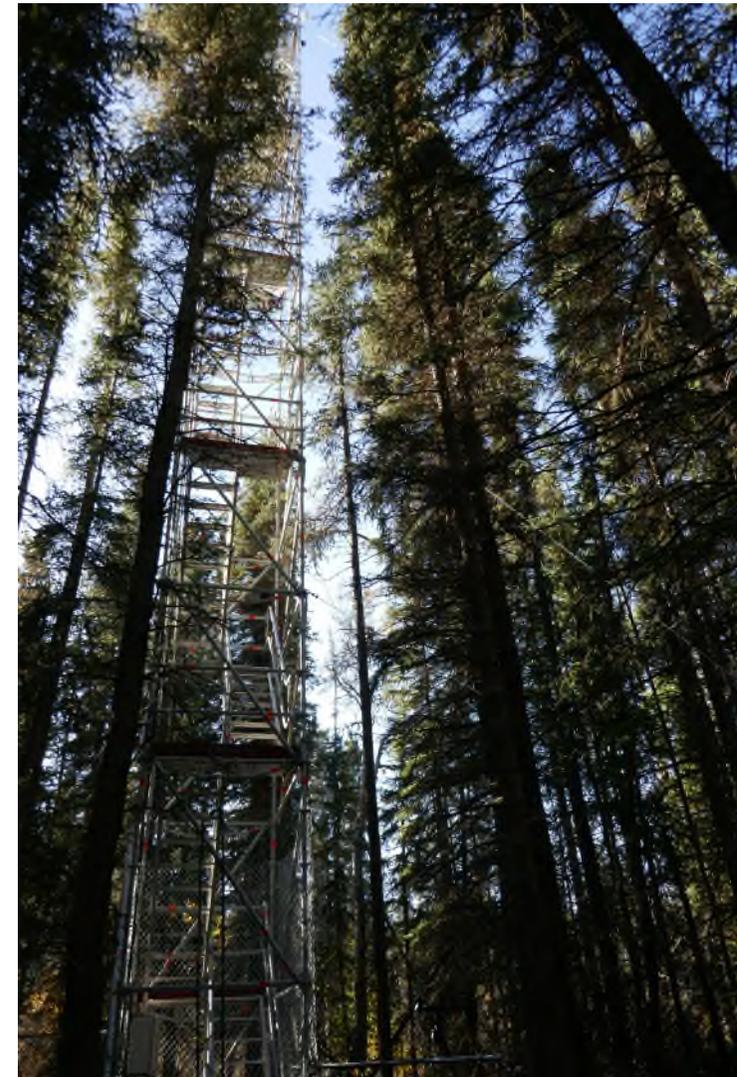
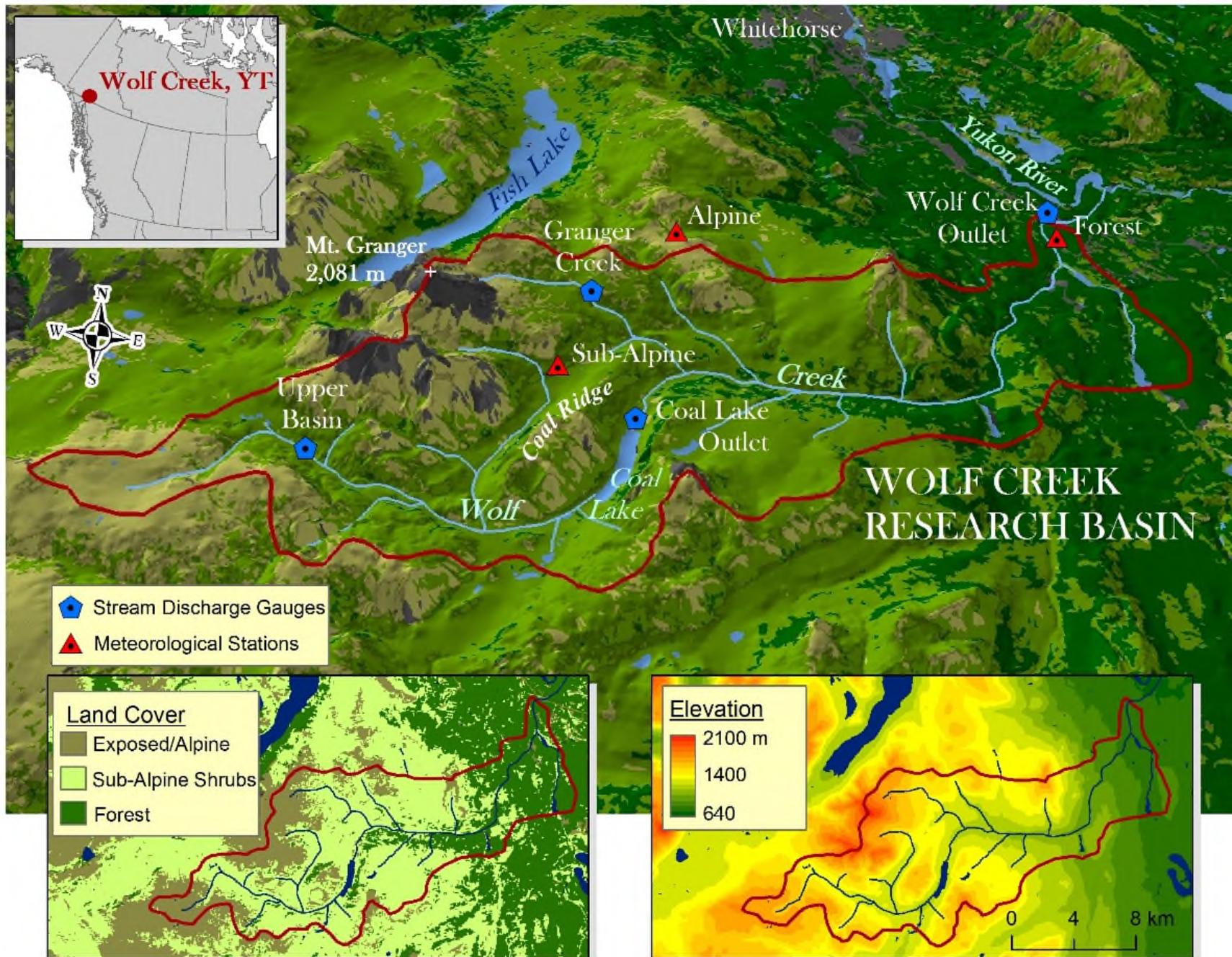


