



Assessment Methods for Ammonia Hot-Spots

(Working Group 3)

**Expert Workshop under the UNECE Convention on
Long-range Transboundary Air Pollution**

4-6 Dec 2006, Edinburgh, Scotland

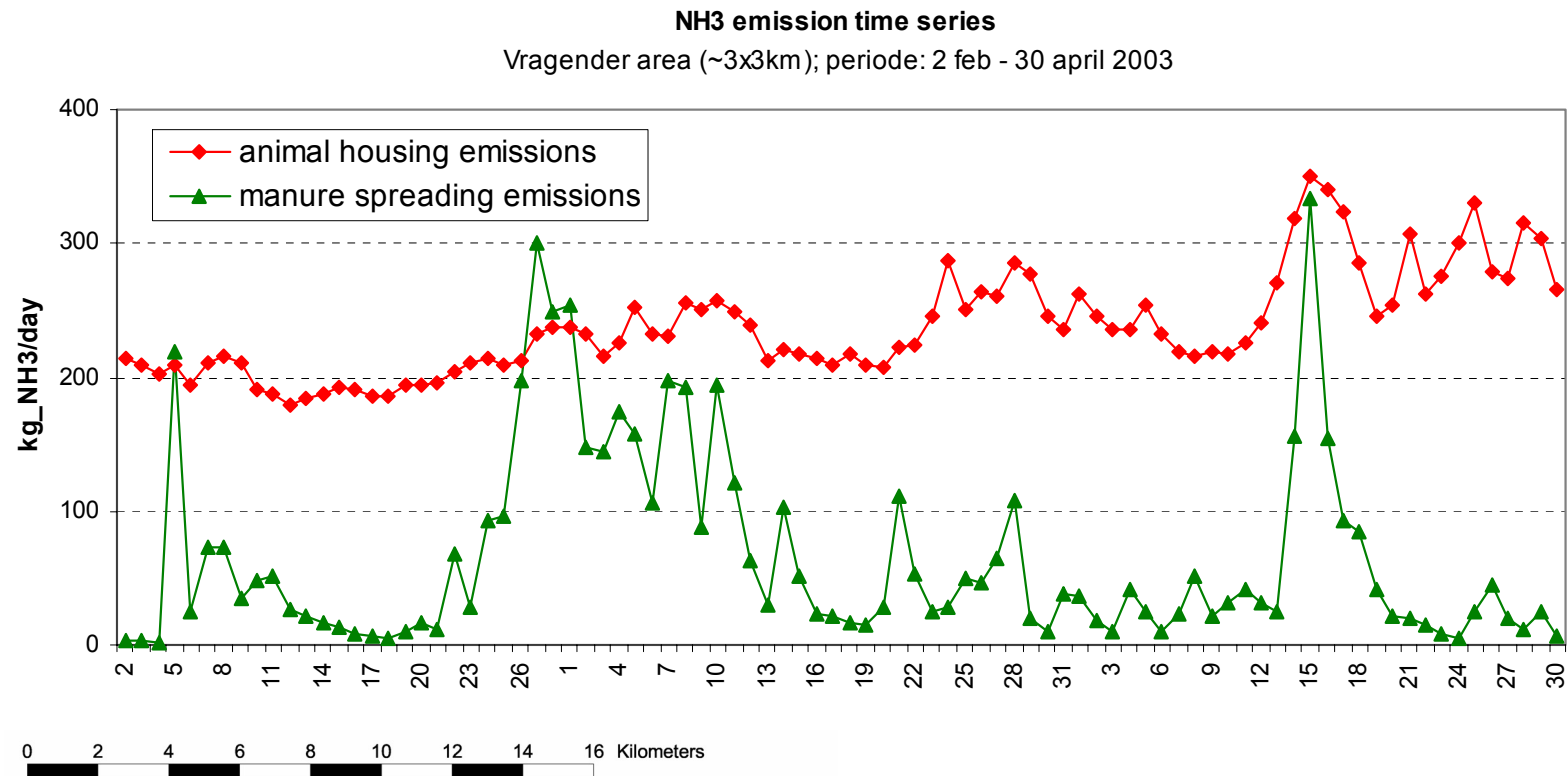


Outline

- **What is a hot-spot?**
- **How can they be assessed?**
 - Objectives
 - Tools
- **Modelling**
 - Uncertainties
 - Research Priorities
- **Integrated assessment**
 - Models/Monitoring

What is a hot-spot?

