Uncertainty in Greenhouse Gas Inventories: Verification, Compliance & Trading
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National Greenhouse Gas Inventories: Understanding Uncertainties vs. Potential for Improving Reliability

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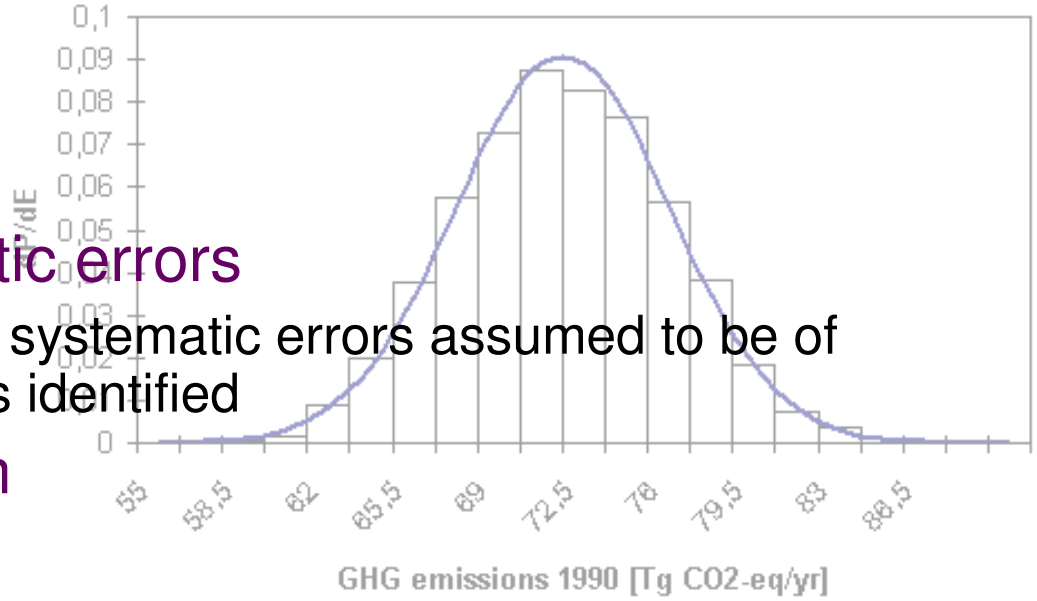
Outline

