

GWFO EXPERT BRIEFS

Scientific Data Shaping Canada's Freshwater Future



GLOBAL WATER FUTURES
OBSERVATORIES

Why Water Data Matters to Farmers

Dr. Andrew Ireson

Global Institute for Water Security, University of Saskatchewan

Why Water Data Matters to Farmers

University of Saskatchewan's Professor Andrew Ireson shares experience from instrumented sites in Canada's breadbasket region

SPEAKER

Dr. Andrew Ireson
Global Institute for Water Security

INTRODUCED BY

Doug Heath
SaskOilseeds



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Talk overview



- The global challenge
- Crops and water
- GWFO Ag Water sites in SK
- Insights from long term data
- Data-informed modelling
- Take home messages



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The global challenge

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Food and Agriculture Organization
of the United Nations

- Globally Agriculture accounts for 72% water withdrawals, today.
- By 2050 there will be 10 billion people
- We will need 50% more food and fiber
- Water demand will increase by 25%
- In short – we need to grow more with less land and less water



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<https://www.fao.org/land-water/water/agricultural-water-management/water-scarcity>



Crops and water

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Winter 2024



Spring 2025



Growing season 2024



Post-harvest 2025

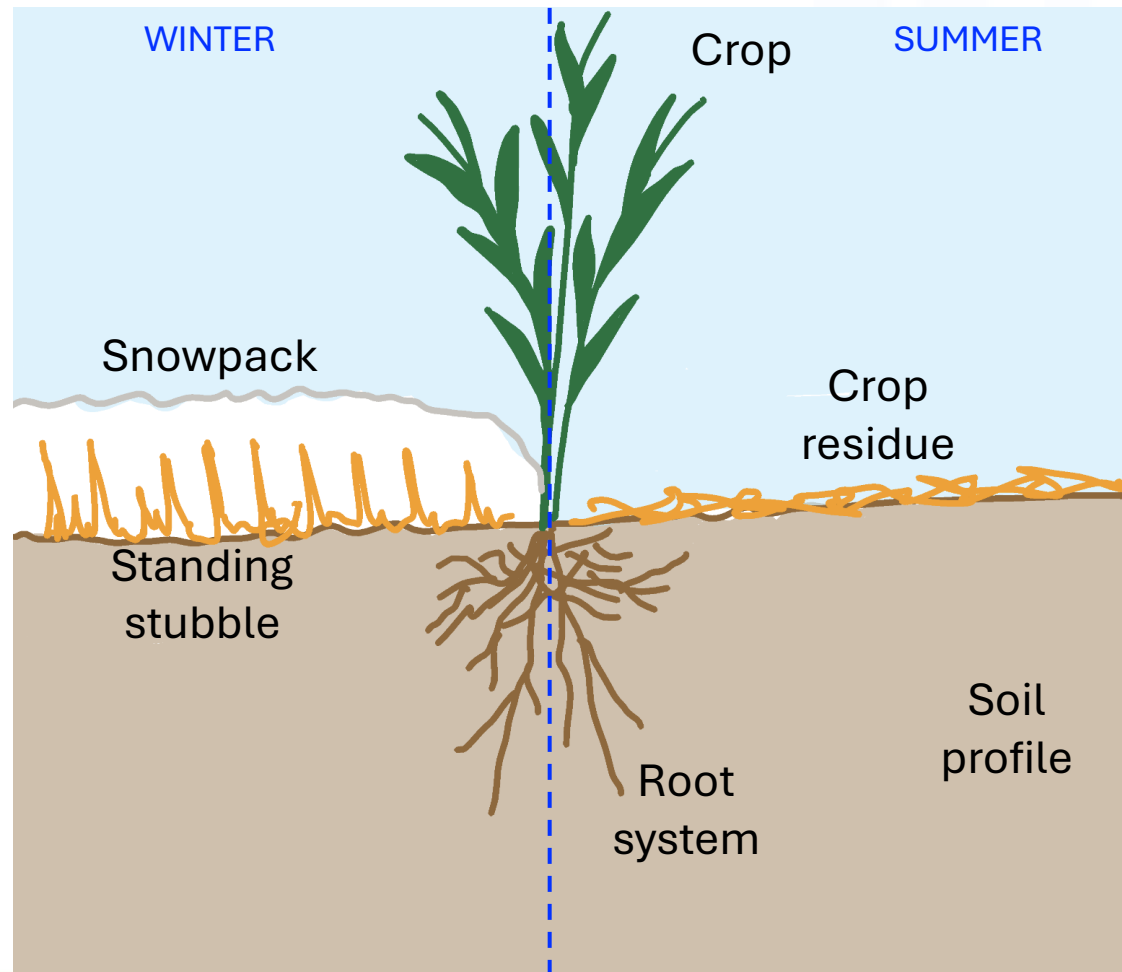


Clavet

Basnet, A. 2026. Modelling Winter Hydrological Processes to Simulate Barley Crop Yield in the Canadian Prairies. MSc Thesis at the University of Saskatchewan.
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Crops and water



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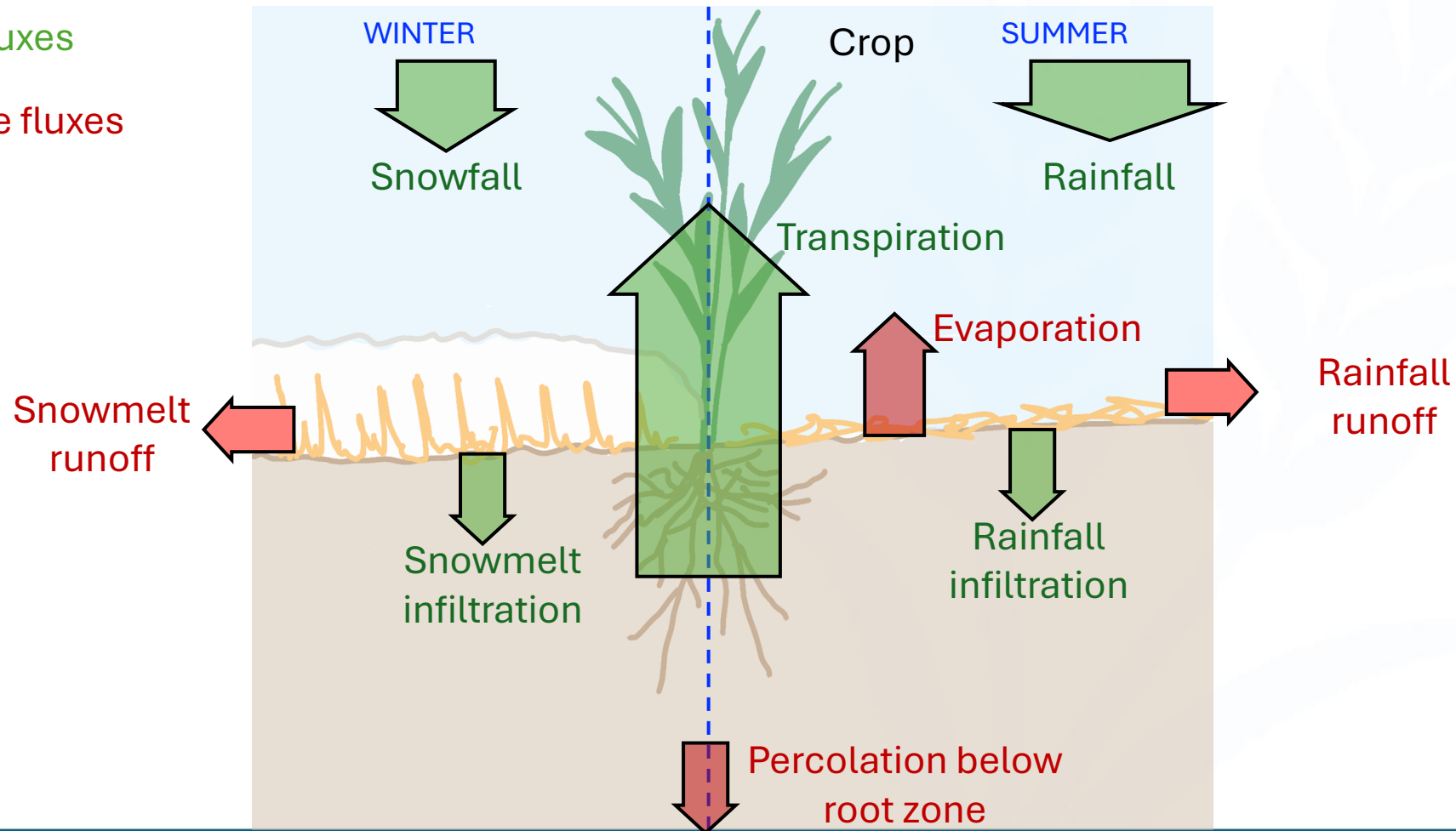
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Crops and water

