

GEUS

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INTRODUCTION

In the registration process of pesticides in EU 1-D leaching models play an important role. These leaching models are based on daily precipitation measurements not capturing the observed hourly variation in rainfall duration and intensity. To what extent this difference in time discretization effects the simulated leaching of pesticides is not known. The present study tests this effect on simulated leaching of bromide and a pesticide at sand and till sites by using the 1-D registration model MACRO 5.0.

CONCLUSION

- Simulated bromide leaching is only affected to a minor extent by the use of hourly instead of daily precipitation.
- Simulated pesticide leaching is affected by the use of hourly instead of daily precipitation. The difference in leached mass is up to 9% and up to a factor 10 in average flux concentration.
- No correlation between leaching and hourly/daily precipitation is observed for the soil types.
- The combination of solute, application date, precipitation, soil type, and daily rain intensity used in MACRO needs to be studied further.

DATA

The analysis is based on calibrated models obtained within The Danish Pesticide Leaching Assessment Programme (PLAP), which intensively monitors pesticide and bromide leaching at five agricultural test sites. Monitoring data available from 1999 to now comprises:

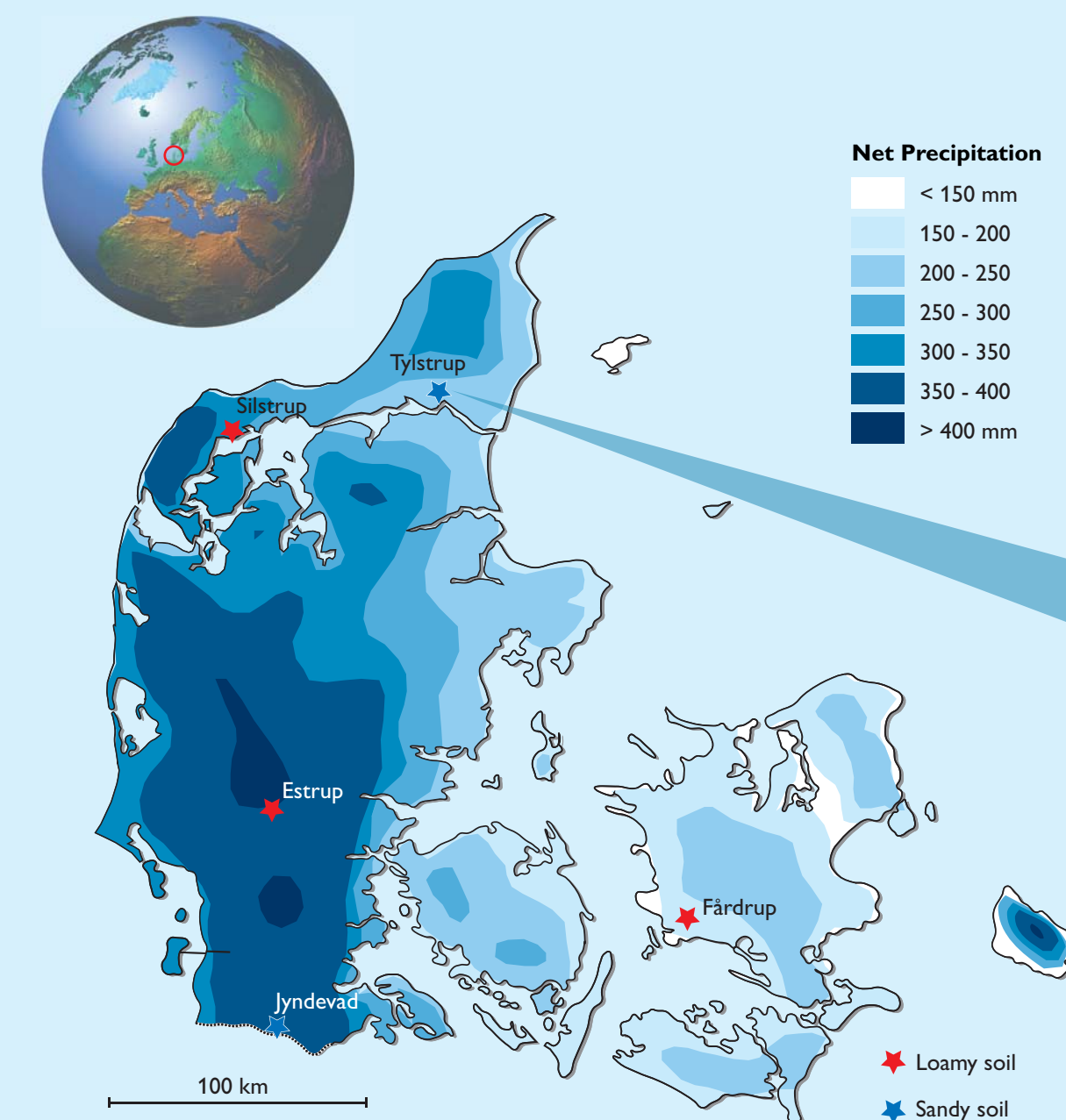
- Daily and hourly precipitation.
- Hourly barometric pressure and soil temperature.
- Elevation of groundwater table.
- Time series of soil water content at 25, 60 and 110 cm b.g.s
- Drainage flow (till sites only).
- Bromide concentration measured in suction cups 1 and 2 m b.g.s.
- Bromide concentration measured in drains approx. 1 m b.g.s.
- Crop growth.

