emep

Co–operative programme for monitoring and evaluation of the long–range transmissions of air pollutants in Europe

Meteorologisk institutt

LRTAP
Long-range Transboundary Air Pollution

MSC-W: progress of activities 19/20

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Sixth Joint session of the EMEP Steering Body and the Working Group on Effects 14-17 September 2020

Overview

Some major activities 2019/2020:

- ‘Condensables’ - model evaluation and source receptor matrices for 2018 + workshop (Session on condensables)
- EC - model evaluation and source receptor matrices for 2018
- Downscaling of EMEP-MSC model results for NO_2, $PM_{2.5}$ and PM_{10} for all of Europe

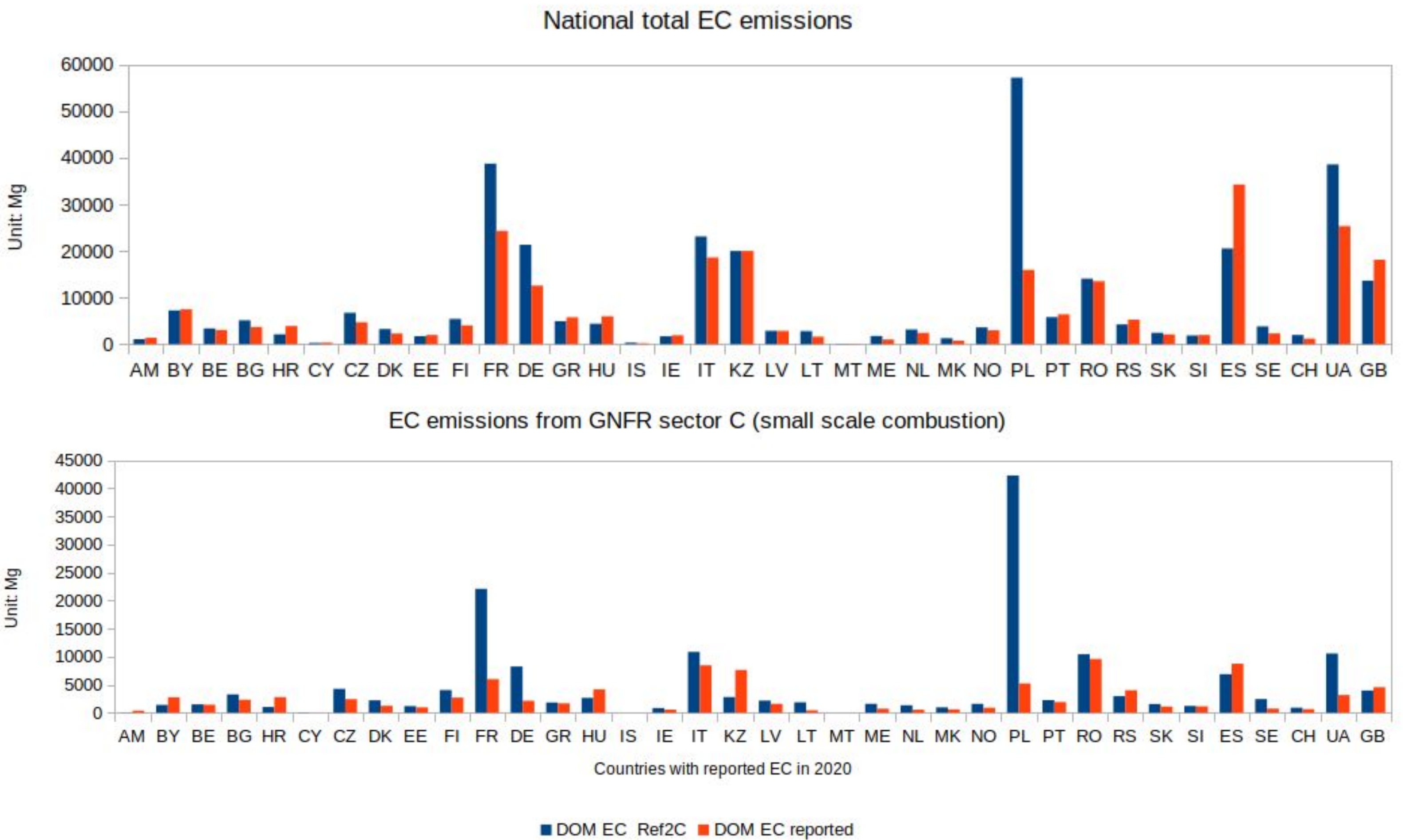
- Further plans

EC - source receptor and model evaluation for 2018

- Related to condensables through the use of EC/PM fractions for emissions
- Large difference between different emission estimates (e.g EU Action on BC[1] review)
- Comparing model runs with reported EC emissions and EC from the inventory which use TNO Ref2 for GNFR C (small combustion) plus EC/OC fractions from TNO (**EMEP** and **EMEPwRef2C**)
- Compared to EMEP EC measurements (EBC last year - to be continued in TFMM EuroCarb)

[1] Review of Reporting Systems for National Black Carbon Emissions Inventories. B Matthews and V-V Paunu. AMAP, 2019.

