

Nitrogen emission reduction: Danish experiences

Torben Moth Iversen

National Environmental Research Institute

University of Aarhus



NATIONAL ENVIRONMENTAL RESEARCH INSTITUTE

UNIVERSITY OF AARHUS

Disposition

- Environmental and agricultural background
- National Action Plan
- Regulation and effect
- Conclusions
- Future challenges





Overview: Danish action plans

- 1985 NPo Action Plan
- 1987 Action Plan I on the Aquatic Environment
 - N reduction 50%
 - P reduction 80%
- 1991 Action Plan for a Sustainable Agriculture
- 1998 Action Plan II
 - evaluations 2000, 2003
- 2000 AP II Midterm Enforcement
- 2001 Ammonia Action Plan
- 2004 Action Plan III
 - evaluations 2008, 2011



National monitoring programme 1989/90

Purpose:

- assess nitrogen and phosphorus emissions
- monitor the ecological effects

Costs: about 35 mill. €/year (2004)



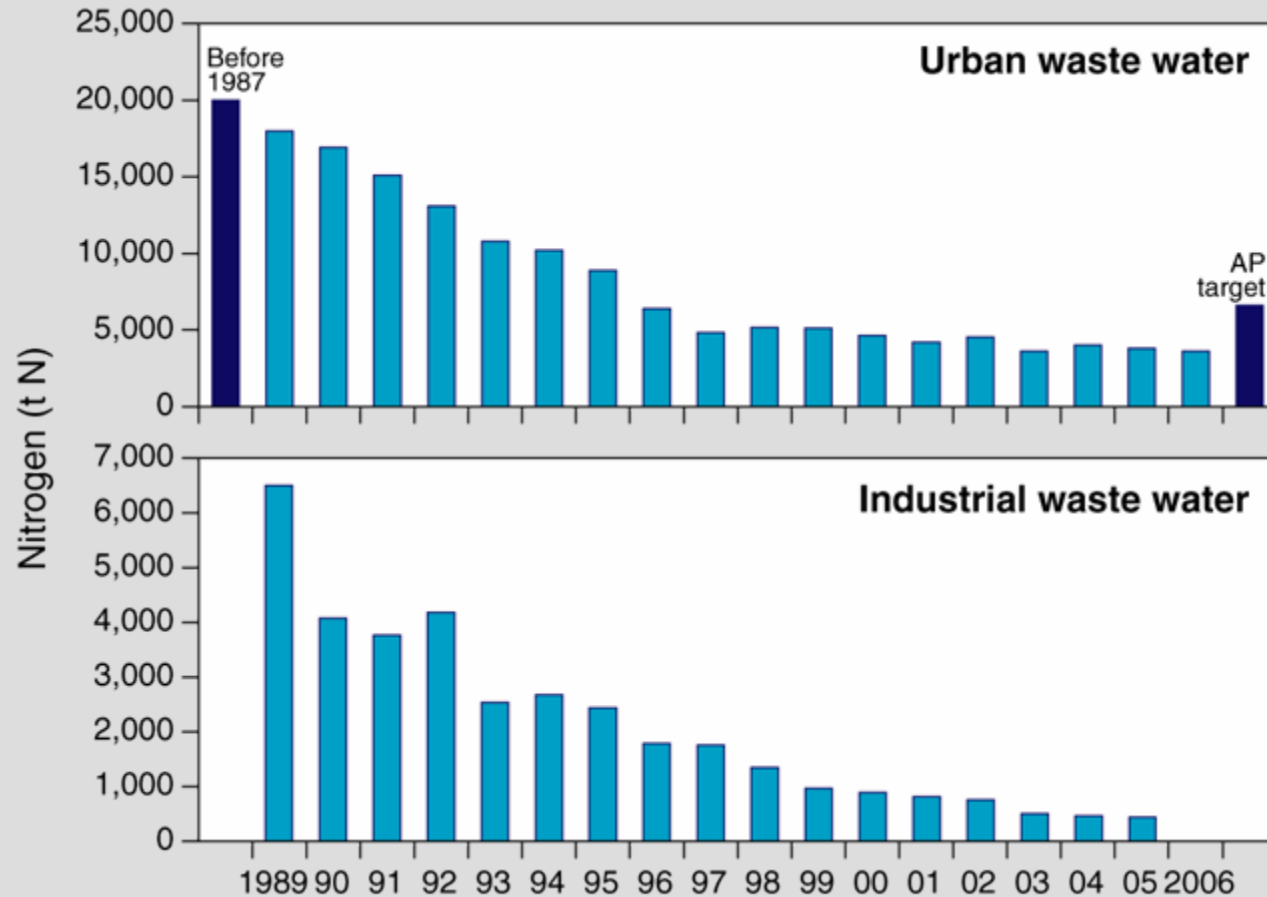
National monitoring programme 1989/90 (2)

