New GWFO Partner - University of Calgary: Field Sites and Research Facilities

Current Leads:
Dr. Masaki Hayashi
Dr. Erin Nicholls
Dr. Alain Pietroniro
Dr. Tricia Stadnyk (UC-HAL)

Global Water Futures Observatory (GWFO) Workshop
January 14, 2026

UC-HAL
Hydrologic Analysis Lab

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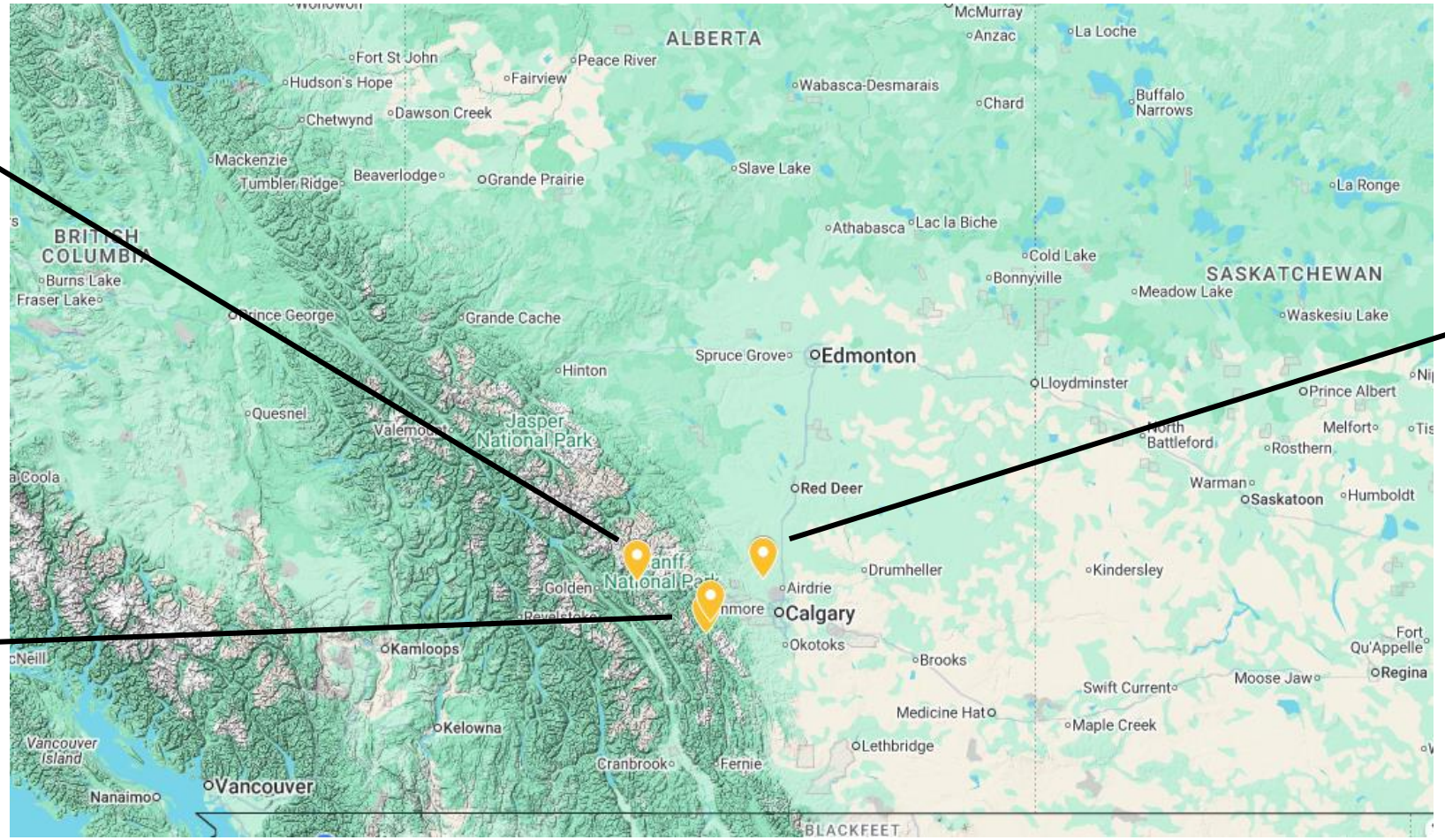
UCalgary GWFO-Affiliated Research Sites