Comparison of EC in EMEP and EMEPwRef2C



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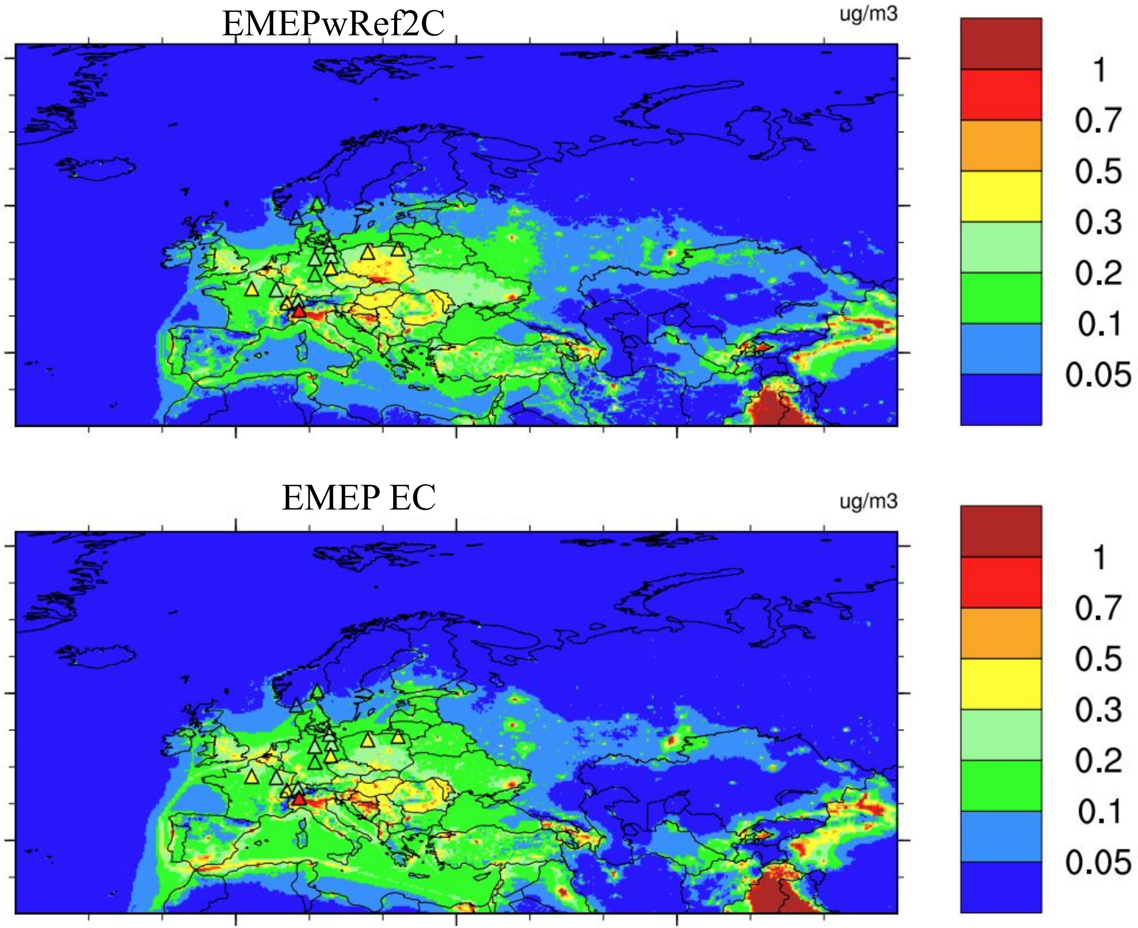
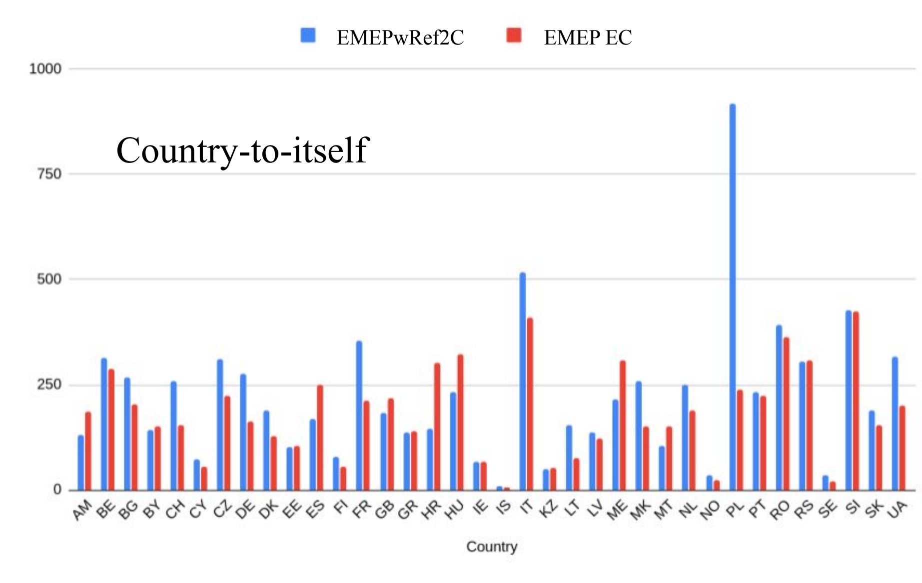
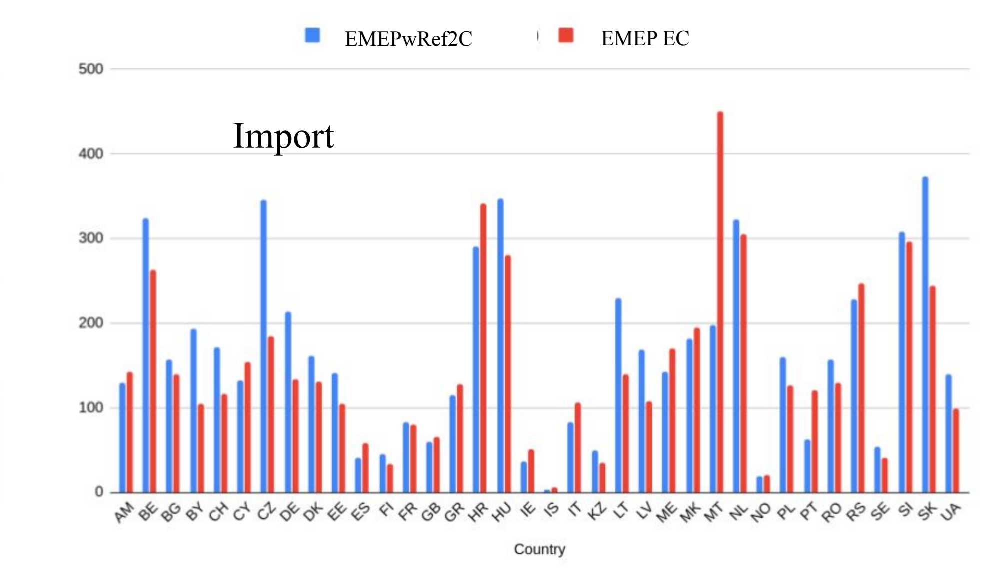