Content:

- air quality and atmospheric deposition
- agricultural watersheds
- groundwater
- rivers
- lakes
- point sources
- coastal and open marine waters
- species and habitats (2004)



Danish N reduction in urban and industrial waste water



Overview, regulatory measures

Nitrogen

- Area-related measures (subsidies)
- Nutrient-related measures (regulations)

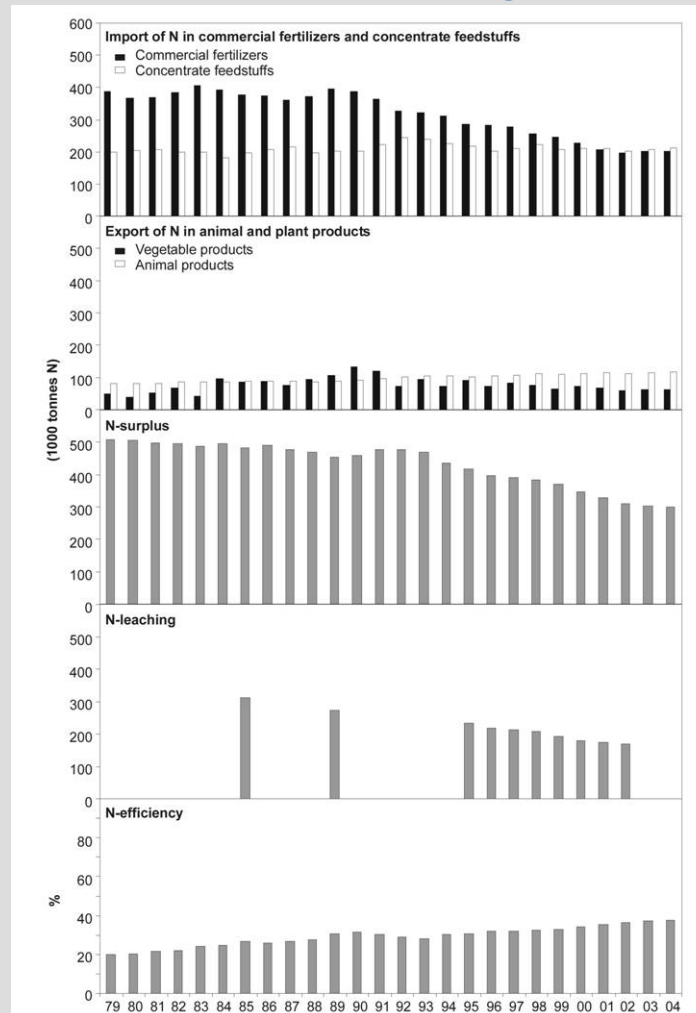
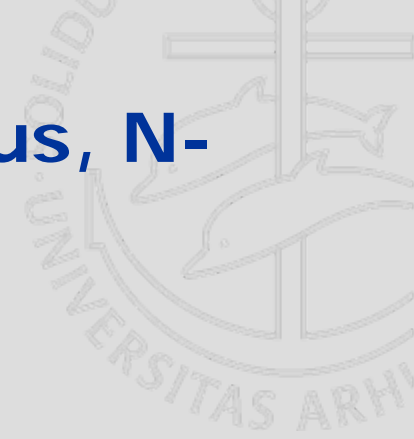