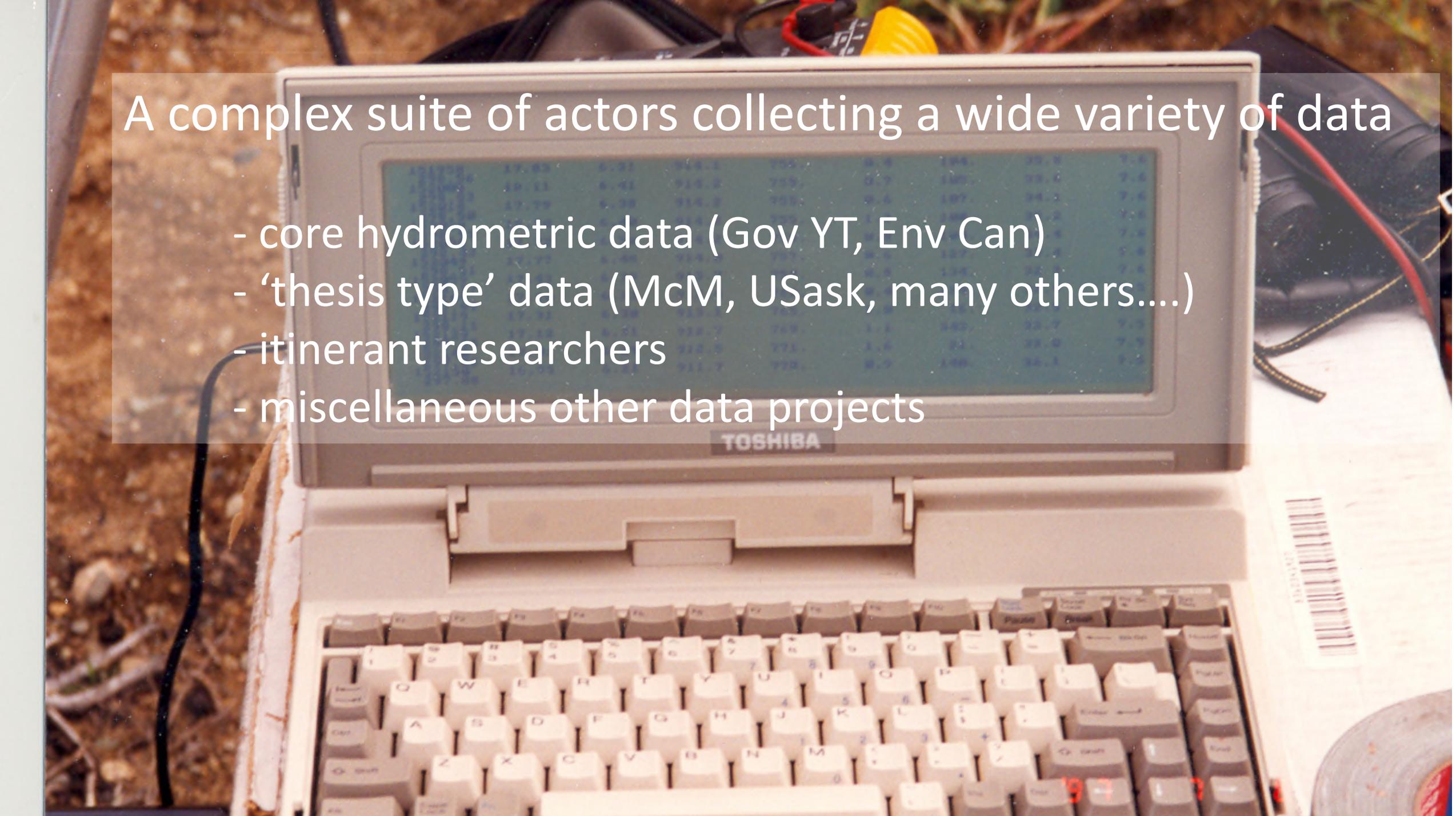
“Best” Practices at an Observatory

Wolf Creek Research Basin, Yukon Territory



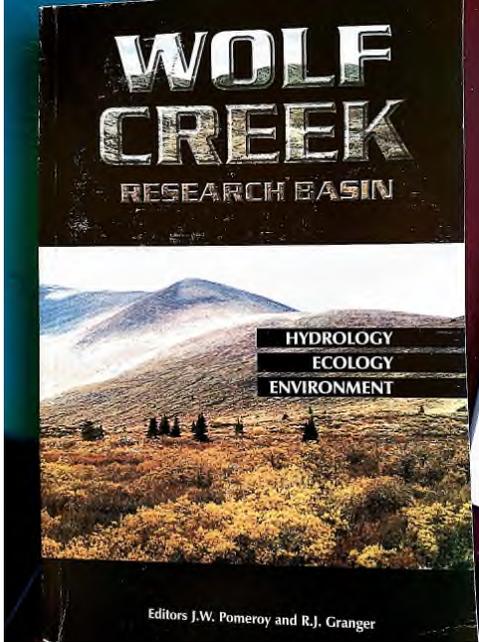
Why Wolf Creek?