MODELLING SETUP

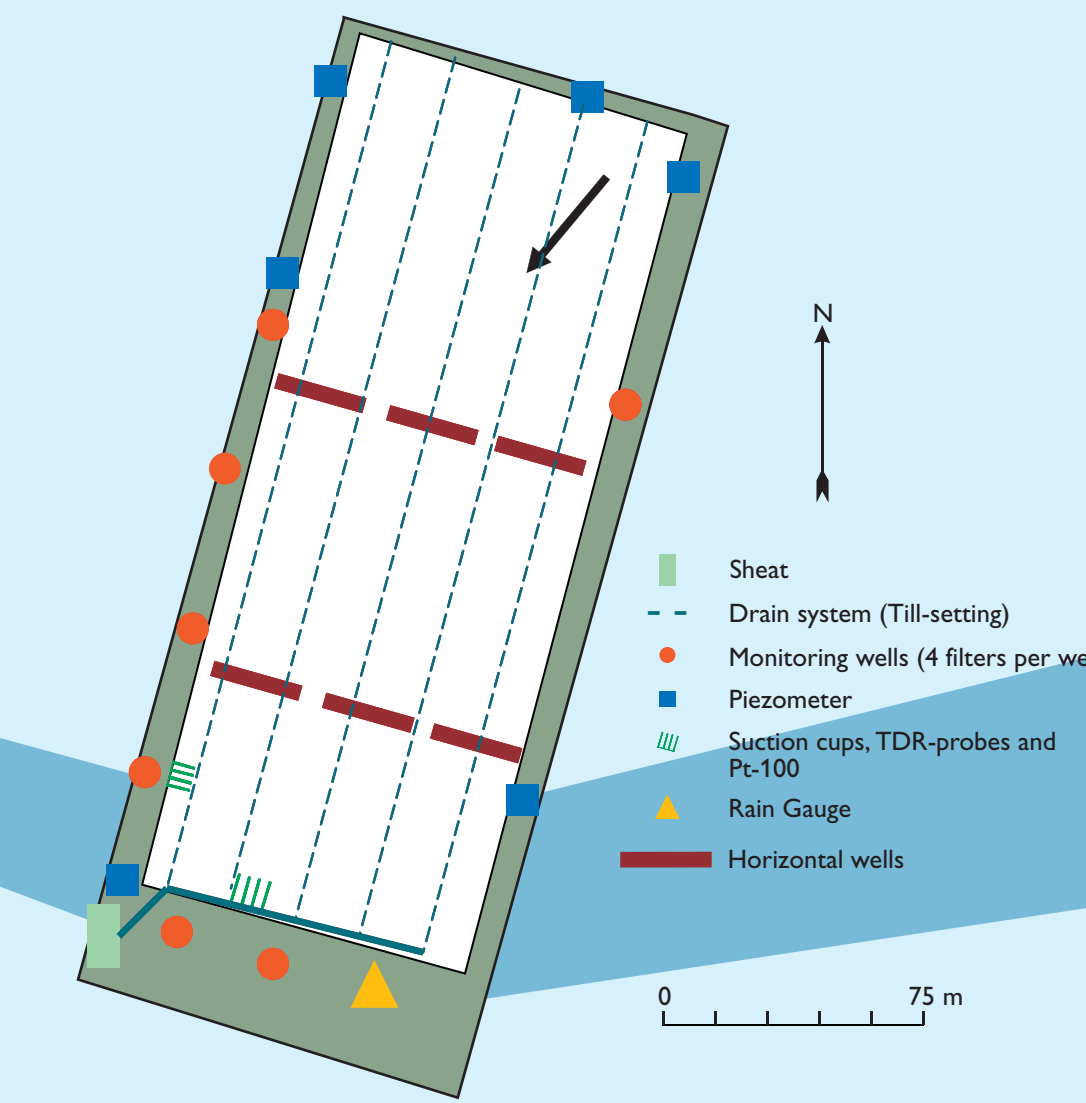
Four calibrated models are used in the study:

- 2 representing the sandy sites.
- 2 representing the till sites.
- The models cover the soil profile to a depth of 5 m b.g.s. always including the groundwater table.
- The models have been calibrated against measured hydraulic and bromide data.