Overview, regulatory measures

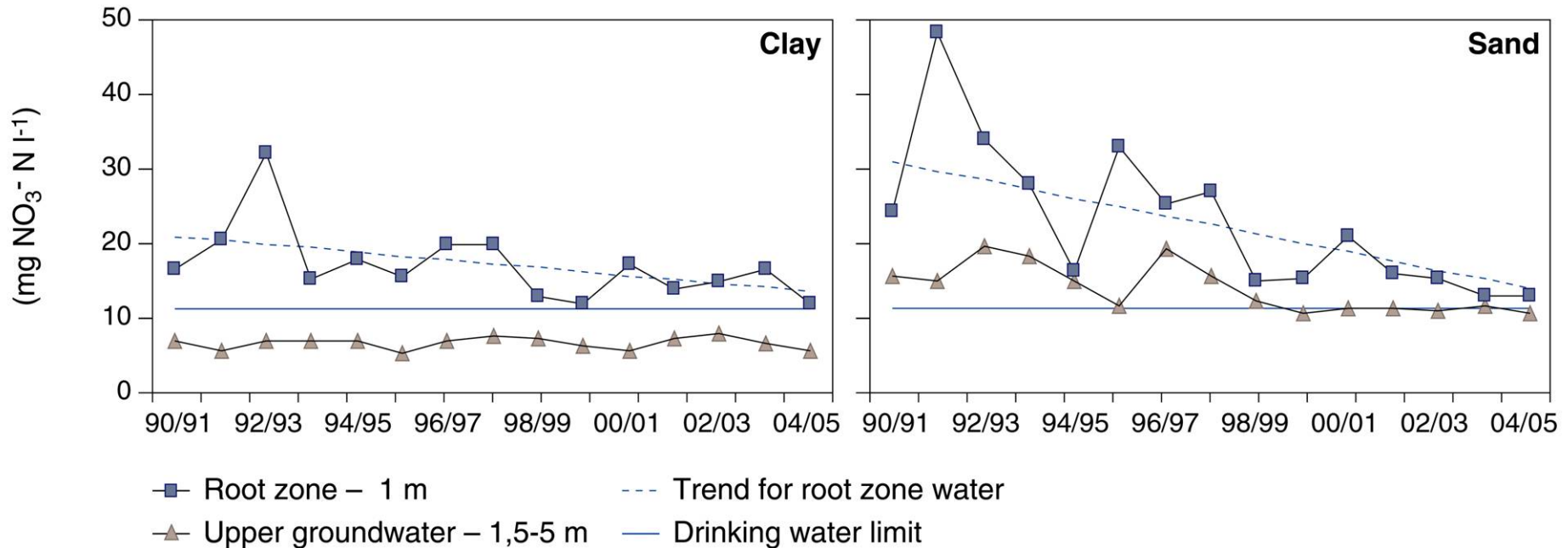
- Storage capacity, slurry
- Slurry spreading regulations
- ▪ Mandatory fertilizer plans
- Mandatory winter green crops
- ▪ Norms for utilization of animal manure N
- ▪ Maximum limits for plant-available N applied to different crops
- Improvement in animal feeding practice
- ▪ Reduction in maximum limits (10% below economic optimum)



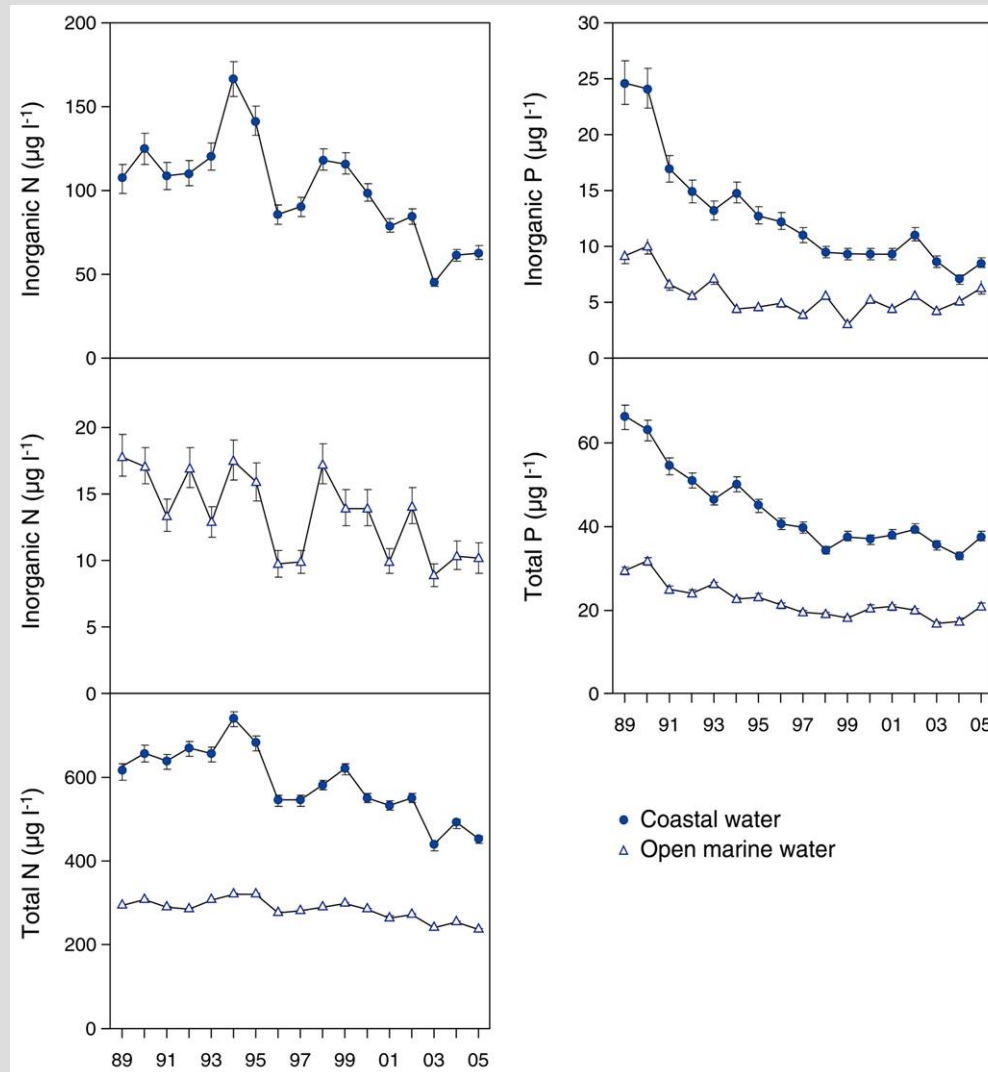
Danish N-import, N-export, N-surplus, N-leaching and N-efficiency