Figure 7.3: Annual mean concentrations of EC in $PM_{2.5}$ in 2018, calculated with the EMEP MSC-W model (colour contours) and observed at EMEP monitoring network (colour triangles) from EMEPwRef2C run (upper panel) and ECgridded run (lower panel).

Source receptor matrices





Country to country itself contribution (C2C) and import from all other countries (IMPORT2C) for $EC_{2.5}$ using EC emissions from EMEP and EMEPwRef2C, respectively. Units: ngm−3

Difference in country-to-itself contribution and import up to factor 2-4

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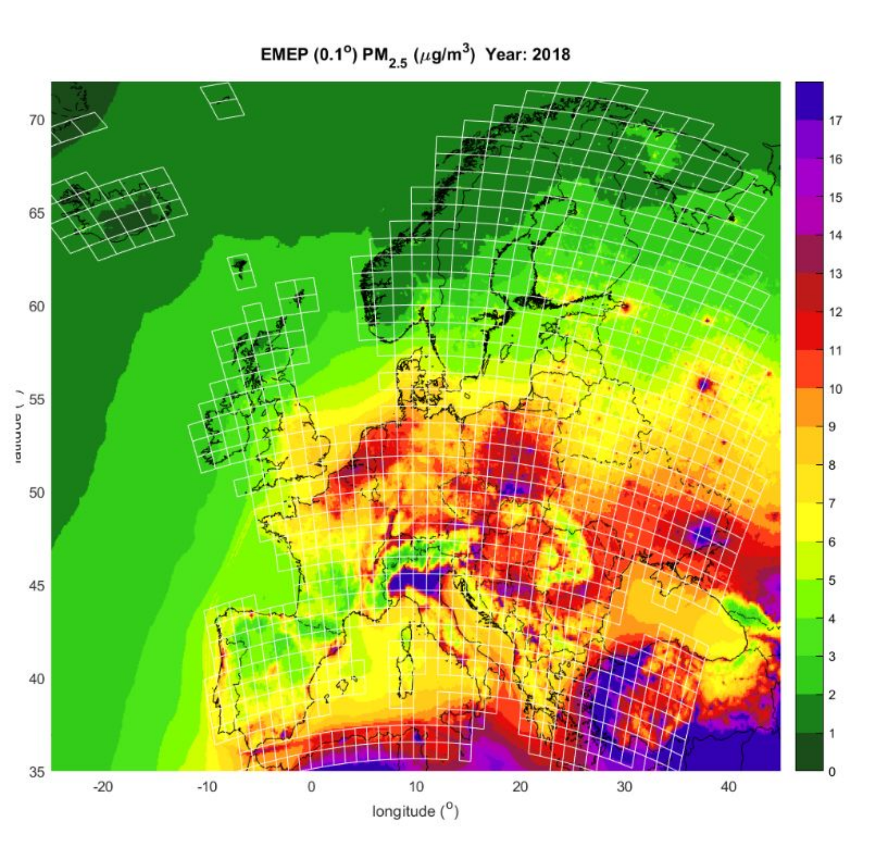
Summary ‘black carbon’