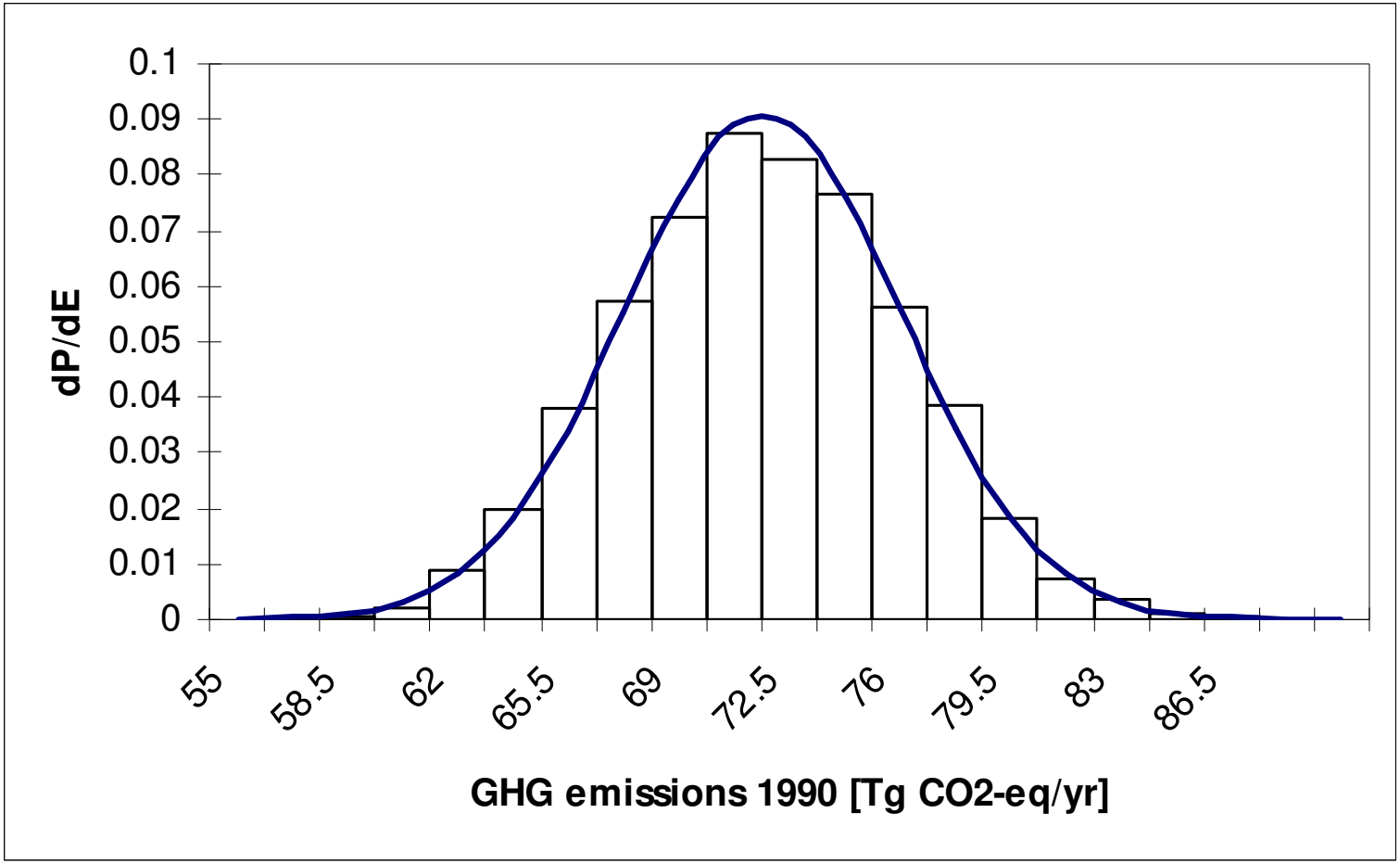
- Uncertainty of GHG inventories
  - example for Austria
- Sensitivity studies to identify potential improvements:
  "conclusions"
- Recommendations:
  - Use of uncertainty in compliance evaluation
  - Use of uncertainty in target setting

Uncertainty calculations: Austria

- Input uncertainties:
  - Statistical differences
  - Reported variation
  - Expert judgement
  - Estimation
- Treatment of systematic errors
  - Magnitude of unknown systematic errors assumed to be of the same size as errors identified
- Monte-Carlo approach
  - impressive
  - easy to operate
  - allows handling of co-variances
  - supports sensitivity analysis