- Large ammonia emission source
- Localised either in space or time



How can they be assessed?

Objectives

- Understanding small-scale processes
- Assessing impacts of dry deposition
- Spatial planning
- Assessing effects of local abatement measures
- Provide relationships for larger-scale models
- Impact on air quality and PM formation

Modelling Tools

- Lagrangian stochastic models
- Local-scale Gaussian/Eulerian models
- Screening/simple models (e.g. SCAIL)

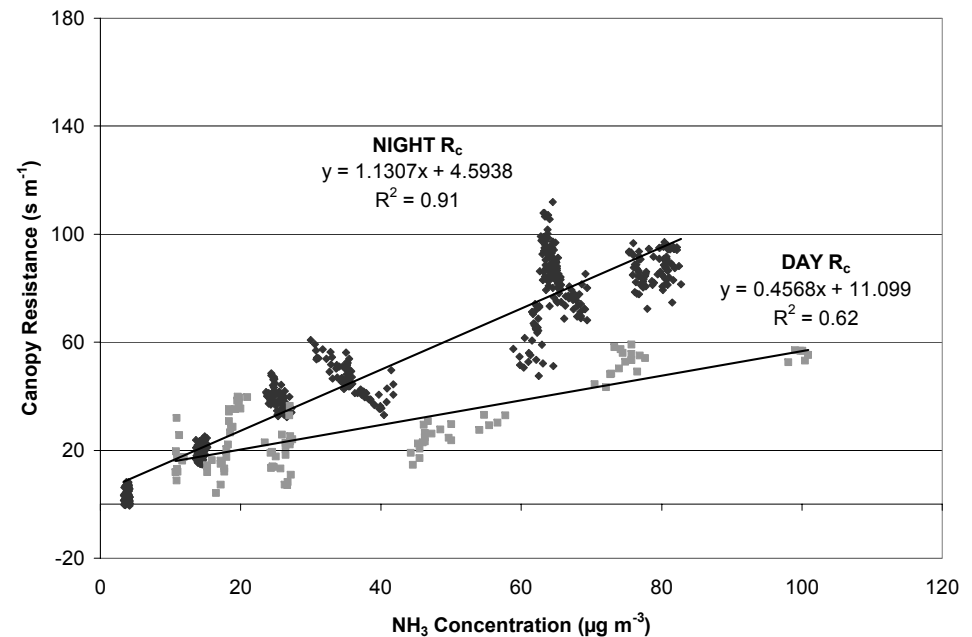
Uncertainties - Emissions

- **Suitable for source type**
- **Temporally variable**
 - Diurnal variation
 - Seasonal variation
- **In the correct location**
- **Depends on objectives/accuracy**

Process-based ?

Uncertainties – Exchange processes

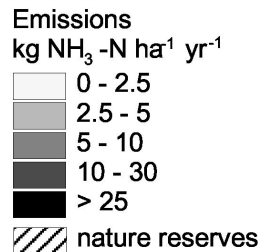
- Better knowledge of compensation point of natural vegetation and crops
- Better knowledge/improvement of surface resistance = $f(\text{NH}_3, \text{surface humidity})$ for different vegetation
- Effect of deposition surface resistance
- Need for in-canopy layer model for simpl