- Large difference in emission estimates leads to large differences in source receptor matrices... (up to factor of 2-4 differences in country-to-itself and import-to-country contributions to EC concentrations) - here ‘only’ due to inclusion of a consistent set of condensables (Ref2 for GNFR C)
- Not possible to judge from the work here which emission estimates are ‘best’ (work last year pointed to substantial difference in ff/bb)
- Further work on comparison to observations (e.g. bb/ff in EIMP) will be performed in TFMM EuroCarb

Multi-scale modelling: uEMEP for Europe



Downscaling for all of Europe (100-250 m) for traffic, residential heating and shipping emissions (EMEP & EMEPwRef2C)

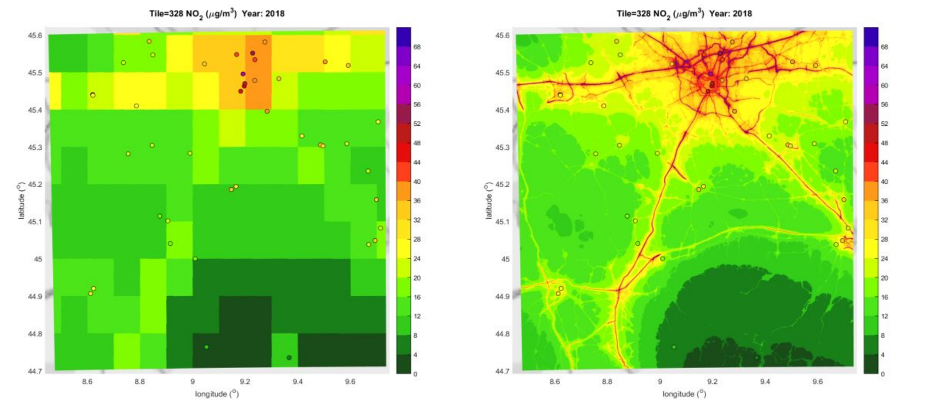


Figure 8.5: Calculated NO_2 concentrations in the 100 km tile (nr. 328) for 2018, part of the all European calculation at 100 m resolution. Left the EMEP calculation at 0.1^o and right the uEMEP calculation at 100 m resolution. The city in this tile is Milan. Airbase stations are shown as circles.

