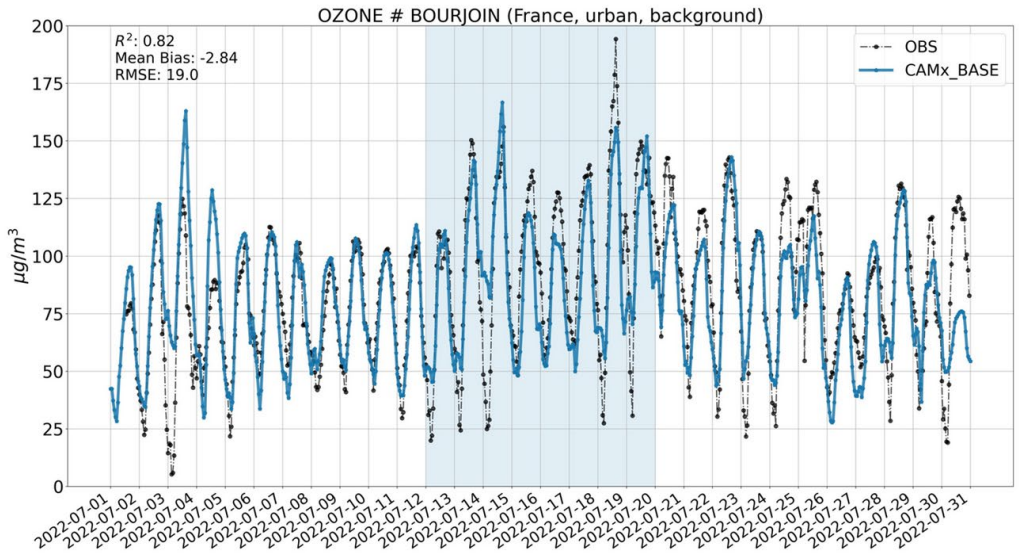
1) BASE – (anthropogenic + biogenic VOC *+ optionally NOx*) --> can we reproduce the episodes and the heatwave
2) DDEP (BASE with dry deposition switched off) --> how much dry deposition impacts near surface concentrations (in time and space)
3) ANT (only anthropogenic emissions) --> how much biogenic emissions increase O3 peaks
4) BIO (only biogenic emissions – biogenic VOC *+ optionally NOx*)

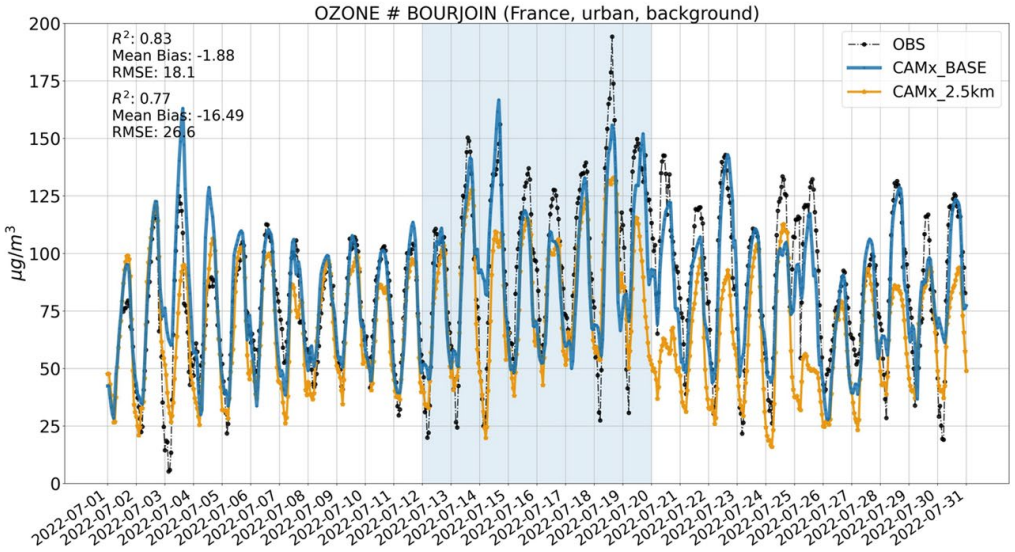
It is possible to deliver only subset of scenarios – preferably BASE+ANT

