

Atmospheric transport and deposition of pesticides in Sweden

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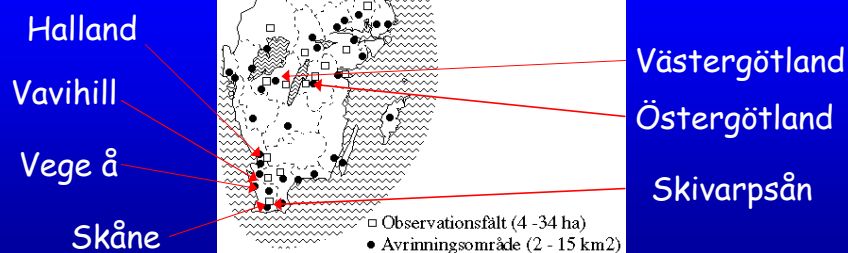


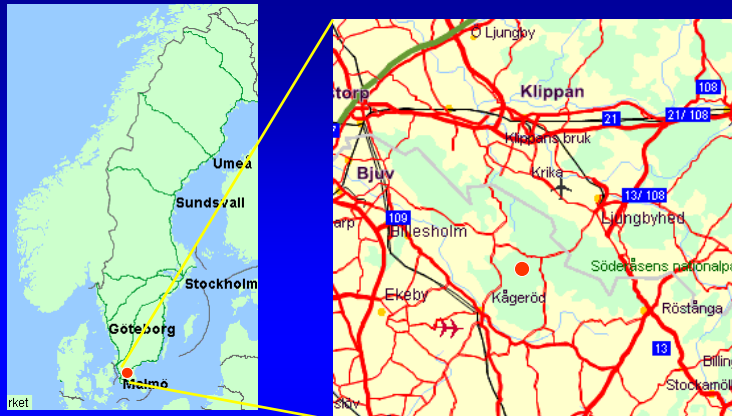
Pesticide Behaviour in Soils, Water and Air
Warwick, UK 28 March 2006

Pesticide Monitoring Programme

as part of the Swedish EPA's national monitoring programmes for agriculture and air (Started in 2002)

- 4 catchments (8-16 km²)
- 2 rivers (90-500 km²)
- Atmospheric deposition at Vavihill





Vavihill a rural monitoring site within the EMEP network in southern Sweden

Located on a ridge in a forested area, >1 km to treated fields

Methods

- Rain water collected
 - Event related sampling using a bulk sampler (a stainless steel funnel, area 0.5 m², above a fridge)
 - 12 samples per year during May/Jun & Sep/Oct
 - Analysis including ca 85 different pesticides and some metabolites



Results 2002-2005

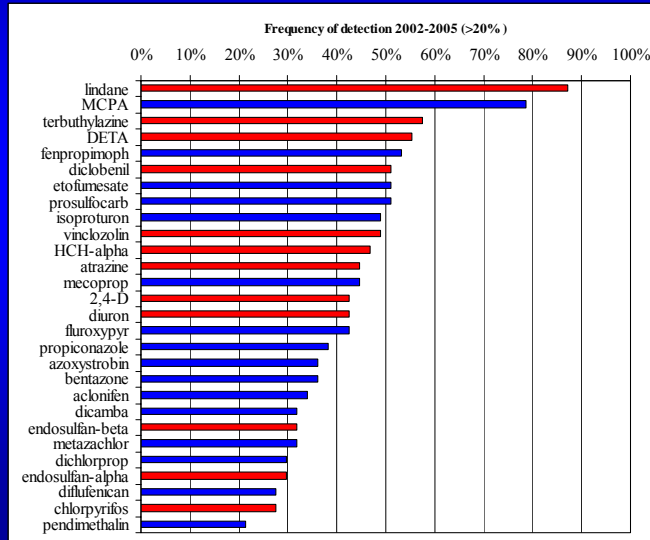
- 40 pesticides & 5 degradation products were detected in rainwater
 - 26 herbicides, 8 fungicides & 6 insecticides
- Most detects at the ng/l-level, though some were occasionally detected above 0.1 $\mu\text{g/l}$ (prosulfocarb, isoproturon, MCPA & pendimethalin)
- Max conc. 0.8 $\mu\text{g/l}$ (prosulfocarb)

Results (ctd)

- 11 of the pesticides detected are no longer registered for use in Sweden (most of them since more than ca 10 y)
 - 2,4-D, atrazine, dichlobenil, diuron, endosulfan, lindane (incl. α -HCH), terbuthylazine (incl. DETA), vinclozolin