Productive fluxes

Unproductive fluxes



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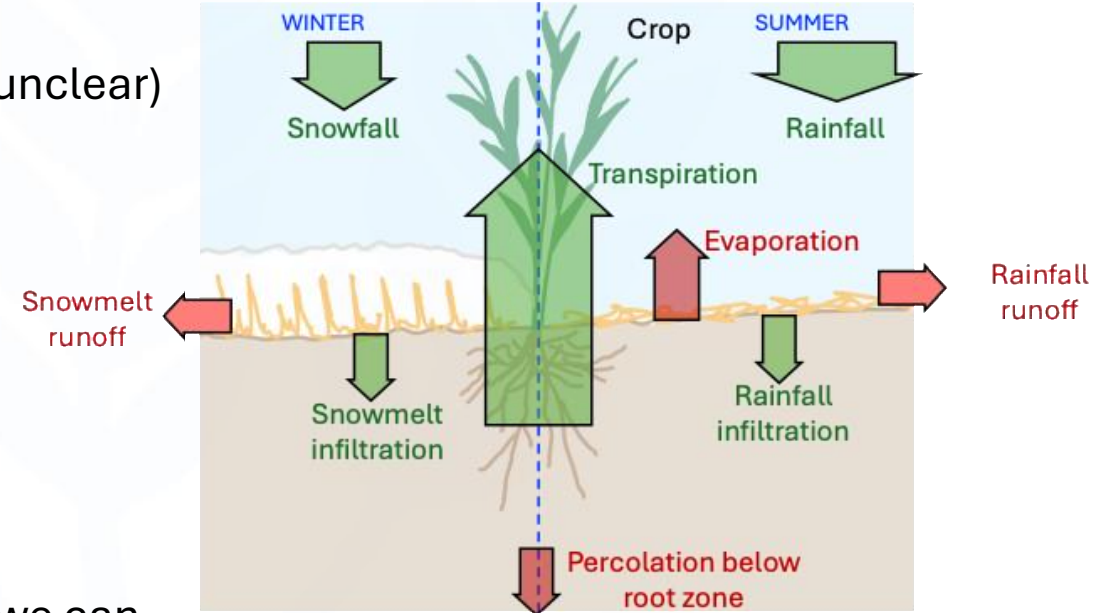
Crop water management objectives

We must live with what the changing climate system provides:

- Snowfall (likely to reduce in future?)
- Rainfall (more intense events in future? Direction of change unclear)
- Evaporative demand (temperature, wind, etc)

What are the levers can we/should we pull?

- **Maximize transpiration** (hence yield):
 - Maximize infiltration:
 - **Maximize snow** on the field (stubble)
 - Maximize snowmelt infiltration (no till)
 - **Irrigation** to augment infiltration when/where we can
 - **Minimize soil evaporation** (residue or mulch?)
 - Minimize percolation (but not to zero)



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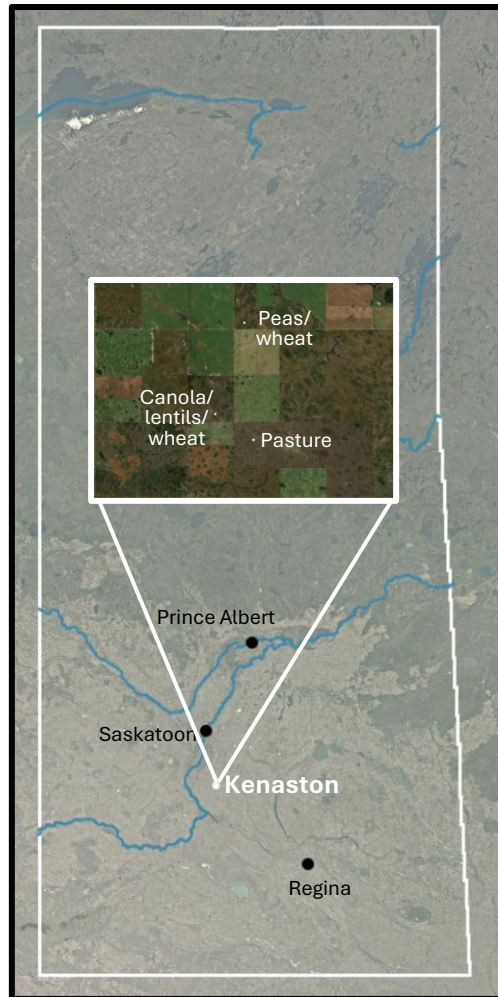
GWFO: Overview of sites in SK

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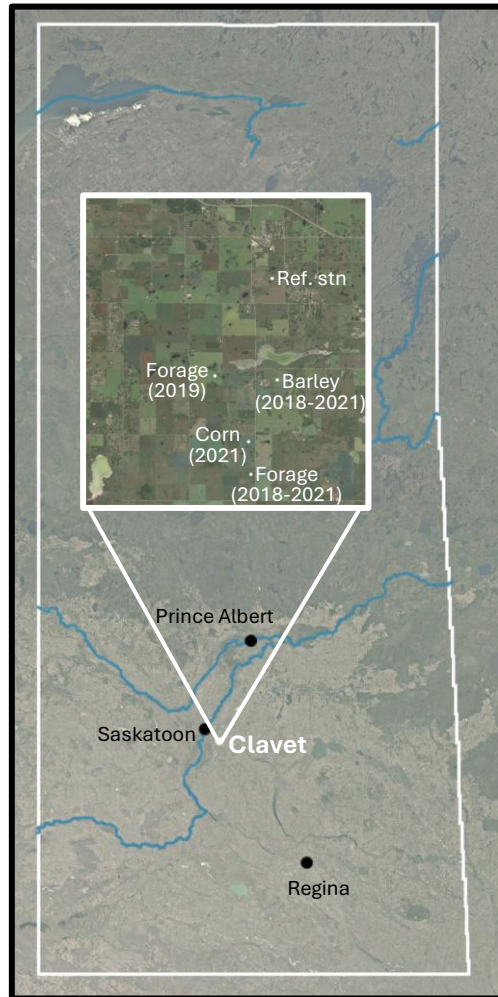




Kenaston

Tetlock, E., et al. (2019). An 11-year (2007–2017) soil moisture and precipitation dataset from the Kenaston Network in the Brightwater Creek basin, Saskatchewan, Canada. Earth System Science Data. <https://doi.org/10.5194/essd-11-787-2019>

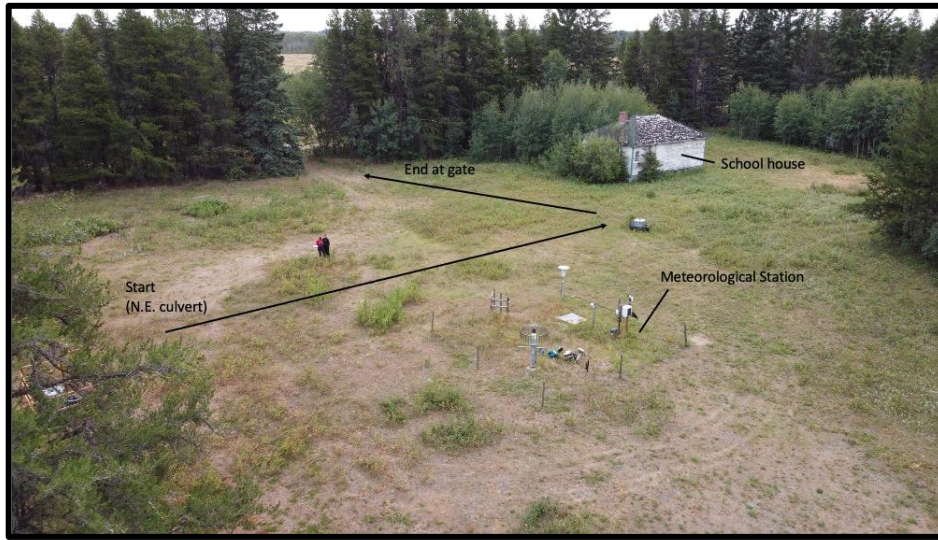
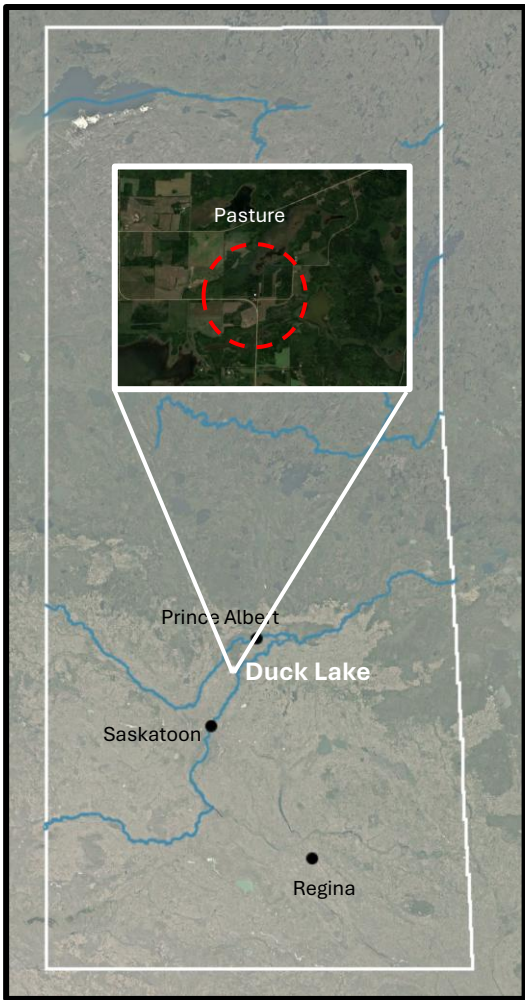




