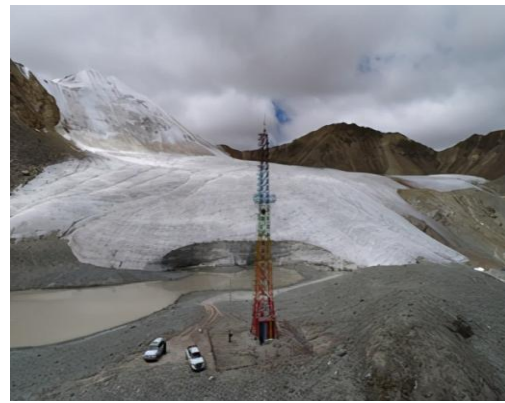


The International Network for Alpine Research Catchment Hydrology (INARCH) and its Common Observing Period Experiment (COPE), 2022–2024

<https://inarch.usask.ca/>

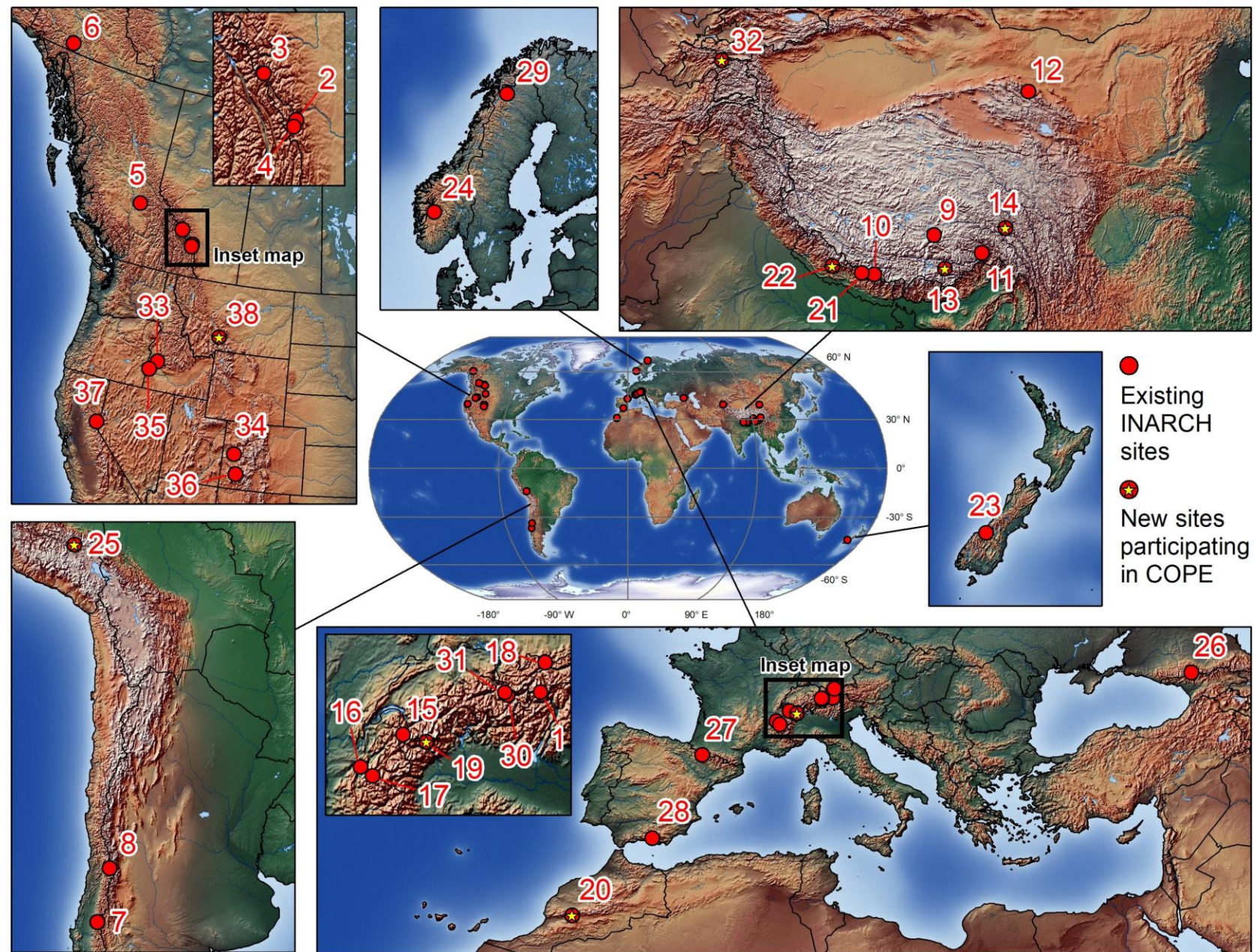
Chris DeBeer



INARCH Basins

Austria 1. Rofental Open Air Laboratory (OpAL);
Canada 2. Marmot Creek Research Basin; 3. Peyto Glacier; 4. Fortress Mountain Snow Observatory; 5. Quesnel River Research Basin; 6. Wolf Creek Research Basin;
Chile 7. Valle Hermoso, Upper Diguillín River Basin; 8. Estero Las Bayas, Upper Maipo River Basin;
China 9. Nam Co Monitoring and Research Station for Multisphere Interactions; 10. Qomolangma Atmospheric and Environmental Observation and Research Station; 11. Southeast Tibet Observation and Research Station for the Alpine Environment; 12. Upper Heihe River Basin; 13. Yala Shampo Cryosphere Hydro-Ecological Station*; 14. Changdu Ecological Monitoring Station*;
France 15. Arve Catchment; 16. Col de Porte Experimental Site; 17. Col du Lac Blanc Experimental Site;
Germany 18. Schneefernerhaus and Research Catchment;
Italy 19. Torgnon Ecosystem Station*;
Morocco 20. Rheraya Catchment, High Atlas Mountains*;
Nepal 21. Langtang Catchment; 22. Hidden Valley, Himalayas*
New Zealand 23. Brewster Glacier;
