

## Atmospheric transport and deposition of pesticides in Sweden

Jenny Kreuger, Martin Larsson & Therese Nanos  
Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden

*Pesticide Behaviour in Soils, Water and Air*  
York, UK 2-4 September 2013

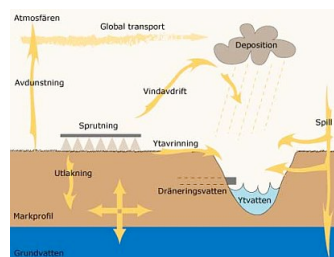


**CKB**

Center for Chemical Pesticides

## Background

- Long-term monitoring of environmental fate of pesticides in Sweden since 2002 (main focus on surface water and groundwater)
- However, one program also includes atmospheric deposition of pesticides (as well as other parameters such as particles, ozone, nitrogen, mercury etc)
- Overall aim of the pesticide monitoring program is to study the extent of deposition of pesticides via rainwater in rural background areas, incl. long-term trends



**CKB**

Center for Chemical Pesticides

## Sampling sites



- Sampling sites located jointly with other international/national atmospheric monitoring programs (e.g. EMEP)
- Located in rural background areas, surrounded by forests, >1 km from treated fields


**CKB**

Center for Chemical Pesticides

## Methods - rain

- Rain water collected
  - Event related sampling using a bulk sampler (a stainless steel funnel, area 0.5 m<sup>2</sup>, above a fridge)
  - Collected in 10 litre bottle
  - Ca 12-15 samples/season
  - Blank samples collected regularly
  - Start in 2002 at Vavihill and in 2009 at Aspvreten
  - Main sampling season today April-October (previously May-June + October)


**CKB**

Center for Chemical Pesticides

## Analytical methods

- On-line LC-MS/MS for a broad range of pesticides
  - Method description *Jansson & Kreuger, 2010, J. AOAC Intern., vol 93, 1732-1747*
- GC-MS for the most non-polar compounds
- Currently including ca 130 different pesticides in the monitoring program, incl. some degradation products, corresponds to ca 90 % of the applied amount of pesticides in Sweden, but also some obsolete
- LOD/LOQ levels are at the ng/l-level for most pesticides


