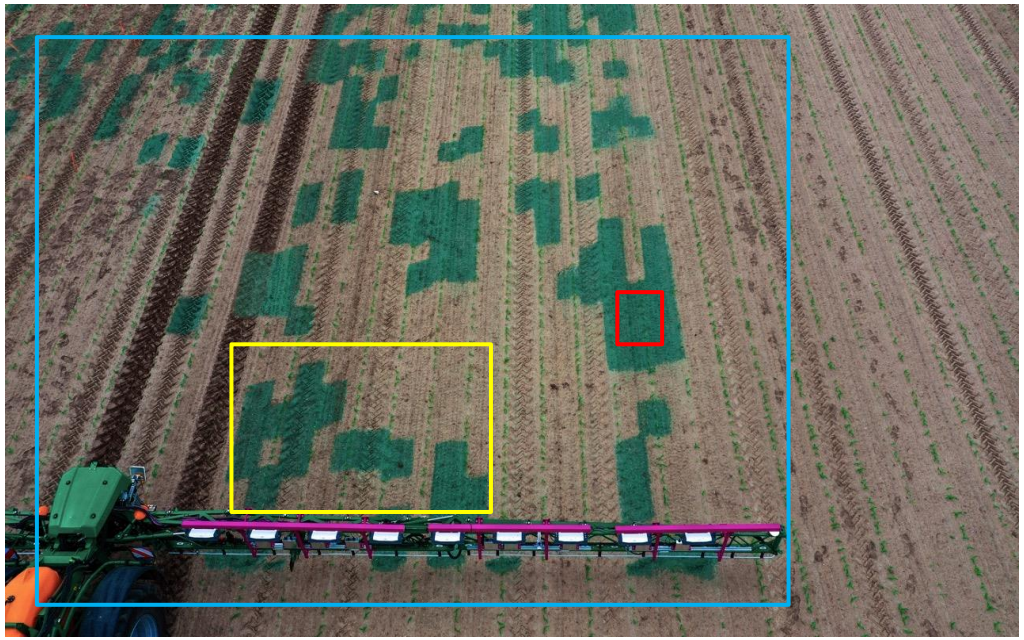
Precision application in a regulatory context

Ground and surface water modeling concepts



Francis P. Donaldson, Ph.D.

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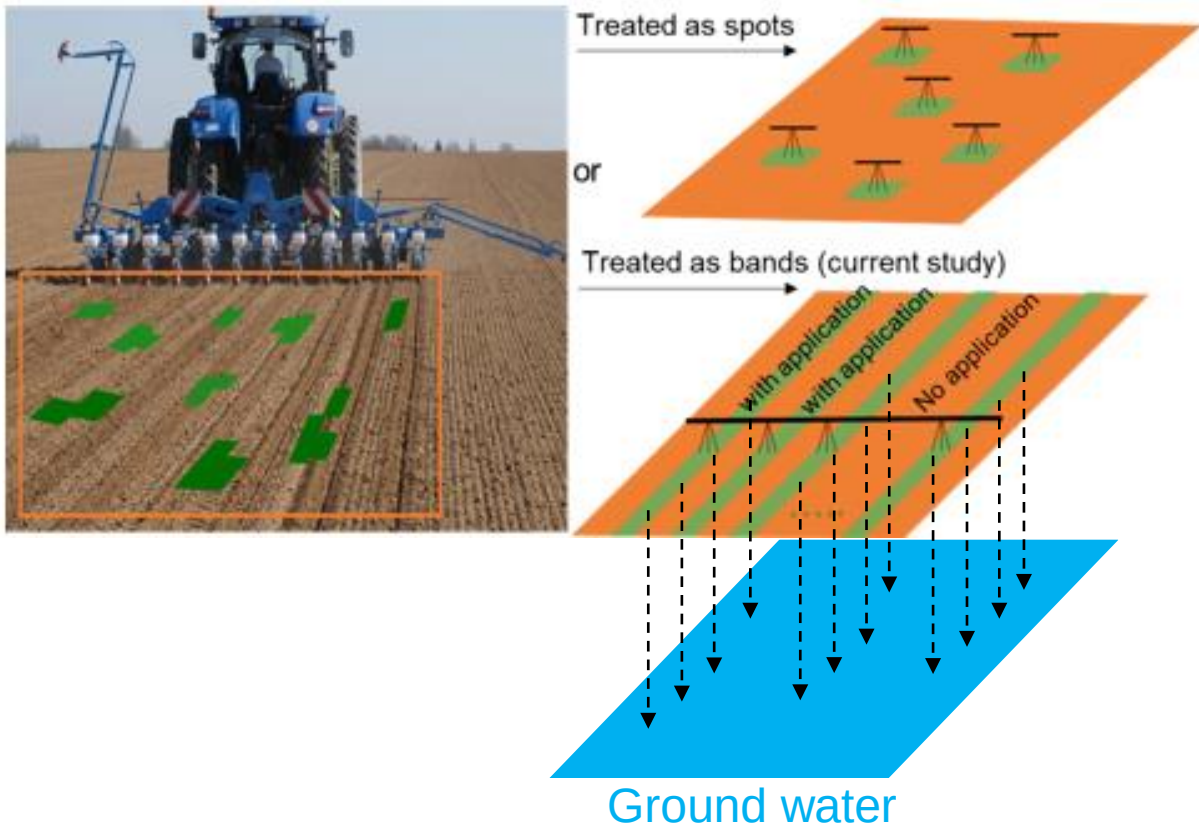
Outline