Austrian GHG emissions



Sensitivity studies

- Input uncertainties

  total uncertainty influenced by few inputs

  requirement to deep investigation limited

- Uncertainty by gas

  similar variances for CO_2, CH_4, N_2O

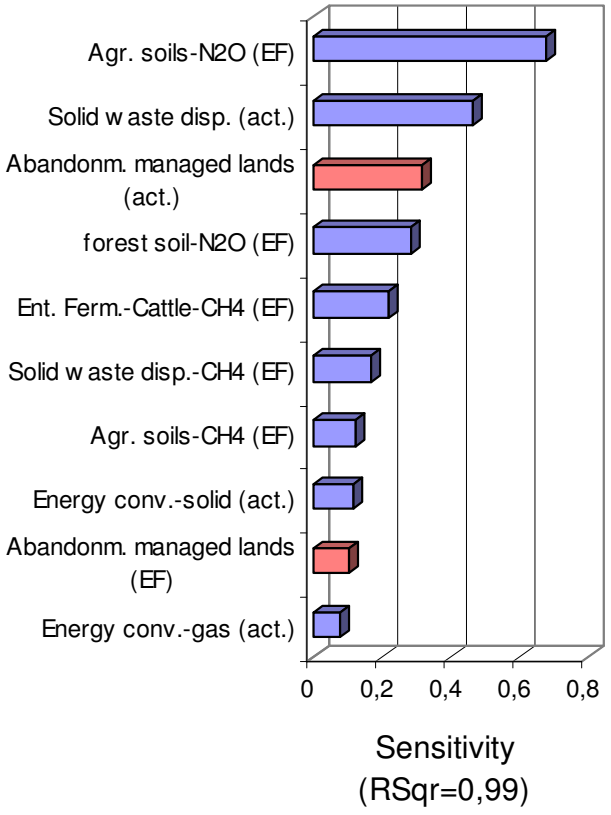
when decreasing variance of any gas

➔ little change to overall uncertainty

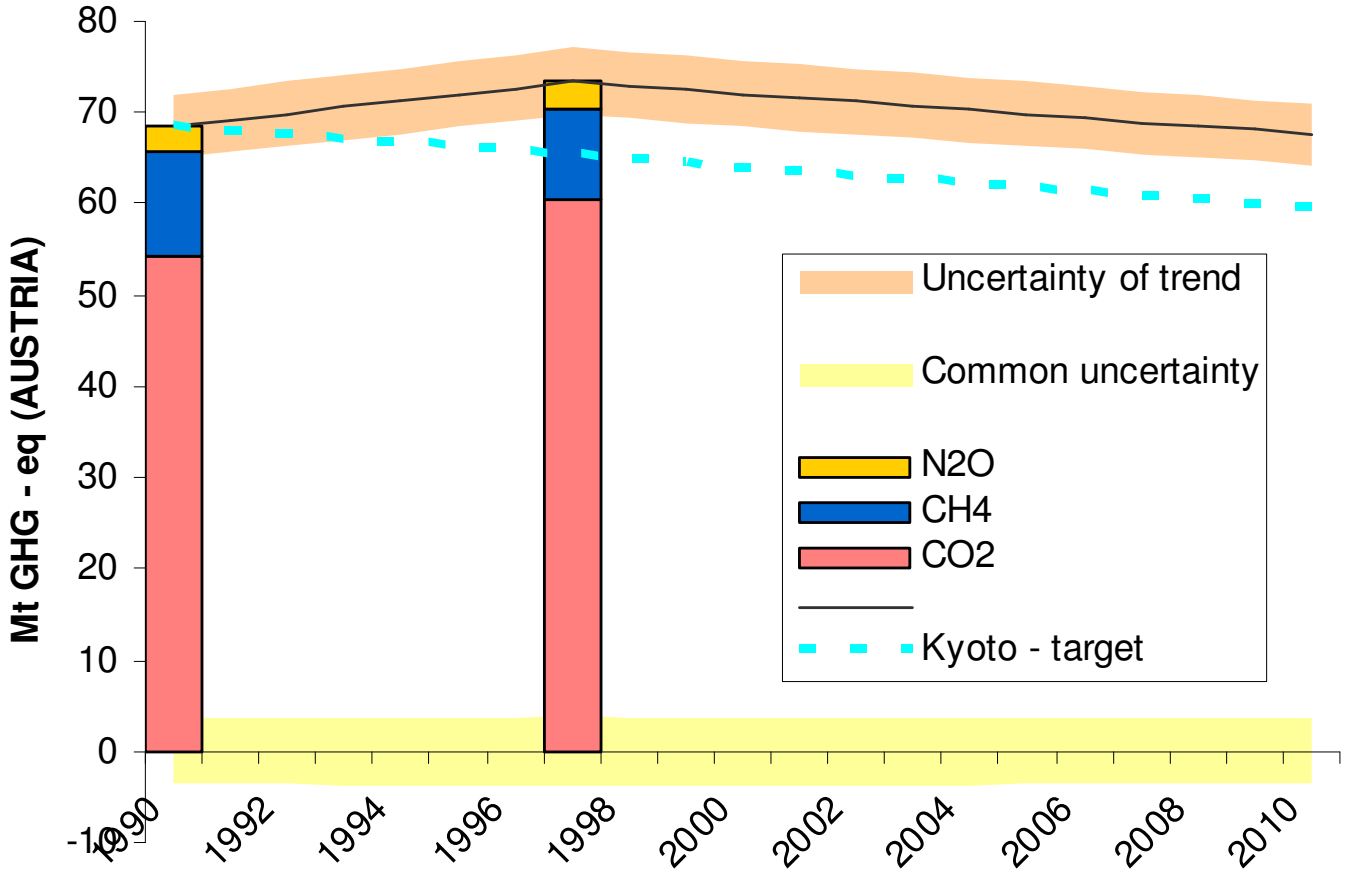
when increasing variance of any gas

➔ increase of overall uncertainty

- Robustness to assumptions on probability density function



Emission vs. trend uncertainty

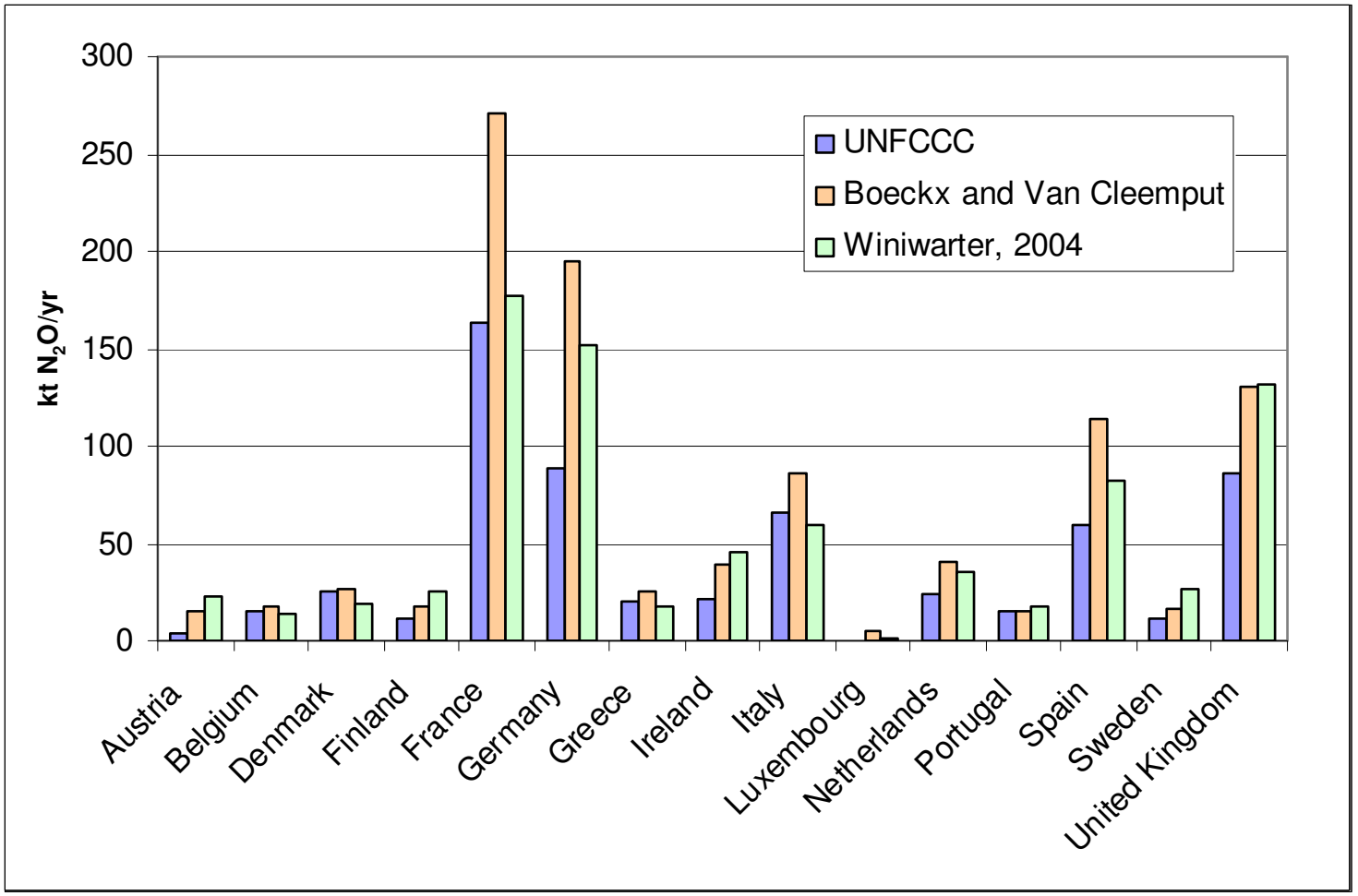


International comparisons

	Austria	Finland	Holland	Norway	UK	USA
CO_2	2	6	3	3	4	3
CH_4	48	20	17	22	17	36
N_2O	90	40	34	200	230	120
HFCs	..	..	41	50	24	25
PFCs	..	..	100	40	20	..
SF_6	..	..	50	5	13	..
Total	10	6	4.4	21	19	13
Total trend (1990-2010)	5	5	..	4	4	..

all uncertainties in % (2s), trend in %-points

Soil N_2O


300
250
200
150
100
50
0
kt N2O/yr
UNFCCC
Boeckx and Van Cleemput
Winiwarter, 2004
Austria
Belgium
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Luxembourg
Netherlands
Portugal
Spain
Sweden
United Kingdom

Conclusions (1)