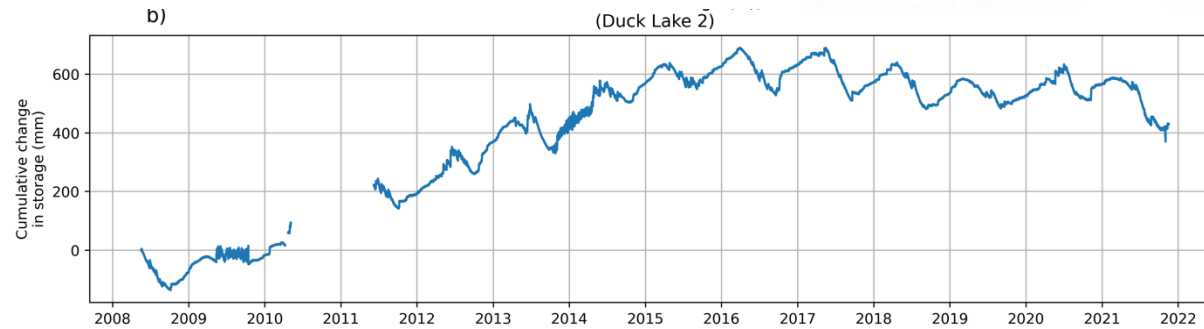
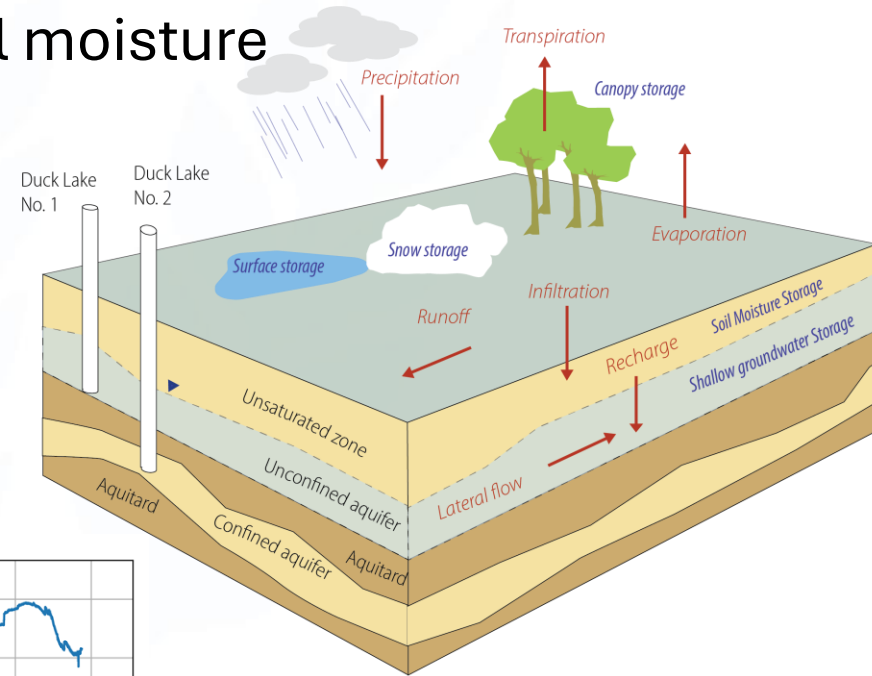
Clavet

Harder, P., Helgason, W. D., Johnson, B., & Pomeroy, J. W. (2025). Observations and management implications of crop and water interactions in cold water-limited regions. *Journal of Hydrology*, 647, 132359. <https://doi.org/10.1016/j.jhydrol.2024.132359>





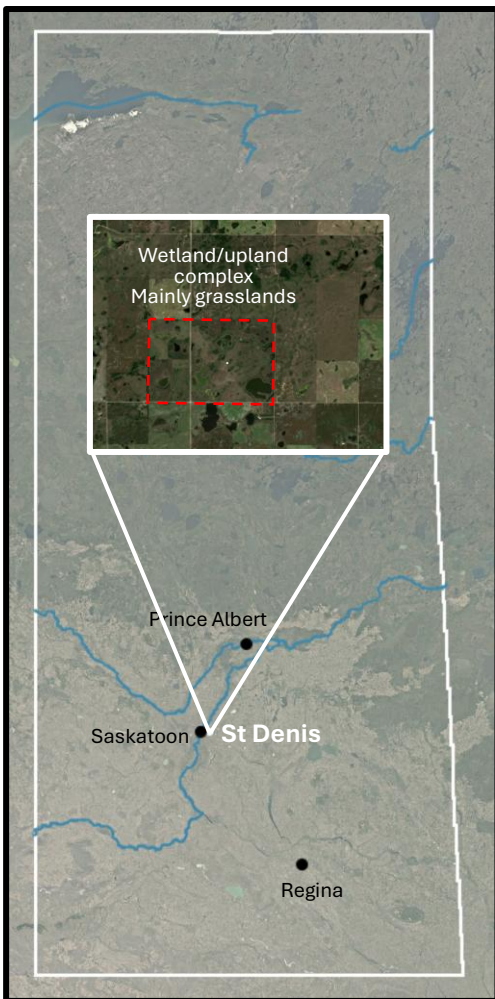
Geological weighing lysimeter ~ Field scale soil moisture



Duck Lake

Braaten, M., & Ireson, A. (2025). A Critical Assessment of Geological Weighing Lysimeters: Part 1—Monitoring Field Scale Soil Moisture Storage. *Hydrological Processes*, 39(1), e70042. <https://doi.org/10.1002/hyp.70042>





St. Denis

Bam, E. K. P., Brannen, R., Budhathoki, S., Ireson, A. M., Spence, C., & van der Kamp, G. (2019). Meteorological, soil moisture, surface water, and groundwater data from the St. Denis National Wildlife Area, Saskatchewan, Canada. *Earth System Science Data*, 11(2), 553–563. <https://doi.org/10.5194/essd-11-553-2019>