A vintage Toshiba laptop computer is shown in an open position. The screen displays a table of data with multiple columns and rows of numbers. The laptop is placed on a surface, and in the background, a surveying instrument (likely a total station) is visible, suggesting a field research environment. The text is overlaid on the image, providing context for the data being displayed.

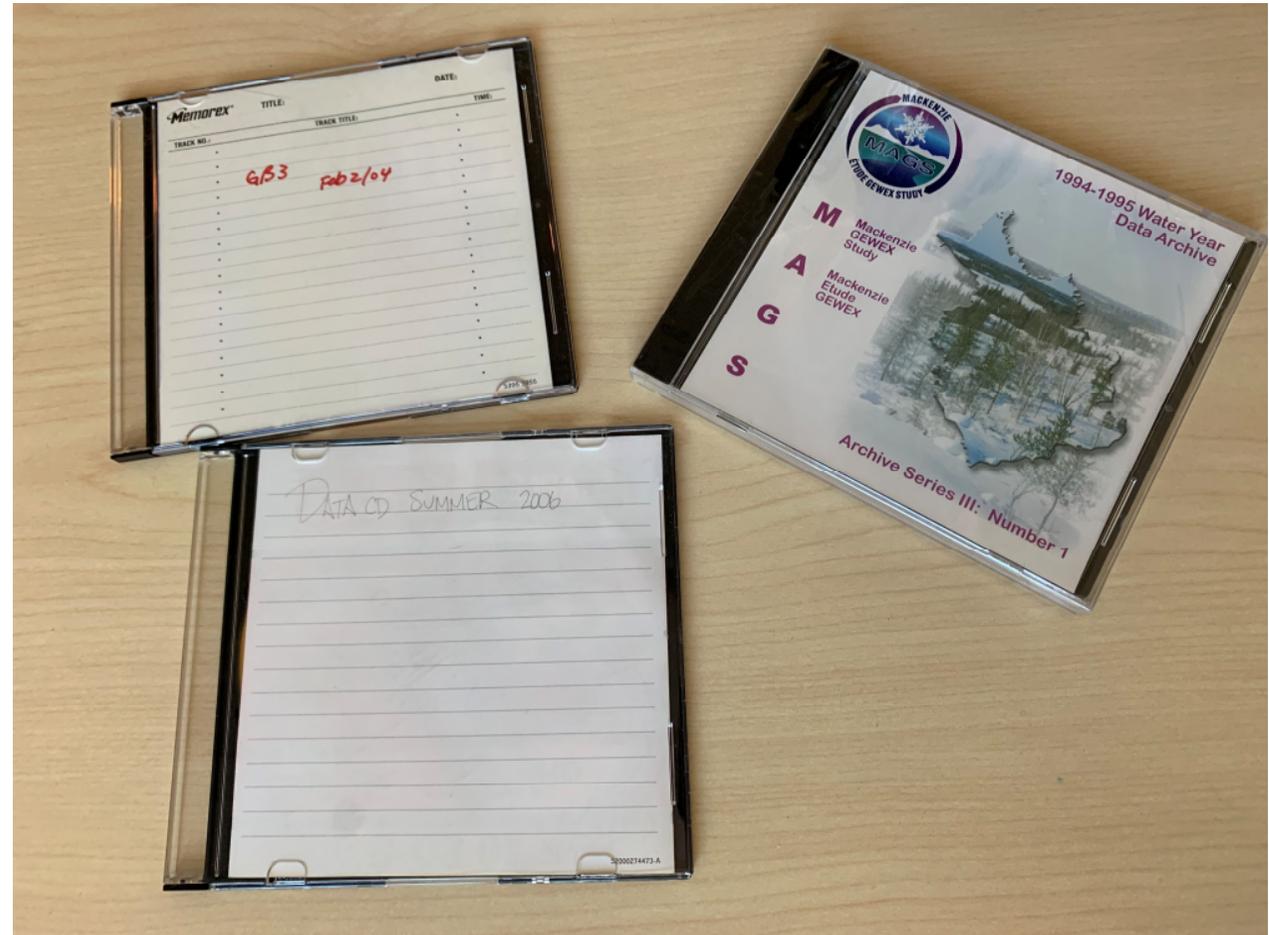
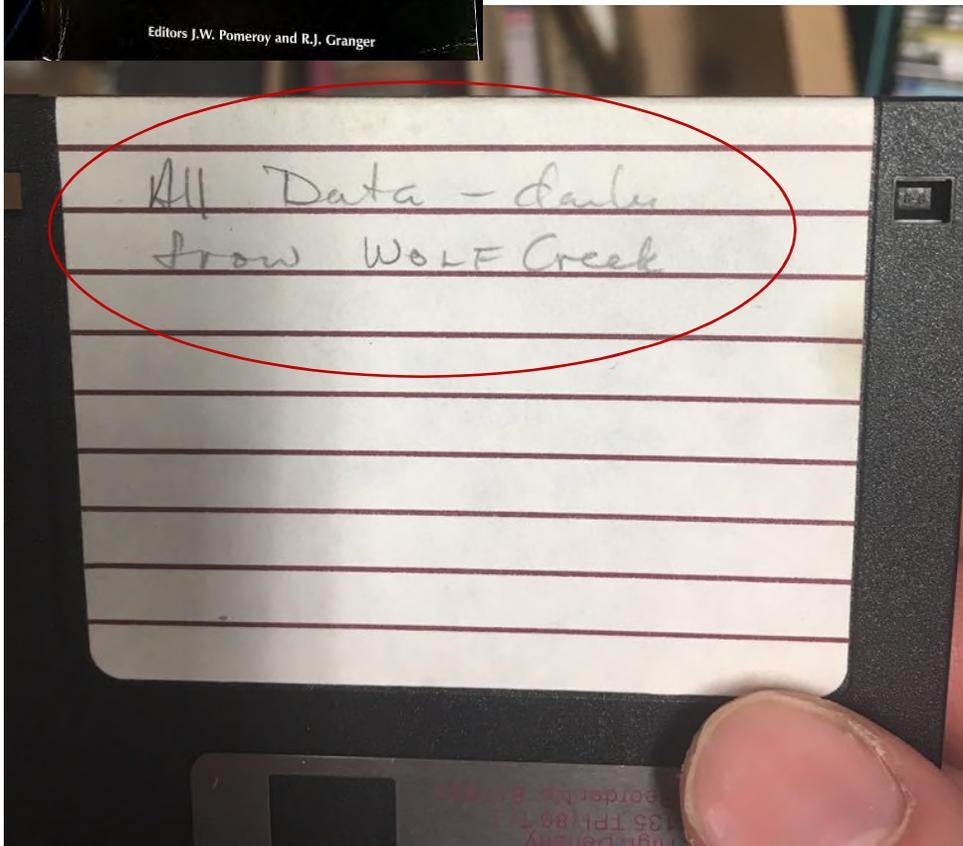
A complex suite of actors collecting a wide variety of data