Lake O'Hara Hydrological Observatory

Marmot Creek & Fortress Mountain Research Basins (CRHO)



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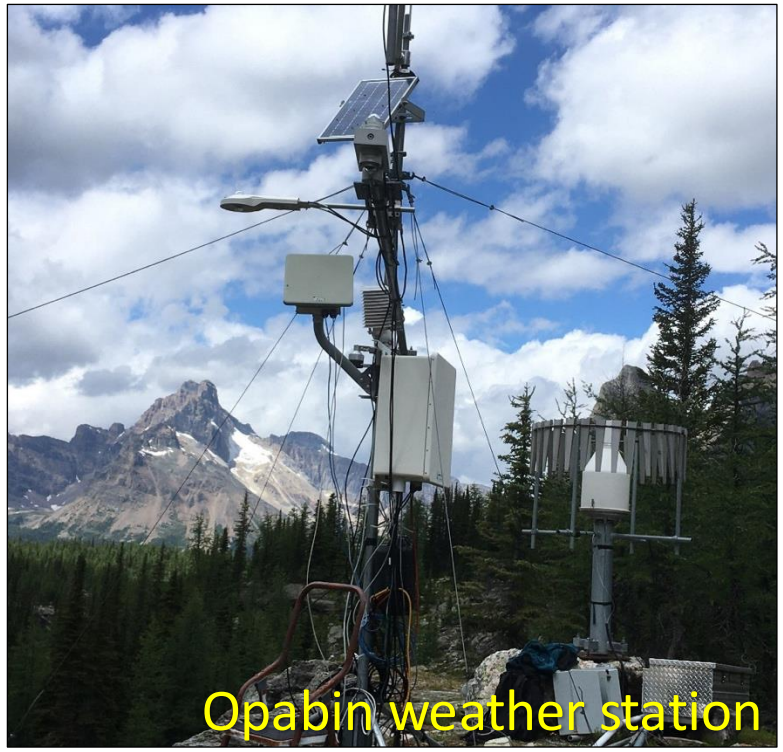
Lake O'Hara Hydrological Observatory (Hayashi)


Opabin weather station


Opabin Creek

- Operation: August 2004 – present
- Objective: Understand the role of groundwater in sustaining stream baseflow
- Lead: Dr. Masaki Hayashi