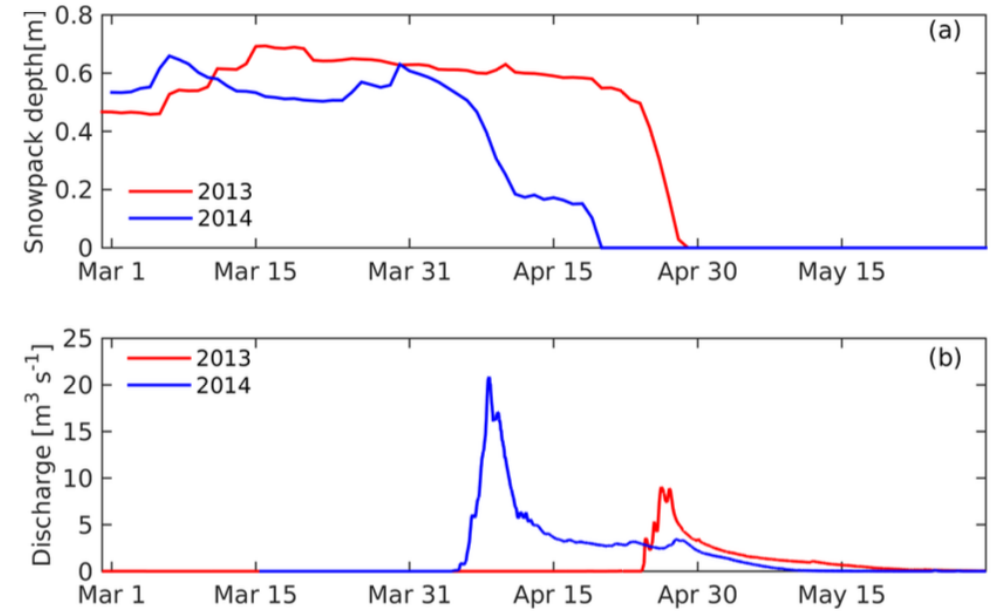
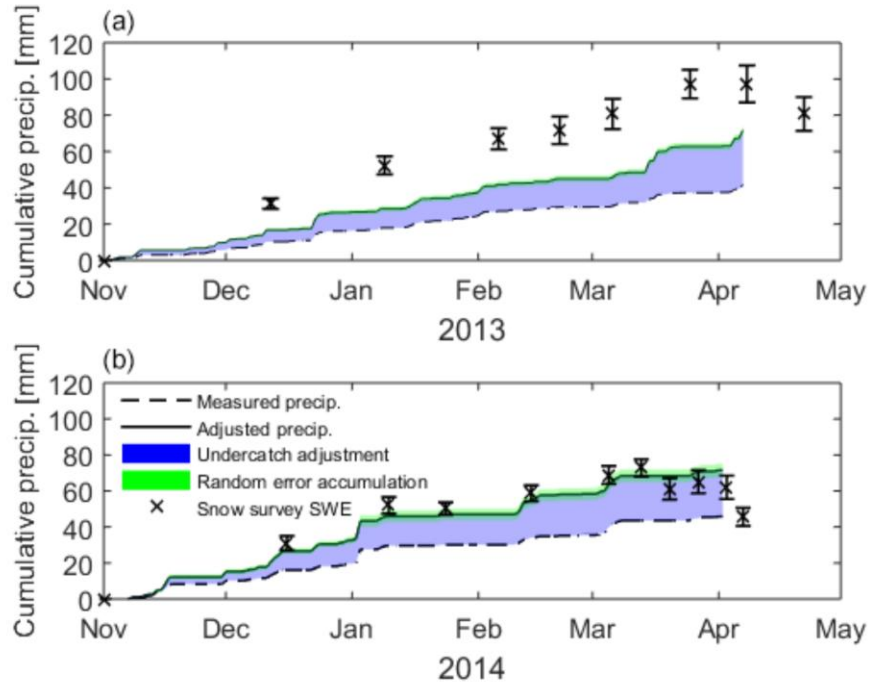
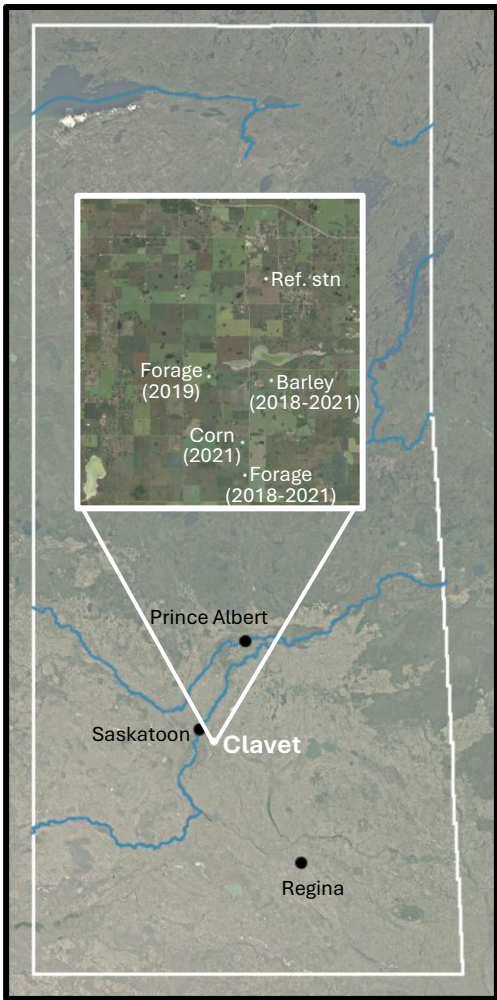


GWFO: Insights from long-term observatories

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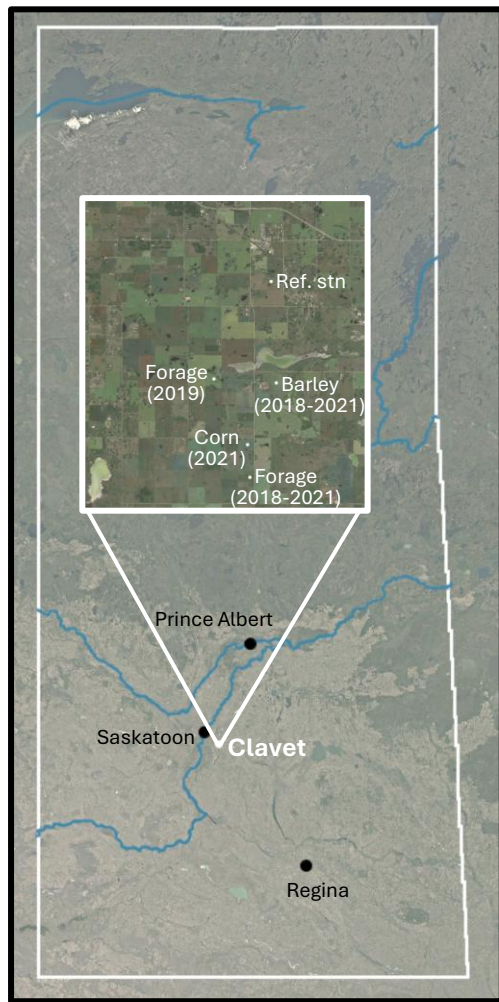
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INSIGHT: Snow fall $\neq$ snow on the ground $\neq$ snowmelt infiltration

Kenaston: Measuring snow and snowmelt



INSIGHT:

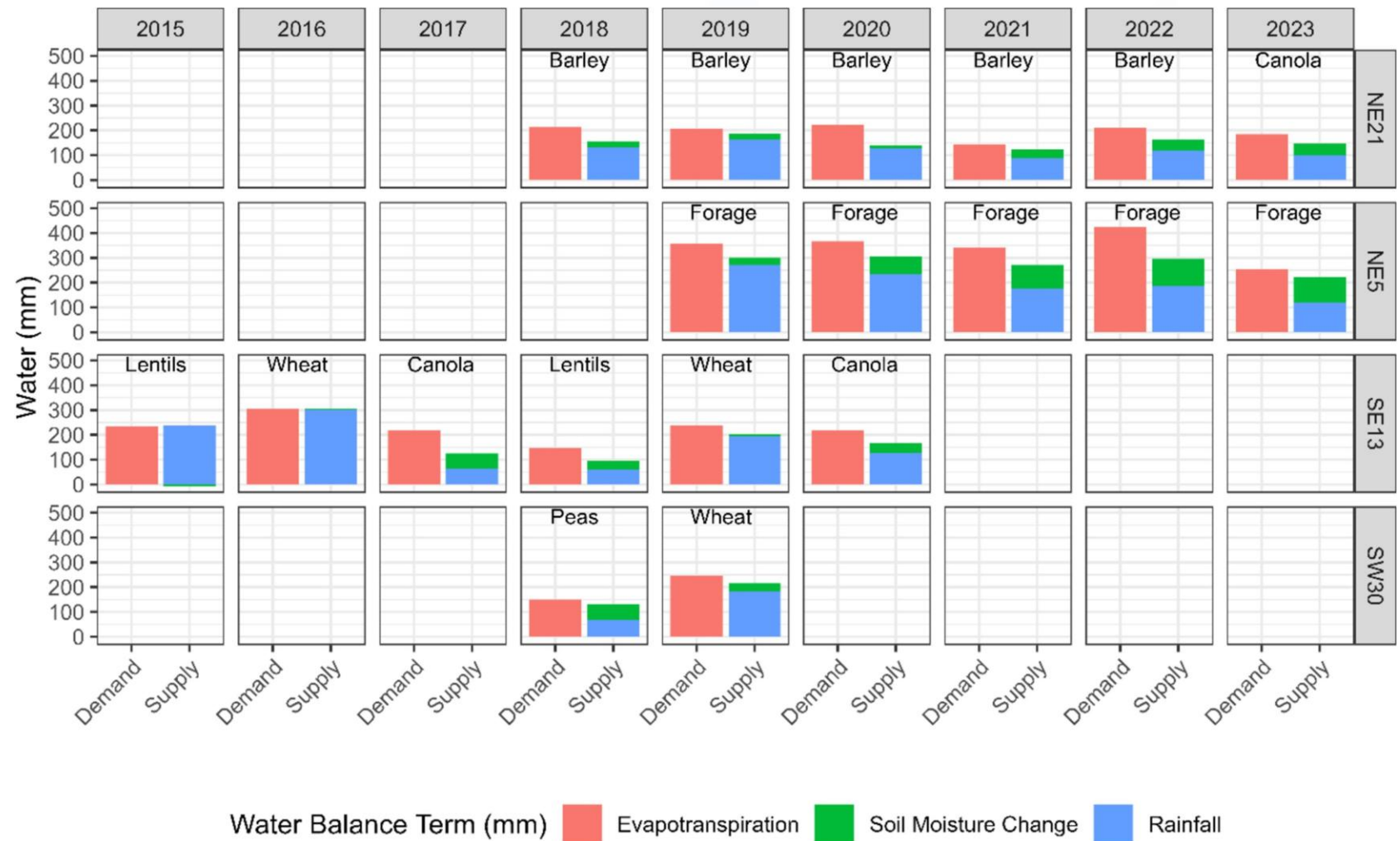
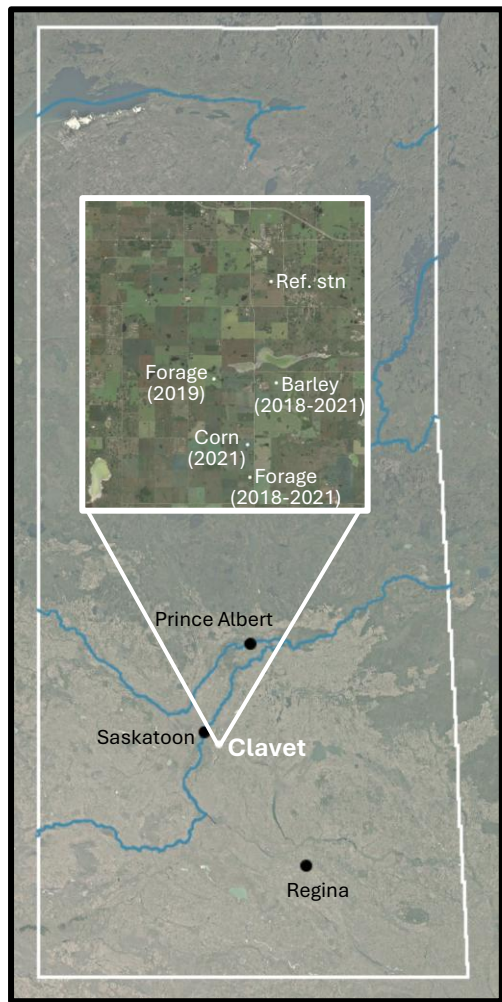
- Harder et al (2025): Standing stubble catches snow, while residue left on field suppresses soil evaporation. Optimization can increase crop available water by 20%
- We also know that tilling the soil reduces the infiltration capacity, leading to more runoff and less infiltration.