**CKB**

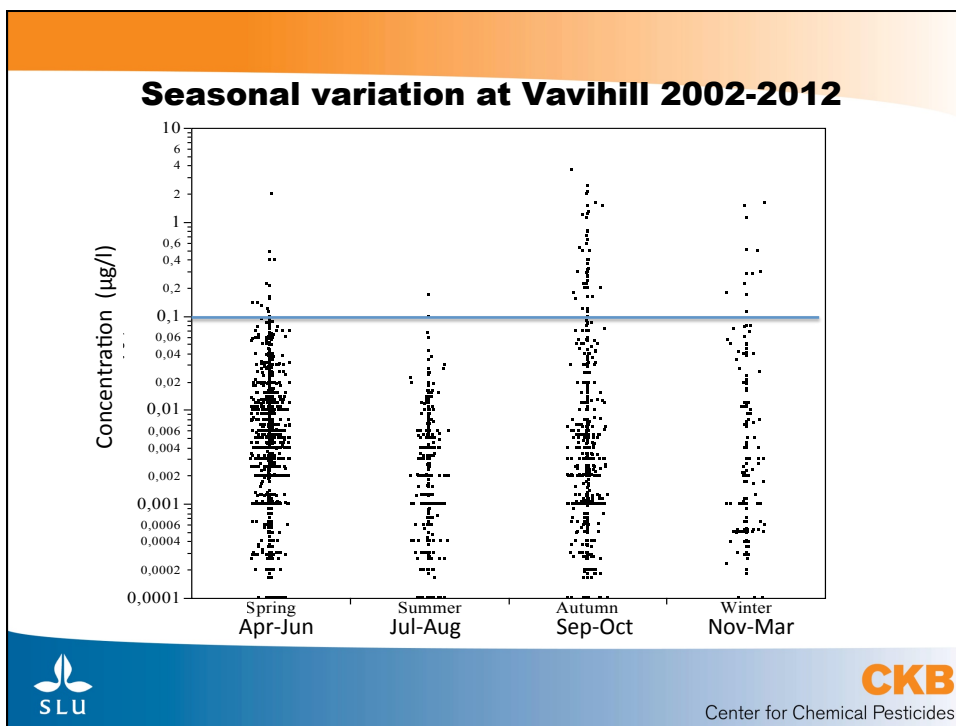
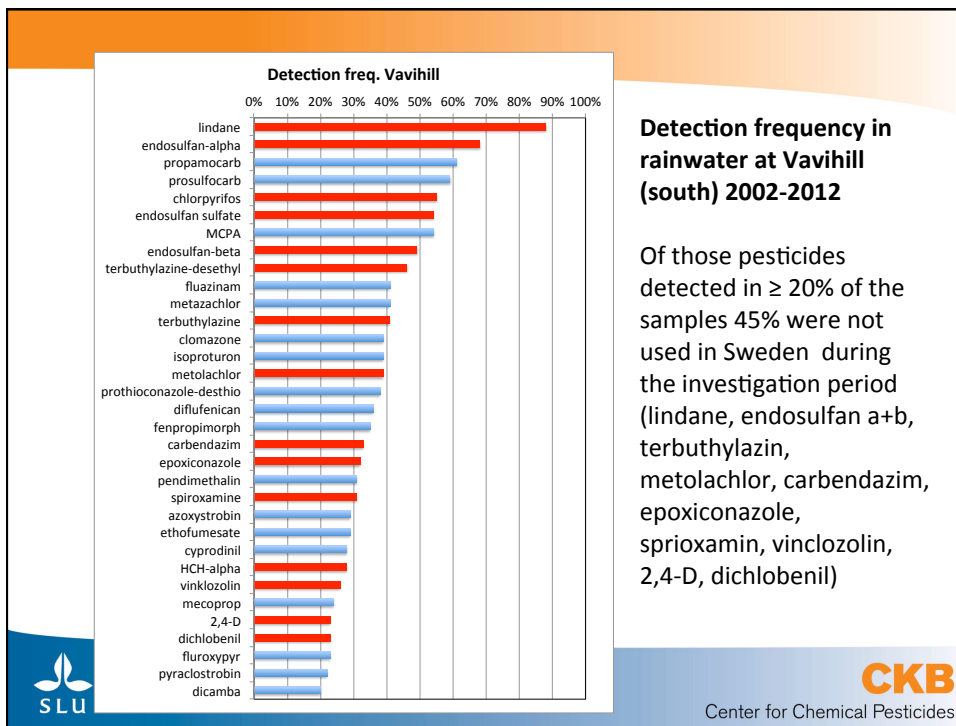
Center for Chemical Pesticides