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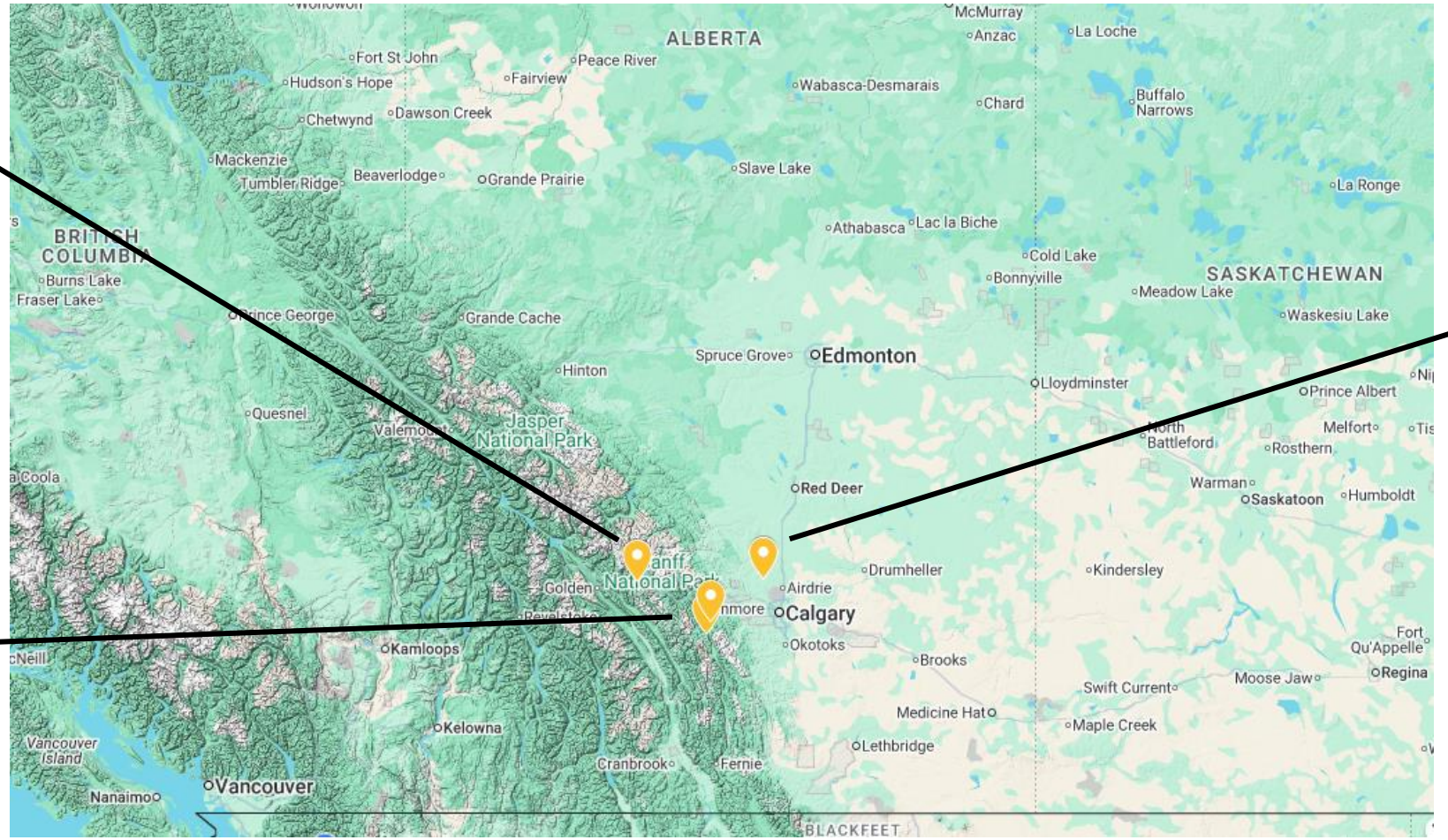

