

1 THE PROBLEM



- **Vegetative filter strips (VFS)** trap pesticides in a thin surface **mixing layer**. Between storms that layer can turn the VFS from a **sink** into a **source** of pollution.
- **VFSMOD** was extended for long-term exposure assessment with degradation, sorption-based redistribution, carry-over and **remobilization** between rainfall events.

BASELINE

all mass left in the mixing layer is remobilized by the next storm

UPDATE

only the **dissolved fraction** is remobilized — never tested against dedicated data

Field studies show the baseline **over-predicts** remobilization, especially for strongly sorbed pesticides.

2 HYPOTHESIS · OBJECTIVES

H

Runoff pesticide prediction improves if the algorithm also lets the mixing layer **leach as the soil drains to field capacity** after a storm



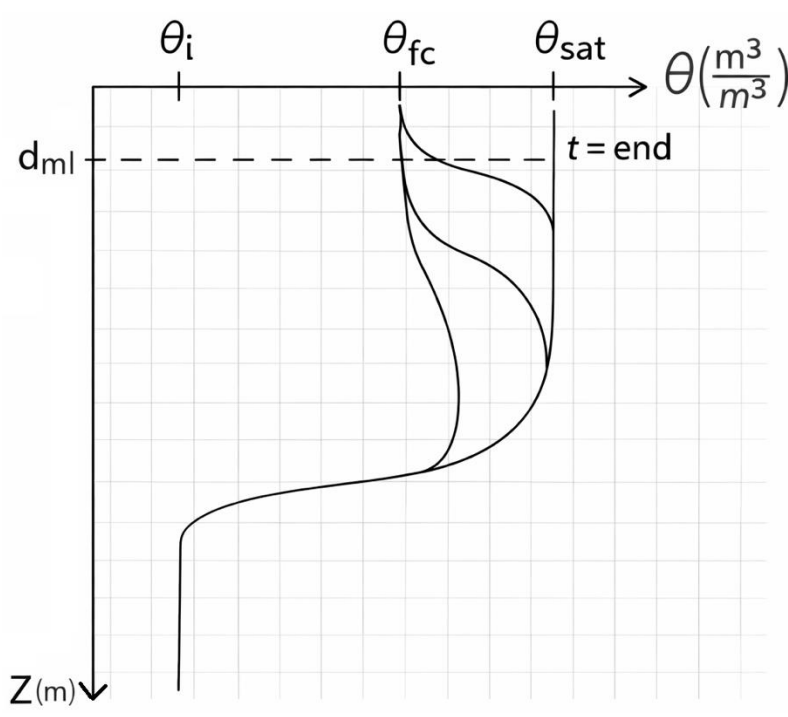
Does drained-to-equilibrium leaching improve VFSMOD's over-prediction of remobilization?

3 METHODS · TEST CHEMICALS

Chemical	K _{oc} (mL g ⁻¹)	DT ₅₀ (days)	Behaviour
Bromide	tracer	—	conservative
Mesosulfuron	64	313	mobile
Fluopyram	267	52.8	intermediate
Diflufenican	3791	230	strongly sorbed

Long half-lives keep **degradation negligible** between sampling and analysis in the experiments, isolating remobilization.

4 METHODS · THE TWO ALGORITHMS



mixing-layer water content drains from θ_{sat} to θ_{fc} after the storm (t = end+1, +2, +3)