Norway 24. Finse Alpine Research Centre;
Peru 25. Salcca-Sibinacocha Catchment*;
Russia 26. Djankuat Research Basin;
Spain 27. Izas Research Basin; 28. Guadalfeo Monitoring Network;
Sweden 29. Tarfala Research Catchment;
Switzerland 30. Dischma Research Catchment; 31. Weissfluhjoch Snow Study Site;
Tajikistan 32. Kyzylsu Glacier and Monitoring Sites*;
United States of America 33. Dry Creek Experimental Watershed; 34. Grand Mesa Study Site; 35. Reynolds Creek Experimental Watershed; 36. Senator Beck Basin Study Area; 37. Sagehen Creek, Sierra Nevada; 38. Bridger Range*.

*new sites participating in the Common Observing Period Experiment (COPE)



<https://inarch.usask.ca/science-basins/research-basins.php>

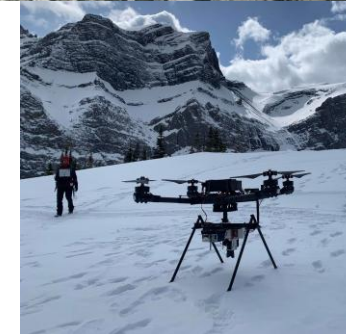
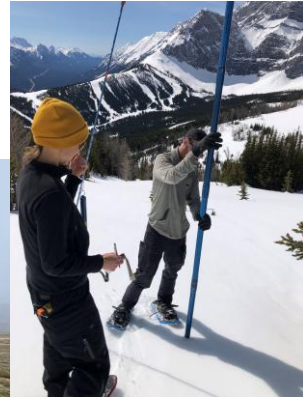
Other/new basins reported in COPE

- Grand Mesa, Colorado, USA
- Fuglebekken Catchment, Svalbard, Norway
- Mount Lebanon
- East River Basin, Colorado, USA
- Tuolumne River Basin, California, USA
- Tenderfoot Creek Experimental Forest (TCEF); Bozeman Creek Watershed (BCW), Montana, USA
- Tombstone Waters Observatory, Yukon, Canada
- Atwater Study Plot / Little Cottonwood Canyon, USA
- Senator Beck Basin, USA
- Sangvor, Tajikistan
- Snowy Mountains, Australia

Common Observing Period Experiment (COPE)