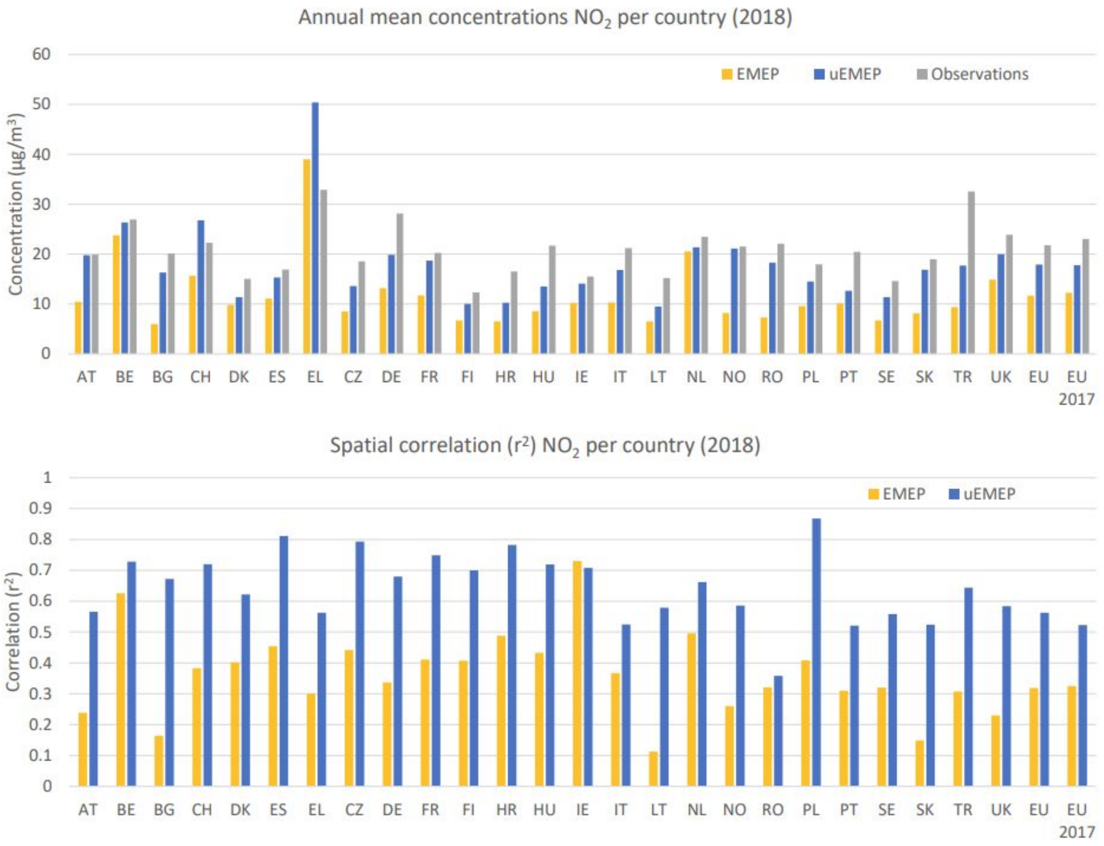


Figure 8.7: Annual mean NO_2 concentrations and spatial correlation (r^2) per country for 2018 calculated with EMEP and uEMEP compared to Airbase observations. Only countries with more than 10 stations are shown but all stations are included in the final EU result.

- Comparison to *all* EEA Airbase obs. data
- In the majority of countries the spatial correlation is doubled
- NO_2 is dominated by traffic emissions and this is spatially very well defined using OSM as a proxy.

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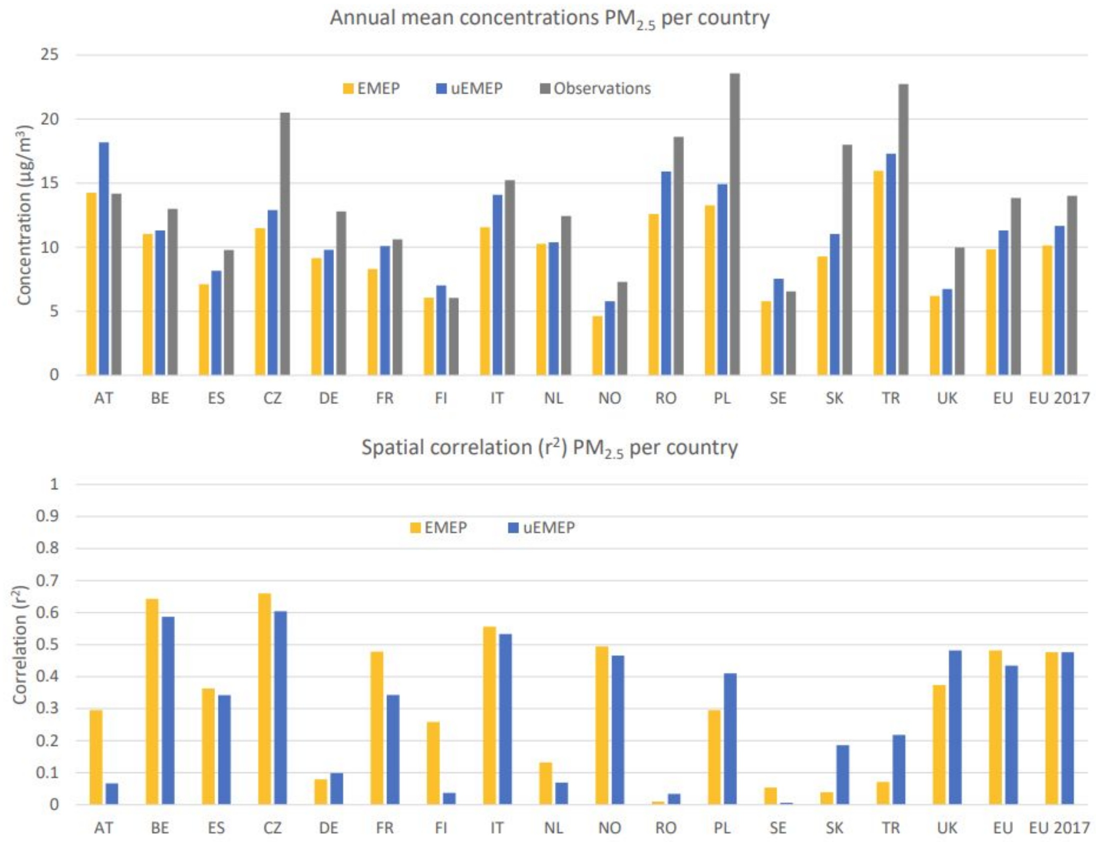