- Improvements possible only in sectors of large uncertainty
- Personal judgement (of experts ...) does have influence on uncertainty estimates
- Scenario analysis and sensitivity runs allow to assess this influence and to understand / evaluate it
- Intuitive aspect gains weight when uncertainties are larger

Conclusions (2)

- Magnitude of uncertainty is similar for industrialized countries
- Differences due to different approaches rather than structural differences
- Uncertainty of trends smaller, but in the same size as national committments
- Meeting or failure to meet the committments will often remain within the bounds of uncertainty
- Whose obligation is it to prove?

What is the Kyoto protocol good for?

- Will NOT halt climate change
- Will NOT lead to decreasing GHG concentrations
- Will NOT lead to stable GHG concentrations

What is the Kyoto protocol good for?

- Will modify increase of GHG concentrations
- Will provide a framework for further steps to be taken

Environmental equity

- Equal/similar treatment of countries

- Co-variance between countries in certain inventory elements will lead to an *uncertainty of country differences* well below trend uncertainty

  (uncertainty of target hits two economies the same way)

Co-variance

- Trend calculation
  - Co-variance of most emission factors
- Country comparison
  - Co-variance of many activity inputs (structural differences will remain)

What is uncertainty assessment good for (1)?

- Will NOT contribute to test/verify a country‘s compliance

Instead:

→ use rigorous guidelines to assess emissions which leave little space for interpretation

Requirements to Guidelines

- Based on scientific agreement (similar to GWP)
- Non-ambiguous
- Allow for inter-country comparisons to homogenize approaches
- To be used for evaluation of national committments

What is uncertainty assessment good for (2)?

- Uncertainty assessment should contribute to definition / revision of guidelines
- Uncertainty assessment should contribute to validation/verification and new target setting

Messages

- Uncertainty of GHG emission trends can be as large as reduction committments
- Uncertainty decreases when comparing inventories -- rigorous guidelines at least can provide fair conditions
- Uncertainty becomes important in revising targets for future committment periods