German Scenarios for the Calculation of Pesticide Leaching Close to Railway Tracks

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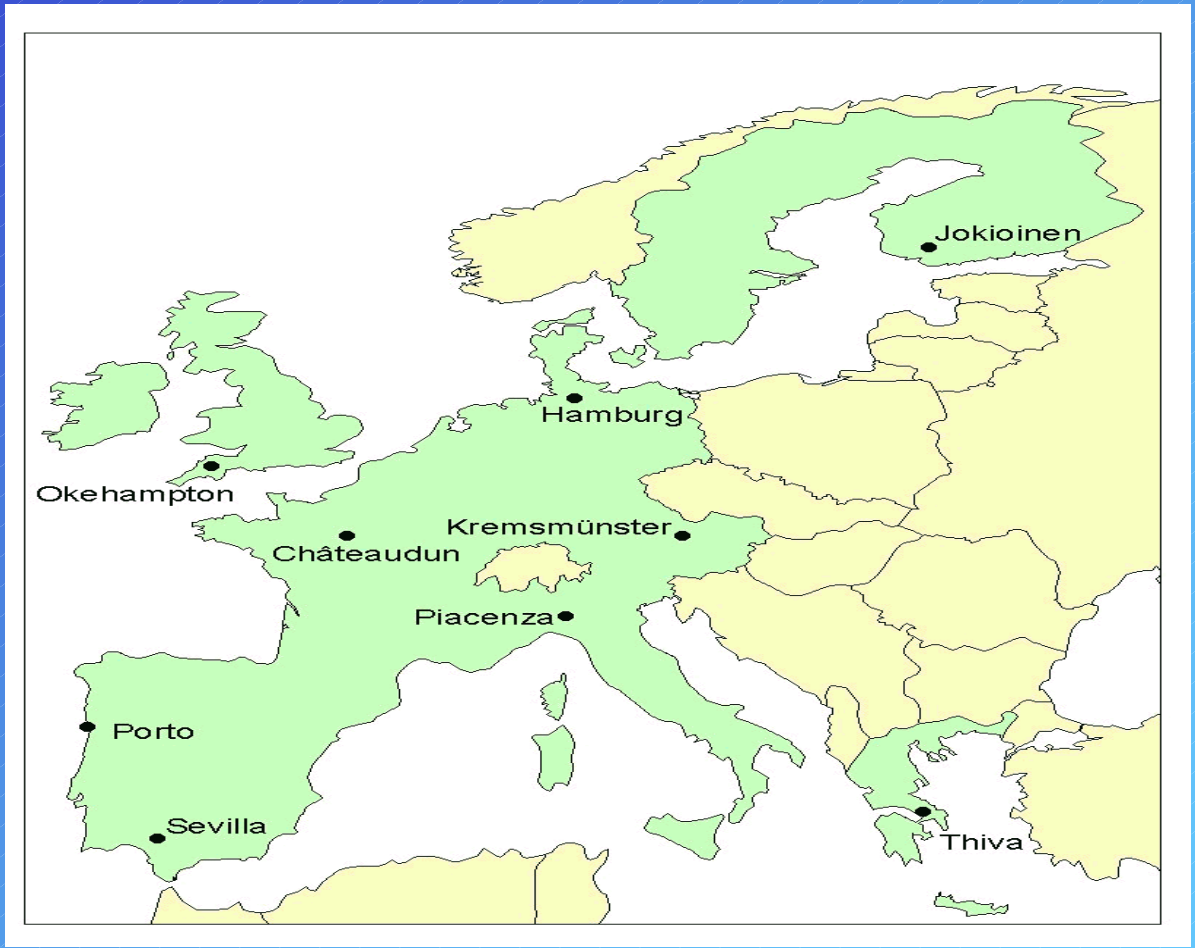
1991: Definition of the German Standard Scenario

Soil:	sandy loam (location Borstel) Topsoil : 1.5 % org. C
Climate:	Hamburg 1961 and 1978 (778 und 872 mm/Jahr)

Since 1991 PELMO-simulations are regularly performed as part of the German pesticide registration. The results of the PELMO-simulations are used to decide whether additional field studies (lysimeter studies) have to be performed