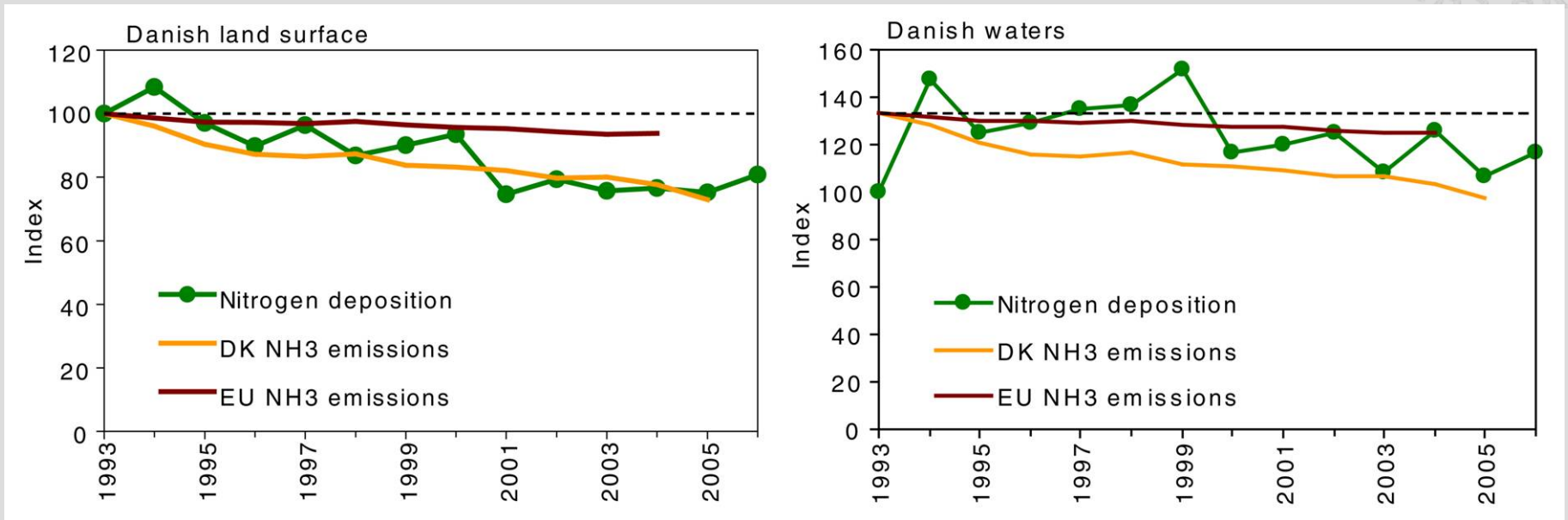
Measured nitrogen concentration in root zone water and upper groundwater



