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Priority improvements to emission inventories

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Reporting of 0.1°x0.1° emissions to EMEP

- Until now 30 countries reported gridded emissions in the new grid (0.1°x0.1° longitude-latitude resolution)
- Not all of the reported gridded data can be used in modelling
  - Only gridded national totals instead of sectoral data (LT)
  - Wrong gridding (e.g. IT, PL and PT for sector F)
  - Late submissions (e.g. FI, MT and SE in 2018)
- Remaining areas: gap filled and spatially distributed by CEIP
- Possibilities for improvement:
  - Report emission data (within deadline)
  - Check spatial distribution, improve if possible and submit new gridded data (preferably before 2022)
  - Check the EMEP status and country reports to see how the model performs for your country
    https://www.emep.int/publ/emep2018_publications.html

0.1°x0.1° gridded emissions - Can we say something about their quality from model calculations?

EMEP MSC-W model runs (all using 0.1° meteorology for 2016):

- Using **EMEP 0.1°x0.1°** emissions for 2016
- Using **CAMS-REG-AP 0.1°x0.05°** emissions for 2016
- Using **EMEP 50km PS** emissions for 2015 (SNAP sectors)

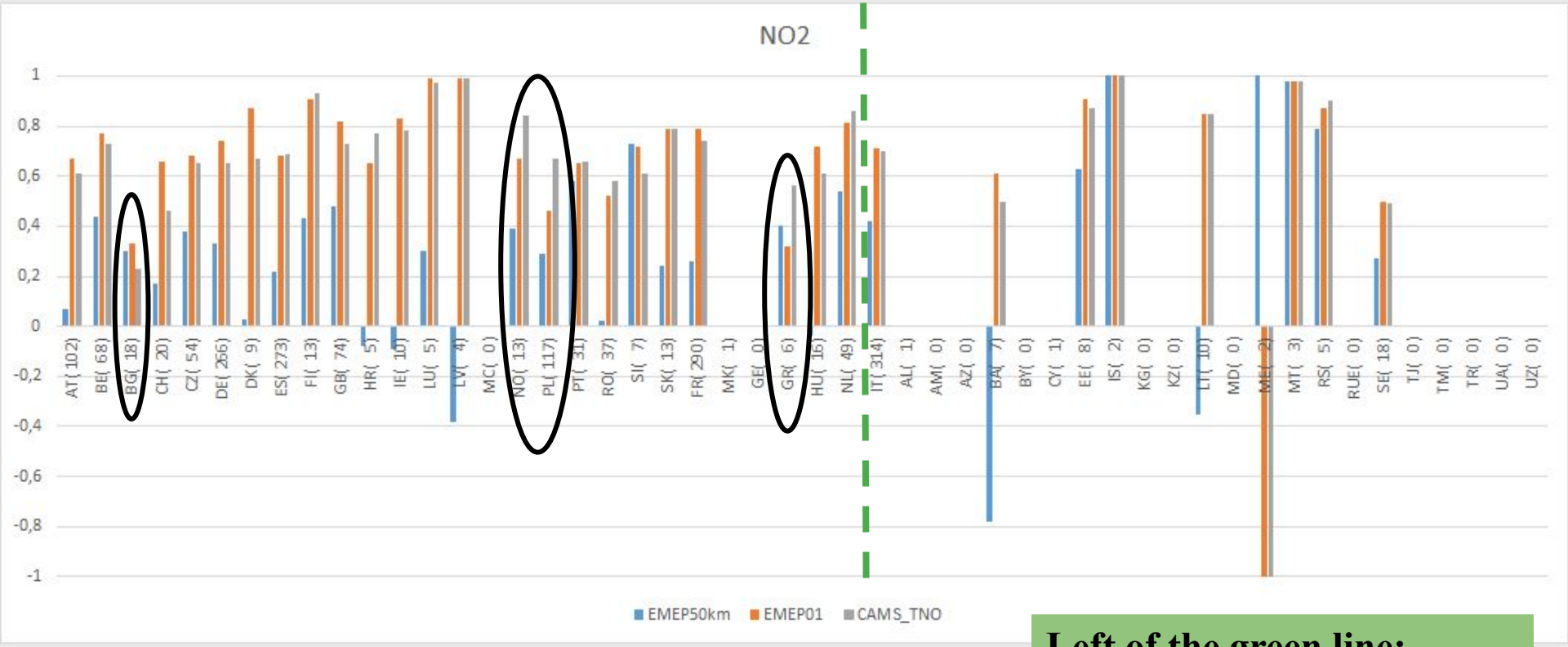
Why compare to CAMS-REG-AP emissions?