2000: Definition of 9 European Standard scenarios by the FOCUS-GW-Working group



Definition of 3 German Scenarios for railway tracks

Particle Size Distribution (%): Prenzlau

Horizon	Clay	Silt	Sand	coarse soil fraction
A(40 cm)	1.3	3.3	47.4	48.0
B(30 cm)	1.5	2.5	66.8	29.2
C(70 cm)	2.8	3.6	85.2	8.4

Particle Size Distribution (%): Immenstadt

Horizon	Clay	Silt	Sand	coarse soil fraction
A(40 cm)	2.9	5.6	13.7	77.8
B(40 cm)	6.0	16.0	15.4	62.6
C(65 cm)	11.7	25.6	11.4	51.3

Particle Size Distribution (%): München

Horizon	Clay	Silt	Sand	coarse soil fraction
A(30 cm)	2.6	4.1	12.0	81.3
B(80 cm)	6.8	10.7	31.4	51.1
C(35 cm)	8.7	13.7	40.2	37.3

1st problem when defining the scenarios:

The locations are characterised by high stone contents, that may lead to a reduced water holding capacity followed by an increased water flux.

Solution considered for the definition of the scenario:
linear correction of necessary soil hydraulic parameters using the stone content

Correction of Field Capacity and Wilting point

$FC = FC_{FS} * (100 - X) / 100$

$WP = WP_{FS} * (100 - X) / 100$

FC: field capacity of the scenario (Vol%)
FC_{FS}: field capacity of the fine soil fraction (Vol%)
WP: wilting point of the scenario (Vol%)
WP_{FS}: wilting point of the fine soil fraction (Vol%)
X: stone content (%)

2nd Problem when defining the scenario

It is not clear, how sorption and degration parameters have to be defined compared to the agricultral situation

Solution considered for the definition of the scenario :
Measurement of sorption and degradation parameters in the laboratory (depth dependent)

1st correction of organic carbon content

(„quality correction“)

$OC_{FSqual} = OC_{FSexp} * KOC_{exp} / KOC_0$

OC_{FSqual}: org. Carbon content used for the scenario (%) (fine soil fraction)

OC_{FSexp}: org. Carbon content of the rail railway profiles (fine soil fraction)

KOC_{exp}: experimental KOC (L/kg) (railway profile)

KOC_0: mean KOC observed in agr. soils

2nd Correction of the org. Carbon content

(„quantity correction“)

$OC_{Scen} = OC_{FSqual} * (100 - X) / 100$

OC_{Szen}: org. Carbon content of the scenario (related to the total soil) (%)

OC_{FSqual}: org. Carbon content of the scenario (related to the fine soil fraction) (%)

X: Stone content(%)

Definition of depth dependent degradation factors

$$k_{Bio} = DT50_0 / DT50$$

k_{Bio}: degradation factor used for the scenarios (-)
Bioabbaufaktor (-)

DT_{50}: experimental DT50, railway profile (d)

DT_{50}: DT50 observed in agr. soils (d)

Location Immenstadt: scenario parameters

Horizont	FK (m^3/m^3)	WP (m^3/m^3)	OC (%)	Bio. Deg. Fac. (-)
A	0.067	0.017	0.57	0.52
B	0.131	0.034	0.35	0.55
C	0.195	0.056	1.71	1.04

