Further updates and status of INARCH Common Observing Period Experiment (COPE)

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INARCH Workshop, Idaho

October 11, 2023

INARCH Basin/Site Information Form

Basin/Site Name

Country; Province/State

Website (If Available)

Operational Management

Basin/Site Location (Centroid Coordinates)

Coordinate Format	Latitude	Longitude
Decimal Degrees		

Oversight/Contacts

Name	Role	Contact Information

Purpose/Scientific Focus

Basin/Site Characteristics

Location (Physiographic Region)	
Area (km^2)	
Elevation (m; Mean, Maximum, Minimum)	
Description (Physical–Ecological–Climatic Characteristics)	
Drainage/River System	
Site History or Historical Context	
Years of Data	

Other Info

Glacierized Area (% and year(s) measured)	
Main Land Cover(s)	
Lithology/Soils	
Mean Monthly and Annual Temperature (°C)	
Mean Total Monthly and Annual Precipitation (mm)	
Snow Characteristics	
Additional Noteworthy Characteristics of Basin/Site	

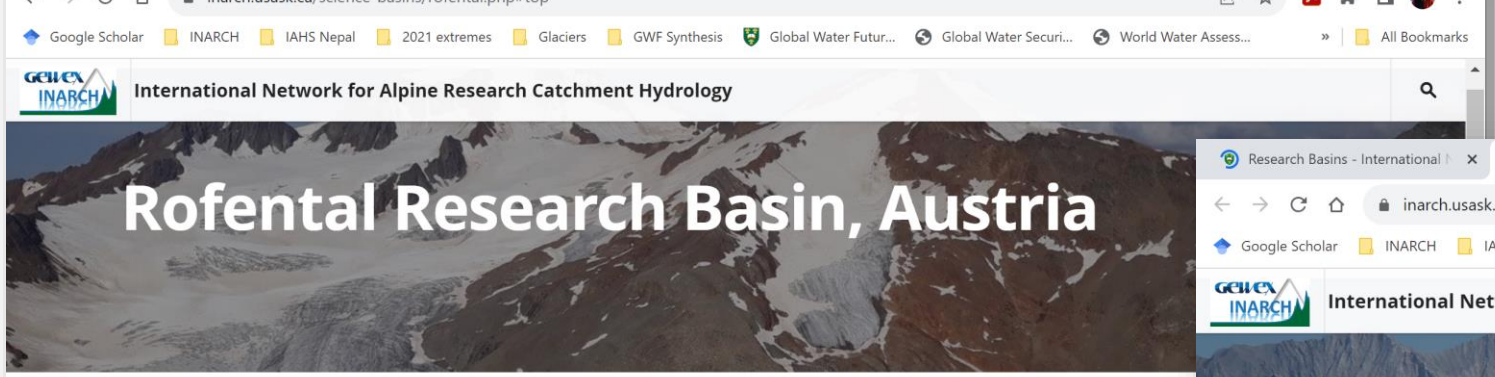
Data and Observations

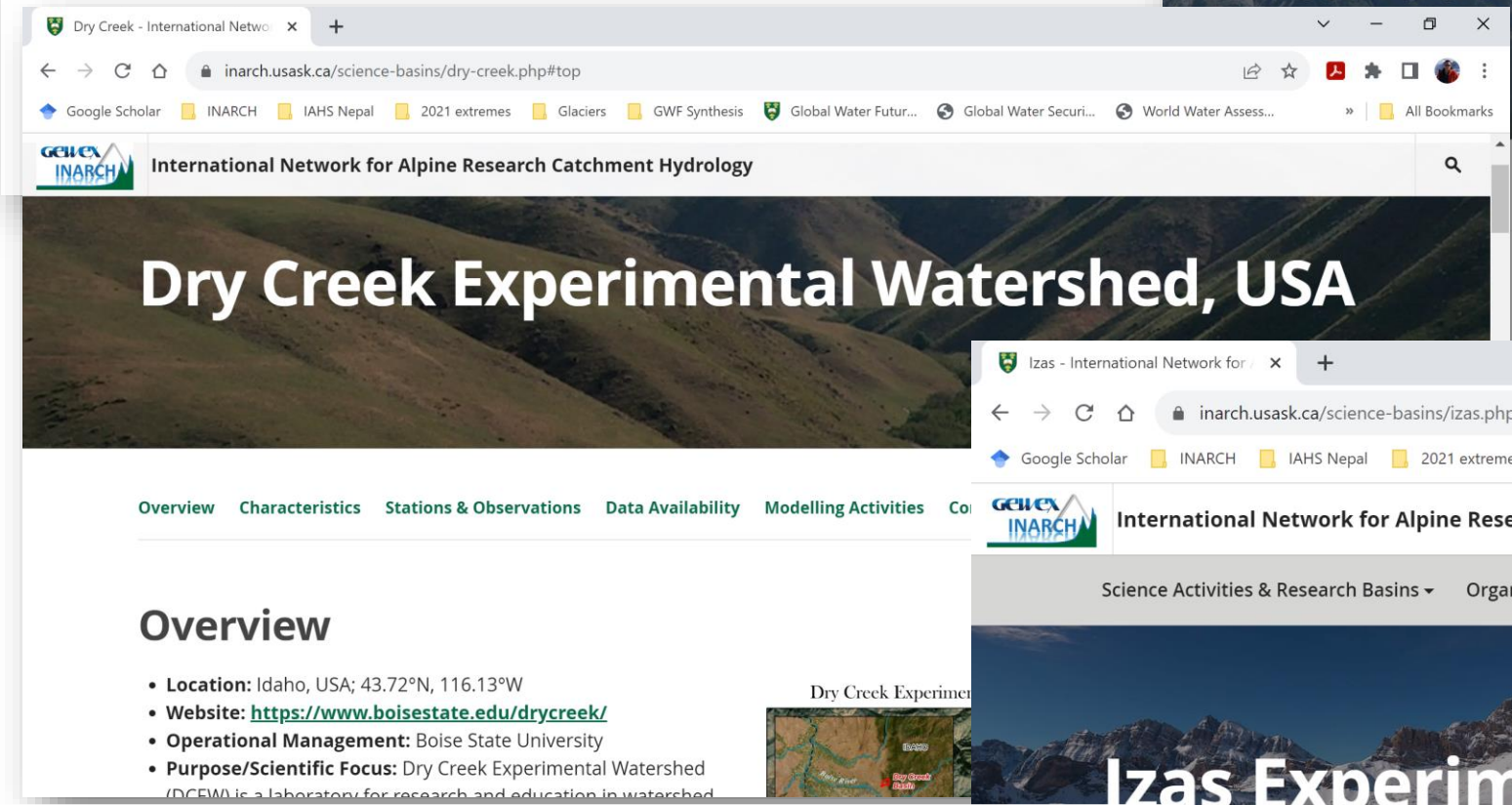
Available Geospatial Data	Notes (e.g., Source, Resolution, Error/Uncertainty, Date, etc.)
Elevation	
Landcover and Soils	
Stream/River Network	
Basin Delineation/Shapefile	
Other Geospatial Data (add rows as necessary)	