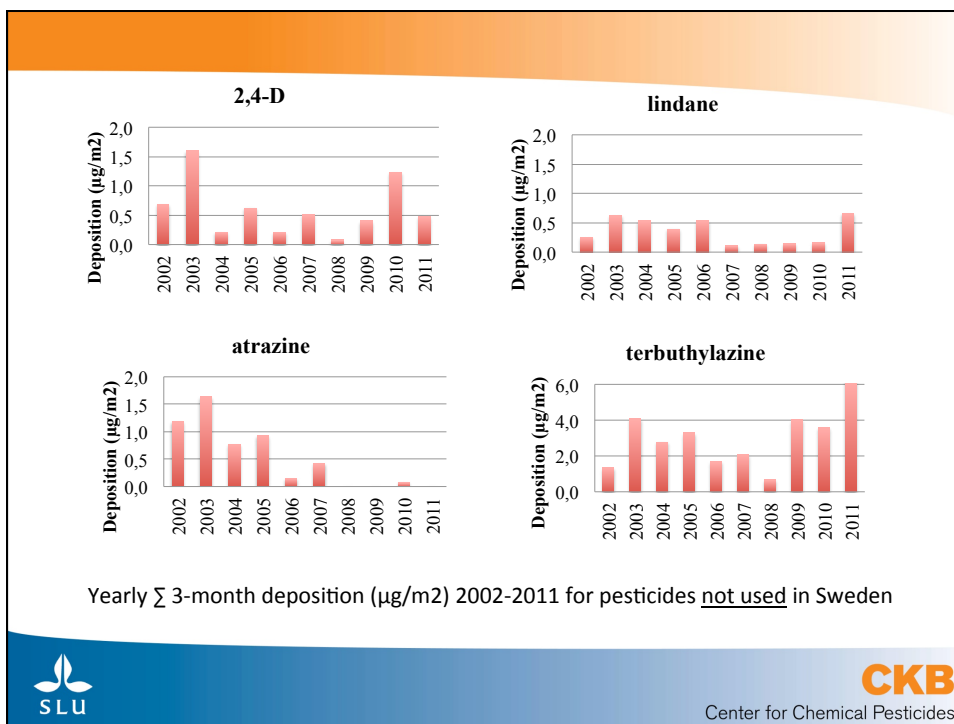
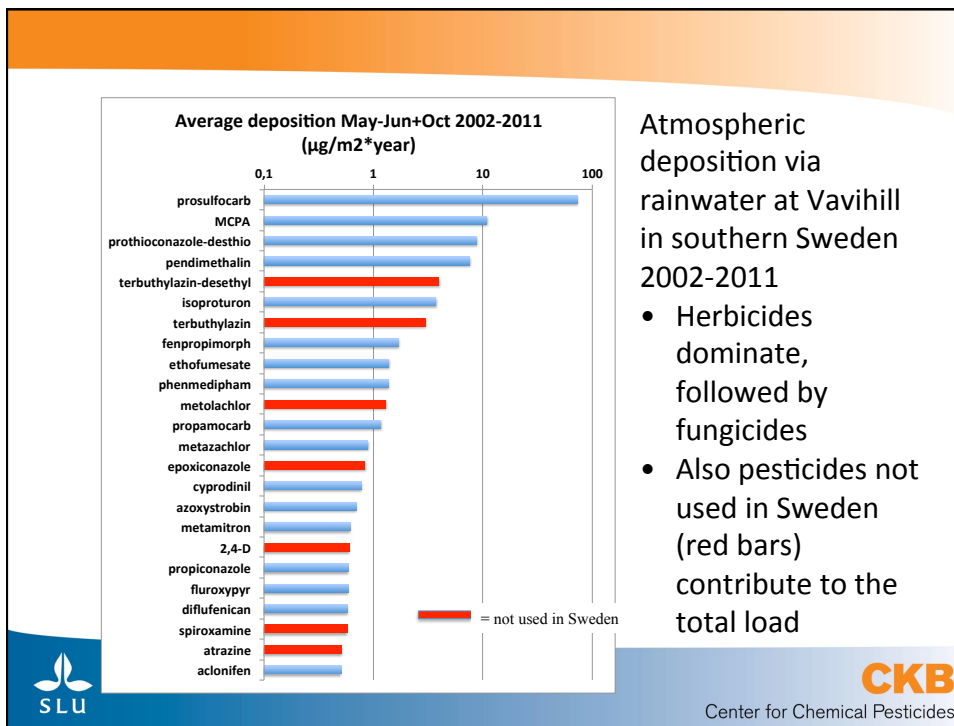
## Results rain 2002-2012