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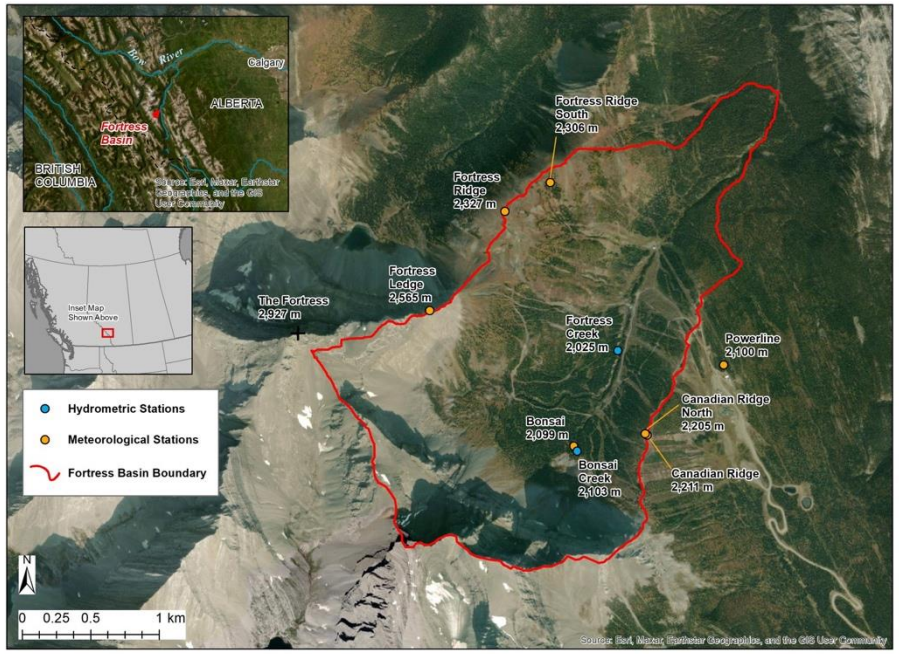
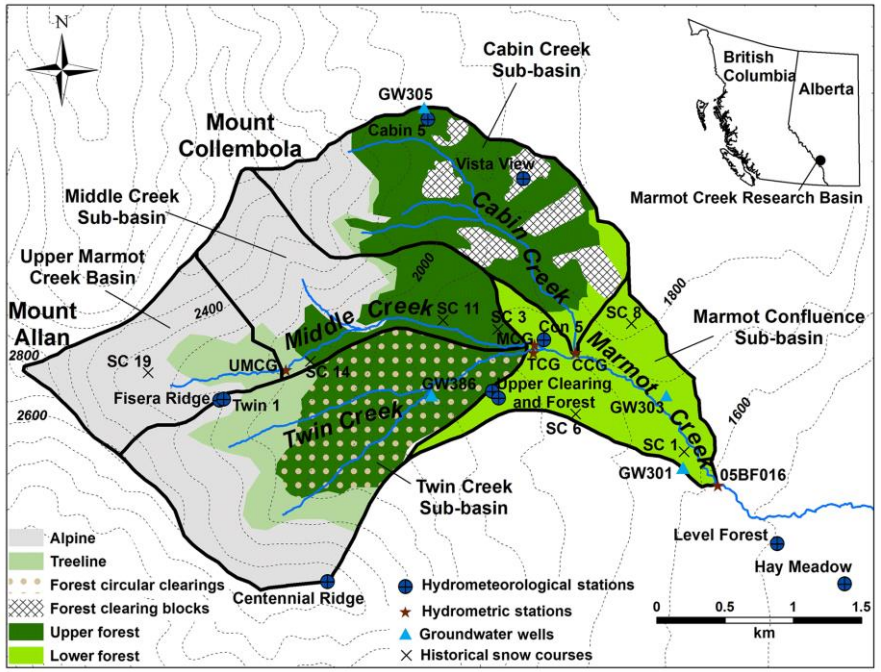
Expanding CRHO Sites: Fortress and Marmot (Pietroniro)

Fortress Mountain Research Basin, Alberta



Map credit: https://gwfo.ca/sites/fortress.php

Marmot Creek Research Basin, Alberta



Map credit: Fang, X., et al., Hydrometeorological data from Marmot Creek Research Basin, Canadian Rockies, Earth Syst. Sci. Data, 11, 455–471, https://doi.org/10.5194/essd-11-455-2019, 2019.

- Lead: Dr. Alain Pietroniro
- Focused on MESH model improvements for snow processes, model improvements and testing (mountain MESH) and flow forecasting experiments.

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Expanding CRHO Sites: Fortress and Marmot

- Expanded SWE measurements: 5 x SSG-2 snow scales, 1 x CS725 SWE sensor
- Expanded soil moisture measurements: 14 x CS655 sensors
- Support operations: snowmobile, technician – Pietroniro CFI

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Fortress: High-frequency stable water isotope monitoring (Stadnyk)

- Lead: Dr. Tricia Stadnyk (UC-HAL)
- Combine hydrometeorological data with **water isotope tracer data** to better understand and represent the hydrologic cycle in high latitude regions, particularly **how seasonal freeze/thaw affects large runoff events**.
- Field investigations for :
  - Trace source waters and flow pathways in under-sampled mountain headwaters
  - Refine traditional snowmelt models
  - Improve runoff and peak flow prediction
  - Provide early indicators of climate change
- Data collection: First high-frequency stable water isotope monitoring site established at Fortress, with expansion plans for addition GWFO sites (e.g., Marmot, W.A. Ranches)