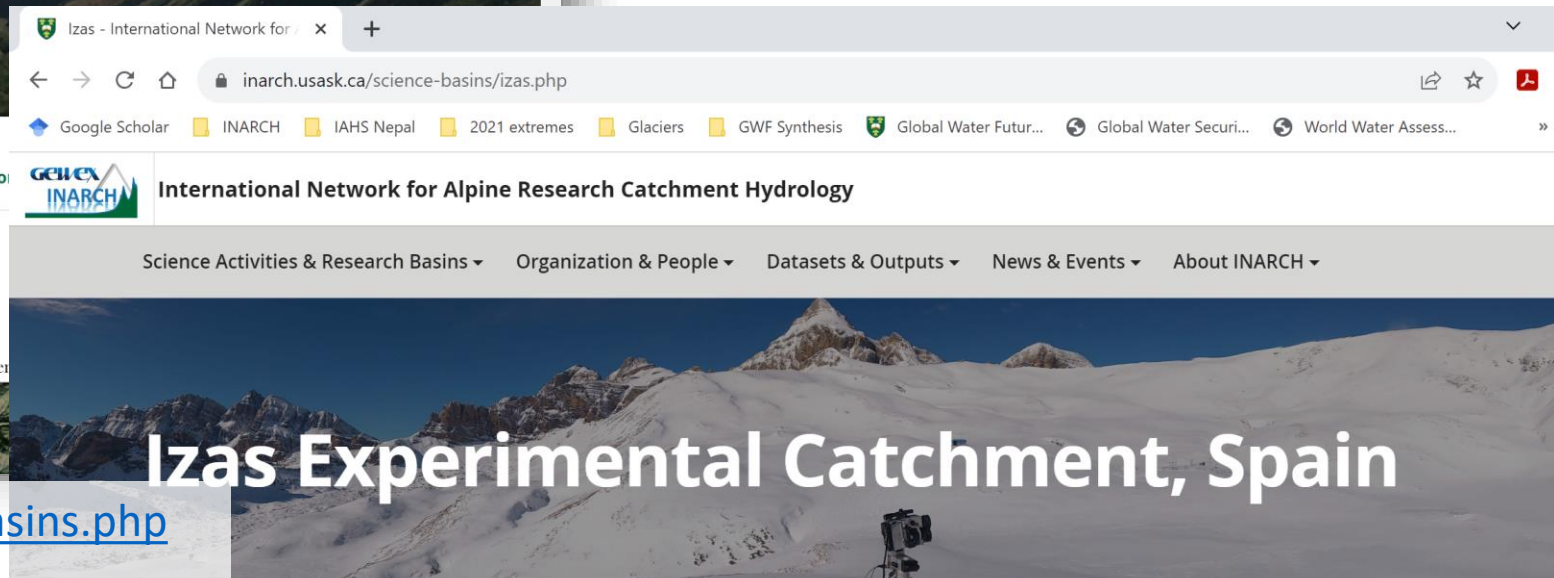
Observation Stations (Specific Instrument/Sensor Details to be Filled Below)

Type	Station Name	Latitude	Longitude	Elevation	Notes/Details
Other Stations (add rows as necessary)					

Data Availability and Access (Please provide links/DOIs to published or available data and descriptions; Add rows as necessary)







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

Updates from other INARCH basins

- Salcca-Sibinacocha, Peru
- Guadalfeo Monitoring Network, Spain
- Kyzylsu Glacier, Tajikistan
- Langtang and Hidden Valley (Mustang), Nepal
- Brewster Glacier, New Zealand
- Djankuat Research Basin, Russia

Sallca-Sibinacocha, Peru

(update from Tom Gribbin and Wouter Buytaert, Imperial College, London)

- Just finished the fieldwork in the Sallca-Sibinacocha. Following are some photos from the upper part (lots of geomorphological mapping, salt-dilution gauging and sensor downloads from this trip!)

- The locals were reporting an unusually dry ‘wet season’ and a fairly wet ‘dry season’, probably linked to El Nino. Certainly while we were there we had lots of dry season snowfall/rain events, which made life difficult while trying to download from Wouter’s ultrasound sensors! Made for some atmospheric photos at times though once the weather cleared

- Main news from our group at the site is the publication of Anthony’s modelling paper on bofedales, with a follow up from me on its way soon bringing in an isotope perspective.