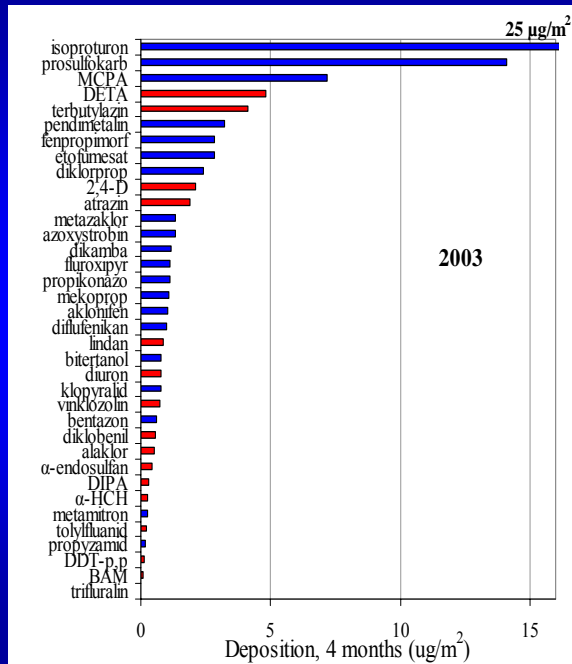
Frequency of detection in rainwater at Vavihill 2002-2005 (n=47)

red bars = pesticides not used in Sweden



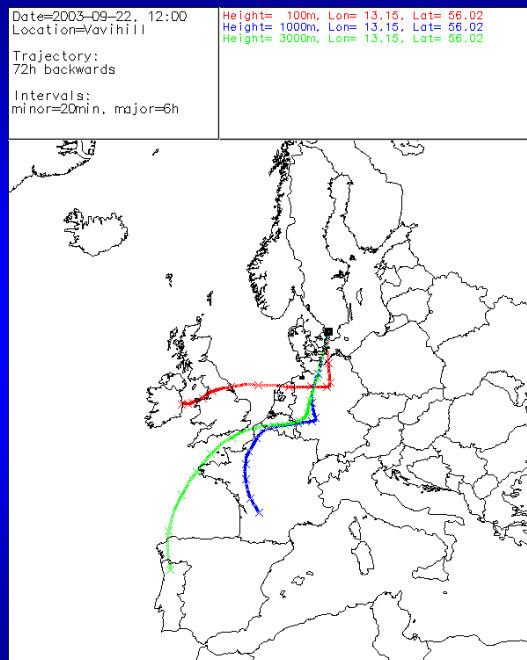
Deposition

- Total deposition 0.3-0.9 g/ha (4 months)
- Deposition 0.01-0.0004% of appl. dose



Question 1

- Is there a correlation between composition of detected pesticides and origin of air-masses

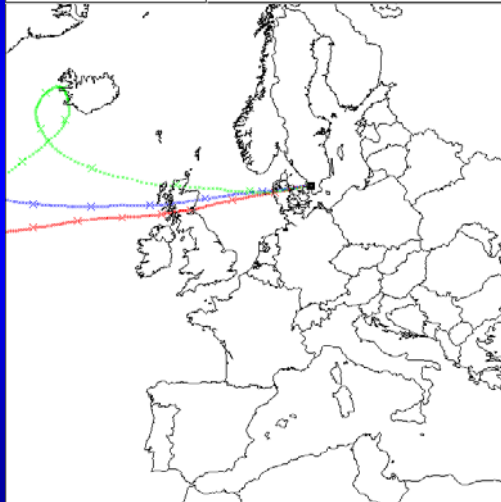


- Major rainfall event occurring when air-masses came from the south-west

- Total deposition included 12 pesticides (6 of these were not registered in Sweden)

Date=2003-10-10, 12:00
Location=Vavihill
Trajectory:
72h backwards
Intervals:
minor=20min, major=6h

Height= 100m, Lon= 13.15, Lat= 56.02
Height= 1000m, Lon= 13.15, Lat= 56.02
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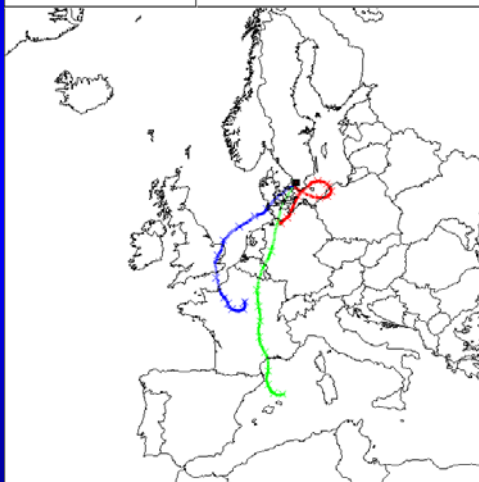


- Major rainfall event occurring when air-masses came from the north-west

- Total deposition included 6 pesticides (2 of these were not registered in Sweden)

Date=2005-05-02, 18:00
Location=Vavihill
Trajectory:
96h backwards
Intervals:
minor=20min, major=6h