- Widely used, independent gridding - might help to find possible gridding mistakes in countries that reported

Comparison to EMEP (background) and **Airbase** measurements (rural, suburban, urban, excluding traffic stations)

- Because we do not expect to see that much change in the background (that is how the EMEP network was designed)
- Lots of data are needed to look at the spatial distribution (EMEP not enough)

NO_2– spatial correlation (model-Airbase) within each country



- Improved spatial correlation for NO_2 from 50km to 0.1
- For countries that have reported, correlation is generally somewhat better for EMEP than CAMS-REG-AP
- Some countries could improve (e.g. BG, PL, NO, GR)

Left of the green line: countries that reported in the new grid
Parenthesis: number of sites

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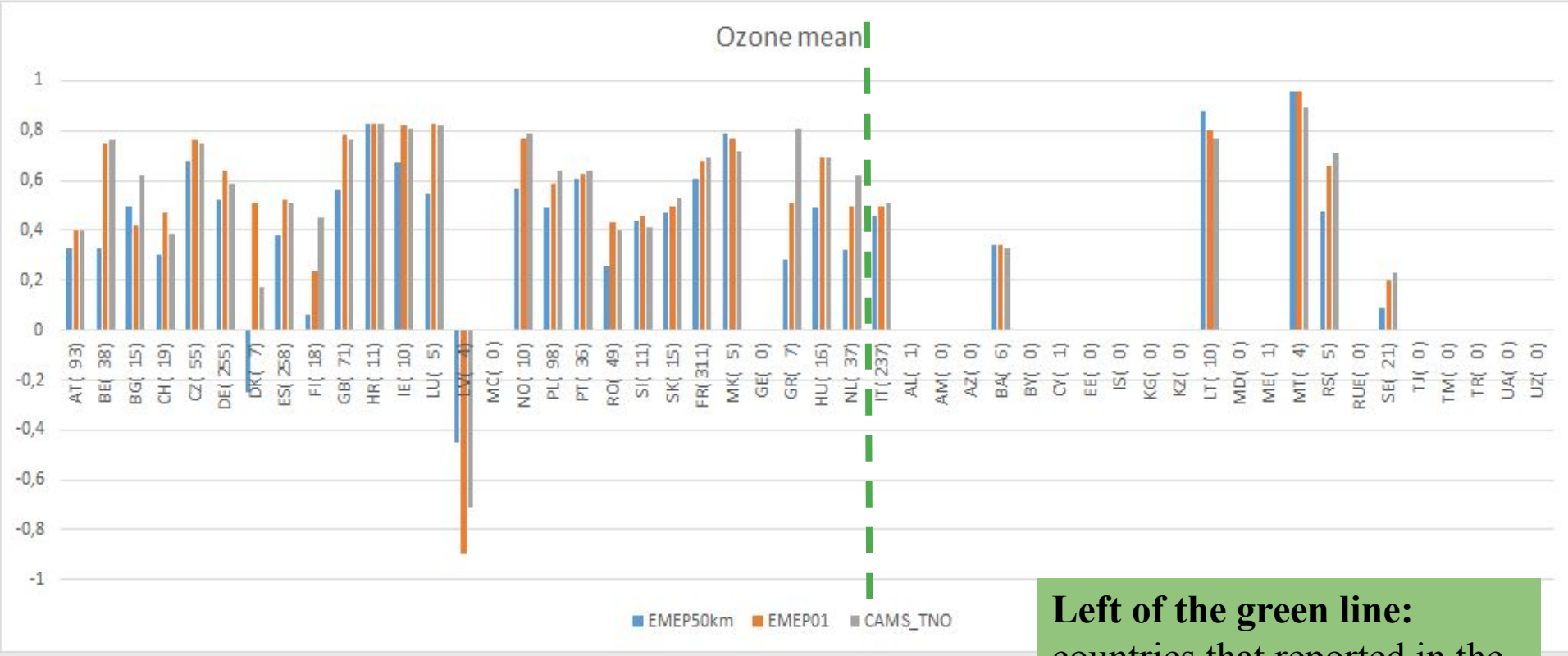
O_3mean – spatial correlation (model-Airbase) for each country