Any other scenarios – e.g. sensitivity to anth-VOC emission profile or bio-VOC temporal variability should be analysed by the individual group – we assume that submitted results are your "best setup" and are consistent for all scenarios

Pre-exercise tests

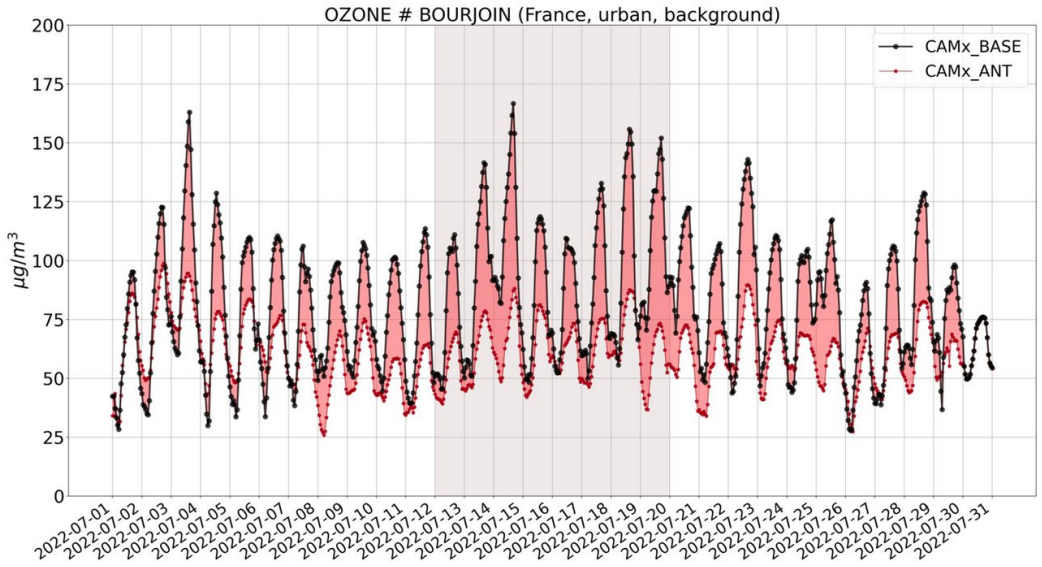
- Overall good model performance for the base case at 10km
- Higher resolution improved the performance during night-time and degraded during the daytime