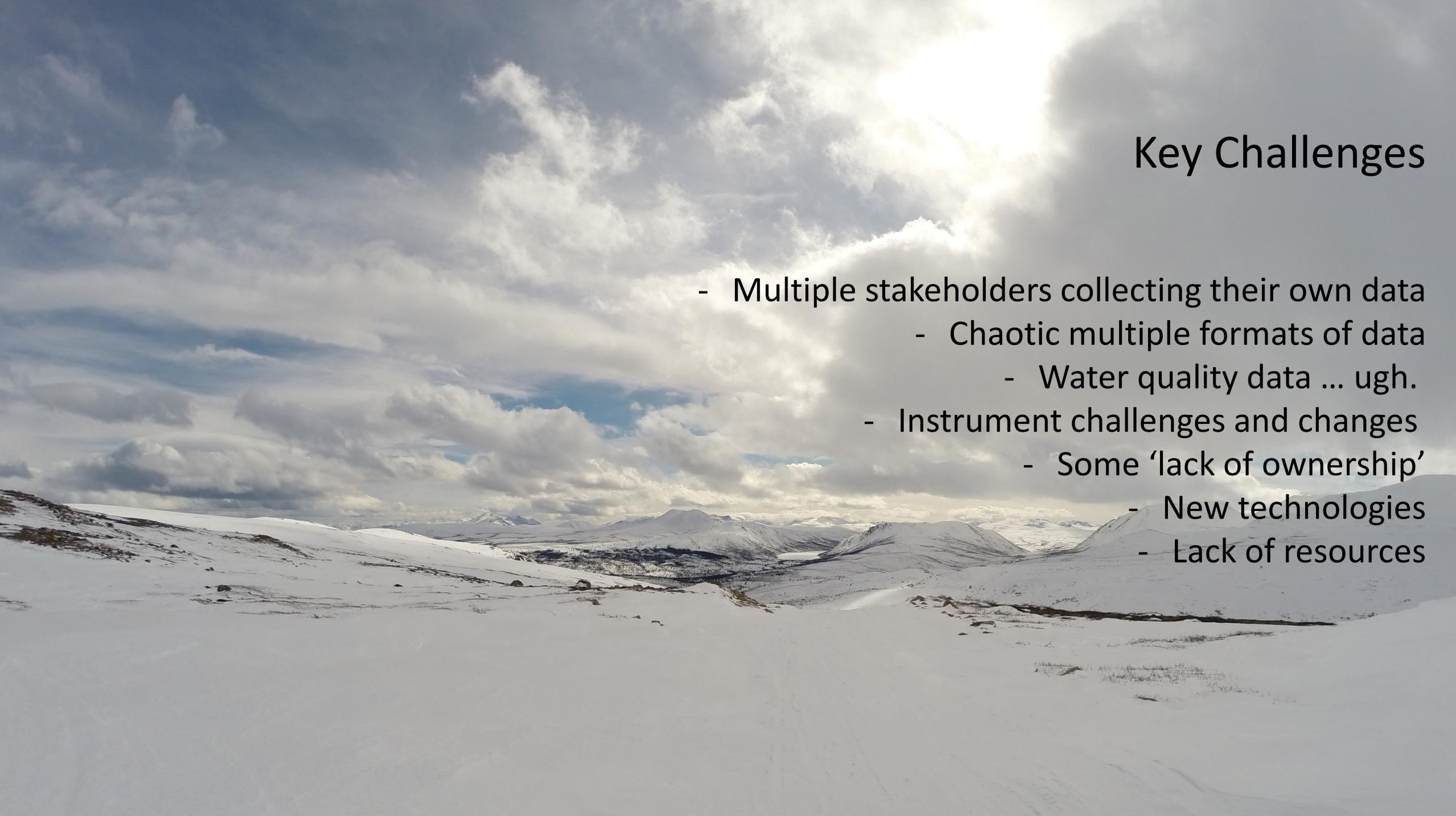
- core hydrometric data (Gov YT, Env Can)
- 'thesis type' data (McM, USask, many others....)
- itinerant researchers
- miscellaneous other data projects



We didn't begin with a coherent data management plan.