2022–2024

- INARCH held field observation phase of COPE
- focusing on obtaining high-quality measurements,
- ensure all sensors are working,
- enhance observations at our mountain research basins,
- fly supplementary UAV acquisitions,
- run high resolution models and
- work together for comparison of processes, data sharing, and model testing in challenging environments
- <https://inarch.usask.ca/science-basins/cope.php>



COPE modelling activities

- we plan to take a variety of different models and apply them in different basins to
 - see how they work,
 - make sure we have the proper forcing information,
 - try different forcing, at different scales,
 - see what corrections are needed for those forcings,
 - calculate snow and ice dynamics and hydrological dynamics at the surface, and
 - look at these diagnostically with available measurements from ice and snow changes, to soil moisture, streamflow, and turbulent fluxes, as available.
- This has not been done globally in alpine regions and could be potentially very powerful.

Common Observing Period Experiment (COPE)

2022–2024

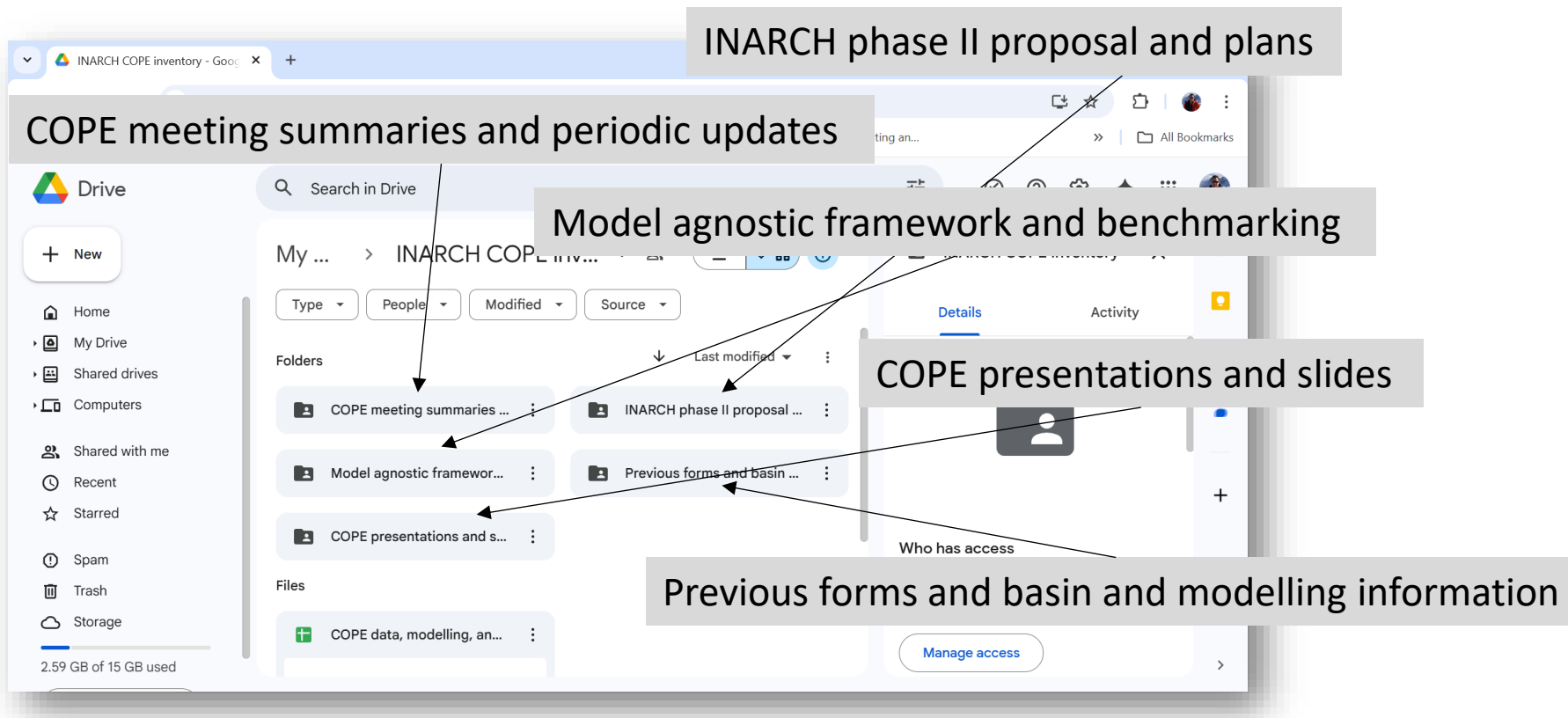
Hydrological, Meteorological, Glaciological Models

