



UNCERTAINTY RANGES AND CORRELATIONS ASSUMED IN TIER 2 STUDIES OF SEVERAL EUROPEAN COUNTRIES

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Introduction

- Several countries carried out Tier 2 uncertainty analyses
- Tier 1 vs. Tier 2
- New Netherlands Monte Carlo uncertainty analysis





Goal

1. Comparison of differences in uncertainty ranges, PDF's and correlations in Tier 2 studies in Europe
2. Assessment of influence of these differences on the uncertainty in the total GHG emissions



Approach



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Country	Year	References
Austria	1997	Winiwarter et al., 2000 Winiwarter et al., 2001
Finland	2003	Monni et al., 2003, Monni et al., 2004, Statistics Finland, 2005
Flanders (Belgium)	2001	Boogaerts et al., 2004
Norway	2000	Rypdal et al., 2000
Netherlands	2004	Ramírez et al., 2007
United Kingdom	2003	Baggott et al., 2005

- Tier 2 studies not conducted annually, reference years differ
- Level of aggregation similar to Netherlands Tier 1



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<http://www.chem.uu.nl/nws/www/publica/publicaties2006/E2006-58.pdf>

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Sub-sector comparison (example)

Sector 1: stationary combustion

In NL > 60 % of total GHG emissions





Sub-sector comparison

Austria includes large systematic uncertainties

Level of aggregation very different in UK/Norway

NL large uncertainty for liquids

IPCC	Source category	Uncertainty in Activity Data (2 std dev in %)						
		NL	FI	UK	NO	AU-R	AU-S	FL
1A1 l	Energy Industries, liquids	7.6 N	2 N	0.8 .. 24 N	3 N	0.5 N	5U	4.3 N
1A1 s	Energy Industries, solids	1 N	1.5 N	1.2 ..5.6 N		0.5N	10U	1 N
1A1 g	Energy Industries, gases	1.4 N	1 N	2.4 N	4 N	2 N	5U	2 N
1A1 o	Energy Industries, other fuels	10 N						
1A2 l	Manufacturing Industries and Construction, liquid	1 N	2 N	1.1..25N	3 N	1 N		3.4 N
1A2 s	Manufacturing Industries and Construction, solid	2 N	1.5 N	1.1..5.6N	5 N	1 N	8U	1.8 N
1A2 g	Manufacturing Industries and Construction, gases	2 N	1 N	2.4 N	4 N	3 N		2 N
1A4 l	Other Sectors, liquids	20 N	3 N	1.4..24N	3 N			11.6 N
1A4 s	Other Sectors, solids*	50 N	10 N	1.2..5.6 N	20 N			11.7 N
1A4 g	Other Sectors, gases	5 N	5 N	2.4 N				5 N

NL (Netherlands), FI (Finland), UK , NO (Norway), AU-R (Austria, random), AU-S (Austria, systematic), FI (Flanders)

pdf's N (normal), U (uniform)

* No key source category



Sub-sector comparison



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- NL uncertainty for liquids relatively large due to residual chemical gas
(the liquid fuel category is composed of: residual chemical gas, HBO, LPG, residual fuel oil, Jet fuel petroleum basis, etc.)
- NO uncertainty for gas is relatively large

IPCC	Source category	Uncertainty in Emission factor (2 std dev in %)					
		NL	FI	UK	NO	AU	FL
1A1 l	Energy Industries, liquids	8.4 N	2 N	2.5 N	3 N	0.5 N	2 N
1A1 s	Energy Industries, solids	3.4 N	3 N	3.6 N	7 N	0.5 N	2 N
1A1 g	Energy Industries, gases	1 N	1 N	1 N	7 N	0.5 N	1 N
1A1 o	Energy Industries, other fuels	5 N					
1A2 l	Manufacturing Industries and Constructior	5 N	2 N	2.5 N	3 N	0.5 N	2 N
1A2 s	Manufacturing Industries and Constructior	14 N	3 N	3.6 N	7 N	0.5 N	5 N
1A2 g	Manufacturing Industries and Constructior	1 N	1 N	1 N	7 N	0.5 N	1 N
1A4 l	Other Sectors, liquids	2 N	2 N	2.3 N	3 N		2 N
1A4 s	Other Sectors, solids*	5 N	5 N	3.6 N	7 N		5 N
1A4 g	Other Sectors, gases	1 N	1 N	1 N			1 N

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), FL (Flanders, Belgium)
pdf's N (normal), U (uniform)

* No key source category



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Correlations

- Most countries correlate activity data when used to calculate more than one emission
- Emission factors are correlated if e.g. Same fuel is present in more subcategories
- AD mostly not correlated between base and end year
- EF fully correlated between base and end year (some exceptions)
- Most studies lack full description of correlations used





Conclusion (with LULUCF)

- NL uncertainty in total GHG is similar to Flanders
- UK: large uncertainty because of N₂O
- AT: larger uncertainty because of systematic unc and LUCF
- FI: larger uncertainty because LUCF CO₂ emissions

	NL 2004		UK 2003		AT (incl sys unc) 1997		BE-FL 2001		FI 1997	
	Level (%)	2 σ (%)	Level (%)	2 σ (%)	Level (%)	2 σ (%)	Level (%)	unc (95 %)	Level (%)	2 σ (%)
Total	100	4.1	100	14	100	10.5	100	-3.95 t +4.97	100	-14 t +15
CO ₂	83	2.1	86	2.4	77	4.7	83	-2.75 t +2.75	86	-15 t +15
CH ₄	8	15.1	6	13	11	47.5	7	-14.6 t +17.2	6	-20 t +20
N ₂ O	8	42	6	226	12	69.4	10	-28.9 t +44.6	8	-40 t +100
F	1	28.1	2	17.9					1	-10 t +20





Conclusion (without LULUCF)

- Without LULUCF, NL, AT & FI uncertainties on similar level
- NO: Large uncertainty because of N₂O

	NL		AT (excl sys unc)		NO		FI	
	2004		1997		2010		1997	
	Level (%)	2 σ (%)	Level (%)	2 σ (%)	Level (%)	2 σ (%)	Level (%)	2 σ (%)
Total	100	3.9	100	3.8	100	17	100	-4 t +8
CO ₂	83	1.5	85	1	76	4	80	-2 t + 2
CH ₄	8	15.1	12	28.5	10	20	8	-20 t +20
N ₂ O	8	42	3	23.9	10	170	11	-40 t +100
F	1	28.1			5		1	-10 t +20





Conclusion

Major differences in GHG uncertainty are caused by:

- Difference in magnitude of N₂O uncertainty
- Share of non-CO₂ greenhouse gases





QUESTIONS?

Full report downloadable from

www.jvds.nl

Direct link:

<http://www.chem.uu.nl/nws/www/publica/publicaties2006/E2006-58.pdf>