Clavet: ET

Harder, P., Helgason, W. D., Johnson, B., & Pomeroy, J. W. (2025). Observations and management implications of crop and water interactions in cold water-limited regions. *Journal of Hydrology*, 647, 132359. <https://doi.org/10.1016/j.jhydrol.2024.132359>





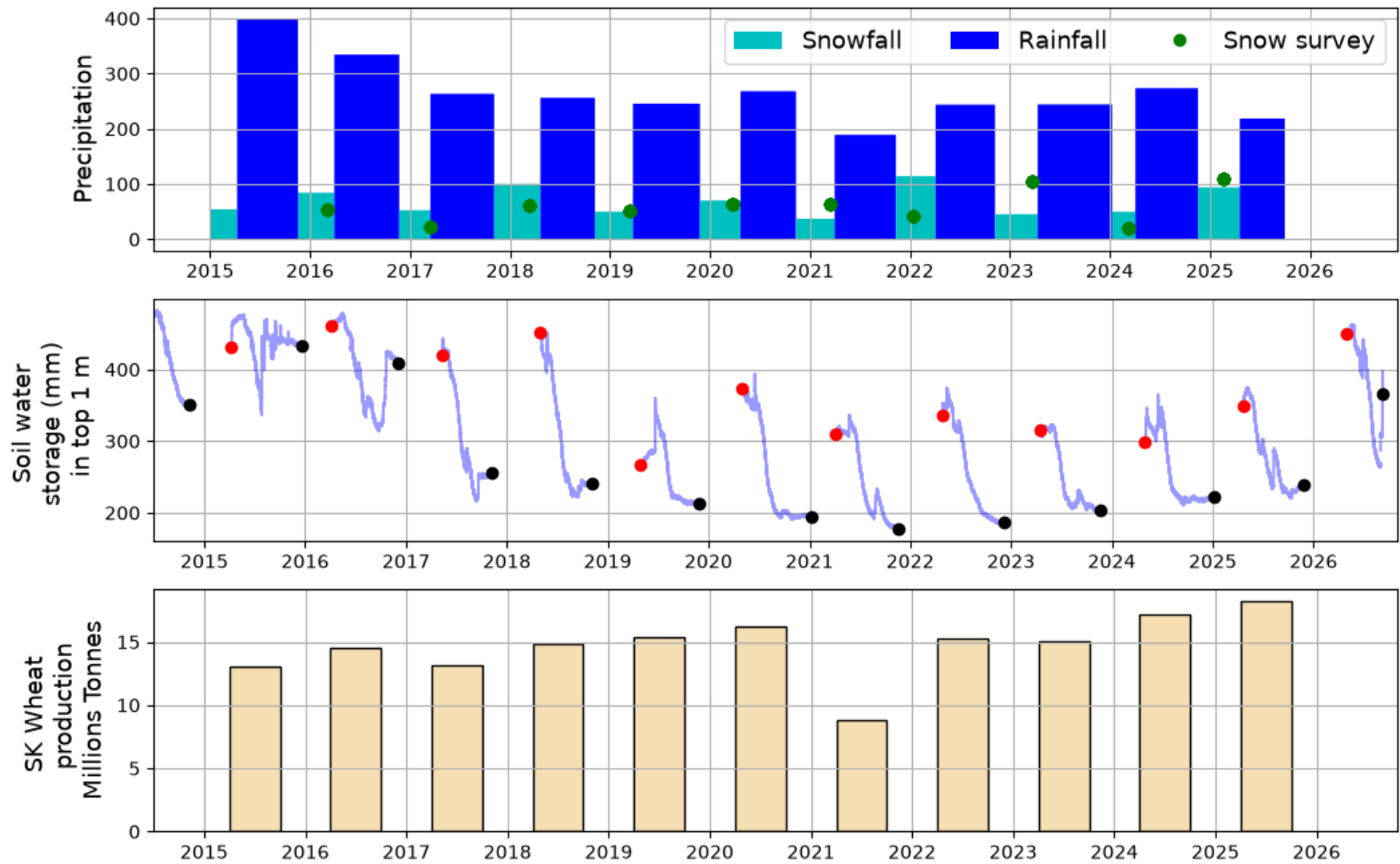
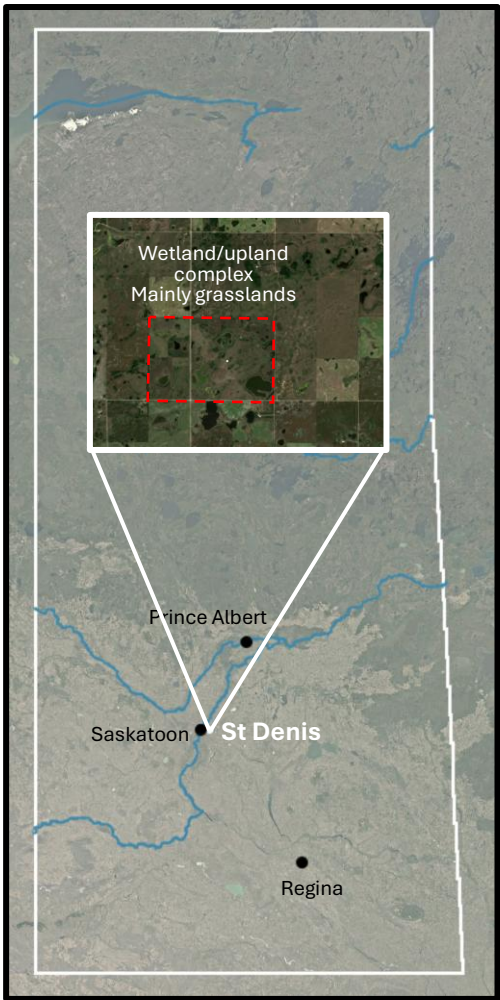
INSIGHT: In prairies ~1/3rd of water used by crops is from snow/antecedent soil moisture



Clavet: ET

Harder, P., Helgason, W. D., Johnson, B., & Pomeroy, J. W. (2025). Observations and management implications of crop and water interactions in cold water-limited regions. *Journal of Hydrology*, 647, 132359. <https://doi.org/10.1016/j.jhydrol.2024.132359>