Figure 8.8: Annual mean $PM_{2.5}$ concentrations and spatial correlation (r^2) per country for 2018 calculated with EMEP and uEMEP compared to Airbase observations. Only countries with more than 10 stations are shown but all stations are included in the final EU result.

- Bias improves
- Why not improved correlation for $PM_{2.5}$?

- Smaller 'delta'
- The largest contributor to PM is residential heating which uses population as a downscaling proxy ('within the grid').
- Tests for Norway show better results when using better proxy data
- Options: use TNO proxies directly, other proxies

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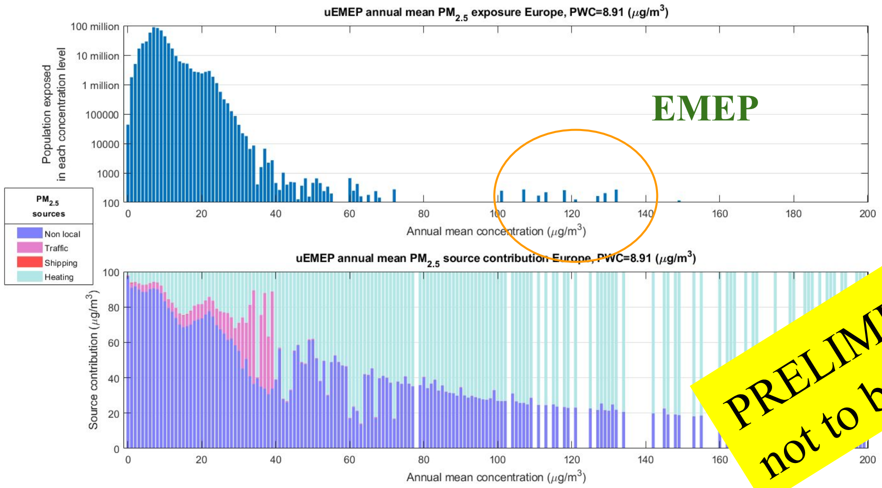
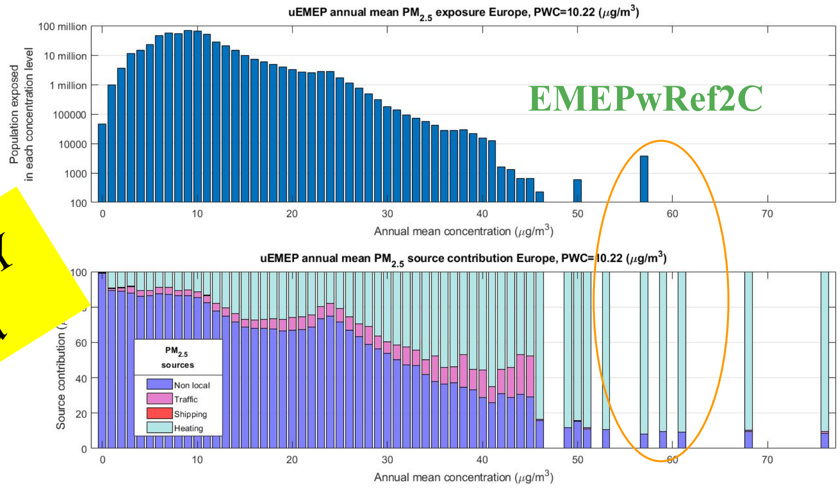
Exposure $PM_{2.5}$, EMEP & EMEPwRef2C

- Higher RWC emissions hits hard for exposure
- Caveats: population proxy, erroneous country gridding, PM water

Note:
logaritmic scale





PRELIMINARY
not to be cited

$PM_{2.5}$ uEMEP: 132 million above 10 ug/m3, 31 million above 15 ug/m3

$PM_{2.5}$, uEMEPwRef2C: 231 million above 10 ug/m3, 51 million above 15 ug/m3

Summary multi-scale EMEP modelling

- Works excellent for NO_2, better bias for PM (but not improved spatial correlation). More work on spatial distribution/proxies are needed for PM
- Add national contribution, combine with SR