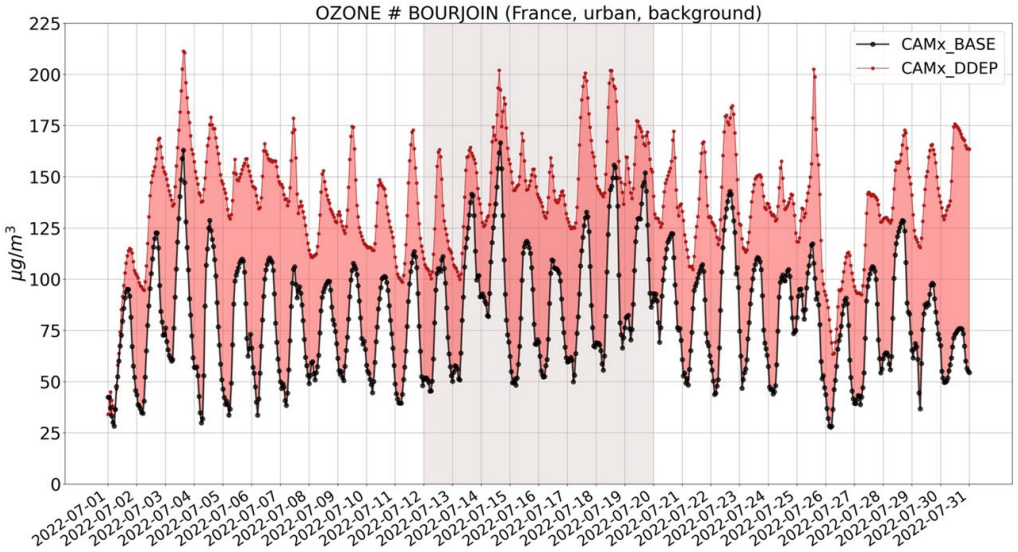




Pre-exercise tests

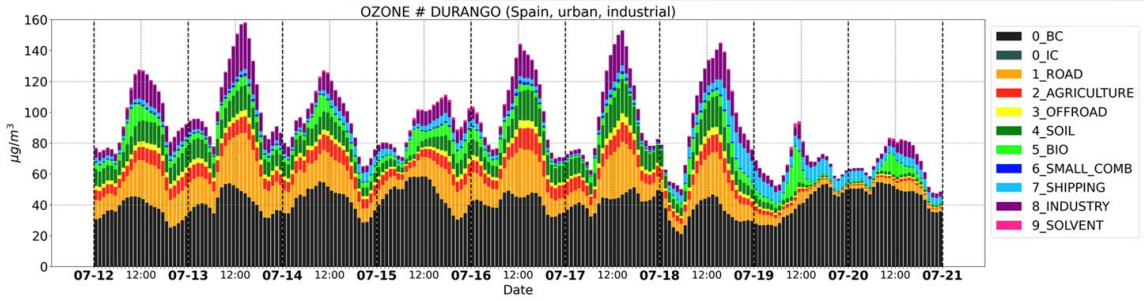
- Biogenic emissions crucial in ozone episode formation, day-time, especially in pick days (question – temporal profiles for bio emissions)
- Dry deposition parameterization is a very important sink term



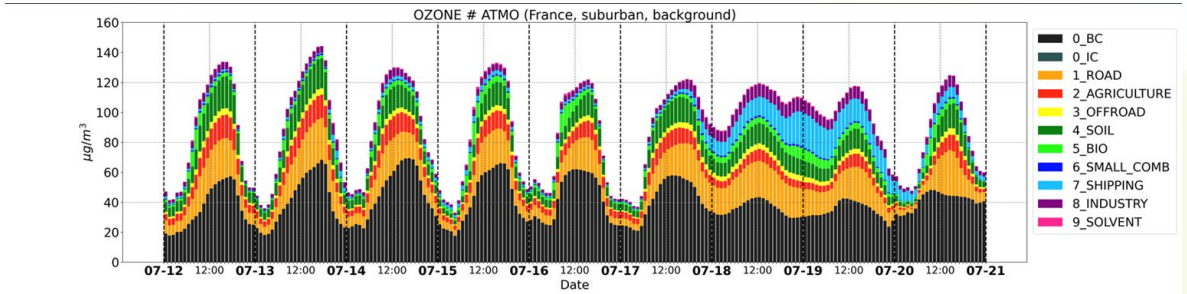


Source Apportionment

- Source identification highly „station dependent”
- Biogenic contribution smaller than difference „base-anthro”
- Industrial contribution smaller than road transport even at industrial stations
- Shipping – potentially source of uncertainty



	2022-07-12	2022-07-13	2022-07-14	2022-07-15	2022-07-16	2022-07-17	2022-07-18	2022-07-19	2022-07-20
0_BC	61.5	61.7	64.4	67.0	62.8	63.7	60.9	70.8	77.0
0_IC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1_ROAD	11.5	13.1	10.6	9.5	11.4	10.8	9.8	4.9	4.1
2_AGRICULTURE	4.8	4.6	5.5	4.2	5.6	5.3	4.2	1.7	1.2
3_OFFROAD	2.0	1.8	1.8	1.6	2.0	2.0	1.9	0.9	0.9
4_SOIL	7.4	6.8	6.3	4.6	7.8	8.9	7.1	2.5	1.7
5_BIO	4.2	2.6	3.4	4.7	2.8	1.8	3.4	5.5	3.7
6_SMALL_COMB	0.5	0.6	0.4	0.4	0.6	0.6	0.4	0.2	0.2
7_SHIPPING	1.5	1.1	2.4	2.7	1.5	1.1	5.2	8.7	6.0
8_INDUSTRY	6.1	7.4	4.6	4.6	5.1	5.7	6.7	4.3	4.8
9_SOLVENT	0.4	0.3	0.4	0.7	0.4	0.2	0.3	0.5	0.4