- Ground water modelling of precision application
  - Focus on banded application
  - Comparison of full-field to partial-field application
- Surface water modelling of precision application
  - Development of a risk assessment framework concept
  - Spot → band modelling
- Summary

Band applications and ground water

Regulatory models for ground water consider 1-dimensional (vertical) transport

- Appropriate for homogenous field application, but groundwater concentrations for a partially treated field may be impacted by
  - Lateral transport
  - Diffusion



How might 1 kg a.i./ha be interpreted when considering only a portion of field is treated (as in a band)?

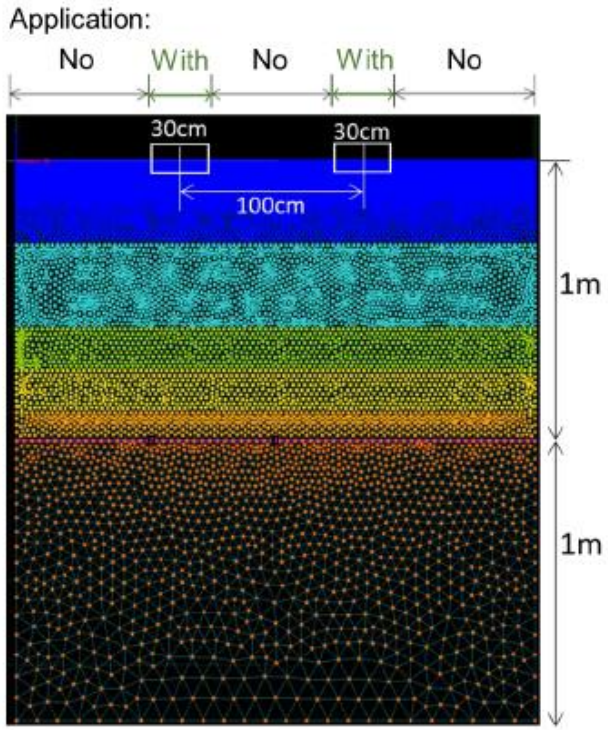
*Li, S., Jene, B. Evaluation of the effect of band application on groundwater concentrations using two-dimensional leaching modelling. Society of Environmental Toxicology and Chemistry (SETAC) Europe 32nd Annual meeting, Copenhagen, DK.

2-Dimensional modelling of a banded application

Band application, considering bands of 30 cm with 1 m between

- Processes include water transport, solute transport, heat transport, root water uptake
- Comparison of a full field application to a banded application
  - TOTAL of 1 kg a.i. applied to 1 ha field (100 L/ha)
  - Full field application
  - Banded application (make up 1/3 of surface)

    ➔ Mass of a.i. in total area = mass in partial area (i.e., band is concentrated accordingly)