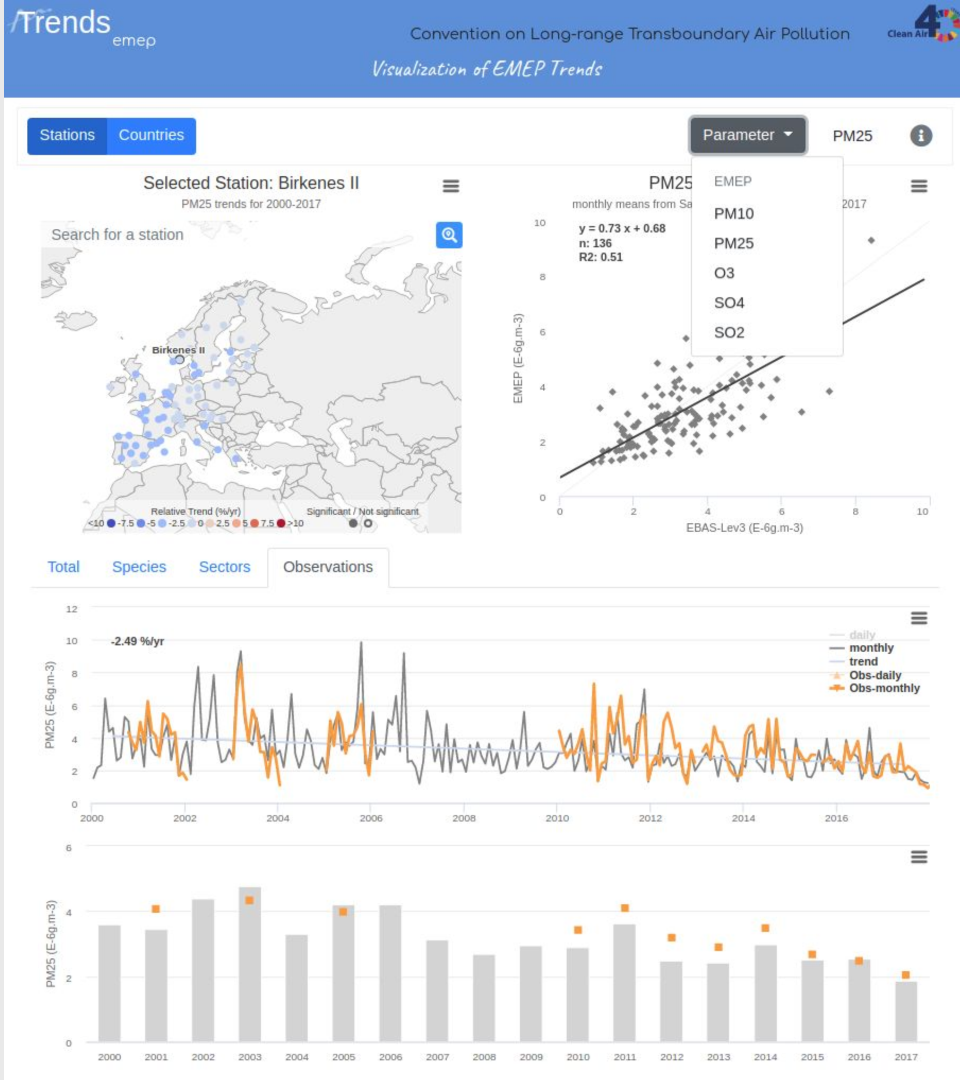
Table 8.3: Source contribution to all air quality stations in Europe calculated with uEMEP. uEMEP local contributions are from emissions within an region of $\pm 0.1^o$ in both latitude and longitude. Non-local EMEP contributions are all emissions from outside this region for the downscaled sources as well as other sources within this region that are not downscaled.

Source	NO_X ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
Traffic (GNFR6)	13.9 (58%)	0.71 (6%)	1.1 (7%)
Residential heating (GNFR3)	1.8 (8%)	2.2 (19%)	2.6 (16%)
Shipping (GNFR7)	0.30 (1%)	0.01 (0.1%)	0.01 (0.1%)
Non-local EMEP	7.9 (33%)	8.4 (75%)	12.3 (77%)
Total	23.9 (100%)	11.3 (100%)	16.0 (100%)