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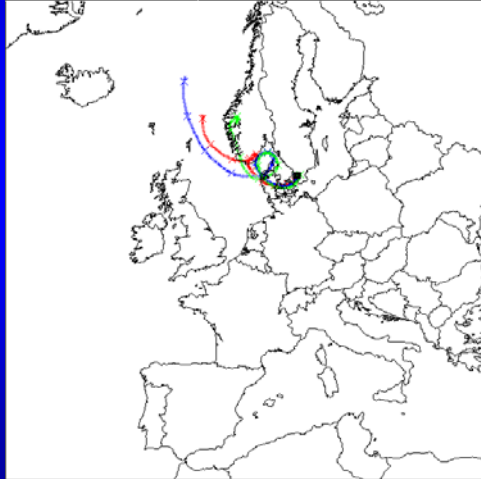


- Major rainfall event occurring when air-masses came from the south-west

- Total deposition included 25 pesticides (10 of these were not registered in Sweden)

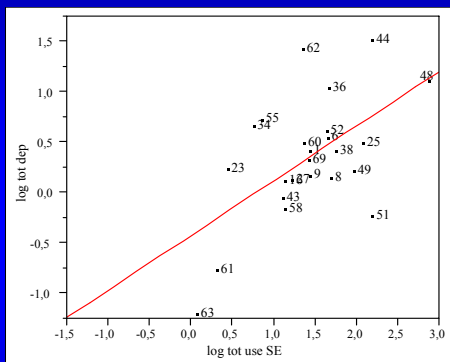
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 Trajectory:
 96h backwards
 Intervals:
 minor=20min, major=6h

Height= 100m, Lon= 13.15, Lat= 56.02
 Height= 1000m, Lon= 13.15, Lat= 56.02
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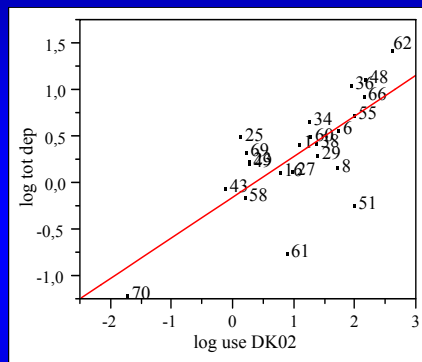


- Major rainfall event occurring when air-masses came from the north-west
- Total deposition included 15 pesticides (5 of these were not registered in Sweden)
- First year lindane only appeared when air-masses came from the south-west

Correlation between sold amounts of pesticides (Sweden and Denmark) and total deposition



$$R^2 = 0.32$$



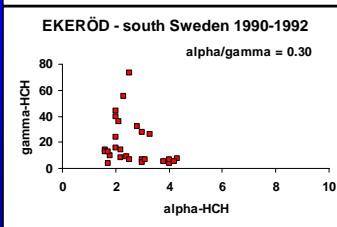
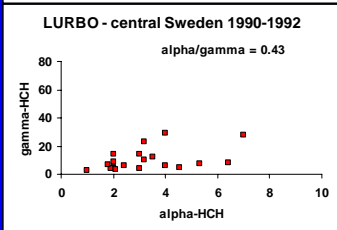
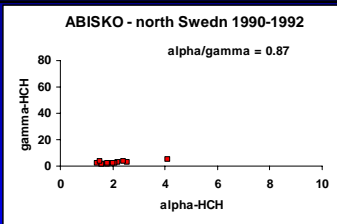
$$R^2 = 0.54$$

Vapour pressure

Substance	log Vp (Pa)	
dichlobenil	-0,8	Prosulfocarb, fenpropimorph and pendimethalin used in Sweden
trifluralin	-2,2	
<u>prosulfocarb</u>	-2,2	
lindane	-2,4	
<u>fenpropimorph</u>	-2,5	
chlorpyrifos	-2,6	
alachlor	-2,7	
<u>pendimethalin</u>	-2,7	

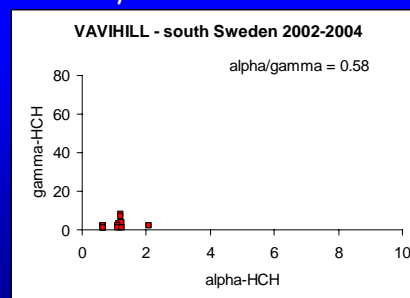
Question 2

- Lindane has now been taken off the market within the EU - are there any changes in the deposition of lindane in Sweden?



Lindane (gamma-HCH) concentrations (ng/l) in Swedish rainwater during recent years compared to the early 90's

- A 10-fold decrease in concentrations during last 10 y (in 2005 lowest conc. ever)
- Alpha/gamma ratio indicating a longer atmospheric residence time for southern Sweden today



Conclusions

- Currently used pesticides are regularly detected at ng/l-levels in rainwater
- Deposited amount corresponds to ca 0.01-0.0004% of applied dose
- A significant contribution to atmospheric deposition in southern Sweden from pesticides that are no longer used within Sweden
- There is a correlation between origin of air-masses and composition of detected pesticides
- Lindane, now banned within the EU, is detected at decreasing concentrations