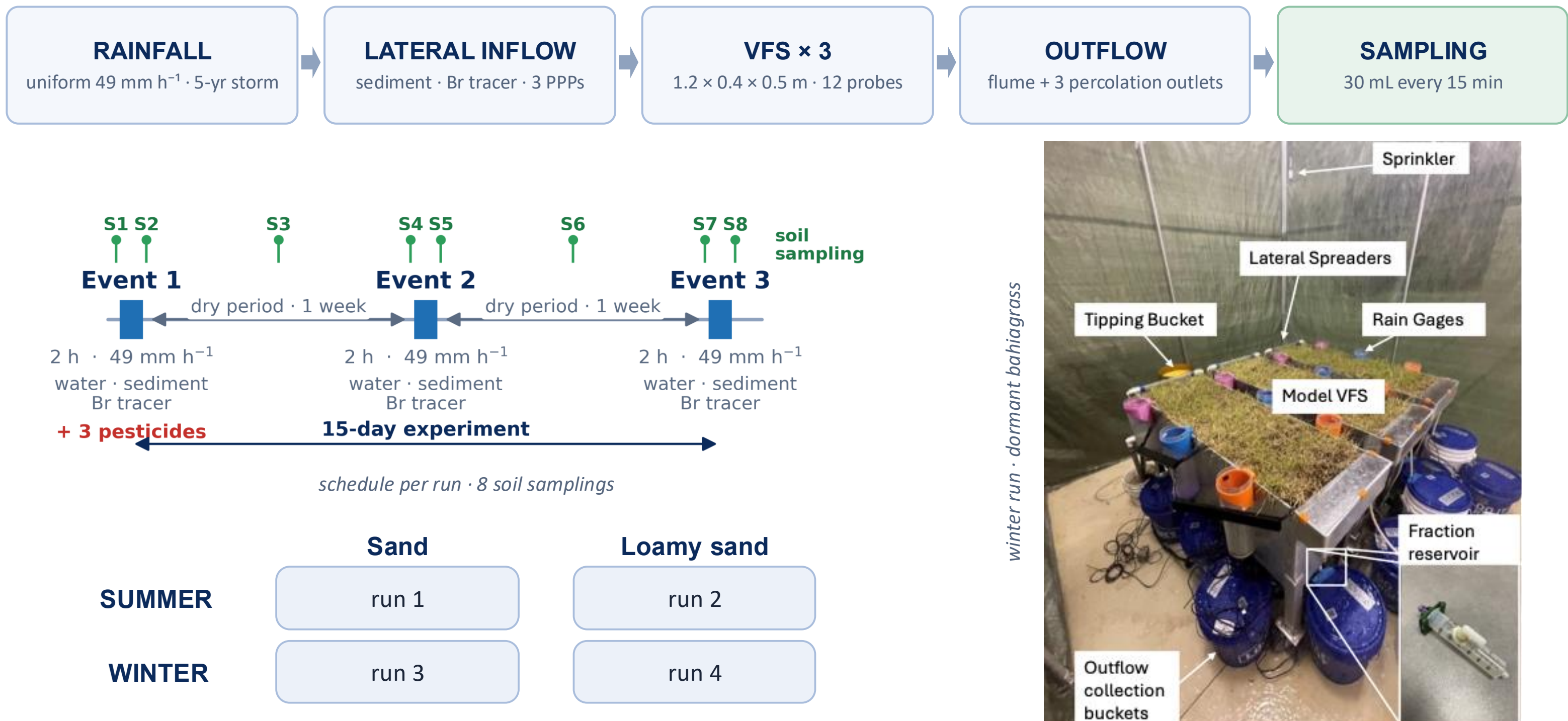
Both versions run in parallel over three chained events per run; fits compared with FITEVAL.