The Trend interface

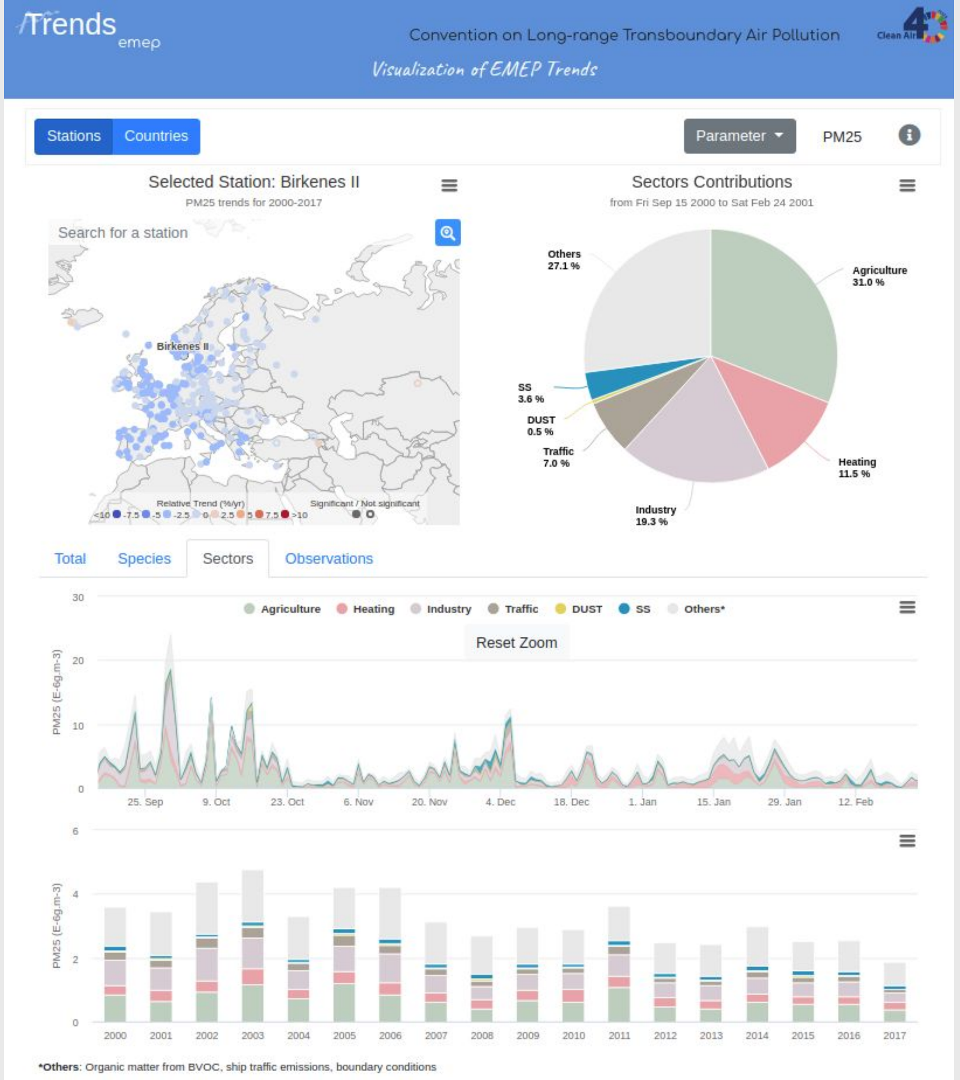
https://aerocom-trends.met.no/EMEP/

- Added more parameters + 2017



- 2018 to be added (‘**with Condensables**’). Source/sector information
- Work together with CCC on defining obs. data set relevant for trends
- Deposition, more parameters

Data from trend interface also used by ETC/ATNI in cooperation with EMEP: main drivers of long term trends



Cooperation with ICP-Vegetation

- Modelleling ozone flux in soil moisture limited area (lead: CIEMAT)
- Parametrization for semi-natural vegetation in the EMEP model (POD_1IAM)
- Modelling ozone flux for other parts of the world (impacts on yield)
- Ozone flux-based risk assessment for vegetation at various air pollution scenarios (for review of the GP).

Further work

- Participate in the **EPCAC activity** with uEMEP: Estimate the effects of local/regional/(inter)national emission reductions on concentrations in the selected cities.
- Include the ‘national contribution’ to uEMEP results (based on SR)
- **TFHTAP exercise**: importance of shipping emissions in other regions of the world - impact on ozone
- EC: TFMM EuroDelta, solid vs liquid fuel sources
- Continued work on EMEP Trend interface, with CCC

Further work II

- GP review: e.g. new modelled trend series (1990 ->2030(?)), updated historical emissions for modelling (for exceedance calculations) + O_3 flux (ICP-veg)
- Nordic Council of Ministers - project application (with **TNO, IIASA, SYKE, NILU**):

Revising historical $PM_{2.5}$ emissions from residential combustion to consistently include condensable organics and assess the implication for the review of Gothenburg Protocol

- *2005-2018 emissions*
- *New model calculations of PM trends (and SR matrices)*
- *Comparison to observations*

Relevant for GP review question 4.4, if funded

4.4	What will be the impact of the inclusion of condensable particles in PM reporting for residential heating on the national emission trends and on the importance of the residential heating sector? What will be the effect of the inclusion of condensable particles on the effectivity of abatement measures? What PM emission reductions will be achieved between 2005 and latest reported year based on the inclusion of condensable particles in PM reporting compared to its non-inclusion?	CEIP. CIAM, TFTEI	Spring 2022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