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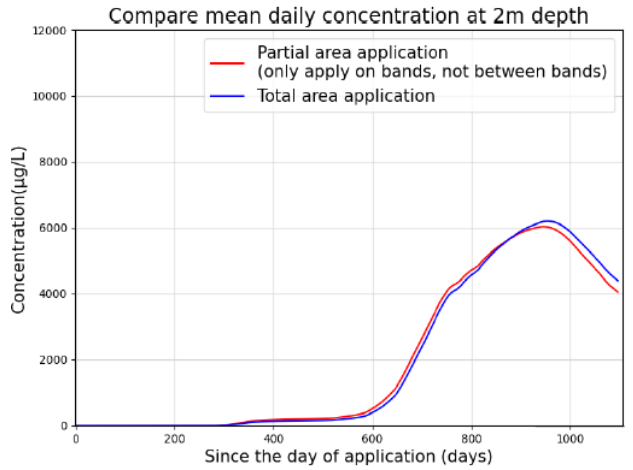
Band applications and ground water
Results and Conclusions

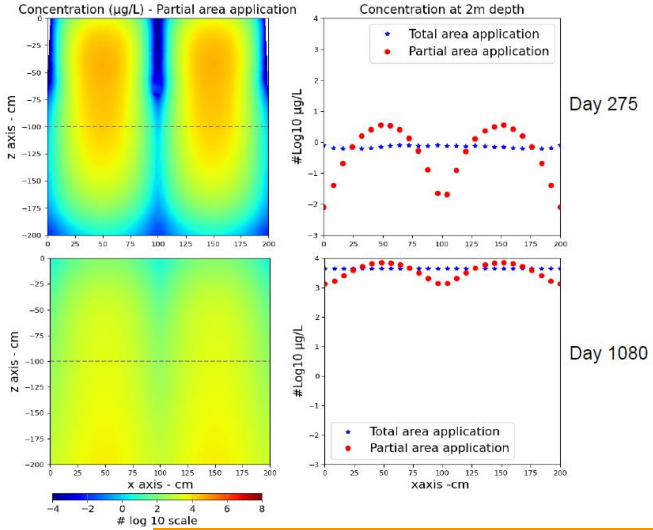
Daily mean concentrations plotted at 2 m depth

- Daily mean leaching concentrations beneath a band application are comparable to total area application (if same total mass is applied)
- Lateral transport and dispersion leads to a dilution of a.i. beneath treated and untreated surface for banded application
  - Compensates for partial area (at higher rate) treatment

➔ **One dimensional models can be used to represent partial area applications**

➔ **Modeled groundwater concentrations can be adjusted based on percent field treated**





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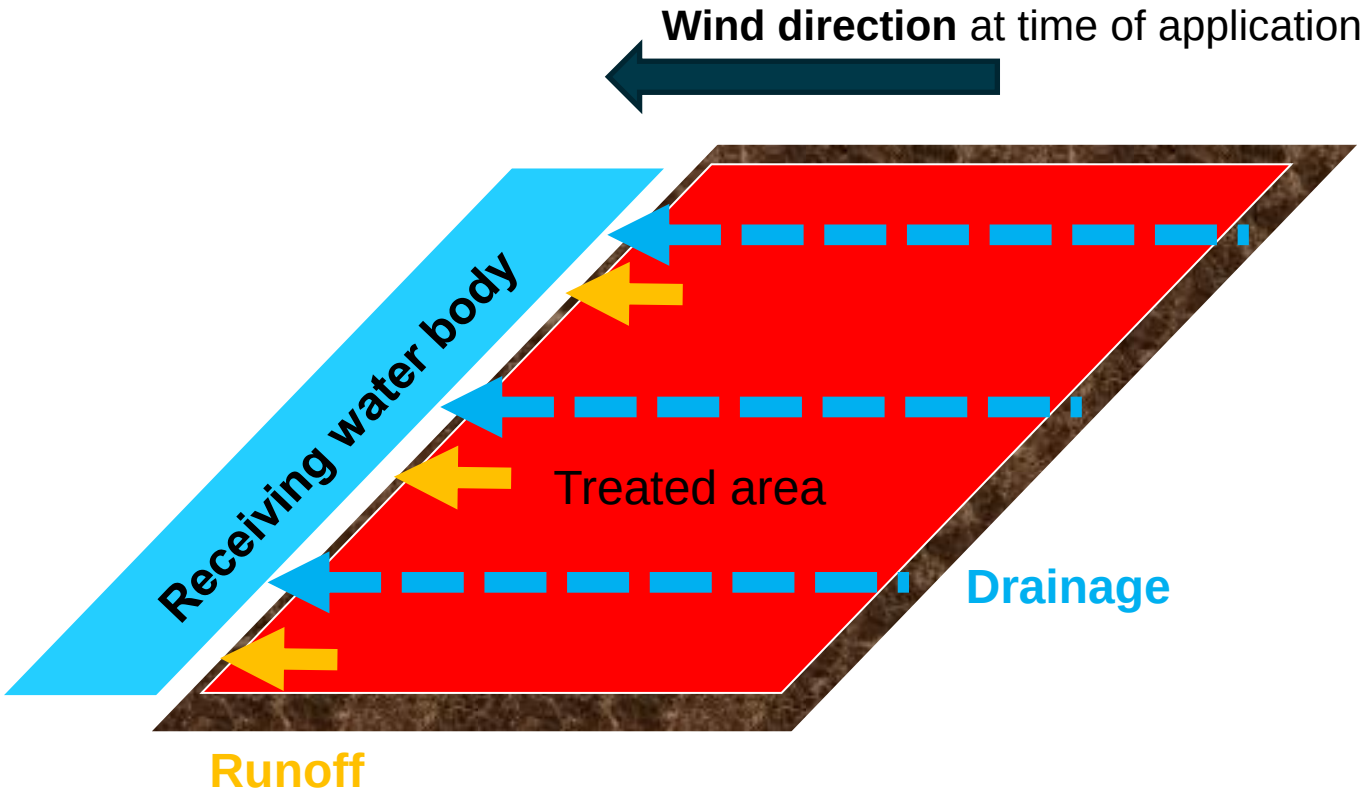
Surface water modeling
Standard situation