Hydrological Processes

RESEARCH ARTICLE | Open Access

Seasonal water storage and release dynamics of *bofedal* wetlands in the Central Andes

Anthony C. Ross, Marc Martinez Mendoza, Fabian Drenkhan, Nilton Montoya, Jan R. Baiker, Jonathan D. Mackay, David M. Hannah, Wouter Buytaert

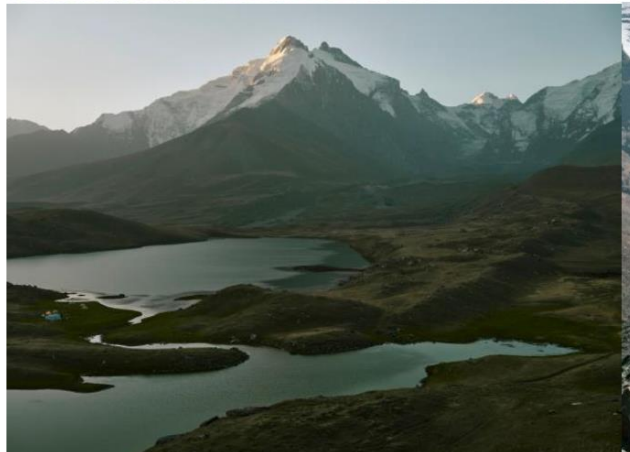
First published: 04 August 2023 | https://doi.org/10.1002/hyp.14940

Guadalfeo Monitoring Network (GMN), Spain

(Rafa Pimentel and María José Polo, University of Córdoba)

Kyzylsu Glacier, Tajikistan (Achille Jouberton and Francesca Pellicciotti, WSL)

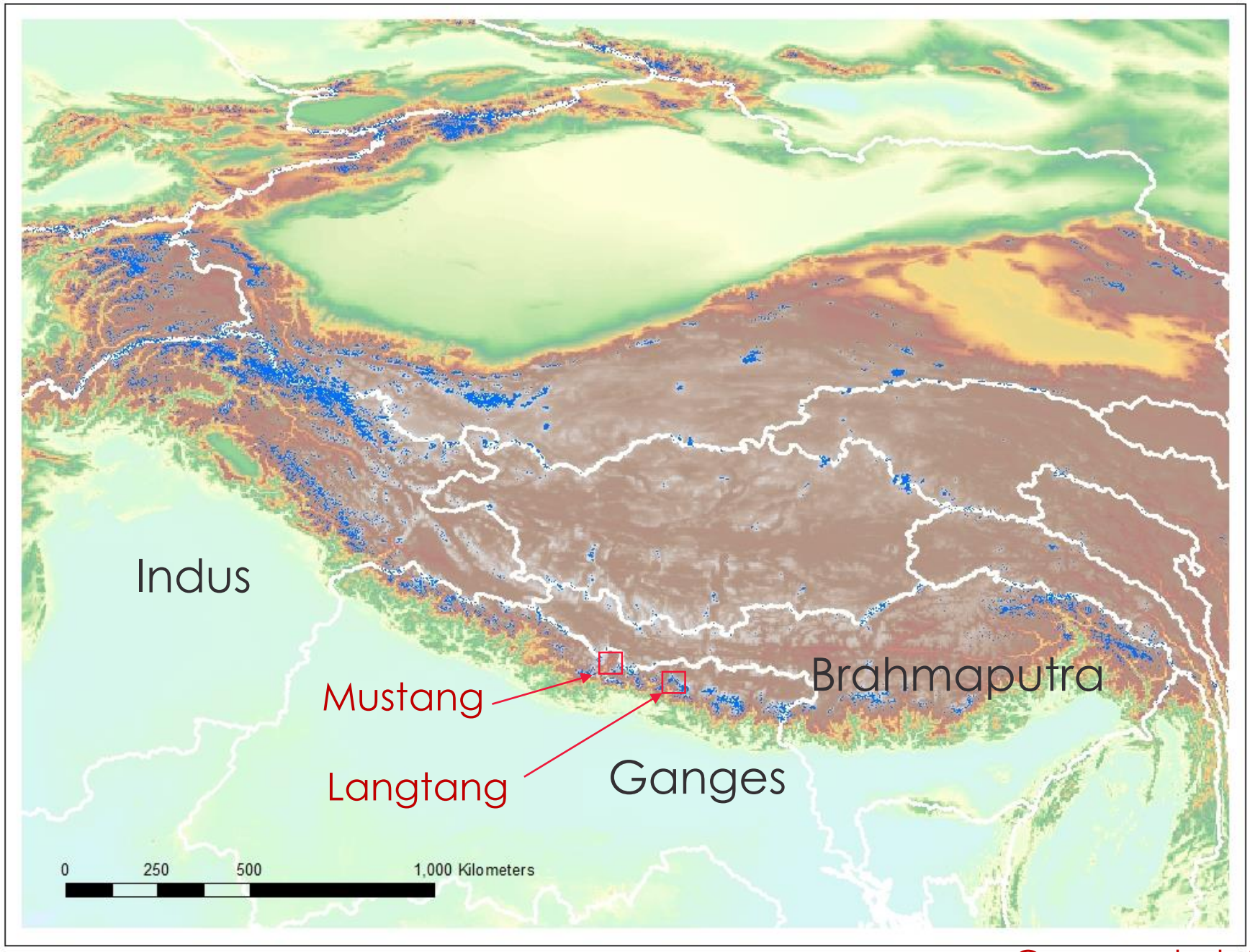
- Field report from recent visit. The main points from that visit:
- Second full year of data retrieved from, among other things, the two main automatic weather stations (AWS_OnGlacier and AWS_Pluviometer).
- Snow depth daily time-series retrieved at 5 different locations.
- Wind-shield, soil moisture and ground temperature sensors installed at the Pluviometer weather station, making it very complete (mainly just longwave radiation measurement missing).
- 2 out of 3 stream gauging stations got destroyed by a flood in July 2023 because of a supra-glacial lake drainage event.
- We invited a professional photographer, Jason Klimatsas, to join our expedition. I share with you a selection of his photos: https://drive.google.com/drive/folders/1WqhR2oi_08DBhzWp3JPs_66i6V_rzUhn?usp=sharing
- Next annual visit planned in 2024 (probably in August-September)