Uncertainties – Specific to model type

- **Lagrangian Stochastic, short-range models:**
 - *Compensation point (C_p)*
 - *Effect of exposure to NH_3 on R_w and C_p*
 - *Detailed turbulence field near buildings/forest edges*
- **Gaussian/Eulerian models:**
 - *Compensation point (C_p)*
 - *Effect of exposure to NH_3 on R_w and C_p*
 - *Chemistry (depending on spatial scale)*
 - *Accurate locations of sources and receptors*
- **Screening/simple model:**
 - *Source strength,*
 - *Applicability to other locations/sources/receptors*

Spatial Planning

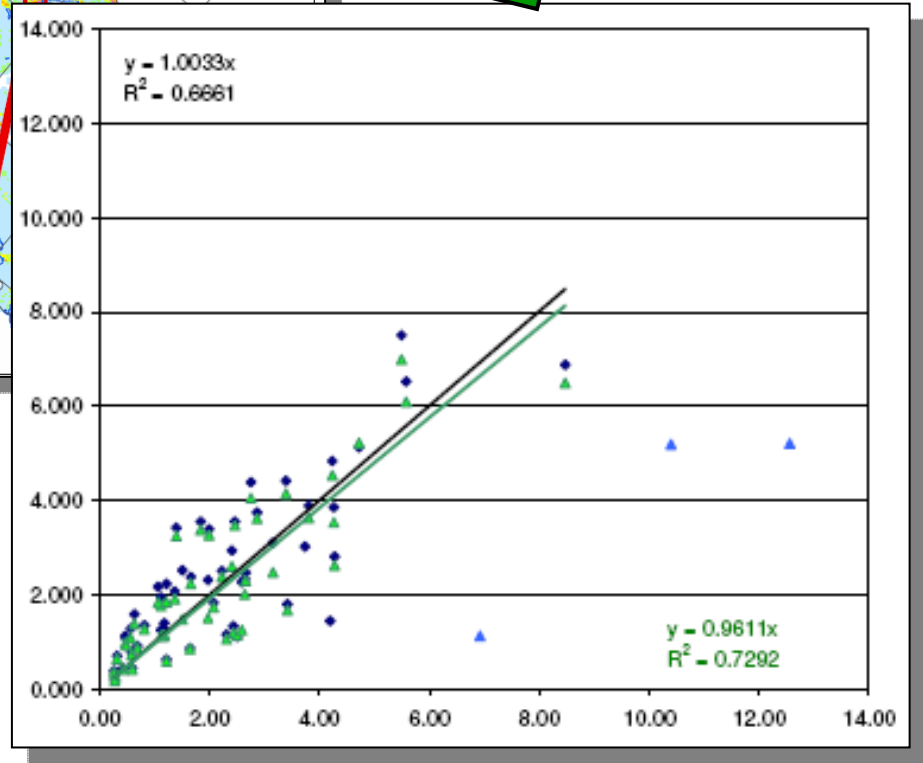
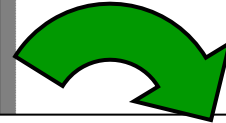
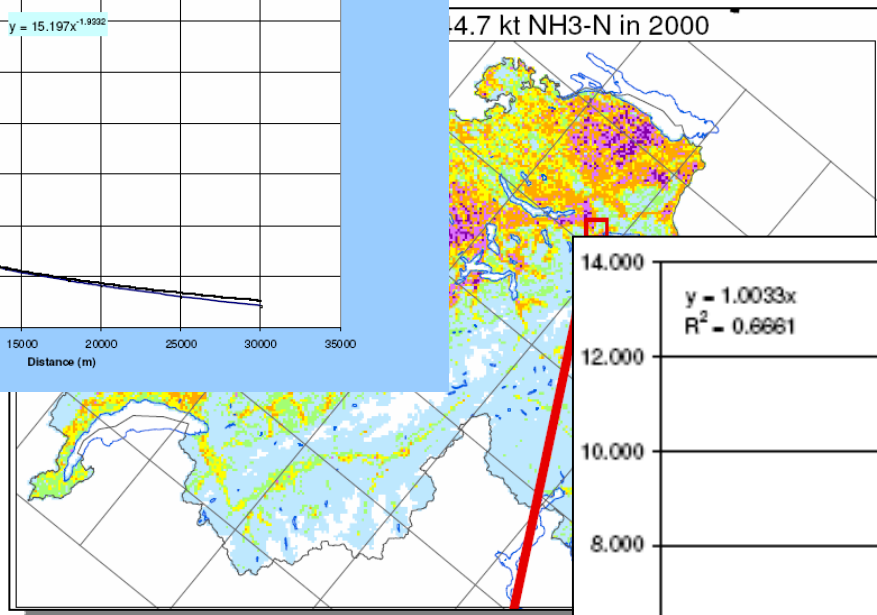
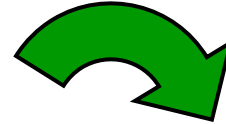
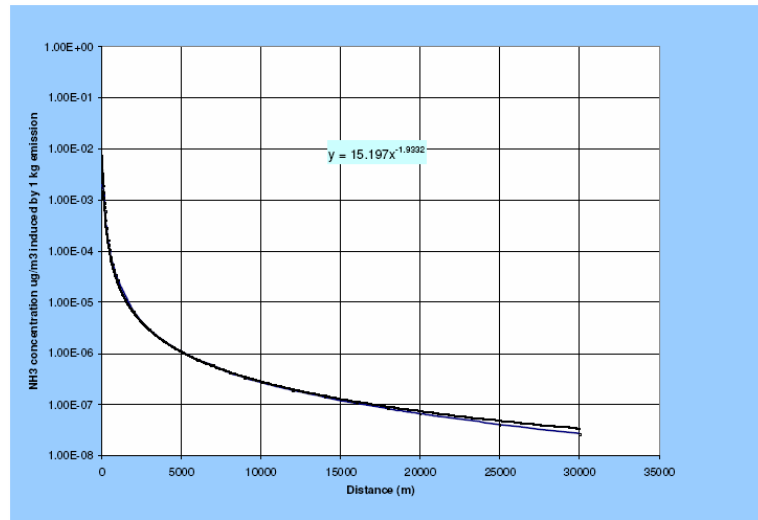