Naming convention! Gb302c01.xls





Key Challenges

- Multiple stakeholders collecting their own data
 - Chaotic multiple formats of data
 - Water quality data ... ugh.
 - Instrument challenges and changes
 - Some 'lack of ownership'
 - New technologies
 - Lack of resources

What were we committed to:

Sharing and open access



Comprehensive data



Student Research and HQP



New Technology



Inter-comparison experiments



Real Time info



Major Science Initiatives



- **National**

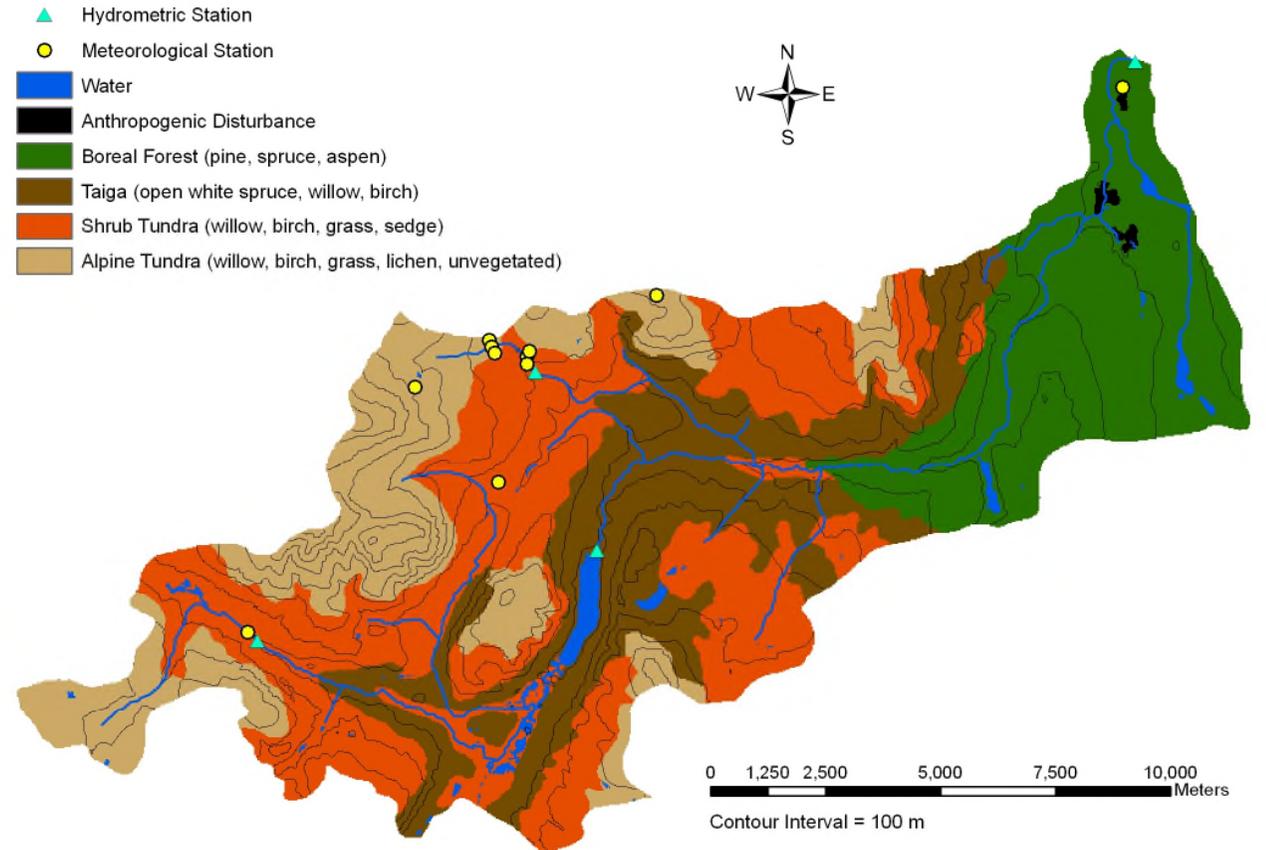
- MAGS
- CFCAS
- IP3
- CCRN
- GWF

- **International**

- GEWEX
- IPY
- INARCH
- NORTH-WATCH
- VEWA
- ABOVE

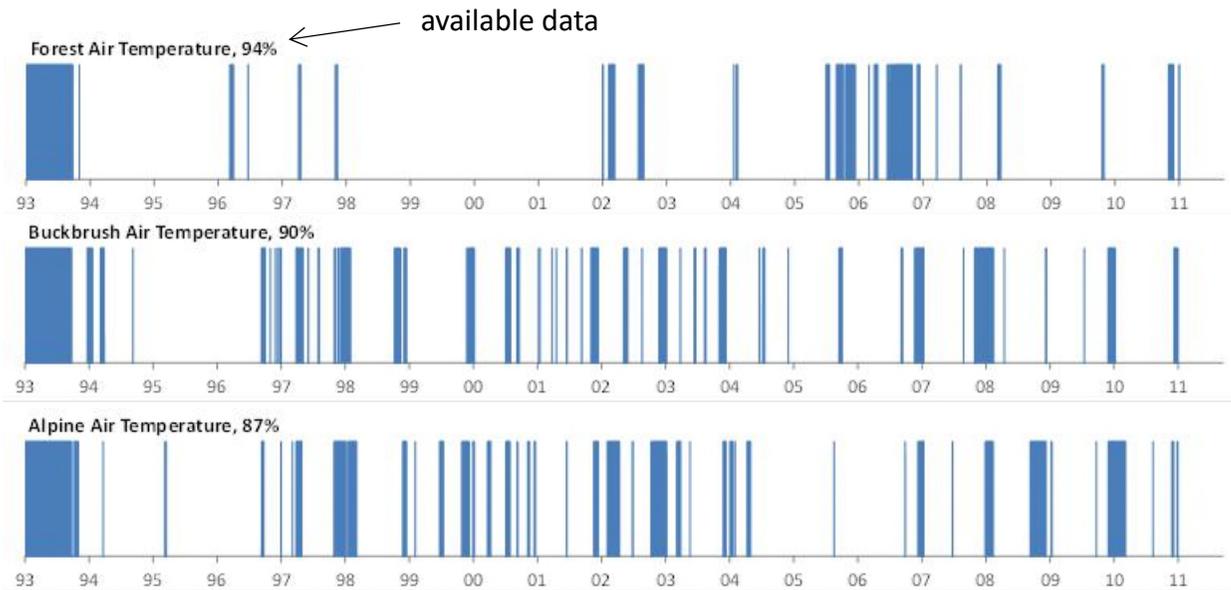
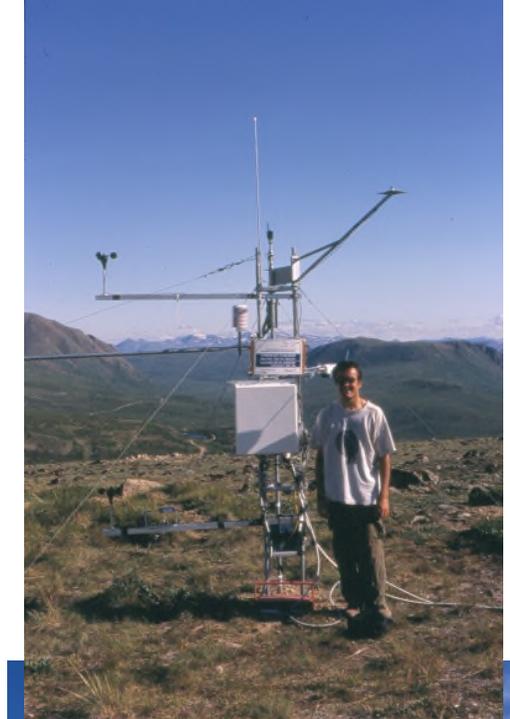
Wolf Creek Archive Summary