- | | | |
|-------------------------------------|---------------------------------------|-------------------|
| 1. CRHM | 7. Thethys-Chloris | 13. AWSM/iSnobal |
| 2. openAMUNDSEN | 8. SPHY | 14. FSM-OSHD |
| 3. OGGM (open global glacier model) | 9. AMelt | 15. S3M |
| 4. Cosipy | 10. SNOWPACK/Alpine3D | 16. TopoPyScale |
| 5. WRF\NoaaMP\CLM\LES models | 11. Canadian Hydrological Model (CHM) | 17. SURFEX-Crocus |
| 6. FSM2 | 12. SnowModel | 18. SnowMet |

- Details of these models are available at <https://inarch.usask.ca/science-basins/cope.php>
- Application of these models in as many places as possible to look at differences in results seen with elevation, vegetation structures, climate, etc.

INARCH COPE inventory – Google Drive

- https://drive.google.com/drive/folders/1PRZpNKhGwrdvs08Pgj_nWlcyiBsolJZK?usp=sharing



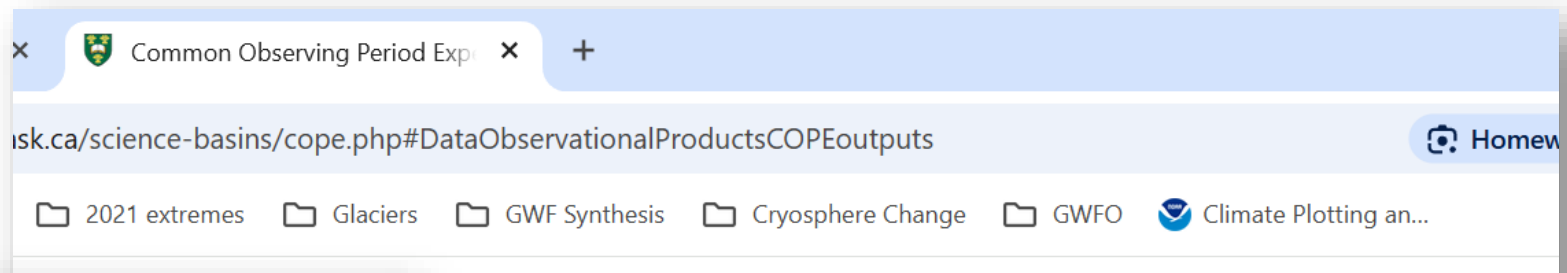
INARCH COPE inventory – Google Drive

- <https://drive.google.com/drive/folders/1PRZpNKhGwrdvs08PgjnWlcyiBsolJZK?usp=sharing>

The image displays two overlapping screenshots from a web browser. The background screenshot shows a Google Drive interface with a folder named 'INARCH COPE inventory'. The foreground screenshot shows a Google Docs spreadsheet titled 'COPE data, modelling, and activity inventory (2024-25)'. The spreadsheet contains a table with columns for Name, Affiliation, Email, Basins and sites currently working at, Data available (links, Github, published, by personal contact, etc.), Models running at these sites or elsewhere, Data needs from other basins and sites (and any formatting, processing, standards, etc.), Basins and sites interested in working at or applying models on, Models interested in applying at your site(s), and Other Comments.

