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GREEN WORLD RESEARCH

Numerical accuracy of PEARL calculations for leaching from lysimeters

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Introduction

Procedure

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Conclusions

Introduction

Earlier workshops: high accuracy needed to solve inverse modelling problems

Normal procedure in past: compartment thicknesses of 5 cm (maximum number of layers usually less than 100)

PEARL:

- 500 compartments
- controls time step so user only responsible for compartment thickness

Aim: evaluate effect of compartment thickness on accuracy for leaching concentrations around 0.1 µg/L



Procedure

scenario considered:

- Hamburg soil
- Hamburg weather (FOCUS database)
- lysimeter of 1.2 m deep
- winter heat

example pesticide:

- $K_{om} = 35 \text{ L/kg}$
- half-life variable 15-20 days
- long-term sorption kinetics:
 $K_{om,ne} = 0.5 K_{om,eq}$
desorption rate coeff. of 0.01 d^{-1}
- default parameters from FOCUS



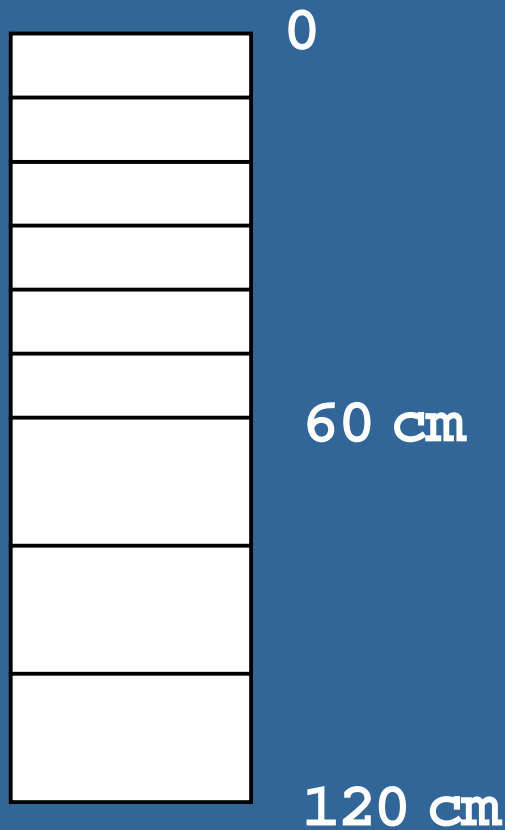
Procedure

case:

- 1 kg/ha applied at 5 June 1905
- total amount leached 1905-1910

component thickness:

- uniform in 0-60 cm and 60-120 cm
- two times thicker in 60-120 cm



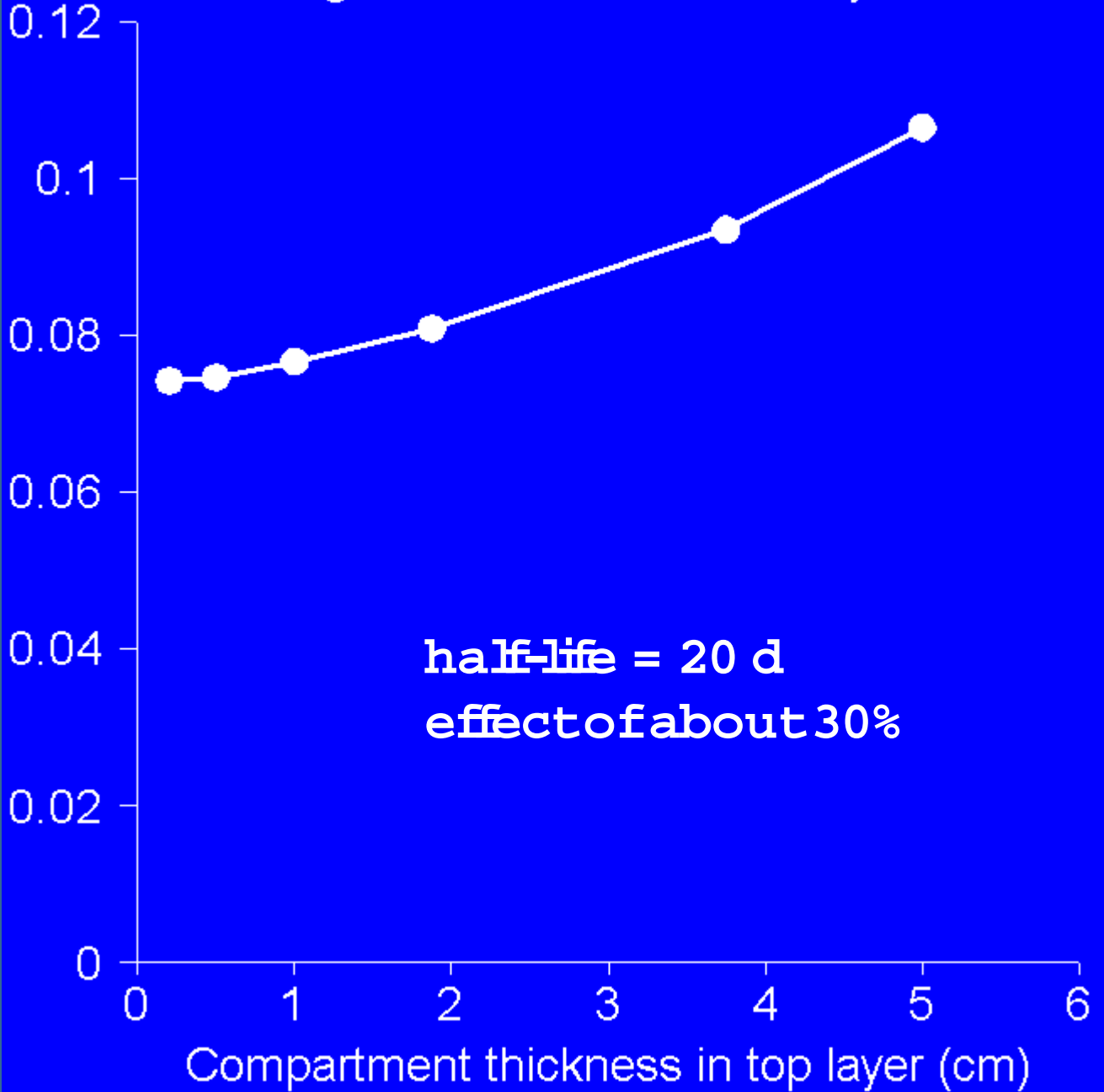
Results

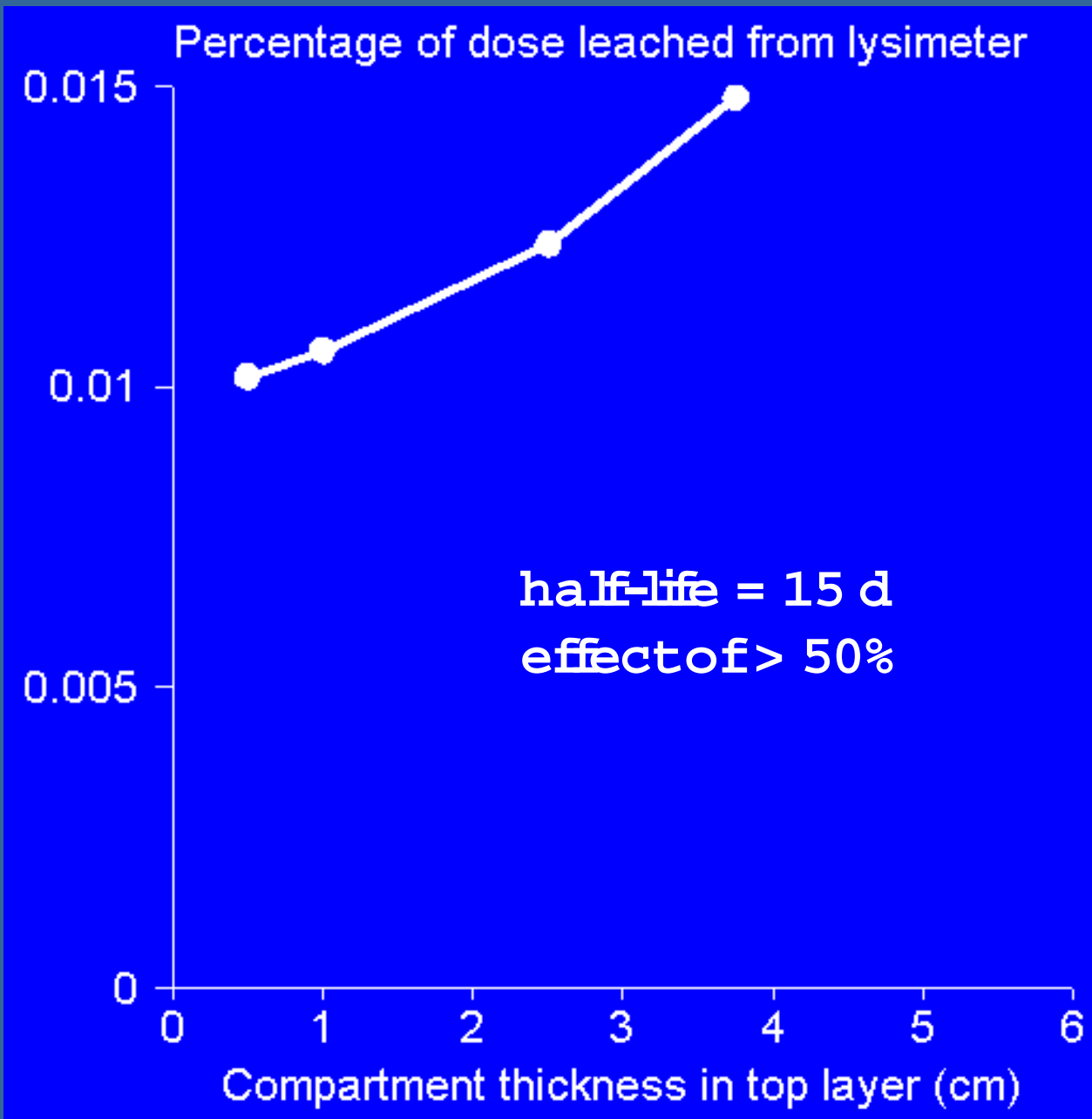
-percentage leached presented as function of component thickness in 0-60 cm layer