CONCLUSIONS · KEY TAKE-HOME MESSAGES

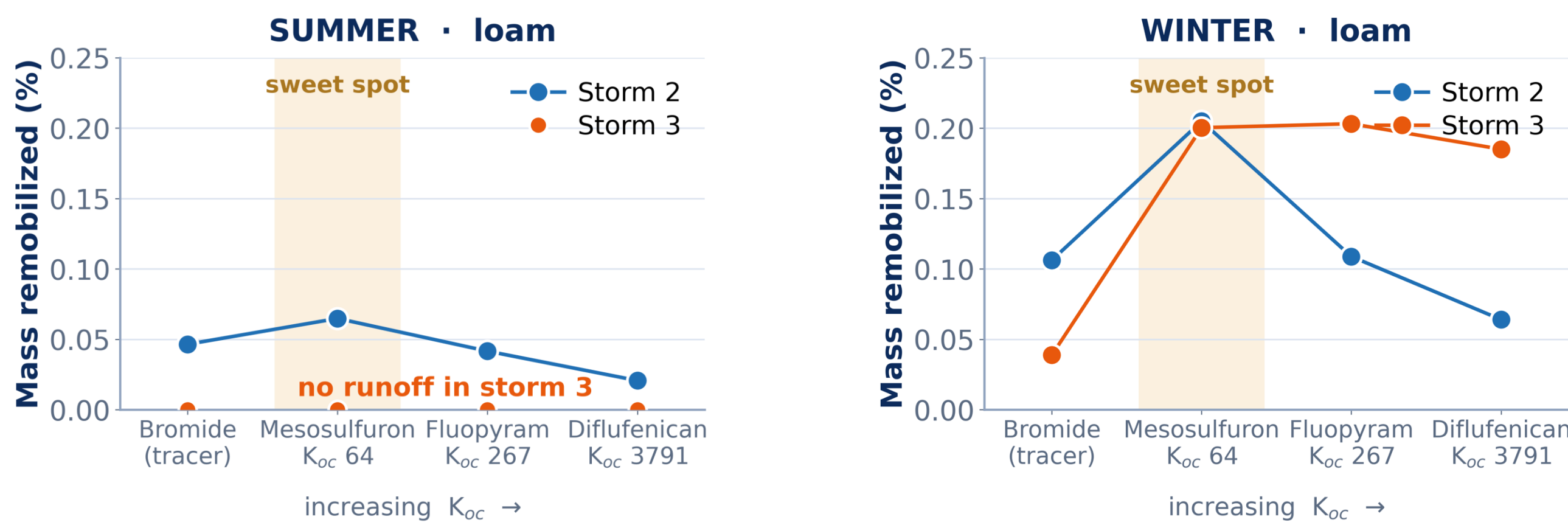
- ✓ Remobilization follows a **K_{oc}-dependent intermediate-range pattern** whose peak shifts across successive events — event-specific mechanistic modelling is needed.
- ✓ The full pore-water algorithm alone **over-predicts** remobilization: NSE = −0.82 for all chemicals and 0.70 for pesticides only, with unacceptable fits still likely.

- ✓ Adding **drained-to-equilibrium leaching** raises NSE to **0.971** (p = 0.011) overall and **0.994** (p = 0) for pesticides, eliminating unacceptable fits.
- ✓ Post-storm equilibrium drainage removes a substantial share of mobile chemicals dissolved mass (like tracers) providing realistic physics basis for pesticide risk assessment.