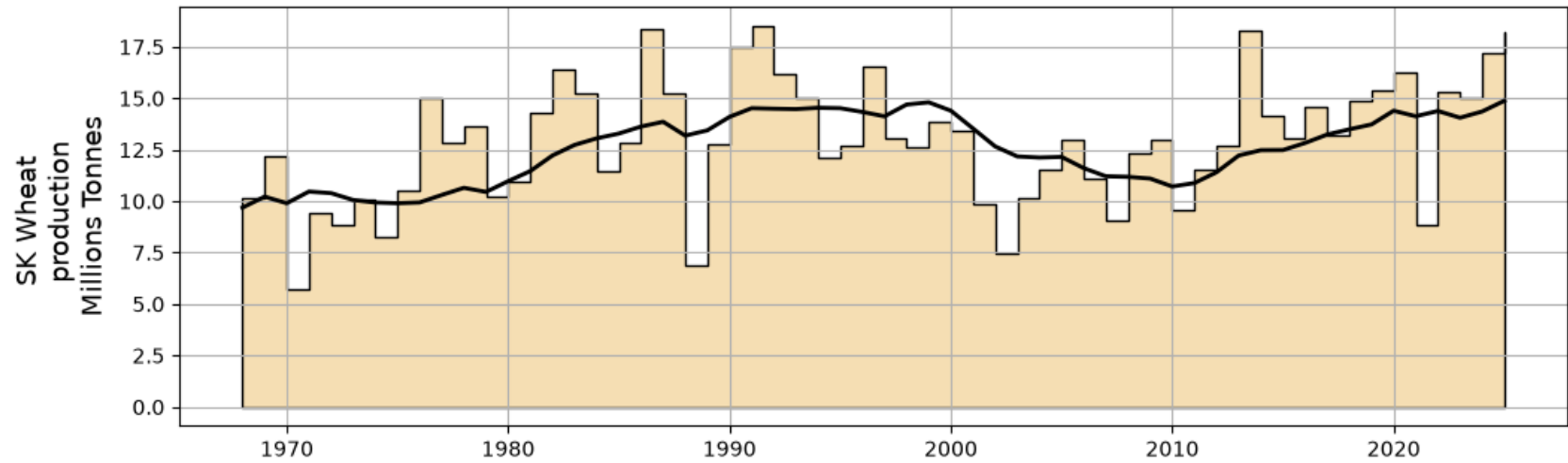
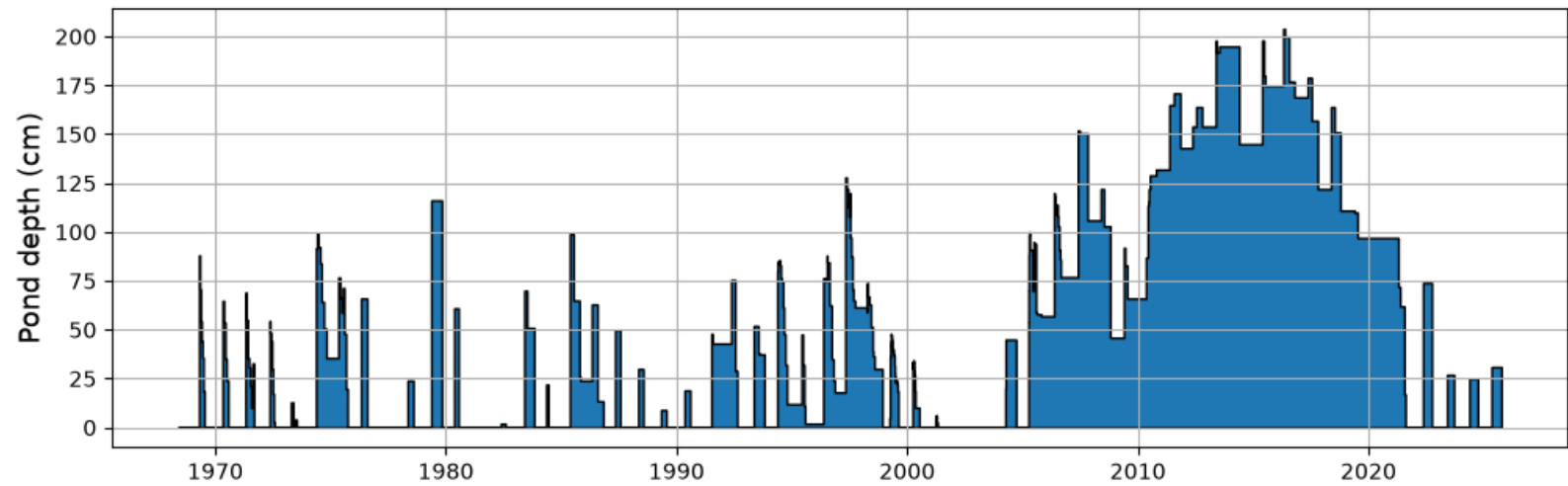
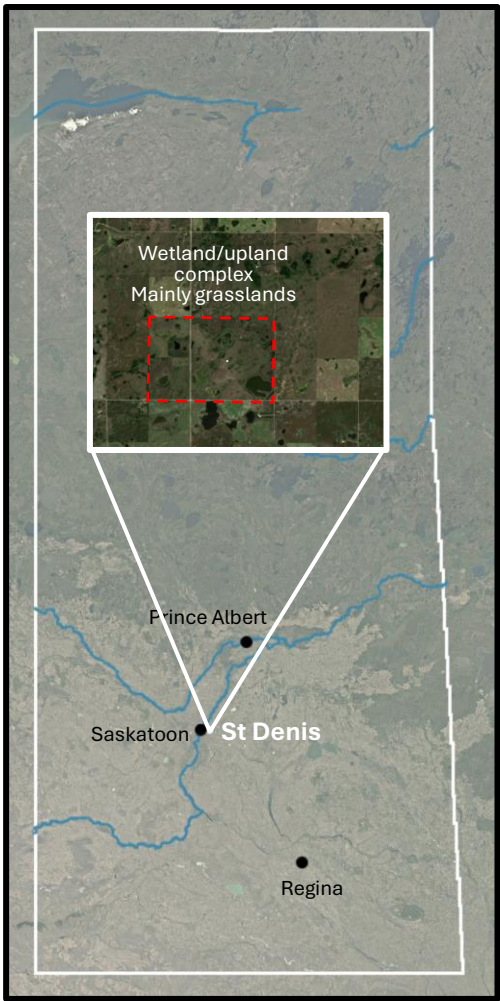




