Atmospheric Ammonia: detecting emission changes and environmental impacts

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Background

- Acidification
- Eutrophication
- Secondary particulate matter
- Transboundary and local impacts
Challenges

• Diffuse source
• Difficult to quantify
• Difficult to control
• Biogeochemical cycle is complex
Current policy climate

- UN/ECE Gothenburg Protocol
- National Emissions Ceiling Directive
- Air Quality Framework Directive and Daughter Directives
- Integrated Pollution Prevention and Control Directive
- Other indirect legislation
Scope of workshop

WG 1: Detecting changes in atmospheric NH₃

WG 2: Critical thresholds for atmospheric NH₃

WG 3: Dealing with NH₃ in “hot-spot” areas

WG 4: Regional modelling of atmospheric NH₃

CCG A: Reliability of NH₃ emissions & abatement efficiencies

CCG B: Ammonia policy context & future challenges

Temporal trends

Explaining model differences

Approaches for local assessment & NH₃ bioindicators

Results of transect studies

Treating sub-grid variability

Model import

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WG1

- Do existing critical thresholds for ammonia reflect current scientific understanding and, if not, what are suitable values according to current knowledge?
Conclusions

• There is a need to not rely solely on critical loads
• New critical levels have been defined based on scientific evidence
• Two critical levels have been defined based on different vegetation types
• Critical level is based on a long term average
• This will result in practical application which will be simpler to apply and more cost effective to regulate on a local level and NH$_3$ specific measures
• To what extent can independent atmospheric measurements verify where regional changes in ammonia emissions have and have not occurred?
Conclusions

- Many conclusions from Bern workshop remain valid
- New knowledge has led to better understanding of emission / transport / deposition including ammonia gap
- Emission reduction policies shown to have been effective from atmospheric monitoring data
- Recognition of need for long term, international monitoring strategy
- Recognition of need for model intercomparison
WG3

• How can transboundary air pollution assessment be downscaled to deal with ammonia hotspots in relation to operational modelling and monitoring?
Conclusions

• Discussed issues of how deposition near hotspots is linked to transboundary air pollution
• Identified how landscape modelling could provide protection against hotspots and when linked with large scale models provide improved understanding
• Need to share country experiences
• Identified recommendations to improve modelling - better estimation of temporal and spatial emissions, focus on compensation point and surface resistance, reference cases to assess different models, improved background data
• Discussed monitoring assessment strategies
WG4

• What are the differences between mesoscale (regional) atmospheric transport and chemistry models in relation to their formulation and results for ammonia?
Conclusions

• Reviewed the parameterizations used in the models, highlighting specific areas of uncertainty – e.g. need to test bidirectional flux
• Discussed differences between the models and noted that nested approach was particularly effective for assessing local and long range impacts
• Recognised the need for model intercomparison especially with EMEP and highlighted need for improved monitoring to verify models
CCGA

- What are the reliability of ammonia emissions data and abatement efficiencies?
Conclusions

• Uncertainty is variable within emission inventories and there is a need for countries to focus on uncertainty analysis
• Activity data is the biggest uncertainty and there is a need to collaborate on an international scale to address this
• Work to improve emission factors is needed especially in E and S Europe
• Key mitigation methods are known and agreed
• Debate on benefits of soft approaches
• Continued need to focus on cost effectiveness and applicability of emerging technologies
CCGB

- What is the agricultural and environmental policy context and how can scientific understanding help address the future challenges to reduce the negative effects of ammonia?
Conclusions

- Need to consider direct and indirect legislation and links to other policy relevant areas
- Need to link legislation to eliminate loopholes
- Assess consequences of revised critical levels
- Highlighted reliability of cause / effect policy chain especially pollution swapping
- Explored strategy approaches
- Need linkage of scales including decisions on priorities
- Need to improve temporal and spatial concentration resolution of models
- Need to analyse reduction policies in multi effect, multi media and multi scale way
Were the objectives achieved?

- Focused on four specific issues of high priority for the Convention
  - to recommend up-to-date values for NH$_3$ critical levels
  - to assess whether observed trends in atmospheric NH$_3$ and NH$_4^+$ match the expectations of emission mitigation policies
  - to identify best-practice for quantifying ammonia impacts in hot-spots
  - to review the status of different transboundary models of atmospheric NH$_x$
- Realised through bringing together international expertise on ammonia across themes of the Convention
- Will provide “Ammonia Science” underpinning for the UNECE Convention on LRTAP - feed into future policy climate
Thank you for your attention

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