- Three permanent met stations in each of the three main Wolf Creek ecozones: “Forest” (boreal forest)
“Alpine” (alpine tundra)
“Buckbrush” (subalpine taiga)
 - Periodic stations within the Granger Basin, one of which is currently active “Granger Plateau”
 - Four permanent hydrometric stations:
- “Upper Wolf”
 - “Coal Lake Outlet”
 - “Granger Creek”
 - “Wolf Creek Highway”



Meteorological Towers

- Since 1993, three permanent towers measure: air temperature, relative humidity, solar radiation, wind speed, ground heat flux, soil moisture, soil temperature, infrared surface temperature, and atmospheric pressure



blue indicates periods of missing data



Hydrometric Stations

Station	Drainage Area (km ²)	Length of Record	Years Missing Peak Freshet
Upper Wolf	14.5	1994-2015	94,95,03,06,13
Granger Creek	4.5	1998-2018	None
Coal Lake Outlet	70.5	1994-2018	94,95
Wolf Creek Hwy	177	1993-2018	09



Precipitation

Location	Gauge	Install	Lost Data	Notes
Forest Tower	Tipping Bucket	1993	Minimal	Rain Only
	Nipher	1993	Minimal	Snow Only
	Geonor T200B	2007	28%	
Alpine Tower	Tipping Bucket	1993	Minimal	Rain Only
	Nipher	1993	Minimal	Snow Only
	Geonor T200B	2010	49%	
Buckbrush Tower	Tipping Bucket	1993	Minimal	Rain Only
	Nipher	1993	Minimal	Snow Only
	Geonor T200B	2010	2%	
	Ott Pluvio 200	2013	0%	
	Ott Pluvio 400	2013	0%	
Granger Basin	Tipping Buckets	periodic measurements during research studies		Rain Only

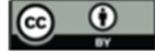


Snow

- **Snow Surveys**
 - Monthly surveys near Forest, Alpine, and Buckbrush Towers starting in 1993
 - Periodic surveys within Granger Basin
- **Snow Pillows**
 - Located at Buckbrush (1994-current)
- **Snow Depth**
 - UDG01 (1993-2007), SR50 (2007-current) at all three towers







A long-term hydrometeorological dataset (1993–2014) of a northern mountain basin: Wolf Creek Research Basin, Yukon Territory, Canada

Kabir Rasouli^{1,2}, John W. Pomeroy², J. Richard Janowicz^{2,3,†}, Tyler J. Williams^{2,3}, and Sean K. Carey⁴

¹Department of Geoscience, University of Calgary, Calgary, AB, Canada

²Centre for Hydrology, University of Saskatchewan, Saskatoon, SK, Canada

³Environment Yukon, Water Resources Branch, Whitehorse, YT, Canada

⁴School of Geography and Earth Sciences, McMaster University, Hamilton, ON, Canada

[†]deceased

Correspondence: Kabir Rasouli (kabir.rasouli@usask.ca)

Received: 26 September 2018 – Discussion started: 10 October 2018

Revised: 18 December 2018 – Accepted: 30 December 2018 – Published: 16 January 2019

Abstract. A set of hydrometeorological data is presented in this paper, which can be used to characterize the hydrometeorology and climate of a subarctic mountain basin and has proven particularly useful for forcing hydrological models and assessing their performance in capturing hydrological processes in subarctic alpine environments. The forcing dataset includes daily precipitation, hourly air temperature, humidity, wind, solar and net radiation, soil temperature, and geographical information system data. The model performance assessment data include snow depth and snow water equivalent, streamflow, soil moisture, and water level in a groundwater well. This dataset was recorded at different elevation bands in Wolf Creek Research Basin, near

Station:	Forest	
Location:	Wolf Creek, Yukon Territory	
Altitude:	739 m	
TimeZone:	PST, UTC-8	

Station:	Buckbrush	
Location:	Wolf Creek, Yukon Territory	
Altitude:	1314 m	
TimeZone:	PST, UTC-8	

Station:	Alpine	
Location:	Wolf Creek, Yukon Territory	
Altitude:	1520 m	
TimeZone:	PST, UTC-8	

Automated collection: most recent data not verified by provider

Automated collection: most recent data not verified by provider

Automated collection: most recent data not verified by provider

[7-day](#)

[Recent](#)

[History](#)

[7-day](#)