Left of the green line: countries that reported in the new grid
Parenthesis: number of sites

- Improved spatial correlation for O_3 from 50km to 0.1
- More similar results between EMEP01 and CAMS-REG-AP (but resembles NO_2)

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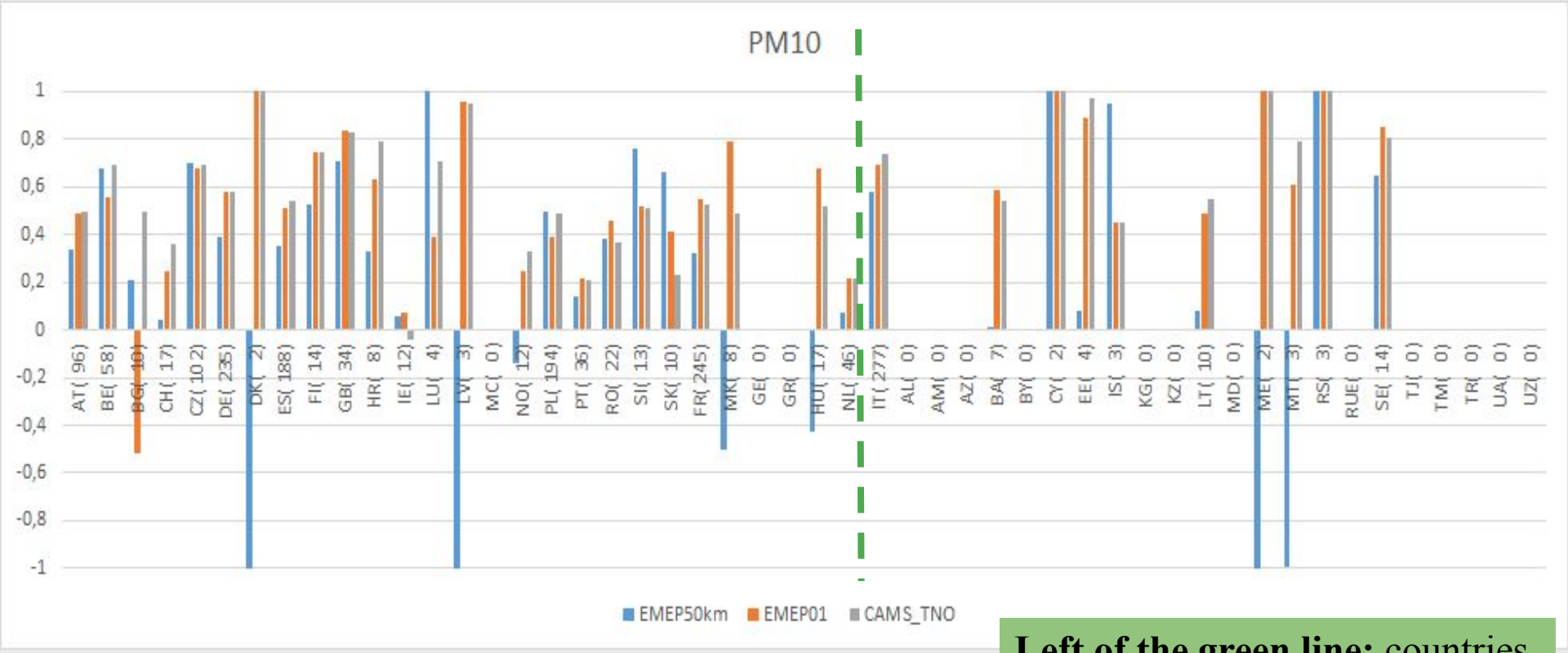
PM_{10}– spatial correlation (model-Airbase) within each country