Entire field treated at GAP rate

- Typical field sprayer
- No spot application
- Overall worst-case for exposure



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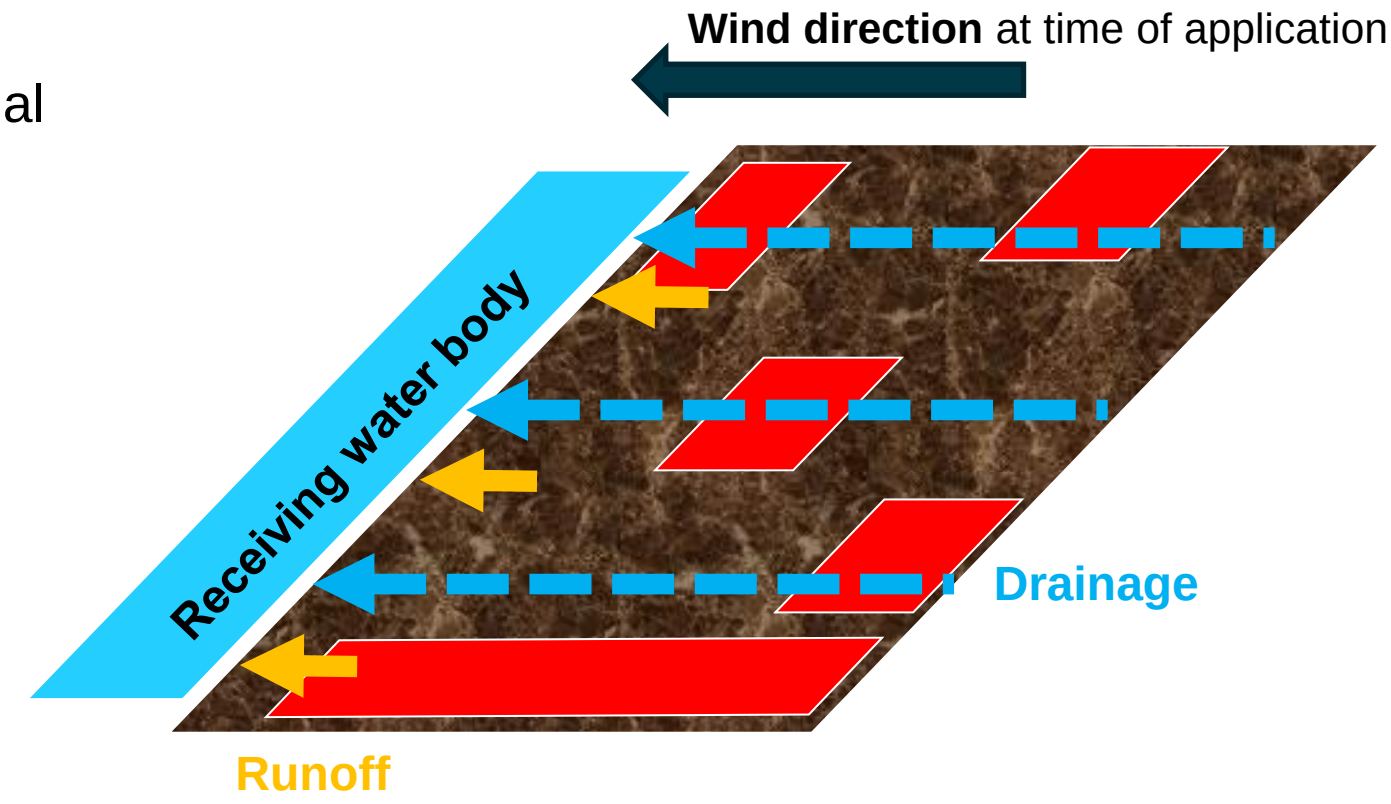
Spot Applications
Only part of field treated