Location München: soil scenario parameters

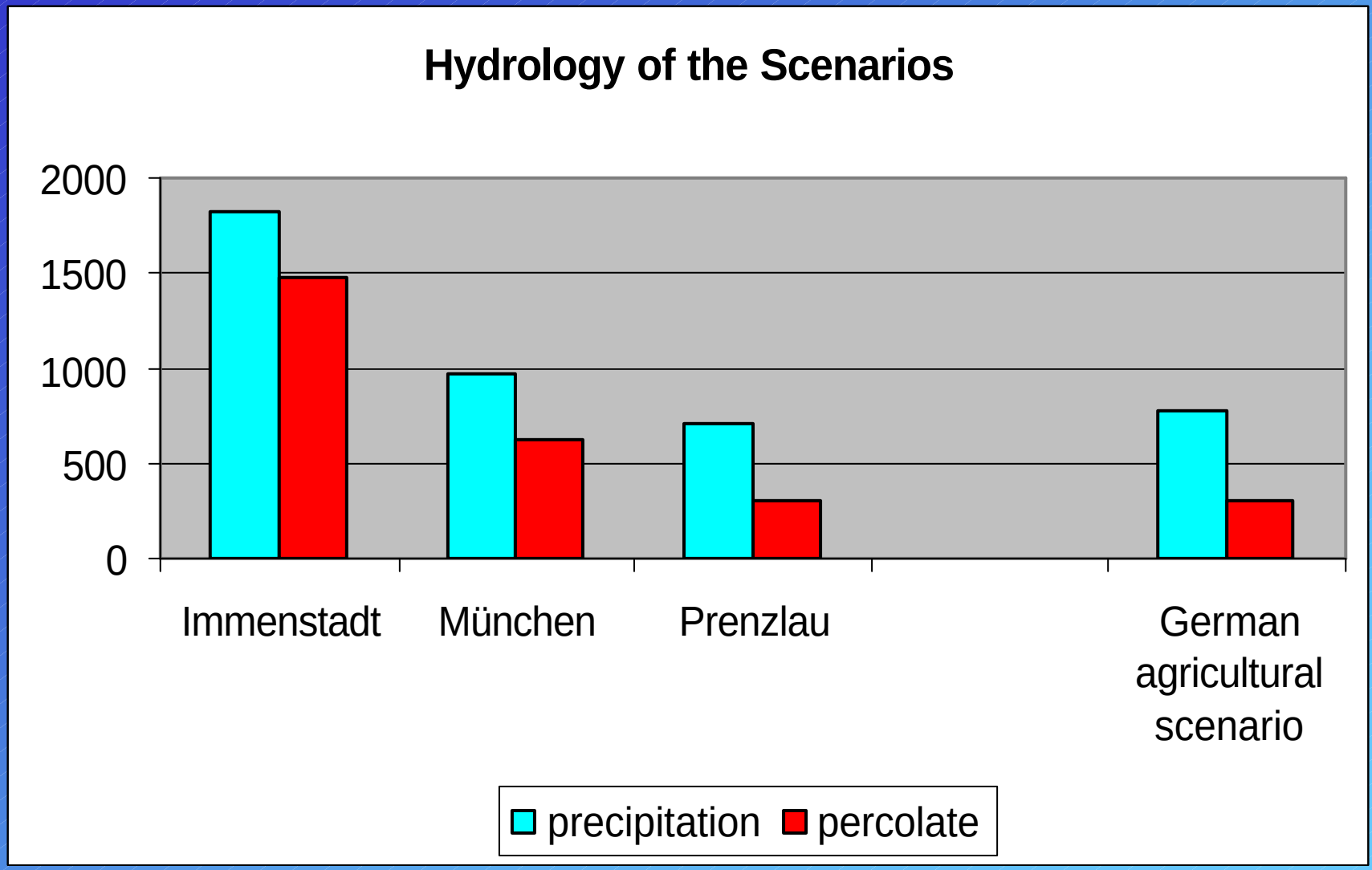
Horizont	FC (m^3/m^3)	WP (m^3/m^3)	OC (%)	Bio. Deg. Fac. (-)
A	0.056	0.014	0.67	1.01
B	0.146	0.037	0.46	0.94
C	0.187	0.048	1.61	0.40