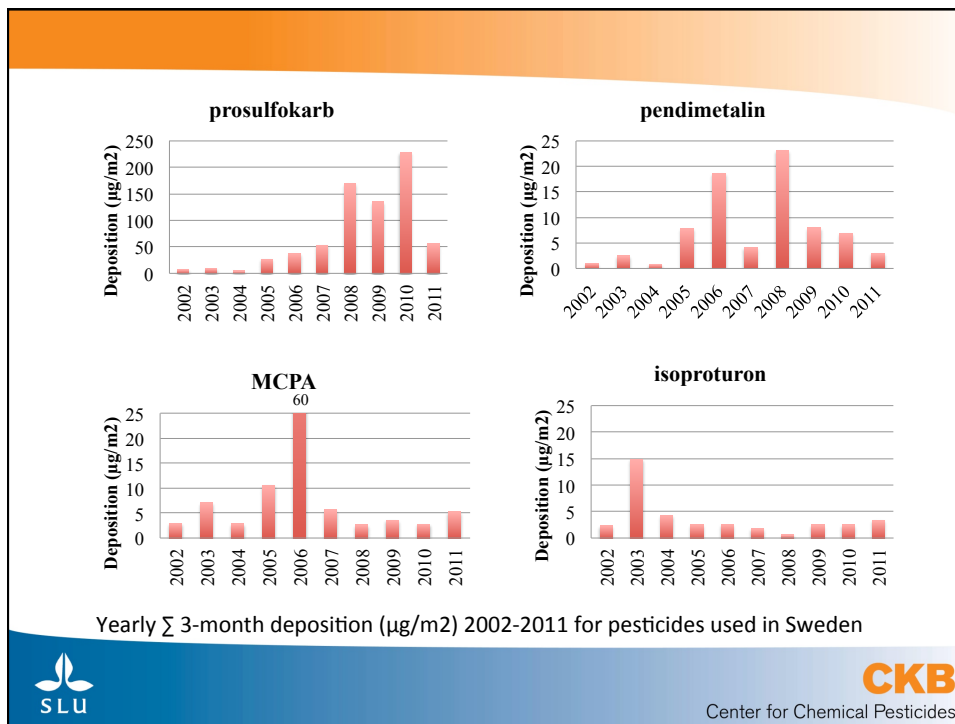
- 82 pesticides & 7 degradation products were detected in rainwater
  - 36 herbicides, 26 fungicides & 20 insecticides
  - 23 of these were banned in Sweden
  - Fewer pesticides and lower concentrations at Aspvreten (northeast)
- Most detects at the low ng/l-level, though some were occasionally detected above 0.1 µg/l
  - prosulfocarb, MCPA, pendimethalin, isoproturon, bentazone, terbutyazine-desethyl, metazachlor and protioconazole-destio
- Max concentration - 3.6 µg/l (prosulfocarb)