INSIGHT: Spring soil moisture + summer rainfall is critical to crop production

St Denis: 10+ year record of soil moisture





INSIGHT: Moisture in the soils/groundwater can have a long memory

St Denis: 50+ year record of pond levels



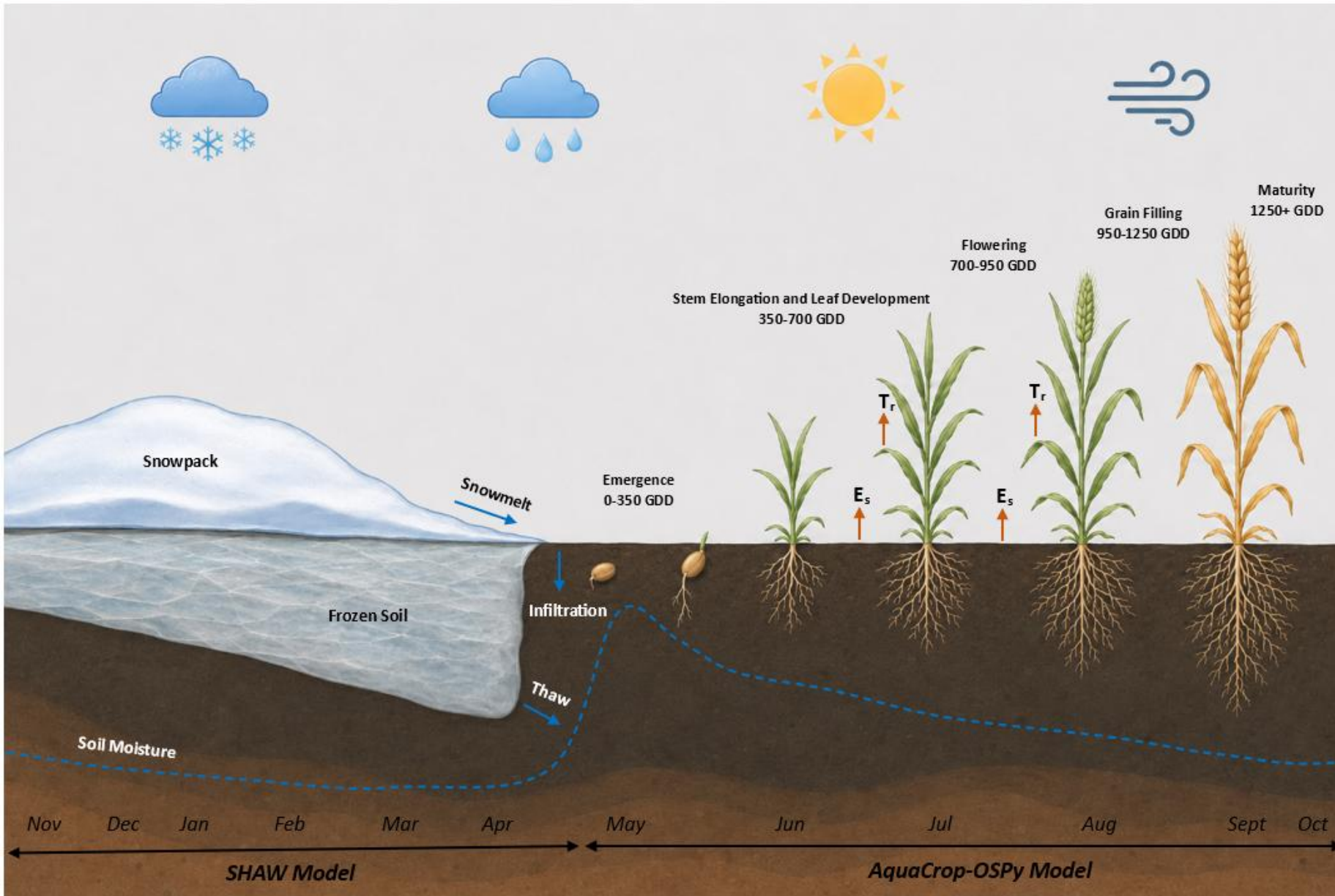
GWFO: Data and models

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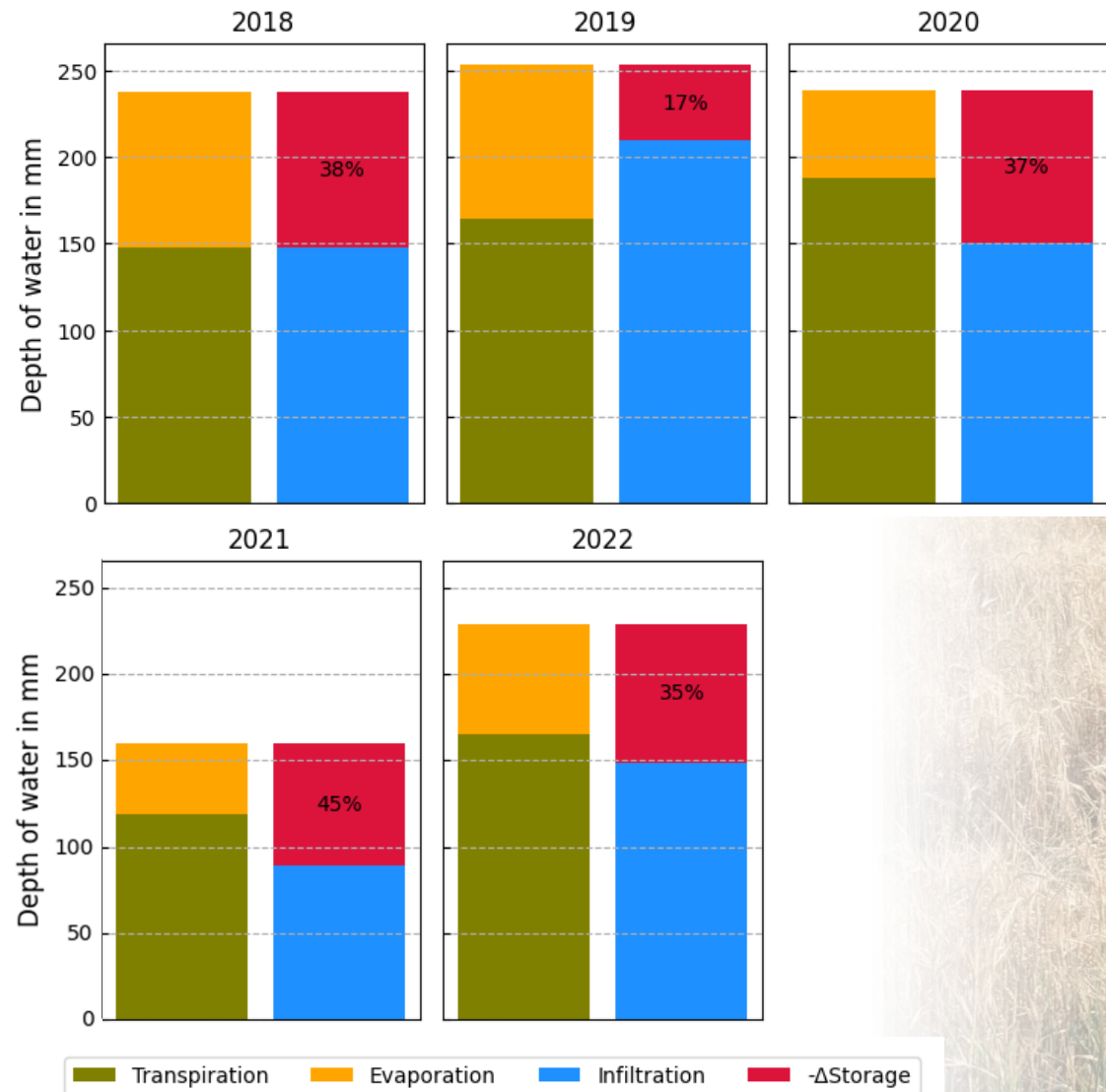
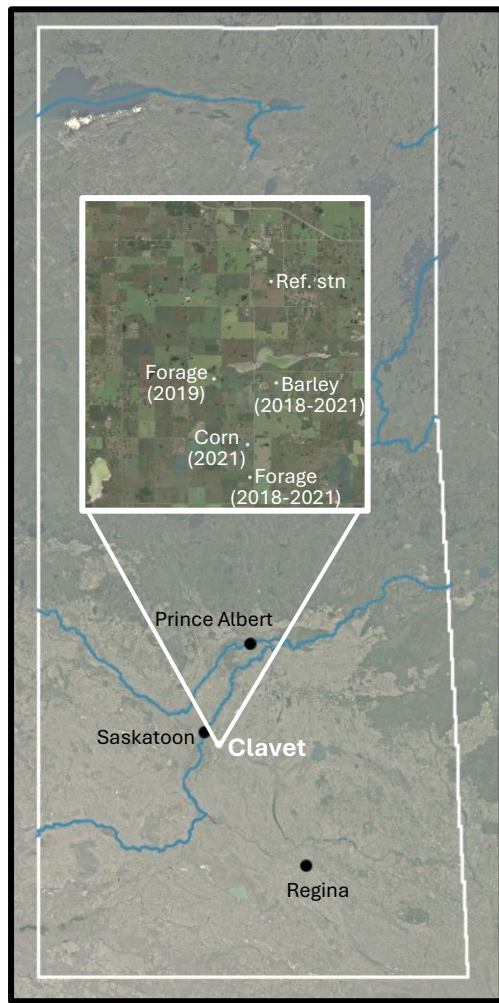
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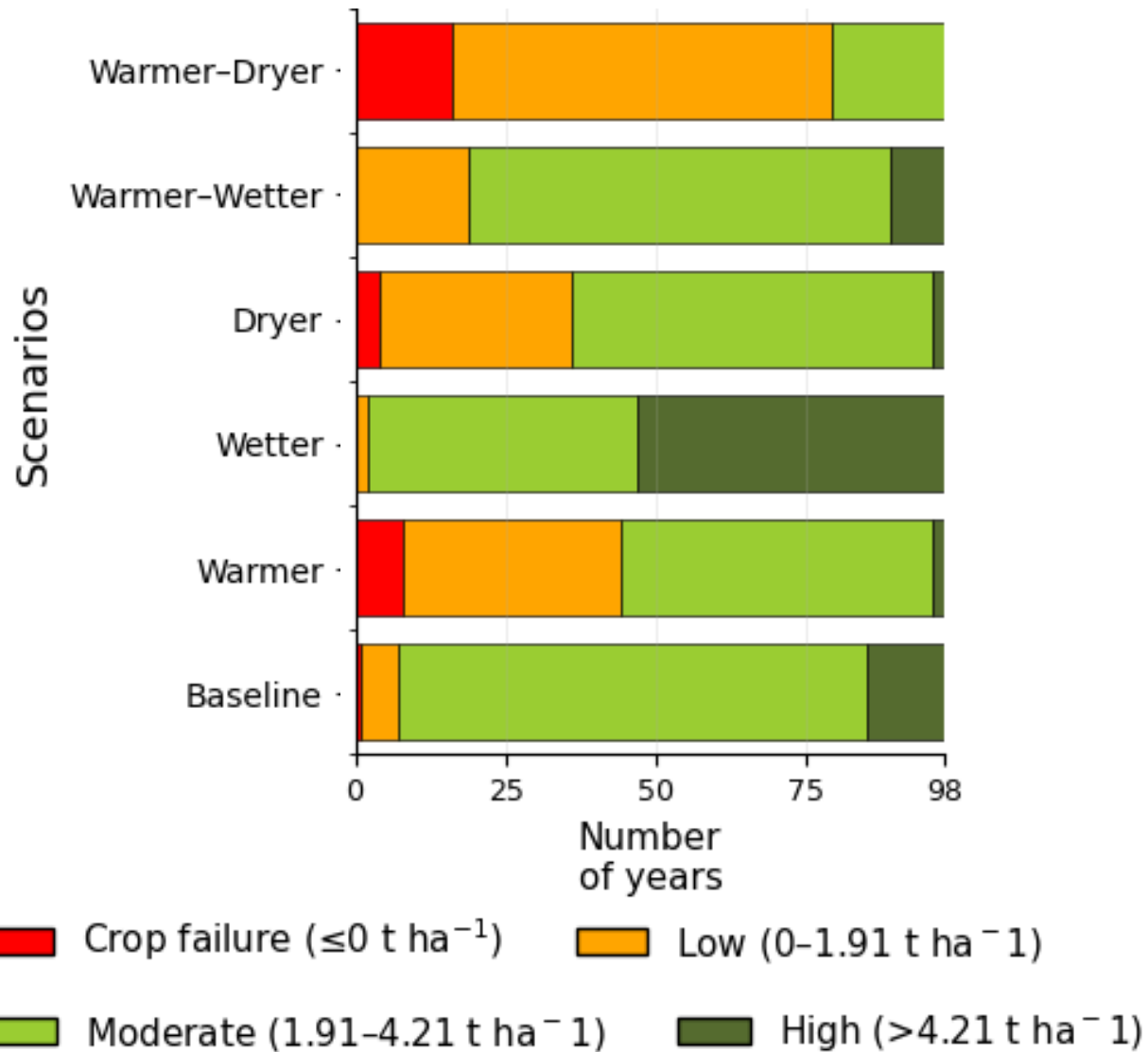