fieldwork outlook

Langtang and Mustang

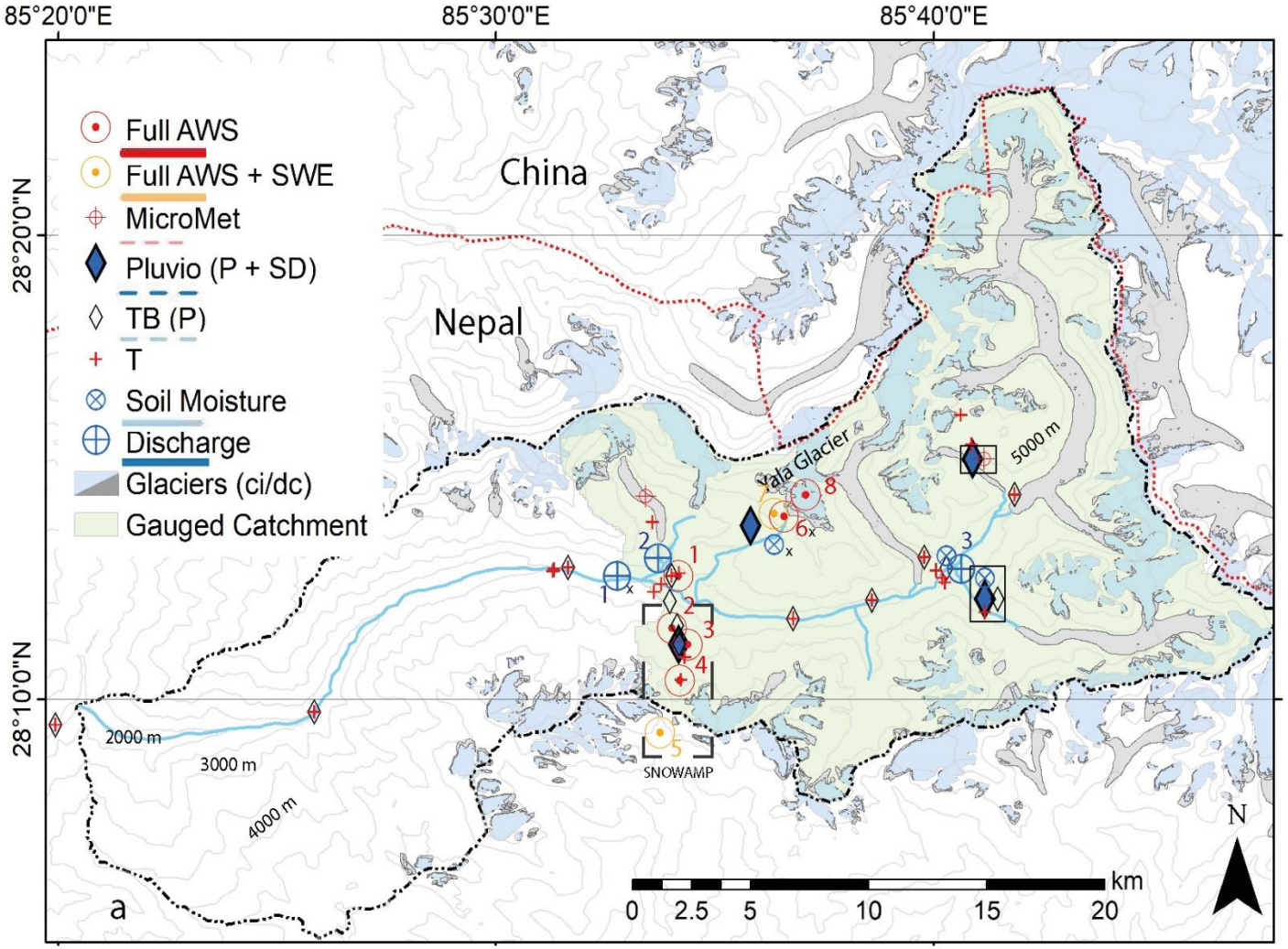
Jakob Steiner



Gurung et al. (in prep.)

Langtang catchment

- fieldwork November 2023 (general station maintenance)
- fieldwork 2024 (likely only again by autumn)
- unclear financing beyond 2024 (as multiple projects end; proposals in review)



Steiner et al. 2021 (HydProc)