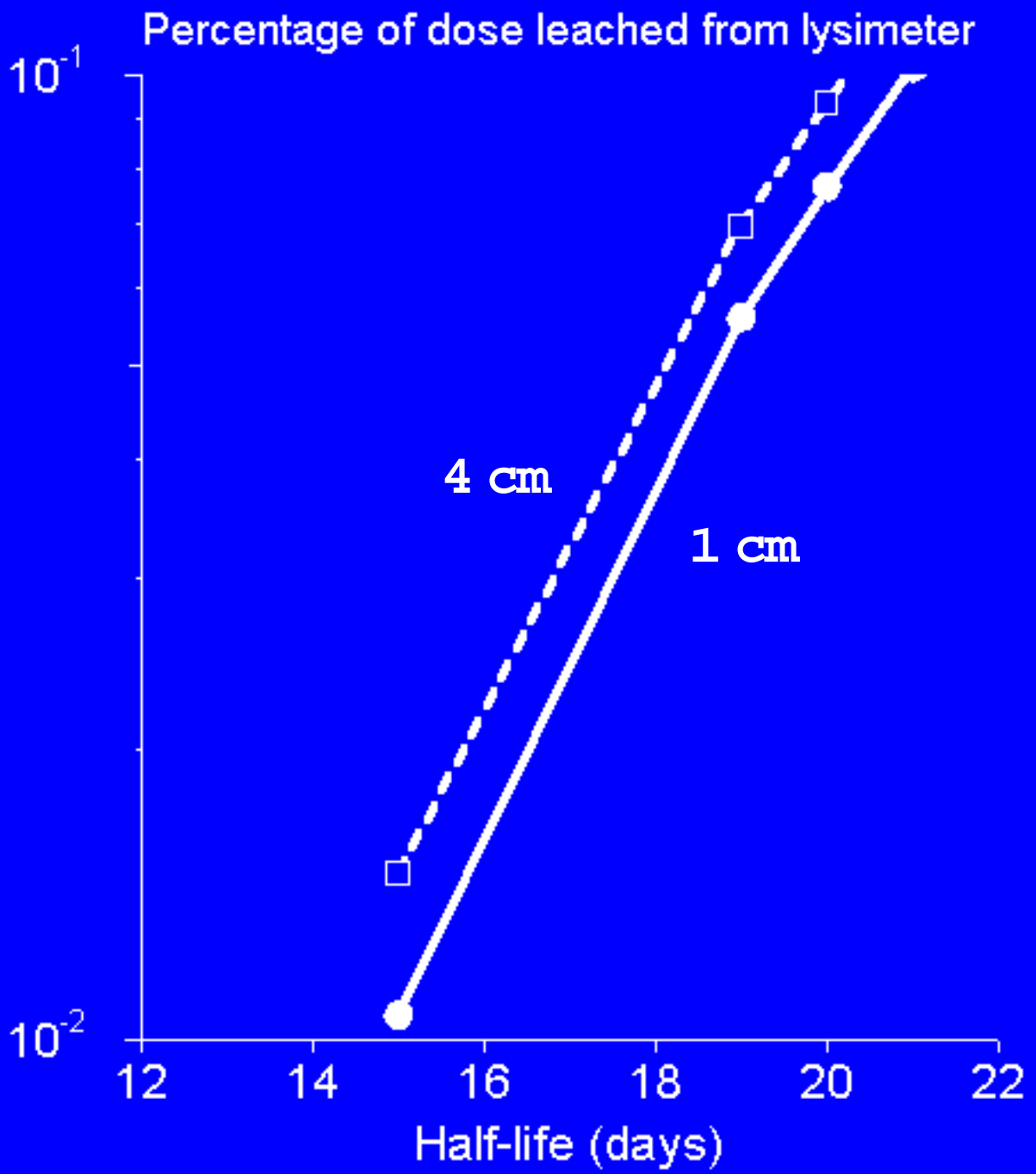
| | | |
|---|------|-----|
| half-life (d) | 15 | 20 |
| % leached | 0.01 | 0.1 |
| C_{MAX} ($\mu\text{g/L}$) in percolate | 0.02 | 0.3 |