- Each spot has a different exposure potential

How to handle in a risk assessment?



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Spot applications: surface water considerations

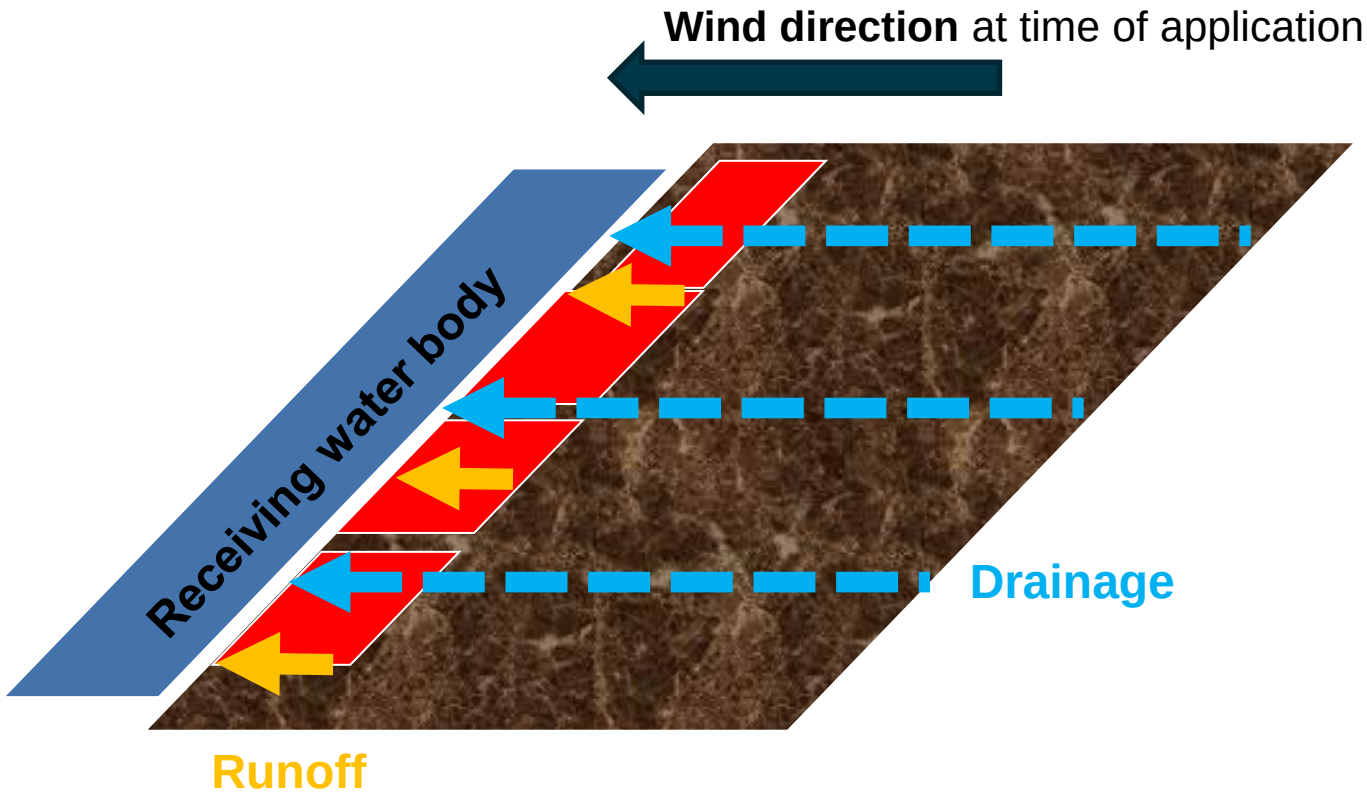
Translate spot applications into the standard regulatory framework for surface water