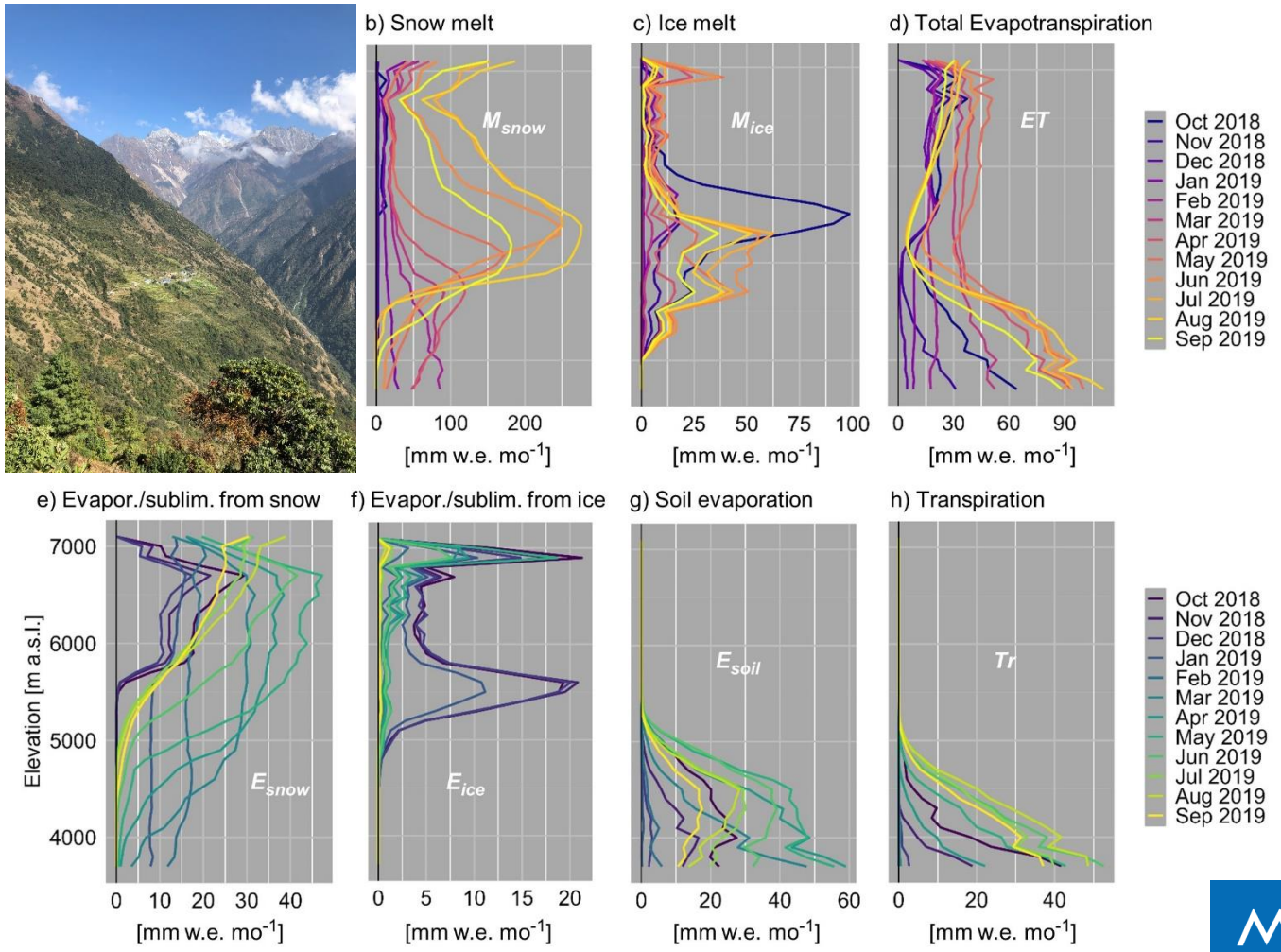
New avenues into subsurface storage and ecohydrology

- suspicion that we underestimate subsurface storage and transport as well as evapotranspiration

- new focus on soil moisture monitoring in combination with snow cover/permafrost change analysis