Location Prenzlau: soil scenario parameters

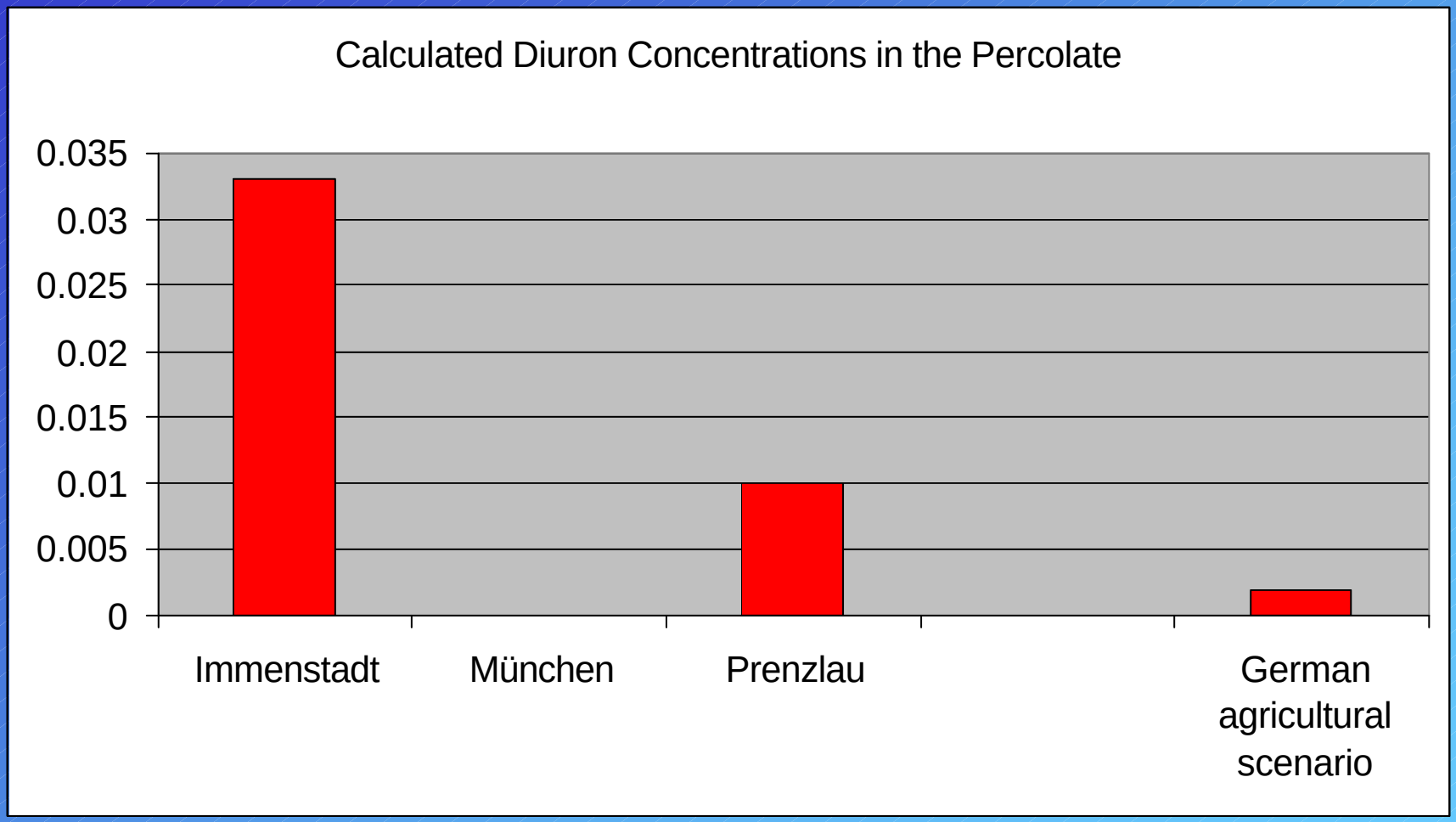
Horizont	FC (m^3/m^3)	WP (m^3/m^3)	OC (%)	Bio. Deg. Fac. (-)
A	0.116	0.020	0.20	2.72
B	0.153	0.026	0.04	3.35
C	0.202	0.037	0.04	1.42

Details of the Example

- Compound: Diuron
- sorption constant KOC = 400 L/kg
- degradation: DT50 = 70 d
- application: every year, 8 kg/ha in May


Hydrology of the Scenarios
2000
1500
1000
500
0
Immenstadt
München
Prenzlau
German agricultural scenario
precipitation
percolate

Ergebnisse von Beispielsimulationen mit den Szenarien



- high coarse soil fraction typical
  - *fast movement of water (realistic worst case)*
- low organic carbon contents in the profiles
  - *increased leaching of pesticide (worst case)*
- Increased degradation in the profiles
  - *not necessarily increased leaching of pesticide compared to agricultural situation*

Climatic conditions directly after the application are driving the pesticide amount reaching deeper soil layers (highly event driven)

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