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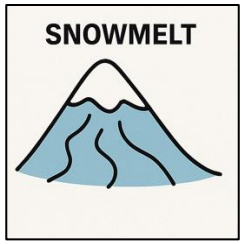
Fortress: High-frequency stable water isotope monitoring

Unique phases of the water cycle = Targeted sampling instruments / methods



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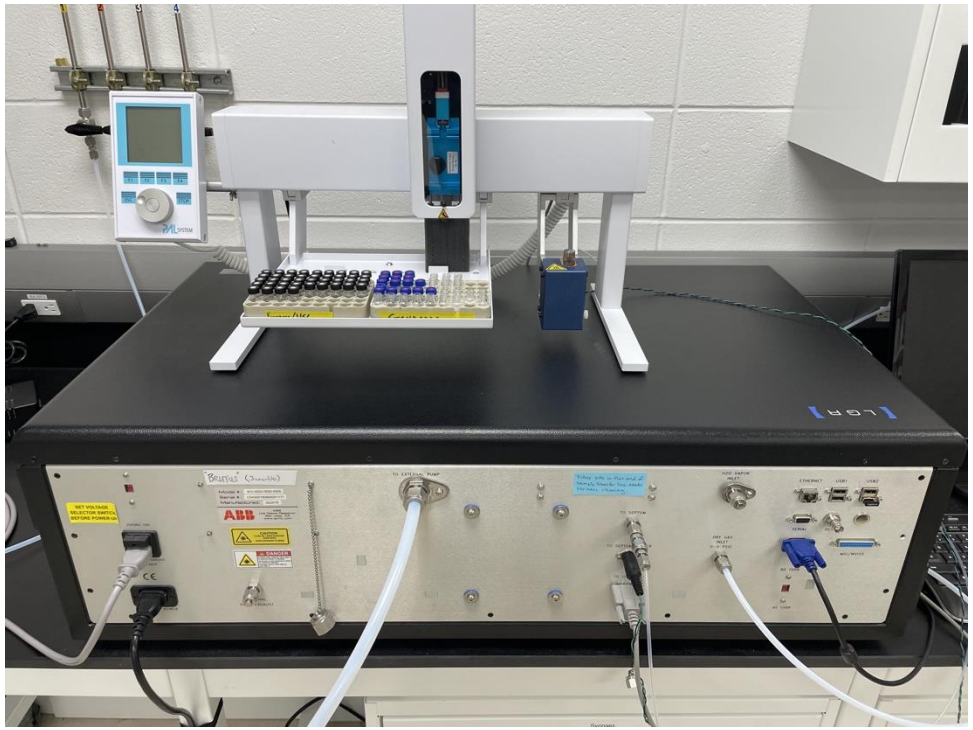
UC-HAL Facilities: Water Isotope Sample Analysis



Los Gatos Research (LGR) Triple Water Isotope Analyzer (lab)

Los Gatos Research (LGR) Portable Water Vapour Isotope Analyzer (field deployable)

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Ecohydrological Infrastructure in Marmot Creek (Nicholls)

- Field Plans 2026
  - Open-path eddy covariance installation(s) planned for May/June 2026 at Upper Forest (1848 m) and/or Level Forest (1492 m)
  - Water Quality Sampling – Begin stream sampling for major ions, DOC, fDOM, and δ^2H and $\delta^{18}O$ (+precip)
  - Future steps and data collection:
    - Soil/veg isotope sampling
    - Dendrometers/sap flow sensors/vegetation surveys
    - Reach-scale measurements of SW-GW interactions

- Research Questions:
  - How does drought, growing season length, late/early season snowfall, and precipitation intensity alter the partitioning of **energy, water, and carbon fluxes across elevation gradients and among forest species**?
  - How do shallow surface water–groundwater–runoff interactions control the partitioning of water storage and fluxes, and what are the **dominant source waters sustaining streamflow and evapotranspiration**?

