GEUS

Recent numerical study of pesticide leaching from golf courses:

Insights to parameter sensitivity and leaching estimates from pesticide simulations with changing model conceptualization

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Introduction

- No regulatory procedure for golf courses in Denmark
  - Degradation rates from golf greens can differ substantially from agricultural soils (Badawi et al., 2016)
- Sensitive parameters known for regulatory models (e.g. Dubus et al., 2001) – based on assumptions of free drainage bc and fixed heads
  - DT50/T½ and sorption properties

Not representative for field conditions where water table fluctuations are generally the rule rather than the exception

(In the Danish Pesticide Leaching Programme, PLAP, seasonal groundwater fluctuations up 5-6 m have been observed in a clay-till setting)

Introduction

- The effect of implementing fluctuating groundwater levels on the simulated fate of pesticides is unaccounted for in relation to traditional procedures using fixed levels or free drainage
  - Are sensitive parameters the same?
  - Are simulated pesticide leaching assessments comparable?

Objective

Determine the sensitive parameters and simulated pesticide leaching potential – following the choice in lower boundary conditions

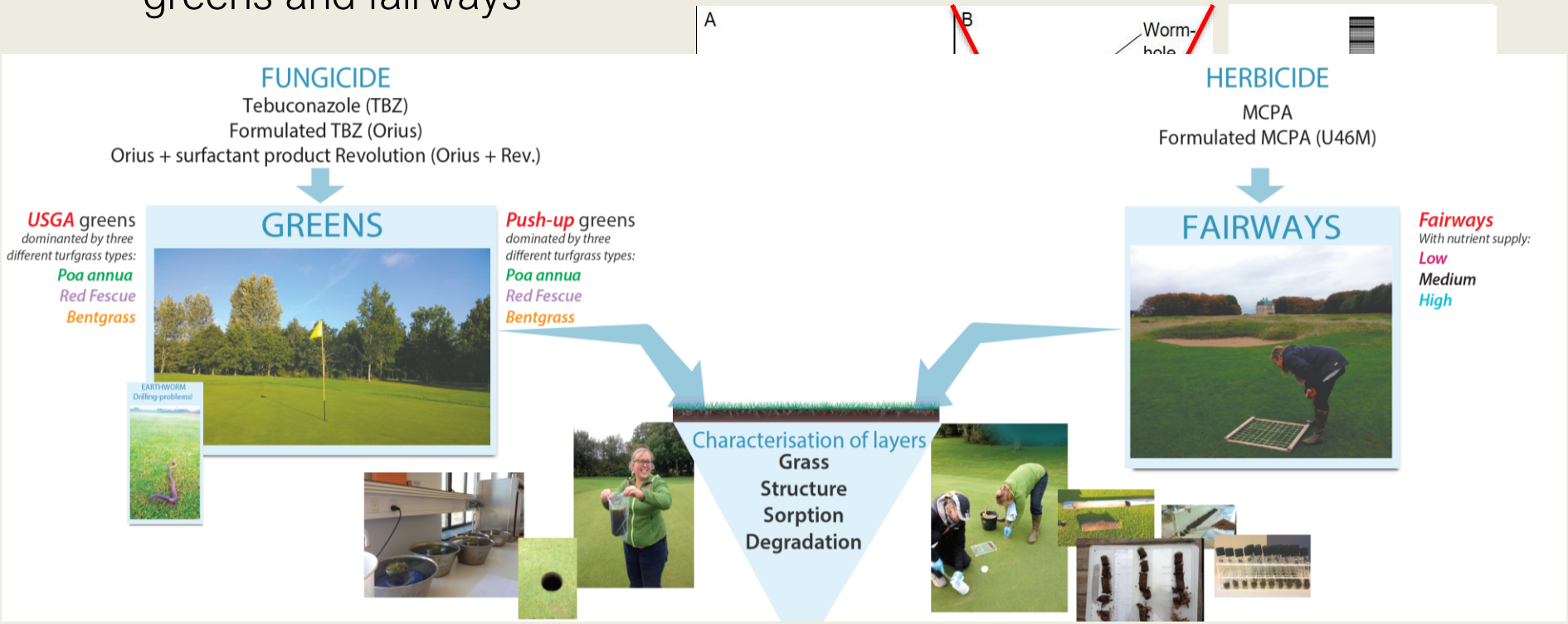
→ Golf turfs underlain by clay tills

Methods

- Model scenarios include:
  - climate data and hydrological data obtained from the Danish Pesticide leaching Asessment Program, PLAP
  - evaluation of greens with tebuconzole, TBZ, application in fall -> increase of groundwater levels
- Model choice -> COMSOL to include detailed process description related to flow and transport