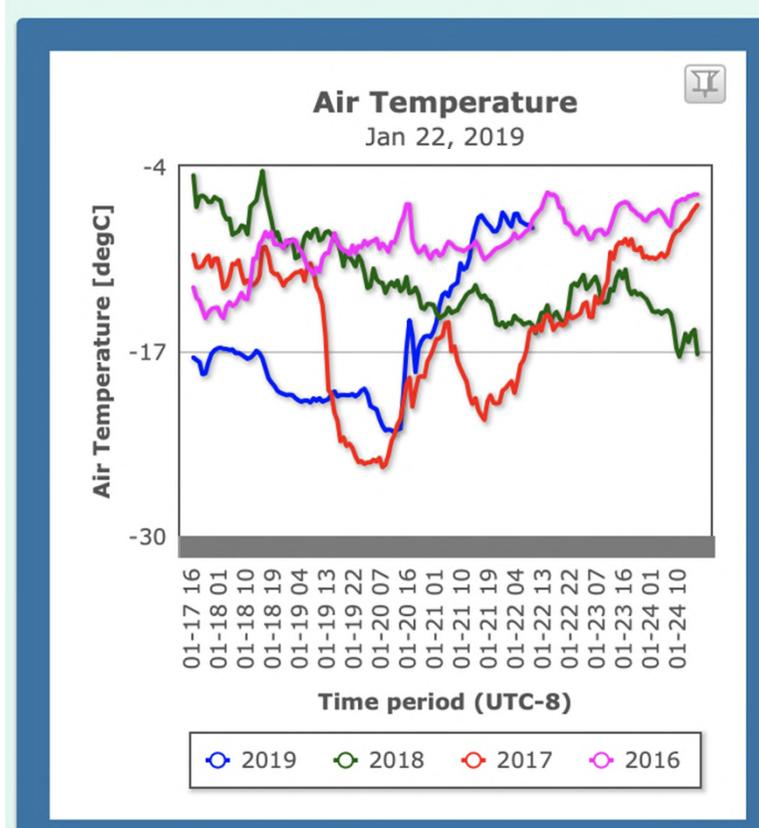
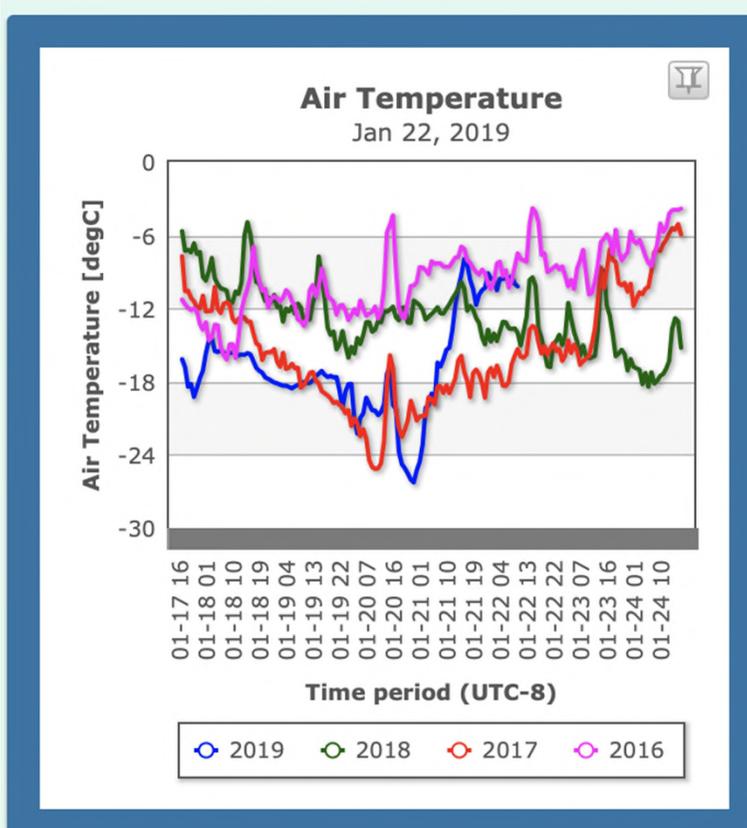
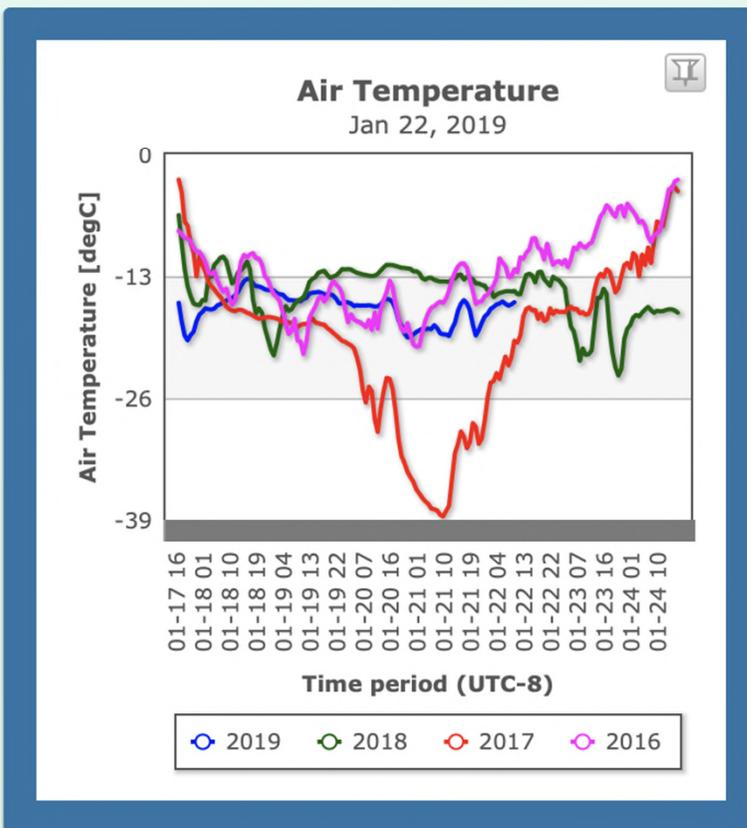
[Recent](#)

[History](#)

[7-day](#)

[Recent](#)

[History](#)



Wolf Creek is a flagship international research site. Scientists from Canada and around the world seek to utilize Wolf Creek's long term data and process understanding to understand biophysical processes in a changing world.