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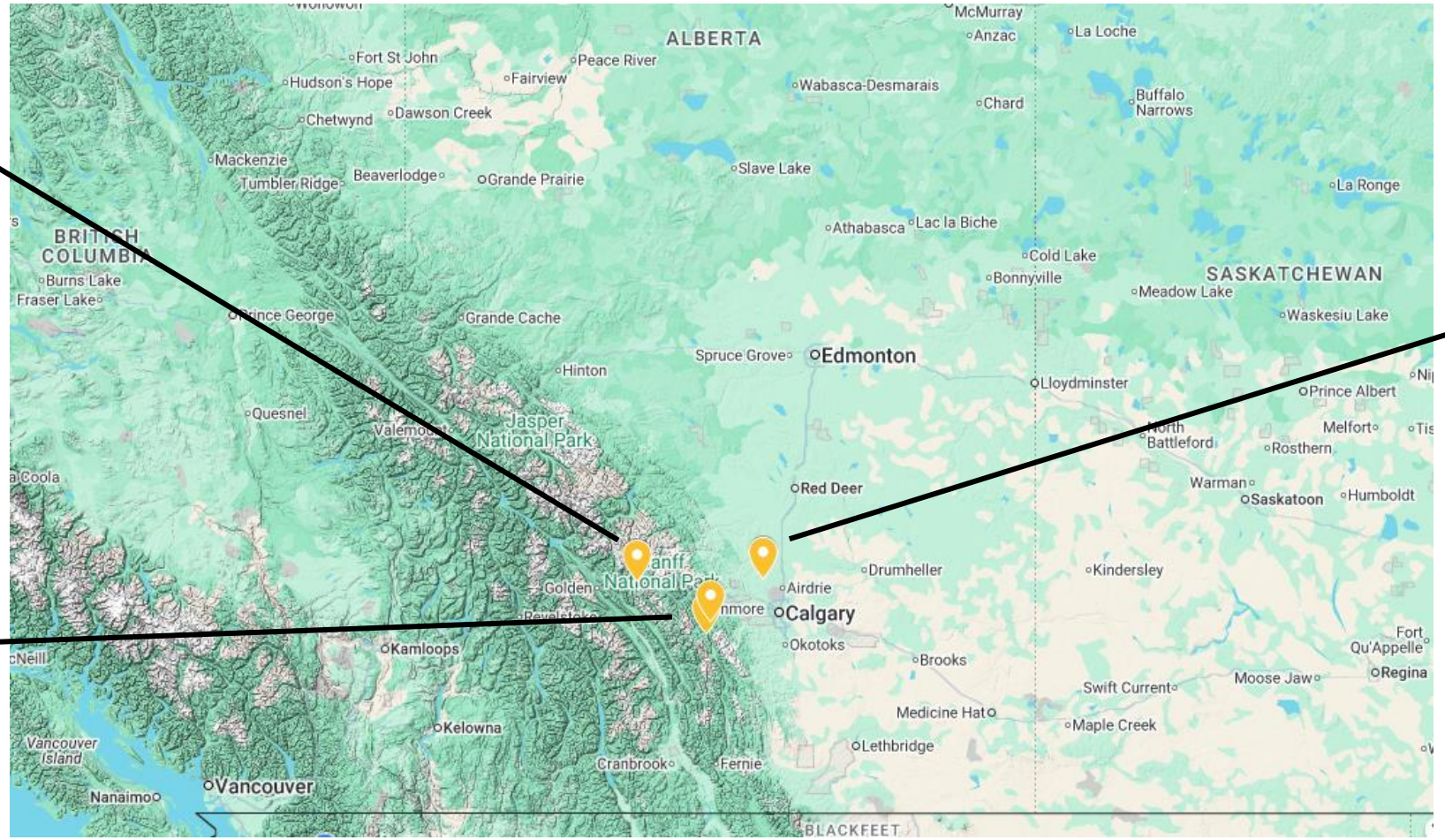