Receptor buffer zones

Linking to larger-scale modelling

- **Regional scale (e.g. EMEP)**
 - Upscaling local interactions
 - Estimates of within-grid recapture
 - Providing boundary conditions
- **Use of local relationships at regional scale**

Use of local relationships at regional scale



Assessment Strategies

- **Objectives**
- **Modelling tools**
- **Monitoring tools**
- **Integrated approaches (model + monitoring)**

Assessment Strategies - Objectives

- **Existing or planned source**
- **Single source and receptor**
- **Multiple source-receptor (local measures)**
- **Comparison with thresholds**
 - Critical levels
 - Critical loads

Assessment Strategies - Tools

- **Modelling tools**
 - Simple/Landscape/Lagrangian Stochastic
- **Monitoring tools**
 - Low cost e.g. passive samplers
 - Comparison with continuous measurement
 - Sampling period
 - Sampling locations
 - Biomonitoring ?
 - Methods for deposition measurement

Assessment Strategies – Integrated approach?

- **Objectives (e.g. existing/planned source)**
- **Combined modelling and monitoring?**
- **Comparison with critical levels:**
 - Measurements used to verify model predictions
- **Comparison with critical loads:**
 - Concentration measurement → Deposition estimate
 - Deposition velocity approach probably too simplistic
 - Inferential modelling approach is better (and possible)

Working Group Achievements

- **Assessed range of objectives**
- **Prioritised uncertainties** (for different model types)
 - **Research priorities**
- **Concluded that model inter-comparisons would be very useful**
- **Suggested possible assessment strategies**
 - Depending on objectives (existing/planned source, single/multi-sources and receptors, comparisons with critical levels/loads)