- Resolve all spots into band applications
- Determine an „effective“ buffer setback for band application and derive percentage of field treated

Spot Applications (Scenario 1)
Worst-case: all spots adjacent to water body

Consider as a band next to water body

- Compared to full-field application
  - Drift potential ➔
  - Runoff potential ➔
  - Drainage potential ↘
    (proportional to the application reduction)



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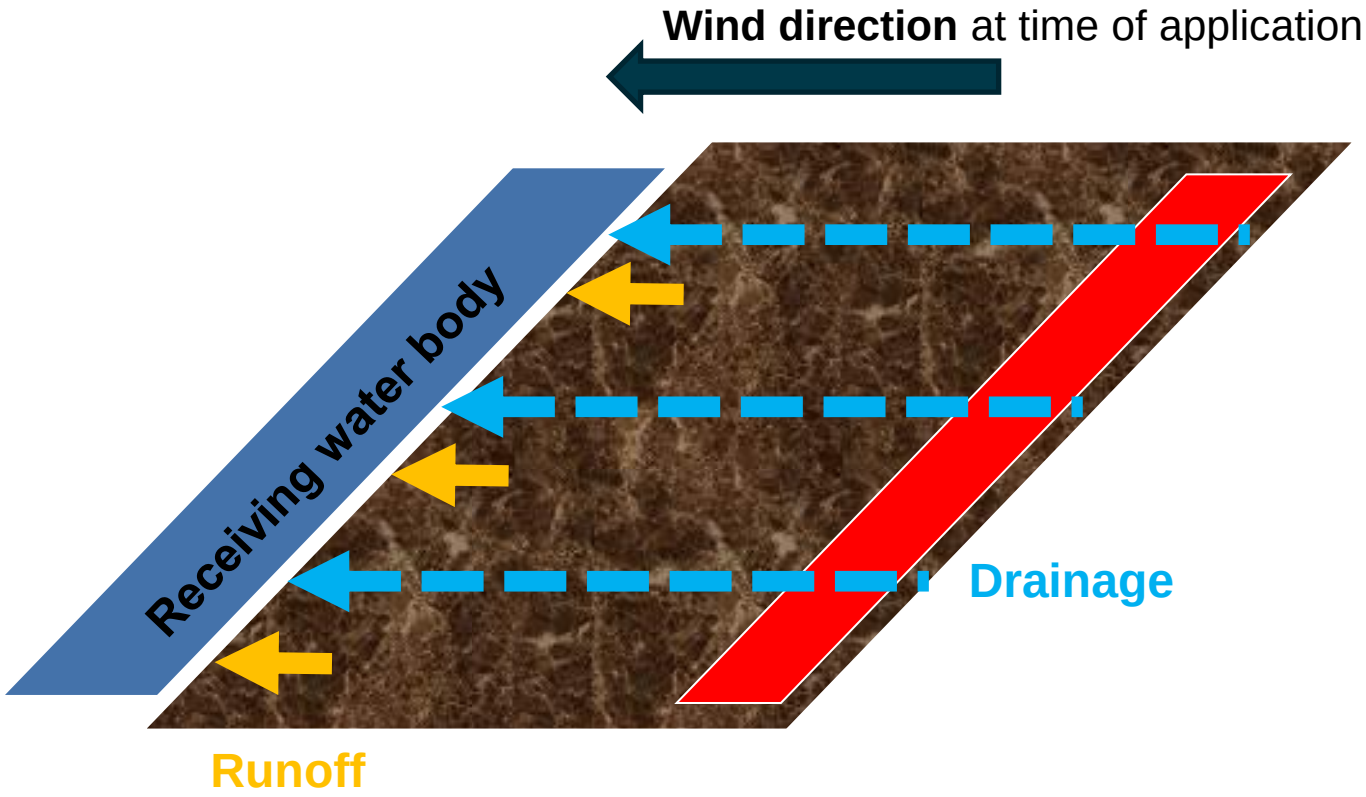
Spot Applications (Scenario 2)