Nature Geoscience Save northern

To the Editor — Northern freshwaters are changing rapidly in response to global warming and human perturbation. Such change is often abrupt and unexpected: catchment storage and release of water is inherently nonlinear. Being able to understand and predict these ecosystems is essential in order to sustain their services and ensure social prosperity in this rapidly changing region. Nevertheless, more and more of the small research catchments in high latitudes are being shut down. Here, we make the case for reversing this trend to sustain long-term catchment research in the north.

Long-term catchment monitoring in the northern latitudes is in a precipitous decline. For example, the number of operational climate stations with precipitation data used for climate research purposes in the Canadian Prairie Provinces and northern territories has diminished rapidly (Fig. 1), and this trend is mirrored in other circumpolar regions of the world. All in all, more than half of previous extant far-northern hydrological research catchments have been closed, with a 40% reduction since the year 2000 (Fig. 1). This decline in our ability to detect, understand and predict the responses in northern water resource systems to the changing climate at human perturbations has key consequences for populations in more southerly latitudes because the northern circumpolar region is key driver of the global climate system¹.

One of the most alarming aspects of the decline in observations of the cold northern regions is that it is contemporaneous with rapid warming. Recent observations show record-breaking temperatures year-on-year in the Arctic². All components of the hydrological cycle have been affected by this warming: changes in the distribution and duration of snow cover and permafrost³;

4. DeBeer, C. M. et al. *Hydrol. Earth Syst. Sci.* **20**, 1573–1598 (2016).
5. Spence, C. et al. *J. Geophys. Res. Biogeosci.* **120**, 113–117 (2015).
6. de Wit, H. A. et al. *Environ. Sci. Technol. Lett.* **3**, 430–435 (2016).
7. Crowther, T. W. et al. *Nature* **540**, 104–108 (2016).

Hjalmar Laudon^{1*}, Christopher Spence², Jim Buttle³, Sean K. Carey⁴, Jeffrey J. McDonnell⁵, James P. McNamara⁶

¹Department of Geography, Trent University, Ontario K9J 7B8, Canada. ²School of Geography and Earth Sciences, McMaster University, Ontario L8S 4K1, Canada. ³Global

⁴UKA Northern Rivers Institute, School of Geosciences, University of Aberdeen, Aberdeen AB24 3UF, UK. ⁵e-mail: Hjalmar.Laudon@slu.se



Experimental data for

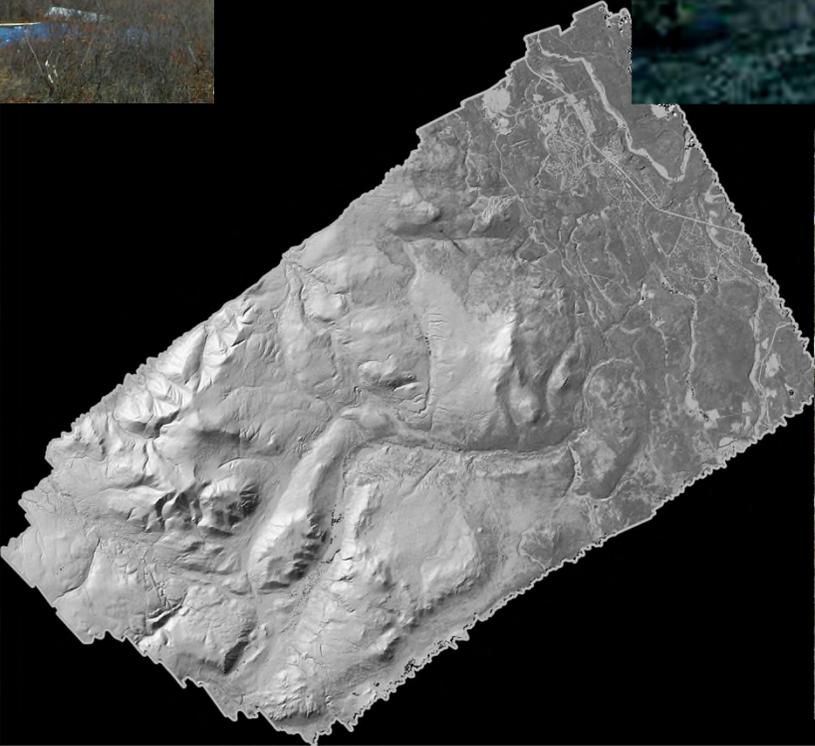
a³ , Hjalmar Laudon⁴ , and

Abert, Aberdeen, UK, ²School of Geography and Earth Sciences, Boise State University, Boise, Idaho, USA, ³Swedish University of Agricultural Sciences, Umeå, Sweden

Experimental watersheds are the foundation of process understanding, observe trends and natural variability. Long-term experimental watersheds also are essential. These studies offer a crucial evidence base for water supplies, predicting and mitigating the effects of climate change on rivers and wetlands. They also show how to manage watersheds to reduce environmental and economic costs.



Other 'data streams'



Back to the Challenges:

- Data is still housed at multiple sites and servers (Wiski, Aquarius, ASCII files)
- Commitment to metadata and sharing, but direct access often challenging
- Remote sensing data archive and tracking of workflow is nascent
- Considerable legacy data that still requires publishing
- Tracking model data
- Resources as always

Is Data Management our Grand Challenge / Wicked Problem?

- 
- Must commit to open data and science
 - Watch out for Tri-Council policies soon
 - Train HQP in data management
 - Code repositories
 - Don't reinvent the wheel, support existing *open* initiatives
 - Quitting is for quitters