Left of the green line: countries that reported in the new grid
Parenthesis: number of sites

- Improved spatial correlation in the majority of countries from 50km to 0.1 deg
- No significant difference between EMEP01 and CAMS-REG-AP

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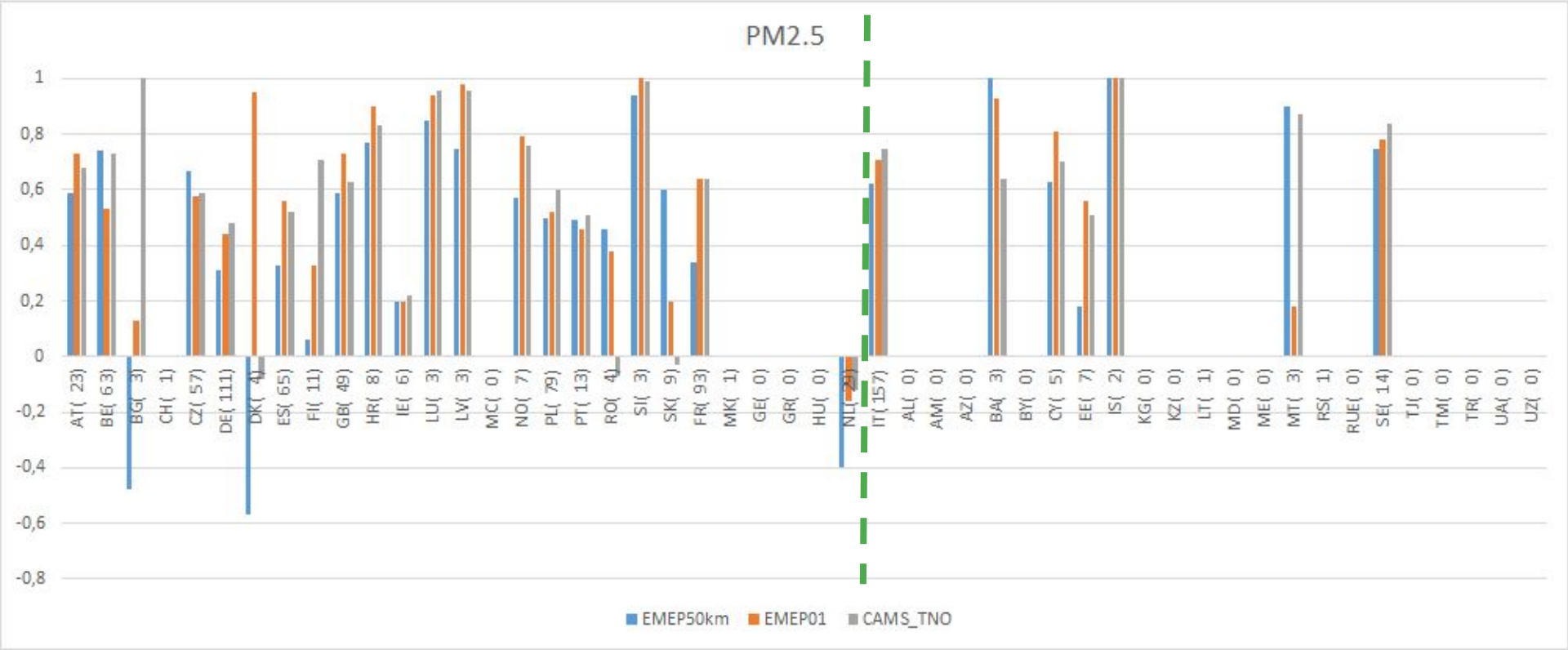
PM_{25}– spatial correlation (model-Airbase) within each country