Best-case: all spots away from water body

Consider as a band at far edge of field

- Compared to full-field application
  - Drift potential ↘
    (in-field buffer)
  - Runoff potential ↘
    (in-field buffer)
  - Drainage potential ↘
    (proportional to the application reduction)



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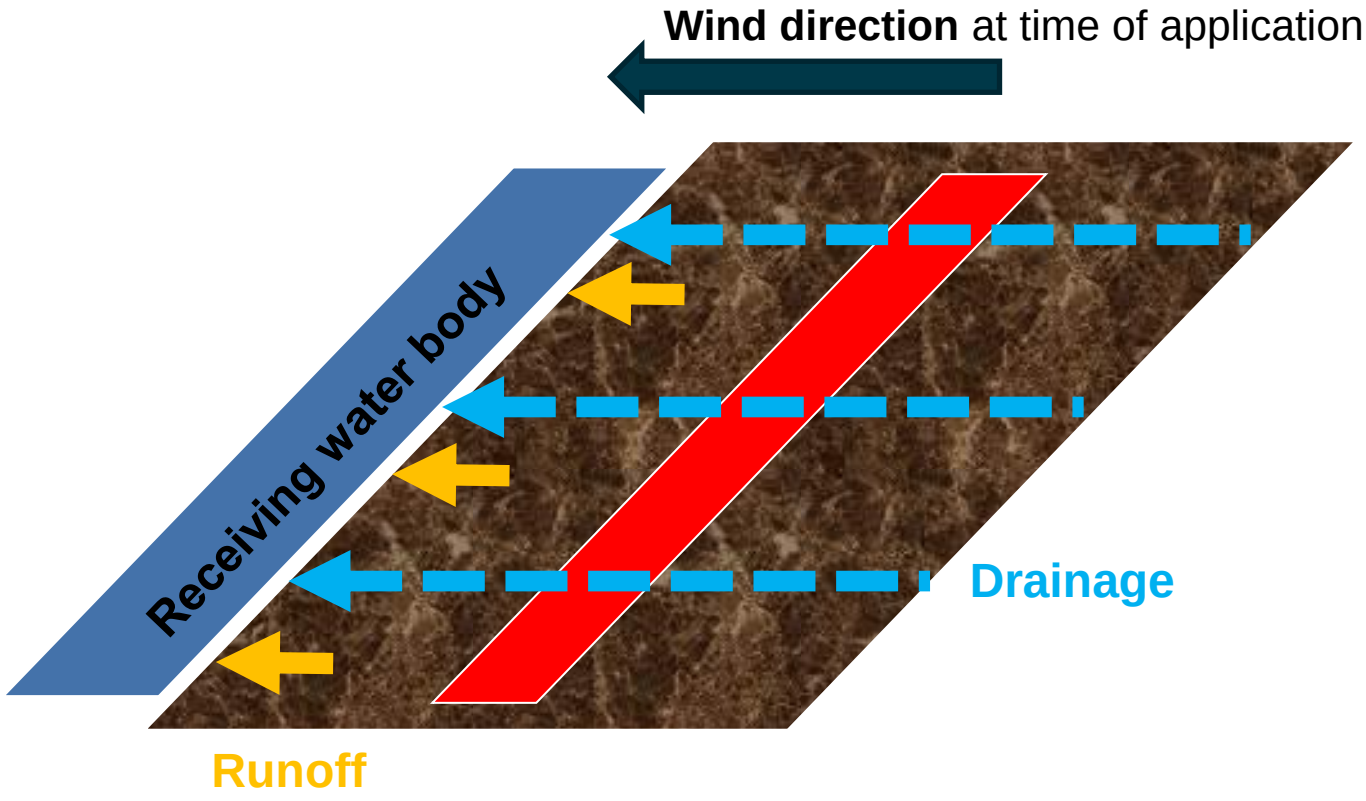
Spot Applications (Scenario 3)