Name	Affiliation	Email	Basins and sites currently working at	Data available (links, Github, published, by personal contact, etc.)	Models running at these sites or elsewhere	Data needs from other basins and sites (and any formatting, processing, standards, etc.)	Basins and sites interested in working at or applying models on	Models interested in applying at your site(s)	Other Comments
Binbin	Institute of Tibetan Plateau Research, Chinese Academy of Sciences	wangbinbin@tpcas.ac.cn	Nam Co Basin and Mt. Everest basin	https://doi.org/10.11888/Atmos.tpcdc.300977	Our group are running WRF coupled with Lake model at Nam Co basin, the dataset can be found in 1 of the 12 stations published through the data links.				note: actually long-term data from 12 stations have been published and the title of the paper is "Dataset of spatially extensive long-term quality-assured land-atmosphere interactions over the Tibetan Plateau", all the data are freely available. If any questions about the data, please don't hesitate to contact me.
Ulrich Strasser Erwin Rottler Michael Warscher	University of Innsbruck Department of Geog	ulrich.strasser@uibk.ac.at erwin.rotter@uibk.ac.at michael.warscher@uibk.ac.at	Rofental/Otztal Alps, Tyrol, Austria	https://doi.org/10.5880/10.5194/gi	openAMUNDSEN: https://github.com/openAMUNDSEN	DEM plus temperature, precipitation, humidity, wind speed, radiation	Zugspitze, Guadalupe, Marmot Creek, Peyto	openAMUNDSEN (h	Data paper: Warscher, M., Marke, T., Rottler, E.; openAMUNDSEN model paper: Strasser, U., Warscher, M., and Rottler, E. (2024) Example modelling: Rottler, E., Warscher, M. and Rottler, E. (2024) details about the catchment: https://mountainhydrology.de/en/experimental-lake-basin/ . We reconstructed a 30+ year time series with full met data based on local AWS and ERA5/land. Additionally, we have several local observations for the last 3 years or so in several places: T, RH, SW, snow depth (manual and automatic), SWE (transects and pits),
	Departamento de Recursos Hídricos, Universidad de		Renegado Creek (Valle Hermoso),		Cold Regions Hydrological Model (CRHM), Canadian Hydrological Model	DEM, landcover map, full met data (AWS scale or gridded),		None in particular,	

COPE data



Dataset Continuous meteorological and snow hydrological measurements for 2013-2023 from three automatic weather stations (AWS) in the upper Rofental, Ötztal Alps, Austria

Cite as:

Department of Geography, University of Innsbruck (2024): Continuous meteorological and snow hydrological measurements for 2013-2023 from three automatic weather stations (AWS) in the upper Rofental, Ötztal Alps, Austria. GFZ Data Services. <https://doi.org/10.5880/fidgeo.2023.037>

Copy citation to clipboard



Impressum

Data, Observational Products, COPE outputs

COPE datasets are being compiled, quality assured and controlled, and released. Those currently available (covering all or part of the COPE period) are listed below, while a more comprehensive listing of INARCH data is [available here](#).

- Tibetan Plateau
 - Ma, Y., Xie, Z., Chen, Y., Liu, S., Che, T., Xu, Z., Shang, L., He, X., Meng, X., Ma, W., Xu, B., Zhao, H., Wang, J., Wu, G., Li, X. (2023). Spatially extensive long-term quality-assured land-atmosphere interactions dataset over the Tibetan Plateau. National Tibetan Plateau / Third Pole Environment Data Center. <https://doi.org/10.11888/Atmos.tpd.300977>.
- Rofental, Ötztal Alps, Austria
 - Department of Geography, University of Innsbruck (2024): Continuous meteorological and snow hydrological measurements for 2013-2023 from three automatic weather stations (AWS)

Austria. GFZ Data Services.

[10.5880/fidgeo.2023.037](https://doi.org/10.5880/fidgeo.2023.037).

ebster, C., Mazzotti, G. (2024). A high-resolution snow and Dischma region in

doi.org/10.16904/envdat.568.

basins products, <https://sgascoin.github.io/INARCH/>

2025). OGGM standard projections aggregated for 10 [ids/17018026](https://doi.org/10.5880/fidgeo.2023.037)

A high-resolution snow and hydrometeorological dataset for the Dischma region in Switzerland

Jan Magnusson Tobias Jonas Yves Bühler Clare Webster Giulia Mazzotti

Jan Magnusson 10.16904/envdat.568 19. Dec 2024

INARCH

Sentinel-2 snow products

Data

Level 2B products (L2B)

Sentinel-2 level 2B snow products have a 5-day revisit and a spatial resolution of 20 m.

LIS_S2-SNOW-FSC*.tif provides the fractional snow cover:

- 0: No-snow

zenodo

Search records...