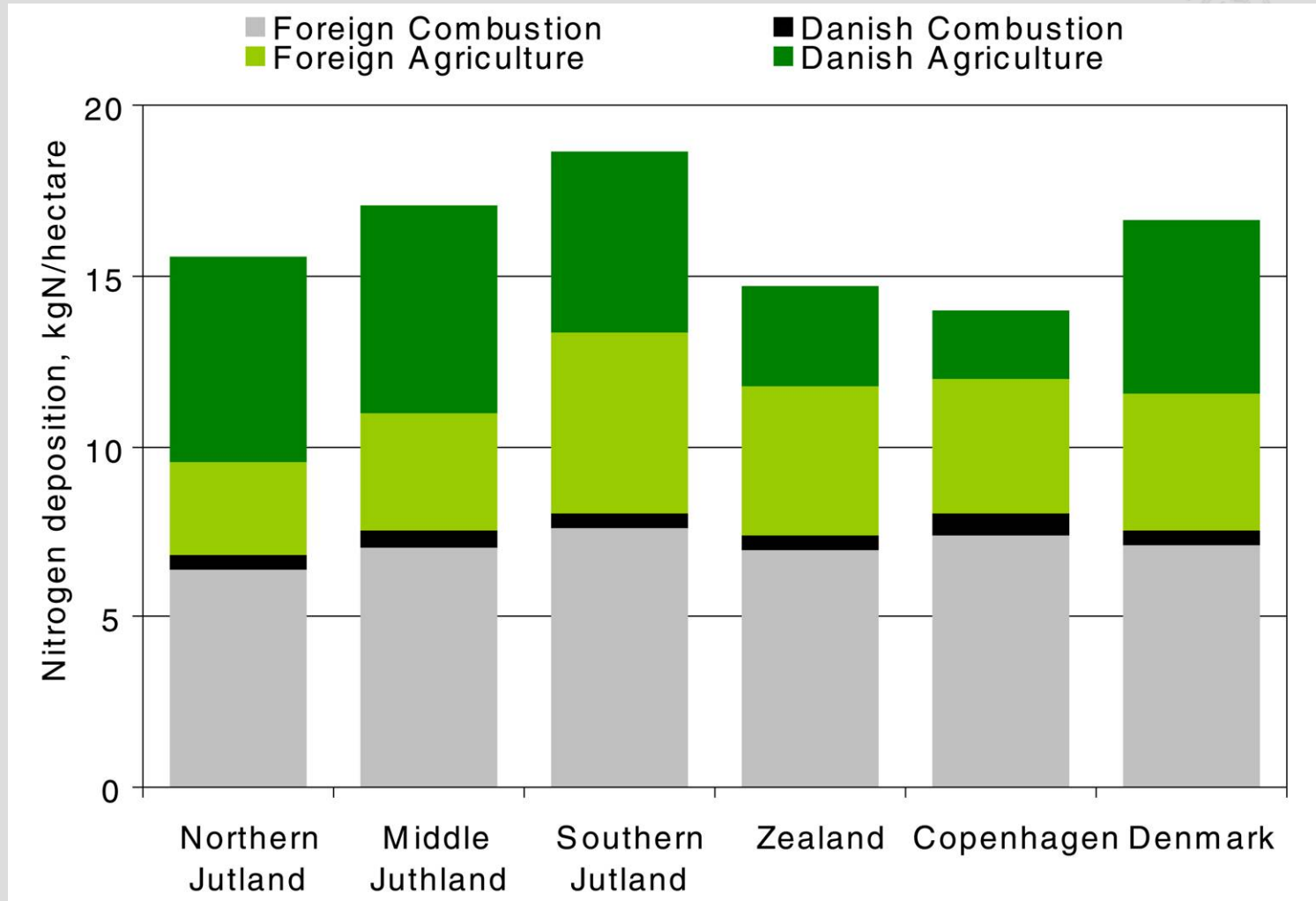
Annual surface water concentrations of nitrogen in Danish coastal water and open Danish marine waters



Trends in NH₃-emissions from EU and DK and in N-deposition to land and water



Nitrogen deposition and its sources



Conclusions

- Remarkable effect on nitrogen household in Denmark
- Effects of improved utilization of animal manure, feed-stuffs and fertilizer plans and limitations
- Complicated system - many individual farmers
- Considerable environmental effect - but with delay
- N-balances good indicators
- Knowledge-based and dialogue-oriented
- Enforcement, monitoring and evaluation



Future challenges

- From national emission reduction targets to local effect targets
 - The Habitat Directive (good conservational status of species and habitats)
 - The Water Framework Directive (good ecological status of water bodies, legally binding)
- The impact of climate change on the nitrogen cycle



Challenges of TFRN

- recommendations on increased spatial and temporal resolution of emission estimates to improve the input to the atmospheric transport models
- recommendations on improved dry and wet deposition models/estimates in the terrestrial habitats