Percentage of dose leached from lysimeter

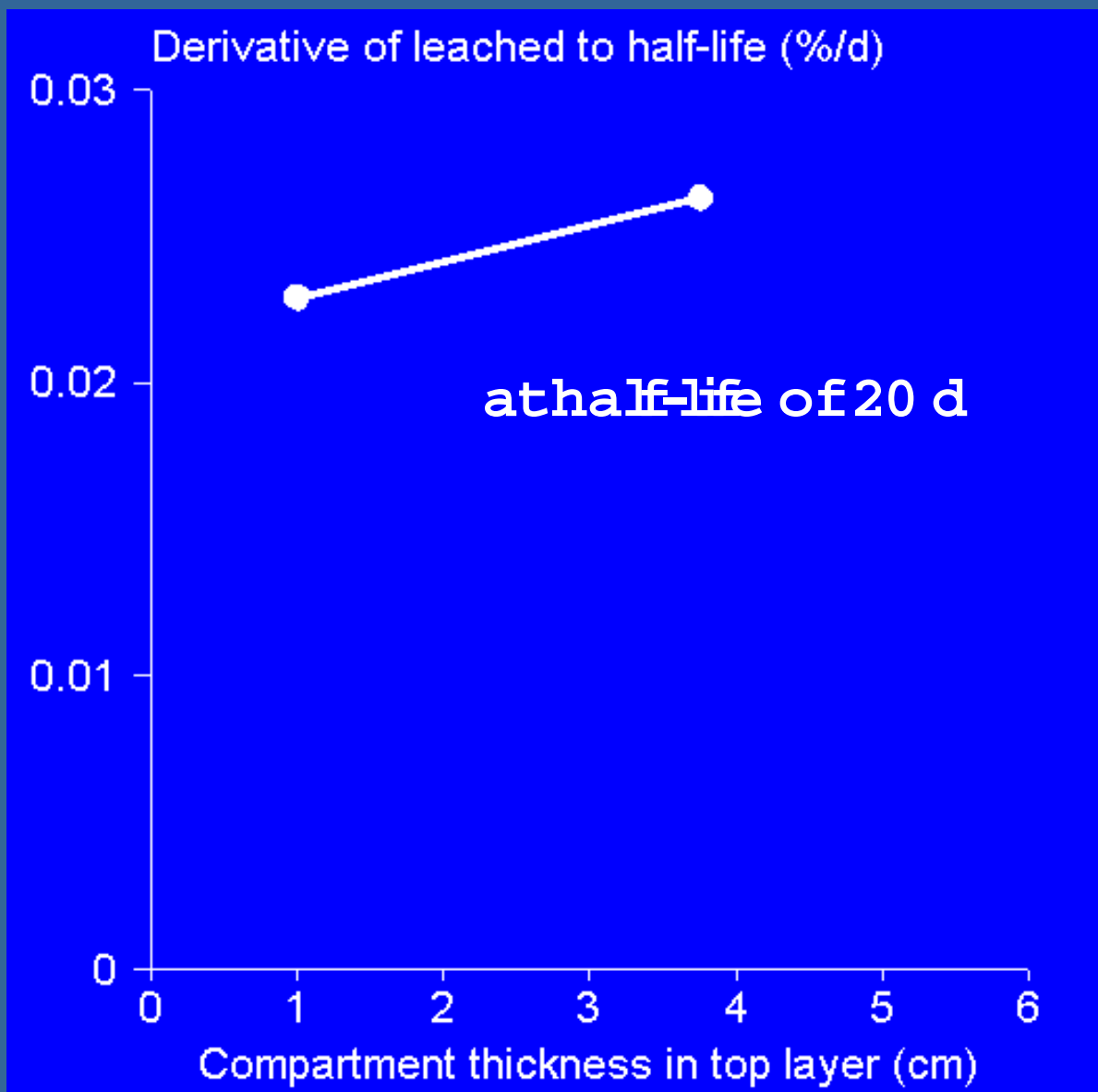






Numerical error corresponds with difference in half-life of order of 1 day



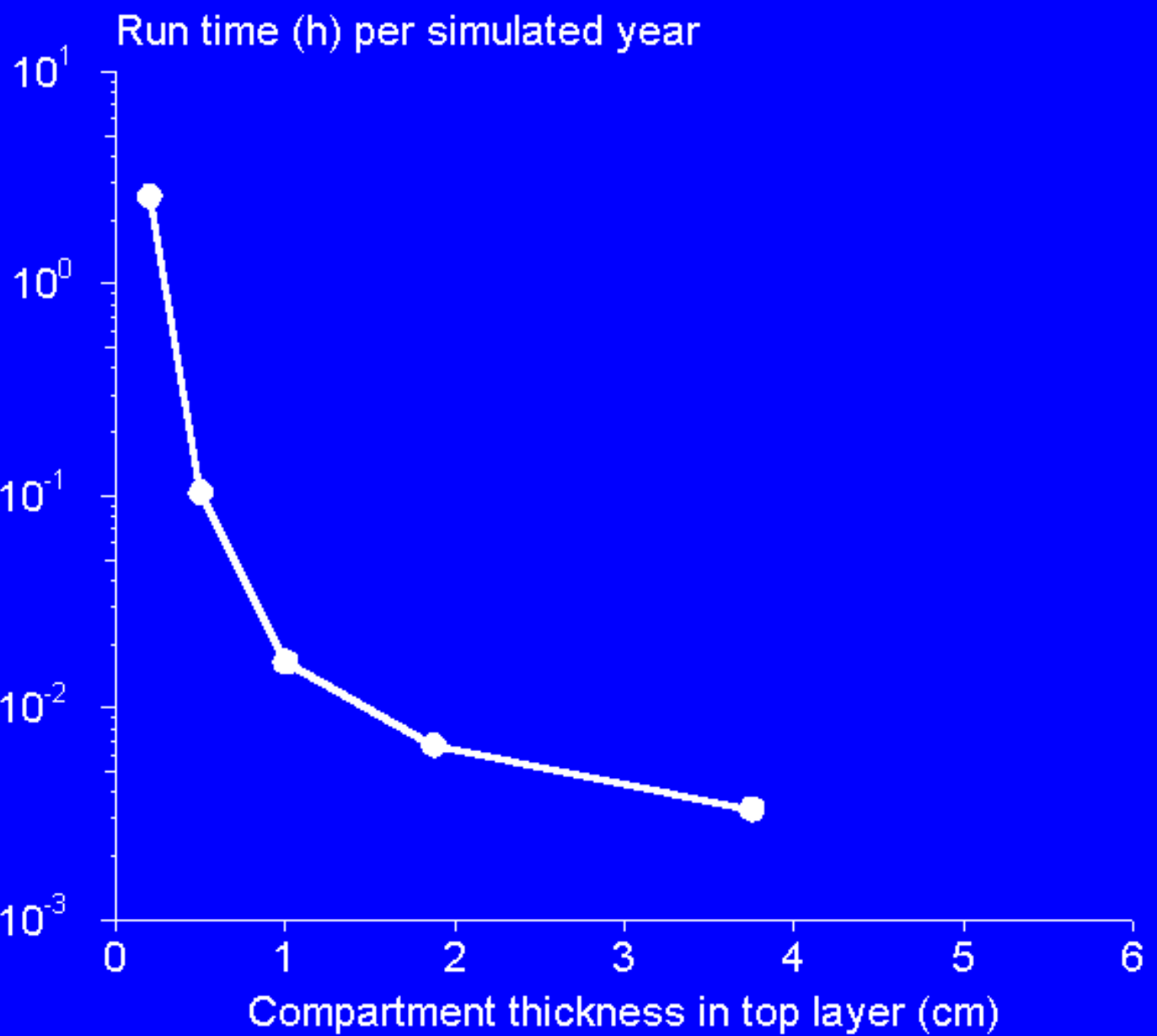


Inverse modelling based on derivatives of model output to parameter values

inaccuracy in derivative limited to 20%



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Conclusions

- higher accuracy leads to less leaching
- in critical range components of 5 cm overestimate leaching by 30-50%
- errors in derivatives in order of 20%
- too thick components, then inverse modelling gives too short half-life (and too large K_{OM})
- sensitivity to half-life overrules inaccuracy
(if correct optimum is found, error in half-life is small)