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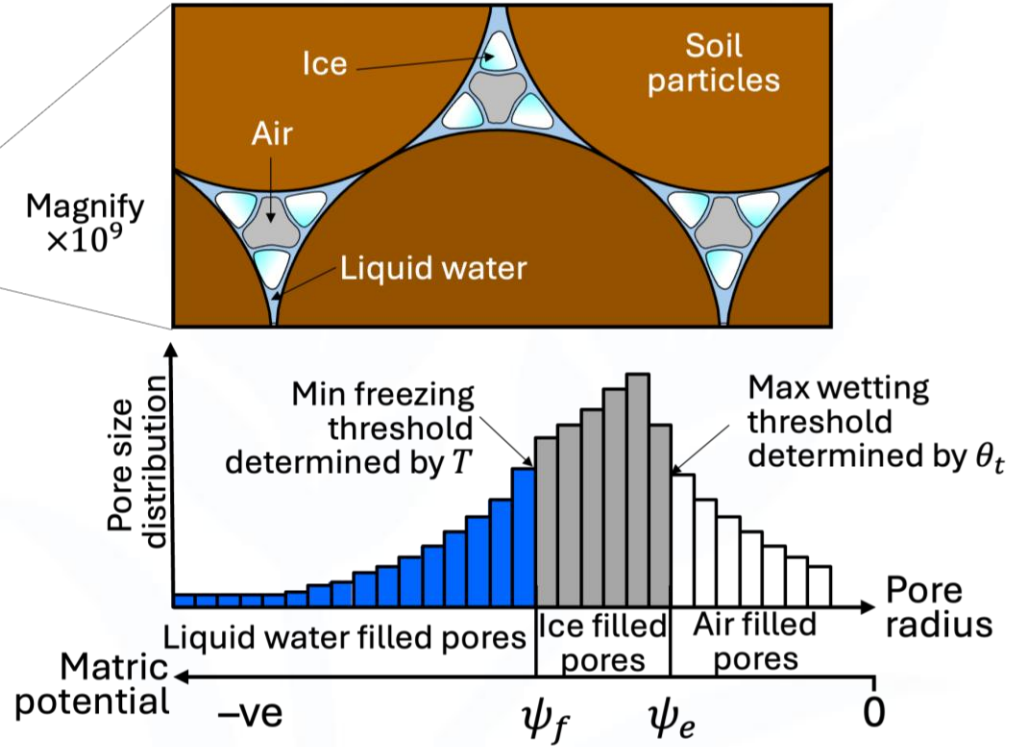
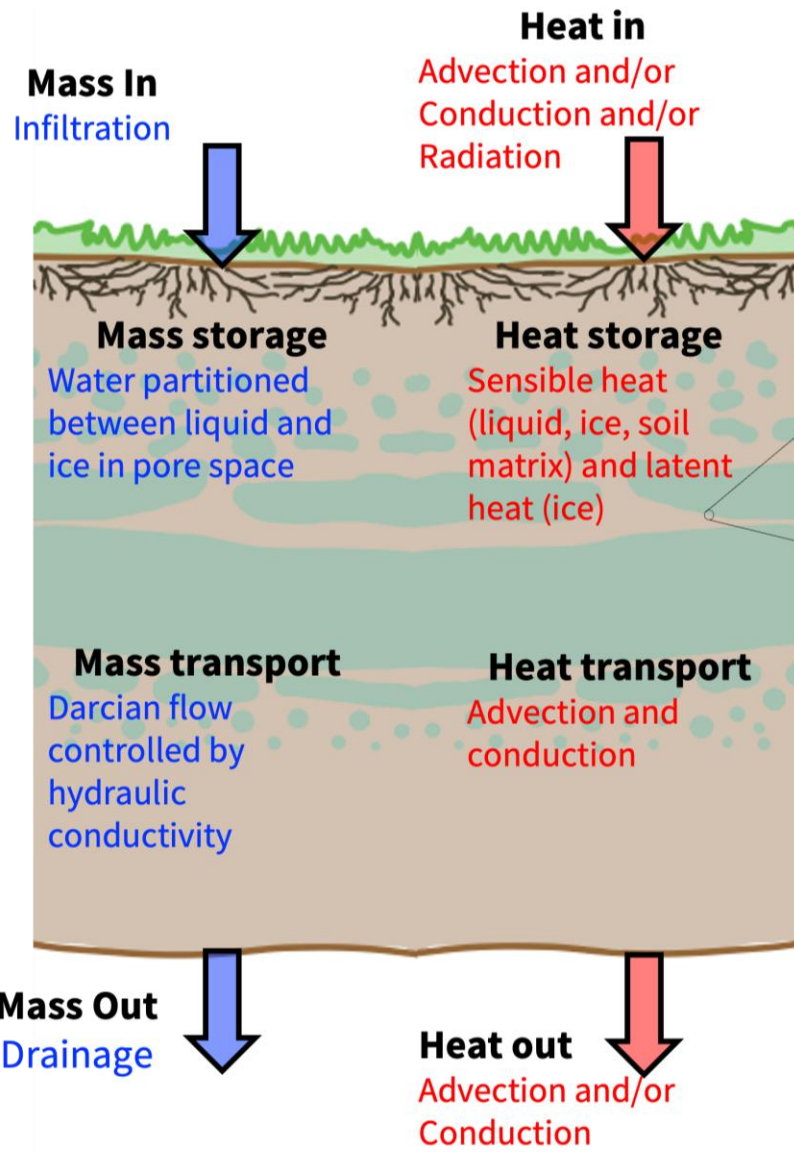


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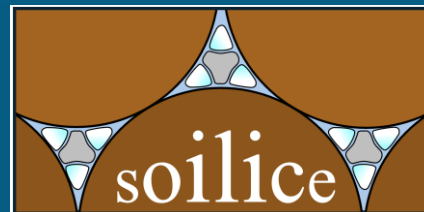
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Next steps: soilice



<https://github.com/amireson/soilice>



Take home messages



- GWFO field sites are continuing to collect data to 2029
- Observatories offer detailed, long-term datasets, providing insights into the changing soil water balance
- These data are made public
- Researchers need to work with producers – *help us to help you*



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Questions?

Use the Q&A feature to submit your questions!

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