	2022-07-12	2022-07-13	2022-07-14	2022-07-15	2022-07-16	2022-07-17	2022-07-18	2022-07-19	2022-07-20
0_BC	63.0	63.9	66.5	66.4	67.9	65.2	60.1	60.6	66.4
0_IC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1_ROAD	11.7	12.4	10.7	10.5	10.1	11.6	12.1	10.4	10.3
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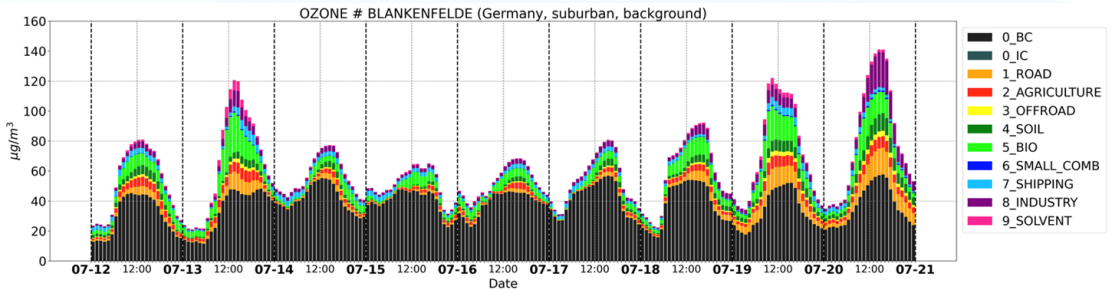
3_OFFROAD	2.1	2.0	1.8	1.7	1.7	2.1	2.0	1.7	1.7
4_SOIL	9.6	8.8	7.7	6.7	7.1	8.3	6.5	5.8	6.4
5_BIO	2.5	1.8	2.3	3.7	3.4	1.7	2.7	2.8	2.4
6_SMALL_COMB	0.5	0.5	0.4	0.4	0.4	0.5	0.6	0.5	0.4
7_SHIPPING	0.8	1.0	1.3	1.9	1.0	1.9	7.8	10.3	4.6
8_INDUSTRY	2.6	2.8	2.8	2.4	2.1	3.0	4.6	4.2	3.5
9_SOLVENT	0.3	0.3	0.3	0.6	0.5	0.3	0.3	0.3	0.3



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0_BC	69.5	66.7	79.0	81.2	79.1	80.5	73.0	64.6	64.4
0_IC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1_ROAD	4.0	4.8	2.4	1.5	1.9	1.8	4.2	7.3	7.6
2_AGRICULTURE	4.7	4.2	2.1	2.1	3.0	1.9	3.2	3.9	3.6
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5_BIO	8.1	11.2	5.4	5.8	7.1	4.8	8.8	9.2	6.9
6_SMALL_COMB	0.2	0.3	0.1	0.1	0.1	0.1	0.2	0.4	0.4
7_SHIPPING	3.8	2.8	3.9	4.0	2.9	3.9	1.7	2.8	1.7
8_INDUSTRY	3.0	4.1	3.3	2.7	2.8	3.6	4.0	4.4	7.8
9_SOLVENT	1.0	2.6	0.6	0.6	0.6	0.3	0.7	1.6	0.8

Timeline

1) End of September – on-line brief dedicated to the modelling exercise – thematic sub-groups:
   - O3/NOx/VOC
   - O3 and meteo
   - VOC emission data
   - Chemical regimes (and resolution)
2) 15/12/2024 --> delivery of BASE
3) 30/01/2025 --> “ANT-only” scenario
4) 30/03/2025 □ rest of scenarios
5) 28/02/2025 --> first feedback from IEP-NRI --> can we answer the science questions?
6) Dedicated session at 26th annual meeting
7) Report and publication

Thank you