Communities

My dashboard



Department of Atmospheric and Cryospheric Sciences (ACINN), University of Innsbruck

Published September 1, 2025 | Version v1

Dataset

Open

OGGM standard projections aggregated for 10 INARCH basins

Schmitt, Patrick¹ ; Nicholson, Lindsey¹ ; Prinz, Rainer¹

Show affiliations

This dataset provides glacier projections from the [Open Global Glacier Model \(OGGM\) v1.6.1 standard projections](#), aggregated for 10 glacierized basins defined by the [INARCH network](#).

The data include annual glacier volume and area, as well as melt, precipitation, and total runoff (annual and monthly). Melt and

Data management system - GWFNet

The image shows two overlapping browser windows of the GWFNet website. The left window shows the homepage with a navigation menu where 'Data Centre' is highlighted with a red circle and a red arrow. The right window shows the 'DataCentre' page with search filters and a map of Canada.

Navigation Menu (Left Window):

- GWFNet Home
- Master Index
- Data Centre**
- Research Programs
- Map
- Advanced Search

Search Interface (Right Window):

GWFO Website

Show Data: ☐ By Variable Type ☒ By Site/Lab/Deployable

Programme Selection:

From: YYYY-MM-DD To: YYYY-MM-DD ☐ Show historical data

[Data Policy](#) [Help](#) [Disclaimer](#)

Instrumented Sites	Zones/Observations
Burstall Creek, Canada	
Fortress Mountain, Canada	
Marmot Creek, Canada	
RAEON - UWRAEON2-23 Buoy 2 - 2023 in Lake Erie	
Wolf Creek Research Basin (GWFO)	

Labs/Deployables

Map: A map of Canada showing two blue dots indicating data locations. Labels include 'UNITED STATES', 'Gulf of Alaska', 'ROCKY MOUNTAINS', 'HUDSON BAY', and 'DAVIS STRAIT'.

INARCH Phase II Science Questions



1. How different are the observation and measurement approaches amongst INARCH basins and do we expect distinctive differences in our understanding of basin response and hydrological predictability because of the sampling schemes, and data quality and quantity?
2. How do the predictability, uncertainty and sensitivity of energy and water exchanges vary with changing atmospheric thermodynamics, ecosystem structure and water management in various high mountain regions of the Earth?
3. What improvements to high mountain energy and water exchange predictability are possible through improved physics in, coupling of, and downscaling of models in complex terrain, and improved and expanded approaches to data collection and assimilation?
4. To what extent do existing model routines have global validity, are transferable, and meaningful in different mountain environments for providing service to society?
5. Can mountain systems be predicted and managed to find solutions to help achieve water sustainability in river basins under climate change?

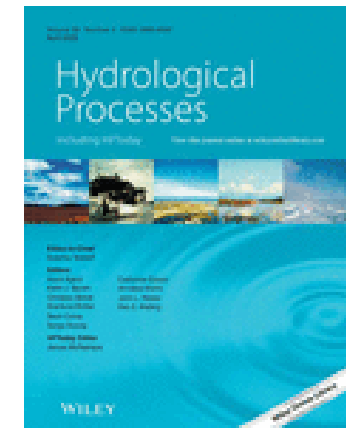
Eventually contribute to answering - How have mountain atmospheric-cryospheric-hydrological-ecosystem-human systems co-evolved to their current states and how will they respond to climate change over the next century?

Common Observing Period Experiment (COPE)