W.A. Ranches

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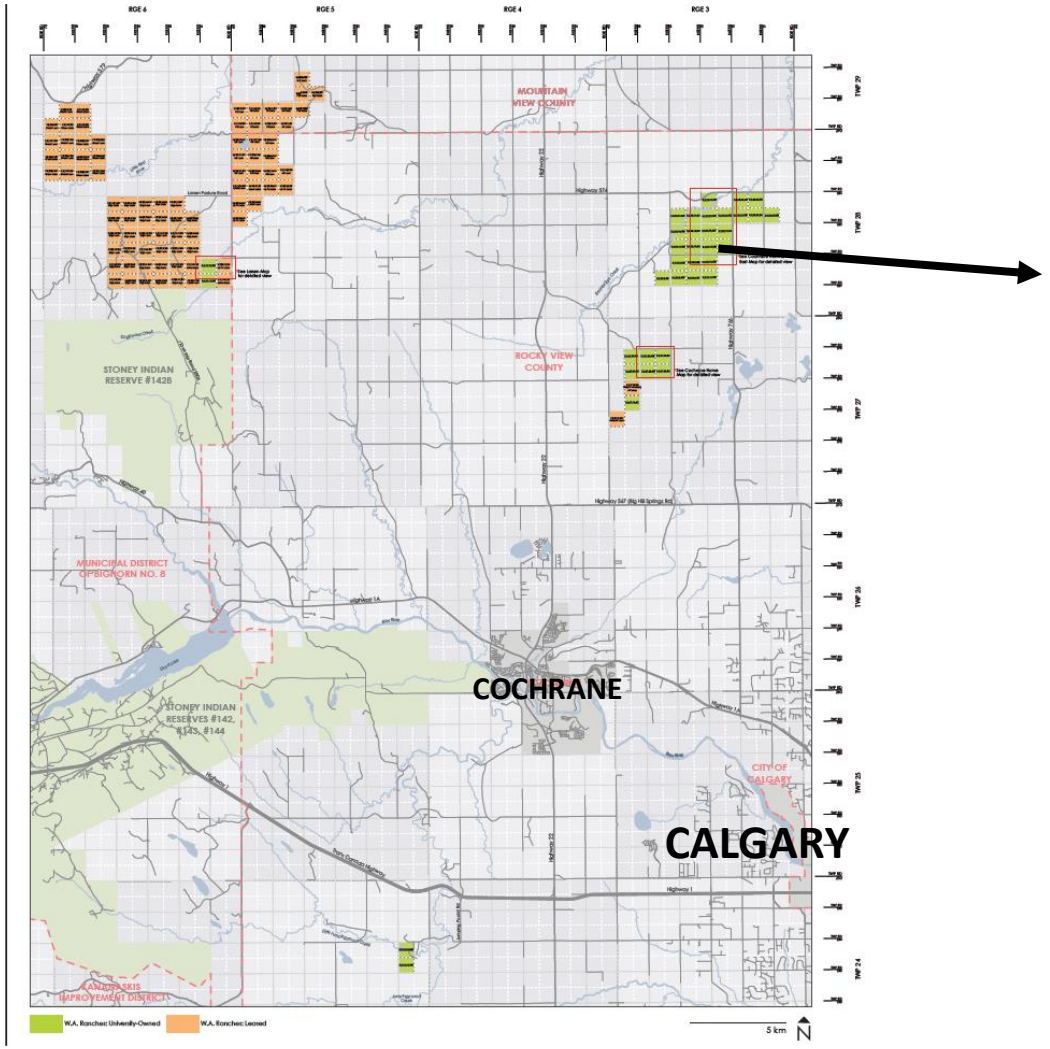
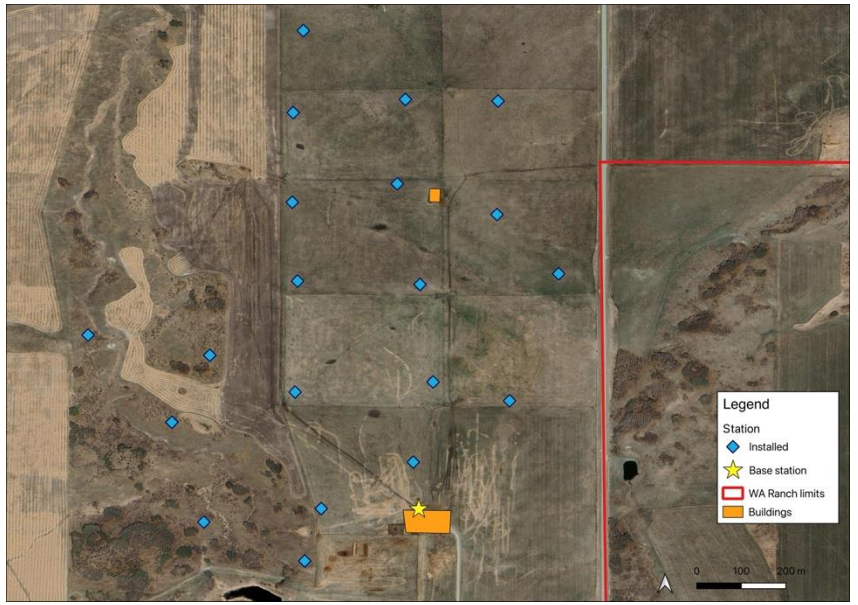
W.A. Ranches – Soil moisture mesonet (Pietroniro)