Left of the green line: countries that reported in the new grid
Parenthesis: number of sites

- Improved spatial correlation in the majority of countries from 50km to 0.1 deg
- No significant difference between EMEP01 and CAMS-REG-AP

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Summary - gridded emissions & model calculations

- Clear improvement in results going from 50km to 0.1° resolution
- Use of national data in the gridding is mostly beneficial
  - Model results (spatial correlation) for NO_2 are somewhat better using EMEP 0.1°x0.1° than CAMS-REG-AP emissions
  - For other components the performance is similar overall
- For countries with few observations it is difficult to interpret whether the new gridding is better than the old and/or CAMS-REG-AP
- More knowledge about the national observation networks is necessary to judge the performance - countries are encouraged to participate in this evaluation
- Some countries might benefit from revising their gridding (or the representativeness of measurement stations); e.g. Bulgaria, Poland, Norway, Greece (and Italy)

Temporal and vertical distribution, and speciation of emissions

- Still mapping of GNFR sectors to time factors, height distribution and emission speciation classes (originally defined for SNAP sectors)
- Define specific and adapted parameters for the GNFR sectors
- What is available?
  - CAMS 81 time profiles (by BSC): monthly, weekly/daily and hourly (gridded) temporal factors (global or regional), for each sector, pollutant and reference year
  - CAMS 81 vertical profiles: default effective height is provided per GNFR sector
  - CAMS 81 emissions splits: updated PM and VOC speciation table for 2000-2015 and 2016
- CAMS-81 profiles yet to be tested in the EMEP MSC-W model
- Feedback from countries would be useful

Condensables

- Probably the biggest single source of uncertainty in PM emissions
- Has been thoroughly discussed by TFEIP in the last years
- In 2017 TFEIP agreed
  - Improve consistency and transparency of reporting
  - All parties should adapt a sector-specific approach for including/excluding condensables (e.g. residential combustion and road transport should include the condensable component, while e.g. industrial sources excludes condensables)
  - The Guidebook would need to provide emission factors consistent with the principles above
- In 2018 the Expert Panel on Combustion and industry agreed that
  - Discussion around condensables is very relevant for small combustion, in particular for biomass
  - Encourage countries to report based on total PM, thus including condensables, if possible

Condensables

- Modellers still do not know if condensables are included for a given country/sector
- How to document this?
  - IIRs - difficult to obtain the information
  - Reporting template (e.g. extra column) - might cause problems for CEIP, a method to communicate this to modellers still needed
- How to deal with inconsistencies (missing reporting)?
  - CEIP estimates
  - EMEP MSC-W modellers
- Split PM into sub-components (BC, OM, SO4, remPPM, for both fine and coarse PMs) in reporting
  - Get a better handle on the OM/BC ratio, and hence condensables
  - Might be difficult for the Parties (and CEIP)

Other issues

- LPS emissions should be explicit
  - Already reported separately (every 4th year), but included in the gridded data for modellers
  - CEIP agreed to provide the LPS data separately in the future
- LPS or hot-spots are visible from satellites now (for SO2 and NH3 at least, and presumably NOx soon)
  - Check if reported emissions match these
- Some countries might include soil emissions of NO and/or NH3
  - Needs to be consistent between countries, and identifiable (no clear recommendation whether they should be included or not)
- Split by fuel type (e.g. traffic by petrol, diesel, etc, residential combustion by wood, coal, etc)

Summary

- Emissions in the new 0.1°x0.1°long-lat grid gives better model performance, but there are still possibilities for improvement:
  - Report (gridded) emission data (within deadline)
  - Check spatial distribution, improve if possible and submit new gridded data
- Several new deliverables for the CAMS 81 project can be useful for CLRTAP modelling, but we need feedback about the data
- Condensable component of PM is still challenging
- Consistency and transparency are important
- More details (further splits to sub-components and/or sub-sectors) would be beneficial


Thank you for your attention
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