Methods

- Field sampling to determine geochemical properties from the top soil of greens and fairways



Methods

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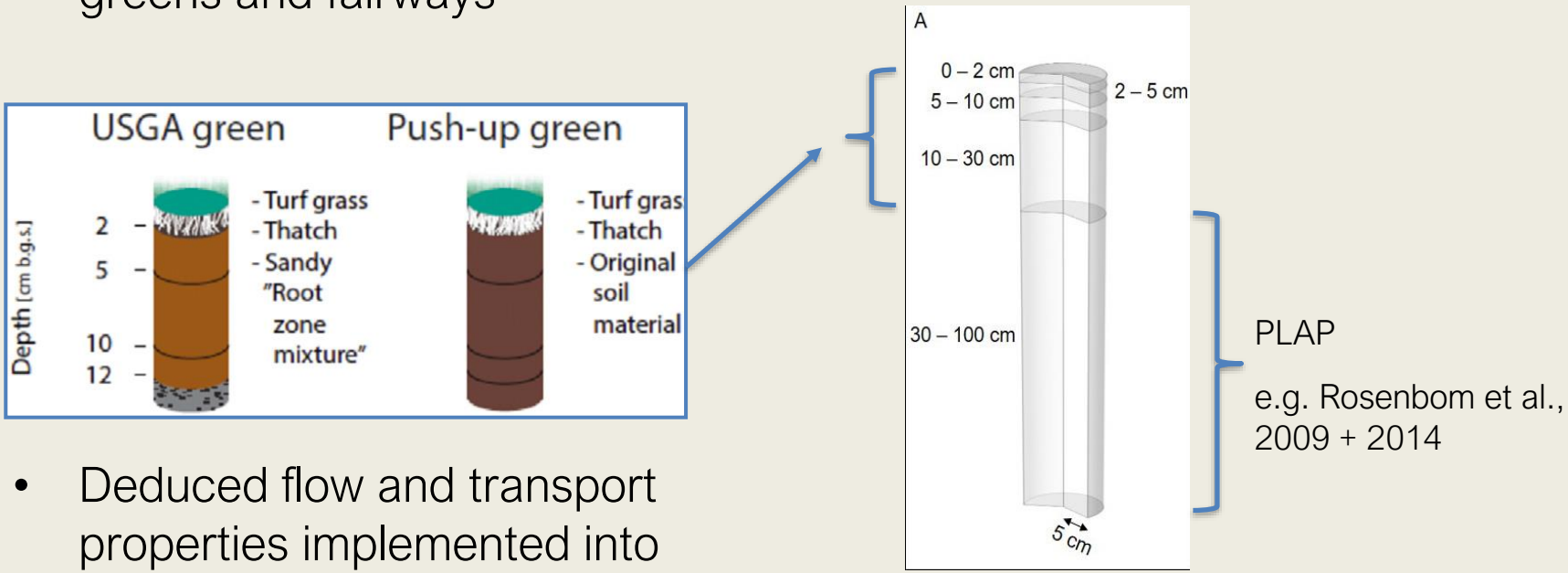
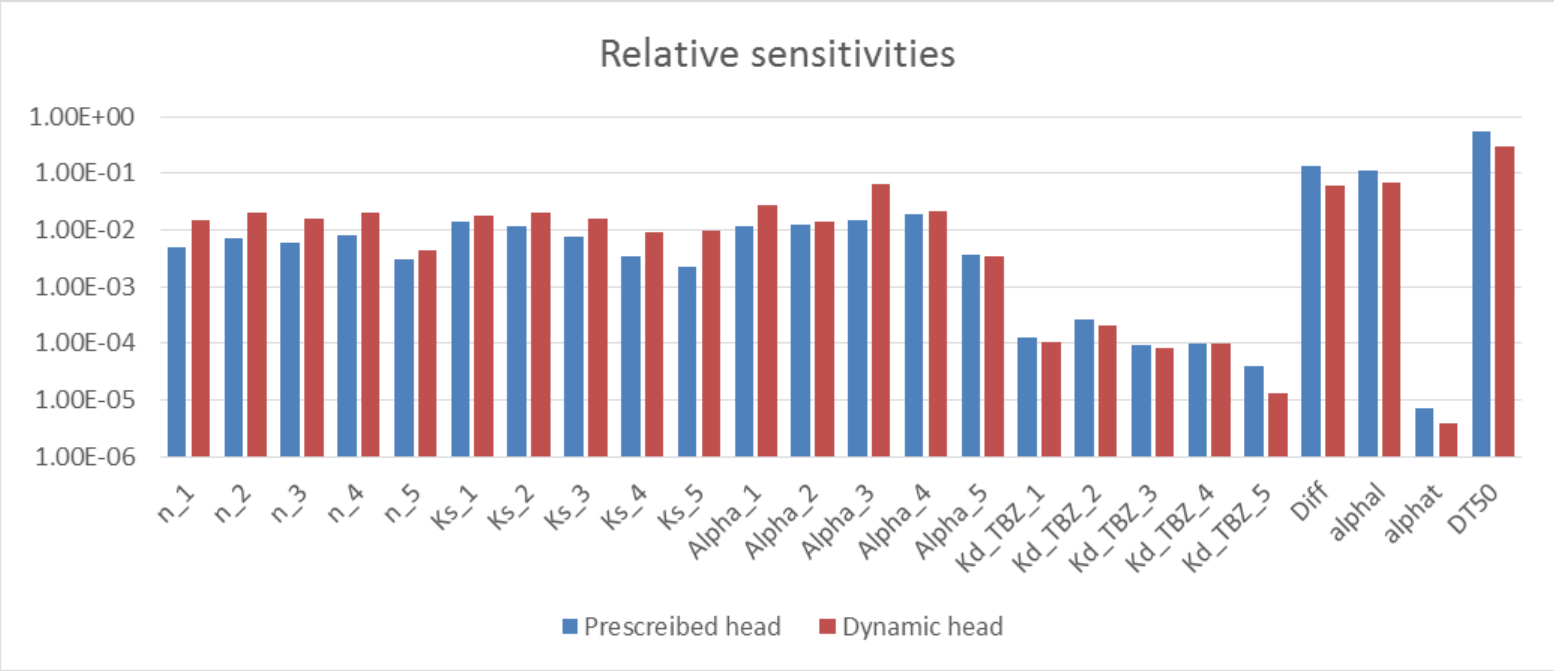