5 METHODS · MESOSCALE MULTI-EVENT VFS



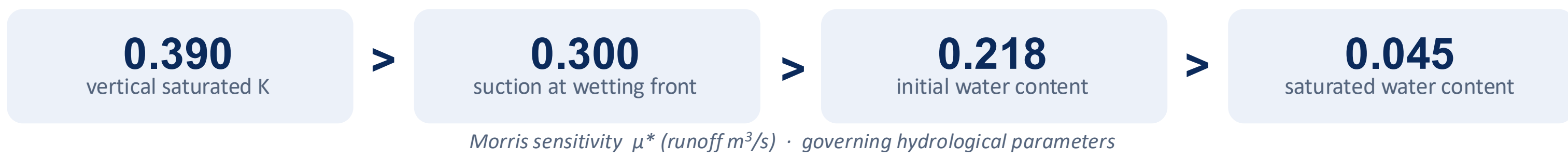
6 RESULTS · REMOBILIZATION BY K_{oc}



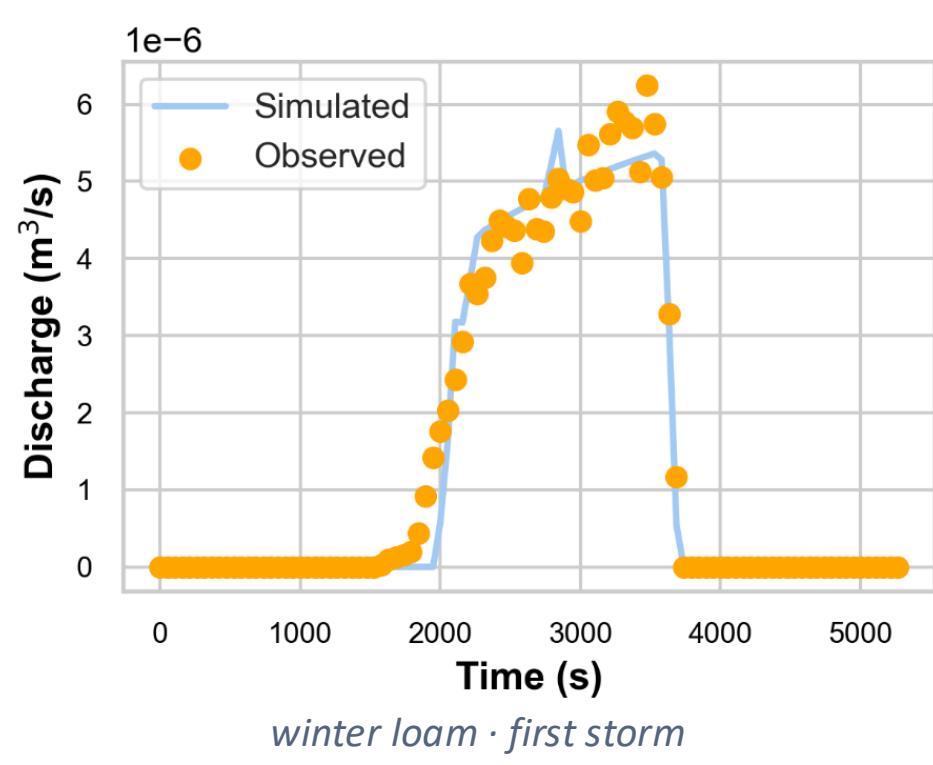
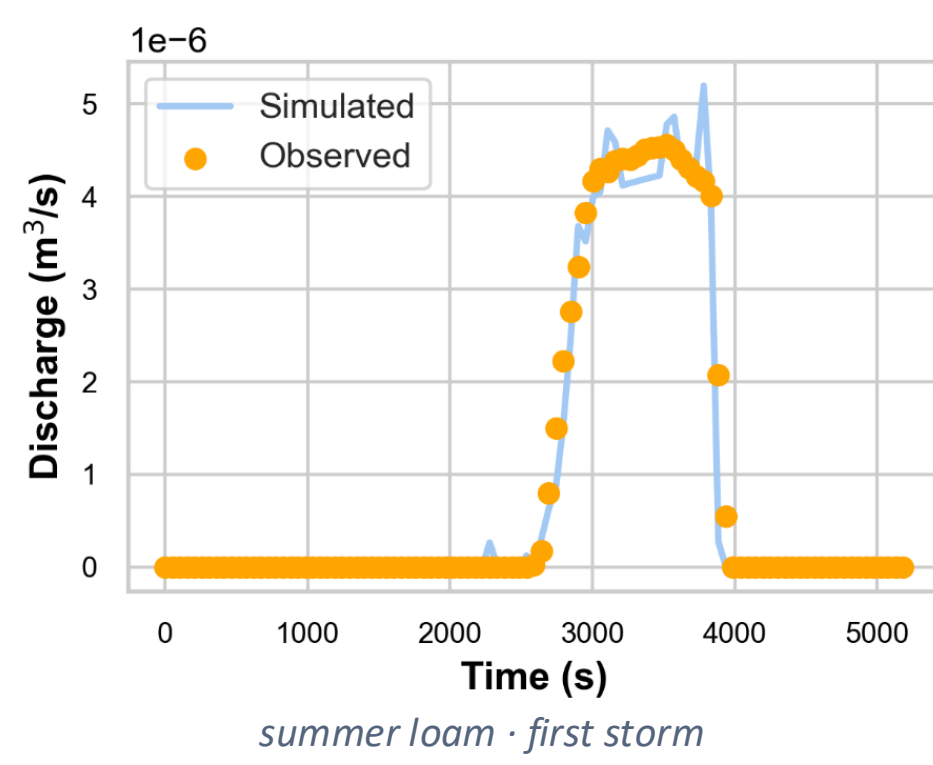
- Remobilized mass follows a **K_{oc} "sweet spot"** — a rising leg, a peak and a falling leg: mid-range sorption remobilizes more than either extreme.
- Storm 2 peaks at **mesosulfuron**; storm 3 shifts the peak to **fluopyram** — the K_{oc} of maximum remobilization **evolves over successive events**. Only the winter loam run produced runoff in both events 2 and 3.