**CKB**

Center for Chemical Pesticides

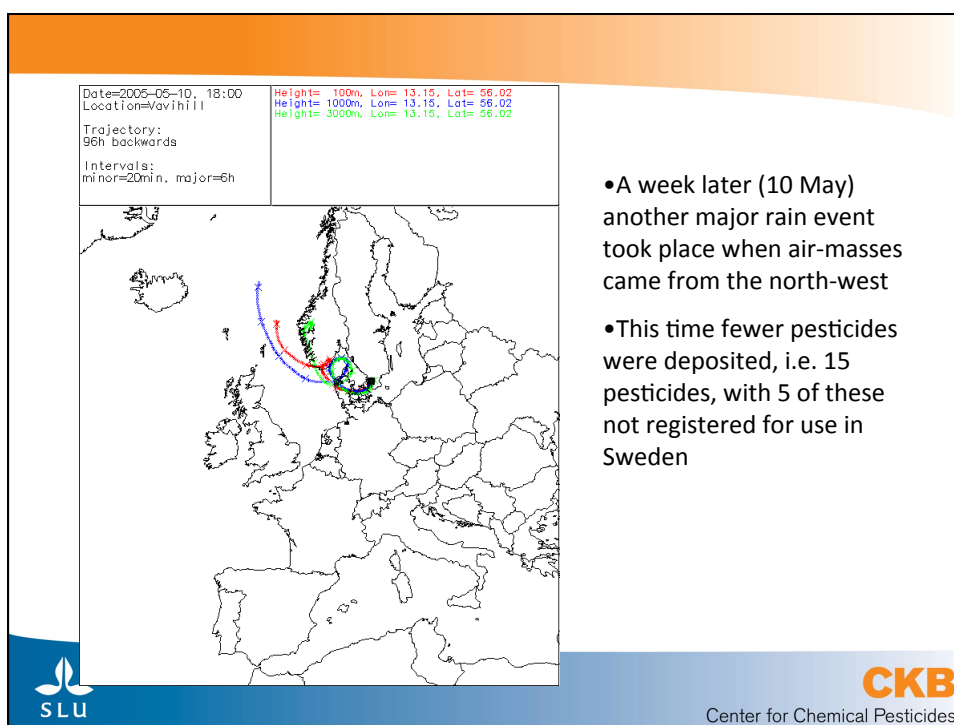
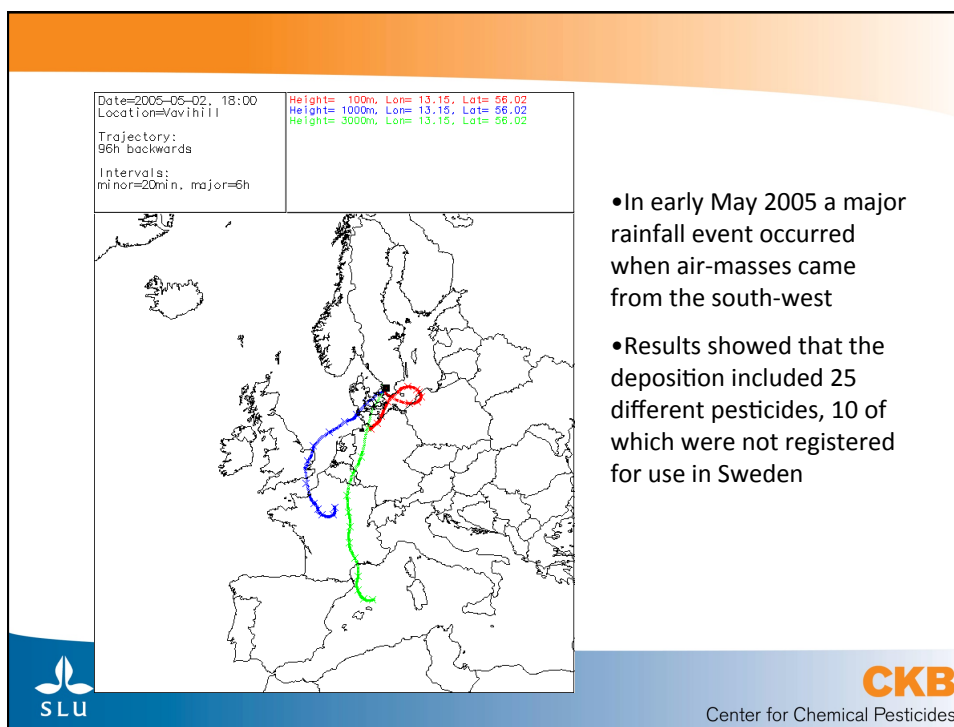






## Back-trajectory analysis

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



## Conclusions

- Currently used pesticides are regularly detected at ng/l-levels in rainwater, with occasional µg/l-level findings
- A larger number of pesticide detected during spring/early summer, however higher concentrations were detected during fall (mainly prosulfocarb)
- Deposited amount corresponds to ca 0.1-0.0001% of the applied dose in the field
- A significant contribution to atmospheric deposition in southern Sweden from pesticides not used within Sweden, i.e. a transboundary atmospheric transport of pesticides
- Lindane and atrazine, now banned within the EU, were detected at decreasing concentrations

**CKB**

Center for Chemical Pesticides

## Thank you! Questions?

### Acknowledgement:

- The national pesticide monitoring programme is funded by the Swedish Environmental Protection Agency
- Information about the monitoring program for pesticides at [www.slu.se/ckb](http://www.slu.se/ckb) (Centre for Chemical Pesticides)

**CKB**

Center for Chemical Pesticides