- Deduced flow and transport properties implemented into the numerical models

Results – sensitivity analysis

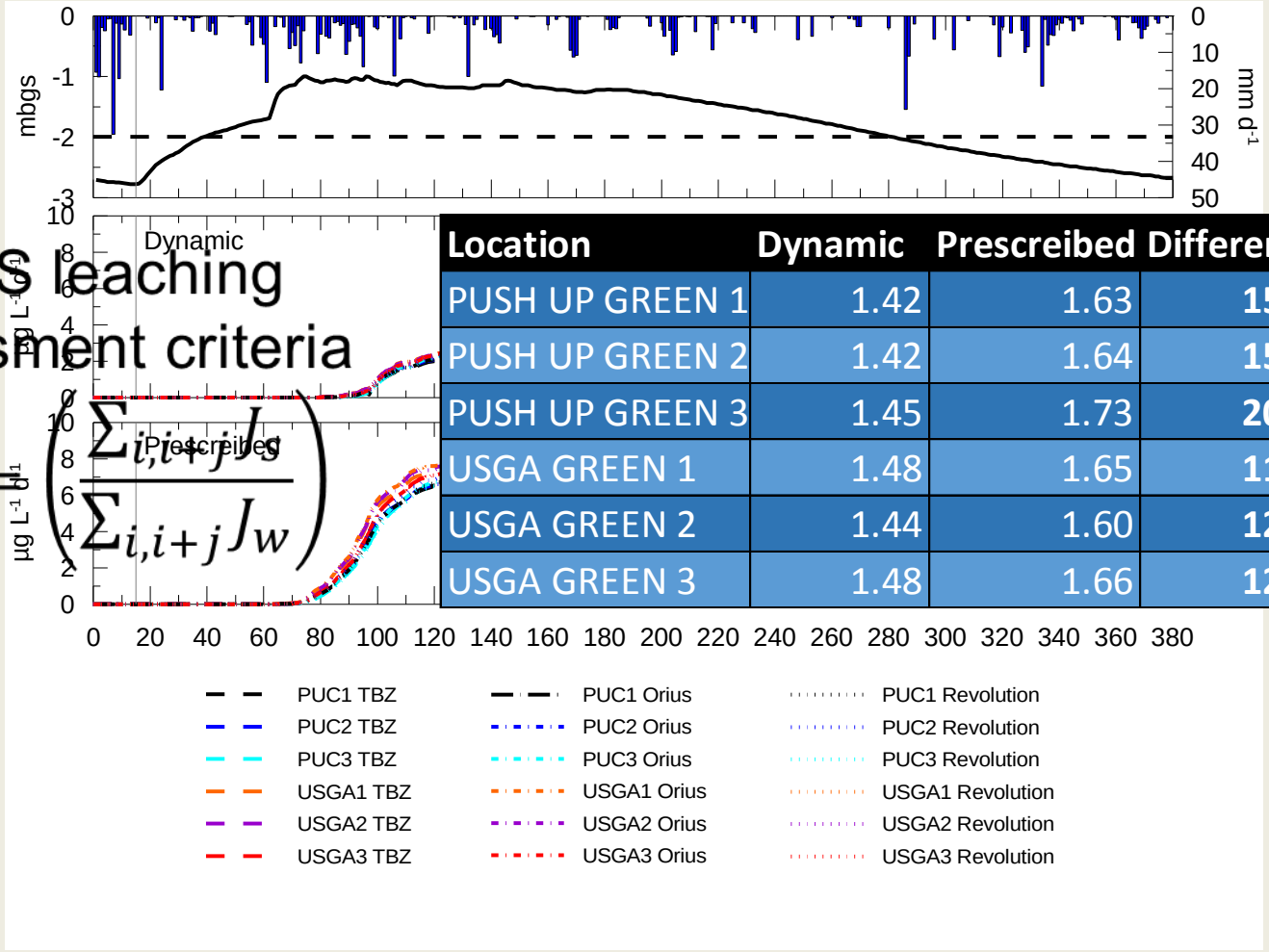


- Sensitive parameters are changing
- Hydraulic parameters more decisive with fluctuating groundwater table
- Fate parameters less dominating with fluctuating groundwater table

Results – simulated pesticide leaching

FOCUS leaching assessment criteria

$$cp_i = \left(\frac{\sum_{i,i+j} J_s}{\sum_{i,i+j} J_w} \right)$$



Location	Dynamic	Prescreibed	Difference
PUSH UP GREEN 1	1.42	1.63	15%
PUSH UP GREEN 2	1.42	1.64	15%
PUSH UP GREEN 3	1.45	1.73	20%
USGA GREEN 1	1.48	1.65	11%
USGA GREEN 2	1.44	1.60	12%
USGA GREEN 3	1.48	1.66	12%

Conclusions

Questions

1) Are sensitive parameters the same?
2) Are simulated pesticide leaching assessments comparable?

Answers

1) No
2) No

Perspectives

This study shows the impact of realistic BC's when simulating the potential groundwater leaching risk of TBZ through greens

The results emphasize the need to:

1) Implement realistic groundwater dynamics

2) Understand in which hydrogeological setting, groundwater dynamics govern the pesticide leaching compared to compound fate properties?