Intermediate case: all spots at middle of field

Consider as a centrally located band

- Compared to full-field application
  - Drift potential ↘
    (in-field buffer)
  - Runoff potential ↘
    (in-field buffer)
  - Drainage potential ↘
    (proportional to the application reduction)



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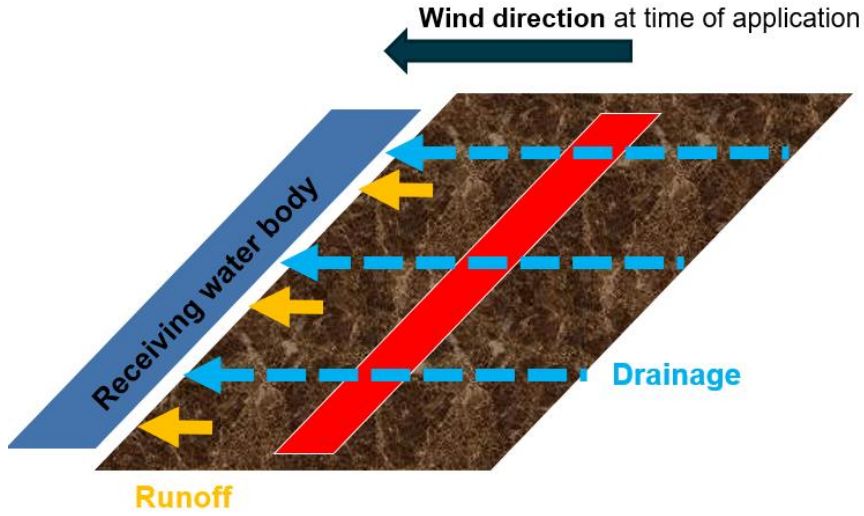
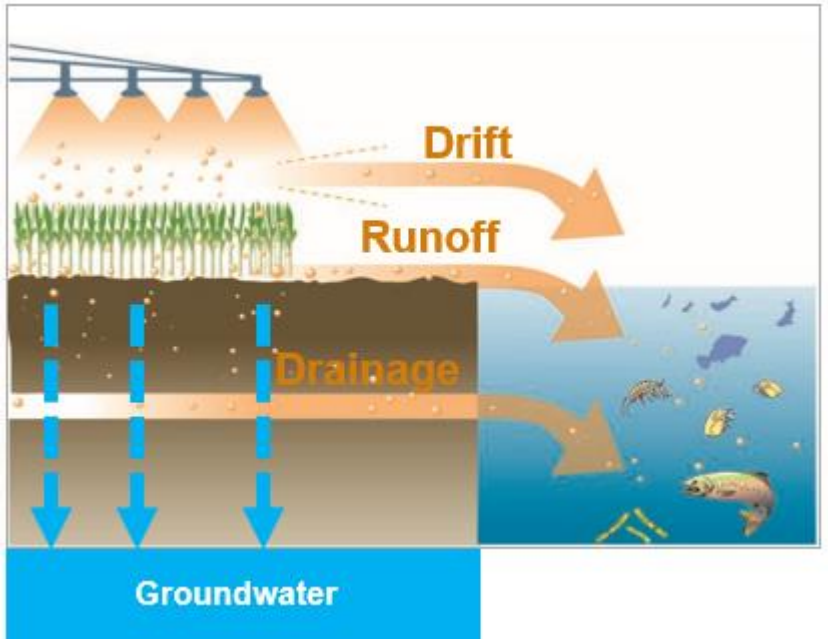
Surface water modelling of spot applications

- Preliminary modelling has been conducted to explore scenario 3
- Impact on runoff and erosion for a number of generic compounds
- Applicability to a risk assessment tested
- Approach is being discussed at industry level to evaluate technical details



Summary

- Two-dimensional ground water modelling demonstrated that lateral transport and diffusion impact ground water concentrations below a treated field
  - Applications to a partially treated field, where total applied mass is the same as in a fully treated field, result in same ground water concentrations
- Surface water modelling concept developed
  - Currently in discussion at industry level
  - Technical details may take some time
  - Discussions with stakeholders can help identify concerns and inform a more robust assessment



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