

Workshop on trends analysis
Topic 6: Modelling
Input to the TFMM trend report

EMEP/MSC-W
Paris 17-18th November 2014

Links to questions of CLRTAP Assessment Report

- How would today's world have looked like, if no abatement would have been taken in the past decades?
(model analyses)
- Which abatement measures/ which sector contributed mainly to improved health and ecosystems protection?
(model analyses)
- To what extent do modelled concentrations and depositions fit the observations?
(measurements&model)
- How reliable are the reported emissions?
(measurements&model – emission understanding)
- Do we have appropriate methods for verifying agreed emission reductions?
(measurements&model – emission understanding)

What should TFMM do?

From a modelling perspective...

- Review and select material for TFMM trend report
- Set a methodological framework and a work plan
- Links to other initiatives (EuroDelta)

Review and select material for TFMM trend report

Public EMEP wiki page@MSCW on trend work :
<https://wiki.met.no/emep/tfmmtrendpublis>

- Aim: overview of peer reviewed and grey literature work that could be used in the CLRTAP Assessment report
- Add your publications/reports etc become a coauthor of the wiki page, send email to emep-mscw@met.no
- Possibility to upload national expert reports, link to pdfs and publication url's

Review and select material for TFMM trend report

- ACP Special issue “ CLRTAP trends of reactive gases, aerosols and deposition 1990-2013 ”
- Deadline Dec 2015 (editors?)
(line up with the CLRTAP Assessment report)
- Possible contributions:
 - EuroDelta trend study
 - EMEP Centers trend studies
 - 'National' contributions
 - Comparison EMEP vs ICP forest data
 - EEA Ozone trend studies
 - Other ideas??

Methodological framework and work plan for modelling

- **EuroDelta** is one framework – will there be other studies for which we should define a framework? Or should we rather ask other studies to be complementary and coherent with EuroDelta?
- **MSC-W + CCC** plan to do additional trend studies – how to make this complementary?

What questions could EuroDelta answer?

- Robustness of trend signal among models?
 - How large is the spread in the trend signals between the models and how does this compare with trend signal in the observations?
 - How (different) do models handle the change in chemical regime?
 - If some models do not 'reproduce' the observed trend for a species – can we identify why not? (missing processes?)
 - Can a multi-model study give confidence to **reported** emission trends? (verify agreed emission changes)
- Trends in different parts of Europe?
 - Do the models agree that different parts of Europe have different trends?
- MORE?

Methodology for EuroDelta studies

- Model simulations should be performed for **consistent** set of BC, emission and meteorology (analysis to be performed every 5 years, 1990/1995/2000/2005/2010)
- Should models use the **same** or **individually preferred**
 - boundary conditions
 - Meteorology
 - emission sets (eg reported?)
- **IF** it should be “the same”, then
 - should it be the best?
 - or some easy accessible?
 - or an independent reference?

Planned trend studies

MSC-W with CCC

- EMEP/MS-CW model calculations 1990-2013 combined with available long term data sets (EMEP, AirBase, ICP forest ++)
- Sensitivity trend runs
- Aim at 4 papers: S, N, O₃, PM

Planned trend studies

MSC-W with CCC... questions

- How do the emissions changes from different sectors impact the trends?
- Are there changes in boundary conditions or hemispheric transport that influence the trends?
- Are there changes in the trans-boundary fluxes?
- What is the year to year meteorological variability and how does this influence the observed trends?
- What trend is detectable in the future? Can we measure the impact of the Gothenburg protocol?

Complementarity and Links EuroDelta and Centres studies

- EuroDelta trend study (5 year interval)
 - This can be done by more models
 - Stability of trend signal across model types
 - Robustness of gross emission effects
- EMEP Centers trend studies (1990-2013)
 - Assessment meteorological variability
 - Attribution of trend to sectors, processes
 - Boundary condition composition
 - Gap filling of trends @ measurement sites
 - Model database for national experts

GAPS

where modelling could contribute

- Ozone:
 - Model studies often ca 10 years – short for trend studies
 - Mean and max studied, but not the highest percentiles etc (where the trends in observations are most pronounced).
Use similar analysis as in observations?
 - The importance of (changes in) hemispheric transport (BCs) is not clear
 - The importance of (changes/variability in) stratospheric intrusions is not clear
 - Trends in different parts of Europe, regional vs sub-urban
 - Importance of NO_x vs VOC reductions for the trend

GAPS

- Sulphur
 - Trends in total deposition (comparison with ICP forest data). Relative changes in dry vs wet deposition
 - Change in seasonality of emissions/changing chemical regimes → trends in different seasons
 - Influence of ship emissions/volcanoes on trends
 - Impact on climate forcing

GAPS

- Nitrogen (oxidized and reduced)
 - Importance of dry vs wet deposition in trends
 - Gas vs particulate trends (also: fine vs coarse nitrate) → changes in transboundary fluxes?
 - How have changes in different sectors contributed? (e.g. in mobile sources; more diesel cars etc)
 - NO_x data from satellites – e.g. can they identify changes in emissions from power plants?

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GAPS

- PM (and AOD)

- Limited PM data, no primary particle emissions from the 90'ies
- Understanding of PM composition changes?
- Does the variability of dust import affect European PM trends?
- What is the elemental carbon trend?
- Is the AOD trend consistent with other aerosol trends?
- Can we use AOD trends to infer regional surface PM trends?
Eg for Eastern Europe
- Is there any shift in chemistry from 1990 to 2012 in the European atmosphere, leading to different particle formation rates?

Issues to be discussed

- Are there other model study initiatives? What material exist in the countries already?
- Multi model comparison: will it help verify reported trends in emissions?
- Eurodelta methodology? Will other (national) studies use the same?
- How to do model-measurement joint analysis? Should we use the same methods?
- Link to assessment report?
- Wiki and ACP special issue?