7 RESULTS · HYDROLOGY & TRANSPORT

Important input factors controlling runoff

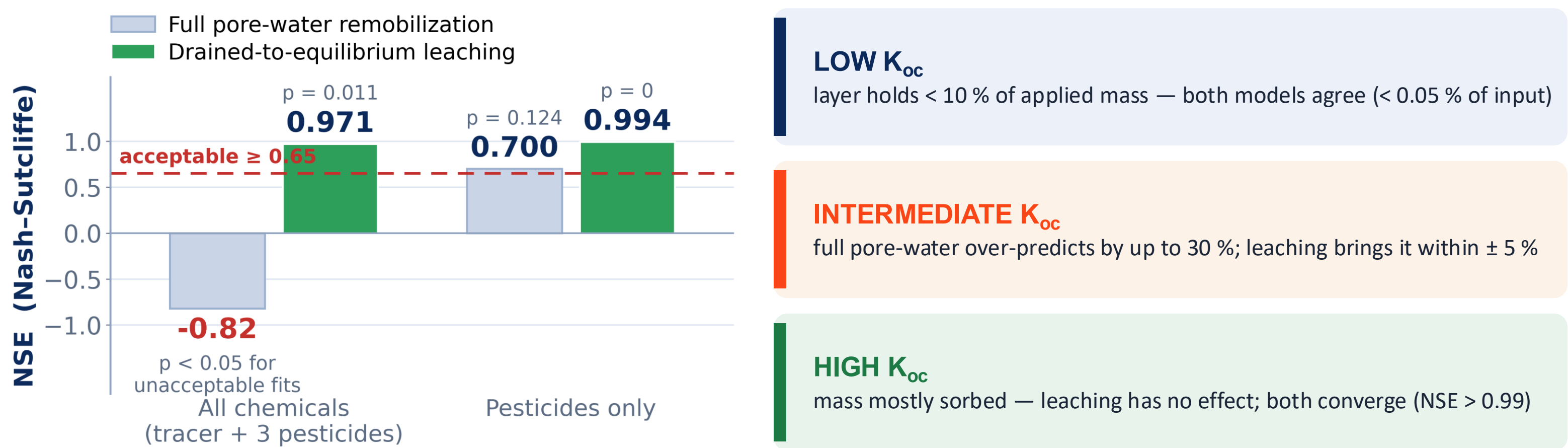


Runoff testing



- **NSE** ~ non-linear R² (also includes negative values for non regression models)
- Very good VFSMOD fit for first-storm hydrographs reach **NSE = 0.975** (summer loam) and **0.976** (winter loam).
- Measured soil profiles show **progressive wetting** (unsaturated flow) during the storms while the Green–Ampt piston front differs early but **matches the final saturated state** — the end state governs chemical transport. Winter-loam Br tracer profiles fall inside the **95 % CI** of the soil probe data, validating the 1-D transport scheme.

8 RESULTS · ALGORITHM PERFORMANCE



- Full pore-water remobilization **over-predicts bromide** by **> 400 %**, giving a negative NSE overall; pesticides-only NSE = 0.70 still carries p = 0.124 for unacceptable fits.
- Drained-to-equilibrium leaching cuts the **bromide bias** to **< 3 %** and removes **> 50 %** of dissolved bromide from the mixing layer, with the effect diminishing as K_{oc} rises for other chemicals.