SENSIVITY OF MACRO-LEACHING USING DAILY/HOURLY PRECIPITATION



Location of the five agricultural sites included in the PLAP-programme.



Overview of the instrumentation on sites. The innermost white area refers to the cultivated land, whereas the grey-green area refers to the surrounding buffer zone. The arrow indicates the flow direction of the groundwater.

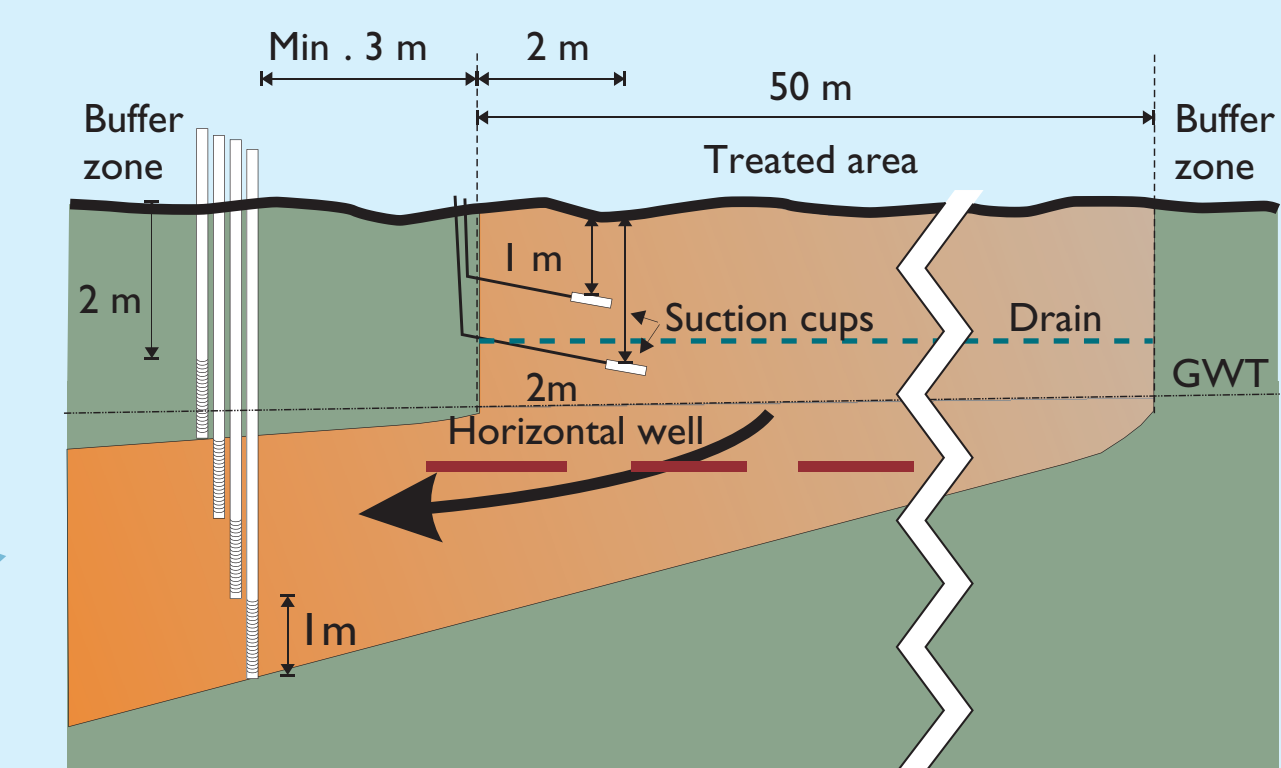


Illustration of the monitoring design as applied at the sites. The groundwater monitoring was carried out by means of vertical monitoring wells situated in the surrounding buffer zone. Additionally, horizontal wells are installed at the till sites. The monitoring of the unsaturated zone was carried out by means of suction cups situated in depths of one and two meters. At the till sites, drain information (water sampling and flow measurements) is also collected.

SIMULATIONS

- 6.5 year simulation period.
- Hourly rain is evenly distributed over the one-hour period.
- Daily rainfall is in simulations distributed with a rainfall intensity of 2 mm/h, starting at midnight.

Bromide application:

- 20 kg/ha bromide at each application:
Tylstrup: May 1999 and March 2003.
Jyndevad: November 1999 and March 2003.
Silstrup and Estrup: May 2000.
- Crop rotation as defined at the sites.

Pesticide application:

- Solute characteristics: $K_{oc} = 400 \text{ ml/g}$, $DT50 = 80 \text{ days}$, $n = 0.90$.
- 1 kg/ha solute applied in November every year.
- Crop rotation: Winter wheat every year.