Soil Moisture Mesonet

20 stations
Area: 1km x 1.2km

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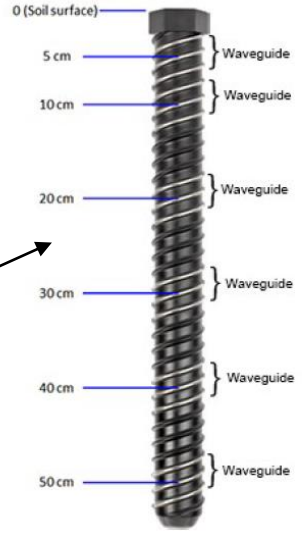
WA Ranches - Motivation

- W.A. Ranches was a family ranch gifted to the University of Calgary (situated in the Faculty of Veterinary Medicine), that continues to be a working cow-calf ranch with a land base of 19,000 acres for cattle, farmland for feed production, and wildlife habitat.
- The ranch has 3 main sites with associated facilities to support ranching, RESEARCH (where we fit in), teaching, and outreach.
- Our site is located ~40min northwest of the UCalgary campus.
- Focus here is on foothills soil moisture for hydrology model application and satellite retrieval validation and possible data assimilation experiments.
- Mimics Kenaston design
- Site may expand to include weather station and groundwater monitoring
- May also be used for undergrad teaching – infrastructure and power is available.
- Each of the 20 mesonet stations are equipped with this precipitation and moisture/temp profiler probes, plus datalogger, solar power, radio comms to base station.
- ~$170,000 in soil moisture mesonet infrastructure provided/established through CFI.

W.A. Ranches – Soil moisture mesonet (est. 2025)



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Additional UCalgary Resources

- Deployable: The drone (lidar).
- Facilities: UCalgary Spy Hill Weather Research Station, BGI (Barrier Lake field station
- Modelling : MESH and HYPE modelling infrastructure on Digital Research Alliance
  - Model agnostic framework
  - Various Github repositories

Thank You! (remove this slide, see speaker notes below)

Acknowledgements:

- Funders: CFI and NSERC CRC Program
- Global Water Futures Observatories (GWFO)
- Fortress Mountain Holdings Ltd.
- Randy Fagan, Zoe Walker, Anthony Kroll
- Everyone in the Stadnyk/Pomeroy labs who answered the call: "*Hey, want to help in the field/lab today? It'll be fun*."

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