2022–2024

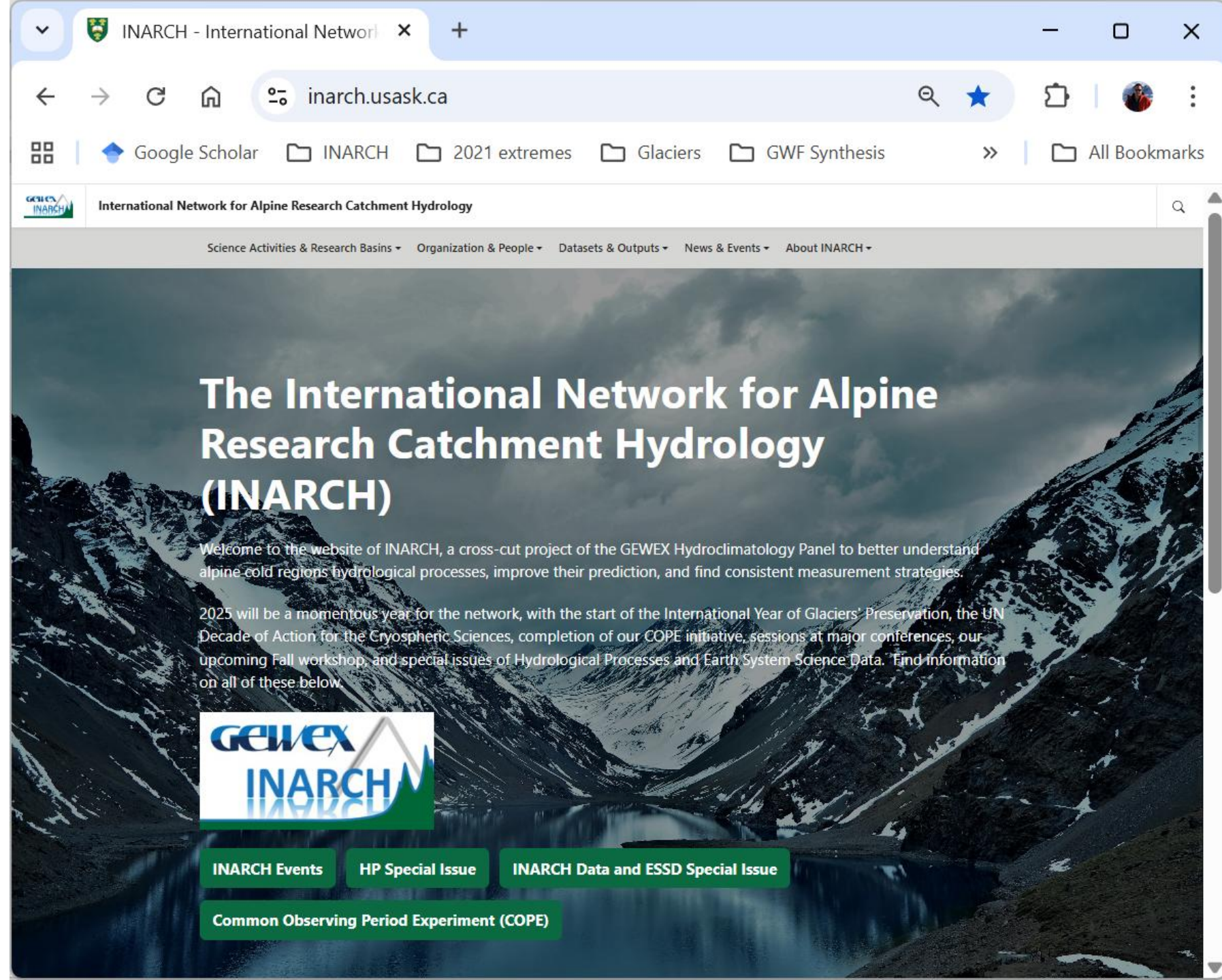
Next steps

- Publish data in ***Earth System Sciences Data* special issue**,
“Hydrometeorological data from mountain and alpine research catchments,”
https://essd.copernicus.org/articles/special_issue871.html
- Call for papers in ***Hydrological Processes* special issue**,
“Improving Measurement, Understanding, and Prediction of Alpine Cold Regions Hydrological Processes and Their Sensitivities to Global Change,”
<https://onlinelibrary.wiley.com/page/journal/10991085/homepage/call-for-papers/si-2024-001778>
- **International Mountain Conference 2025:** INARCH will convene a focus session, FS 3.116
[*High mountain hydrology and cryosphere: observations, modelling, prospects*](#) at IMC 2025, September 15, 2025.
 - 17 talks, 16 posters



Website

- Please look at the website and let me know of changes, additions, more materials, etc.



In summary

- What COPE data already available/published?
 - Not much, need more, need to make it easily available across INARCH; perhaps eventually an overarching data publication with all COPE data in ESSD
 - We have GWFNet and the data portal. This can be an easy, central access point for metadata and to download data
- For all COPE activities, records, meeting notes, materials, lists and inventories there is a Google drive
 - The link can be shared with you. Please go there to access any materials you need and add/edit the inventory or other things
- Send Chris any other updates on publications or activities for the website and for our reporting to GEWEX