- first modelling on catchment scale ET at elevation

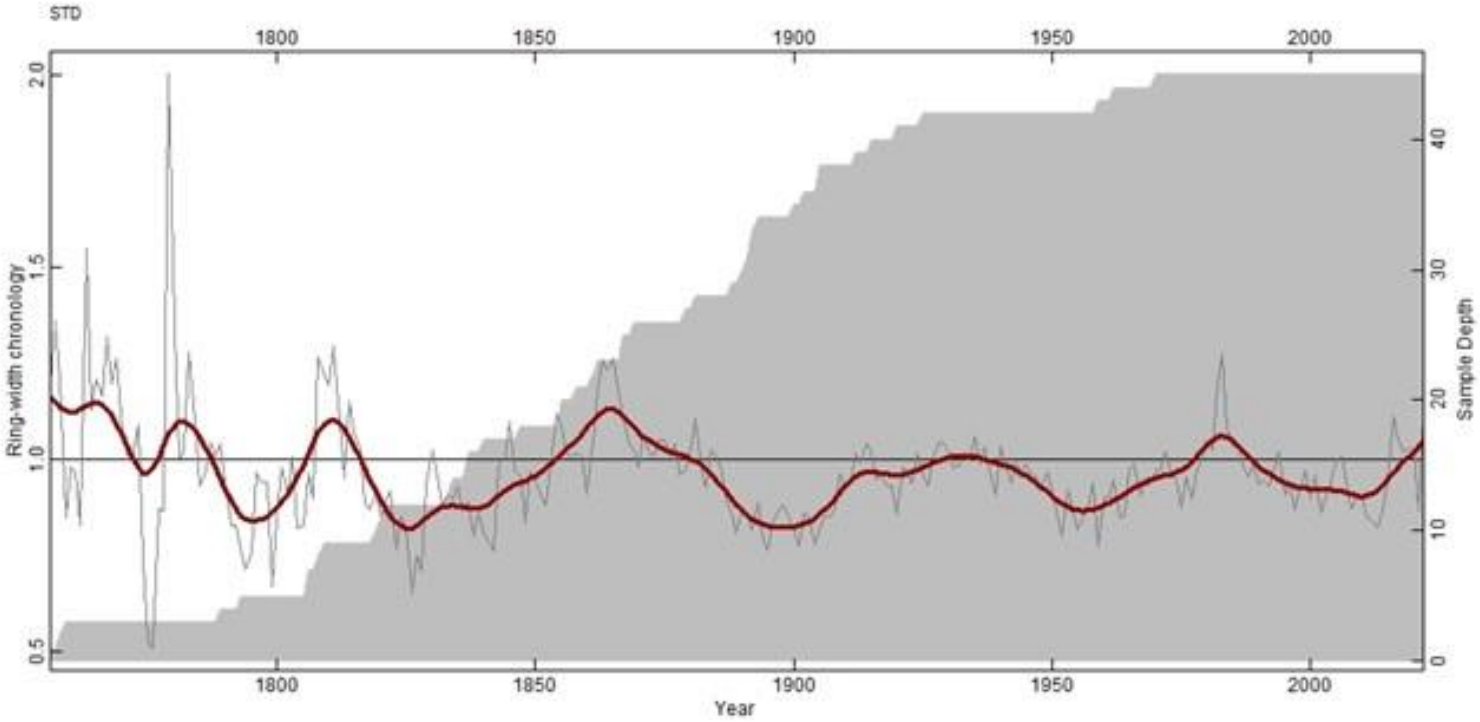
Buri et al. 2023 (in press in WRR)



Tree ring coring

- potential window into the past

- potential window into more interdisciplinarity (ecology – hydrology – climate science)



Mustang catchment

- fieldwork currently ongoing to install two new AWS with SWE monitoring

- mass balance and thermistor installation planned

- future financing in discussion, unclear scale as of now (likely focus on sediment dynamics and precipitation sources)

Brewster Glacier, New Zealand

(Nicolas Cullen and Todd Redpath (U. Otago), and Jono Conway (NIWA)

- Active met stations at both lake and glacier locations
- Glacier mass balance and snow pits
- Abrahim, B. N., Cullen, N. J., & Conway, J. P. (2022). A decade of surface meteorology and radiation exchanges at Brewster Glacier in the Southern Alps of New Zealand. International Journal of Climatology, 4(2), 1612-1631. doi: 10.1002/joc.7323
- Data available on request: nicolas.cullen@otago.ac.nz
- Abrahim, B. N., Cullen, N. J., Conway, J. P., & Sirguey, P. (2023). Applying a distributed mass-balance model to identify uncertainties in glaciological mass balance on Brewster Glacier, New Zealand. Journal of Glaciology, 69(276), 1030-1046. doi: 10.1017/jog.2022.123
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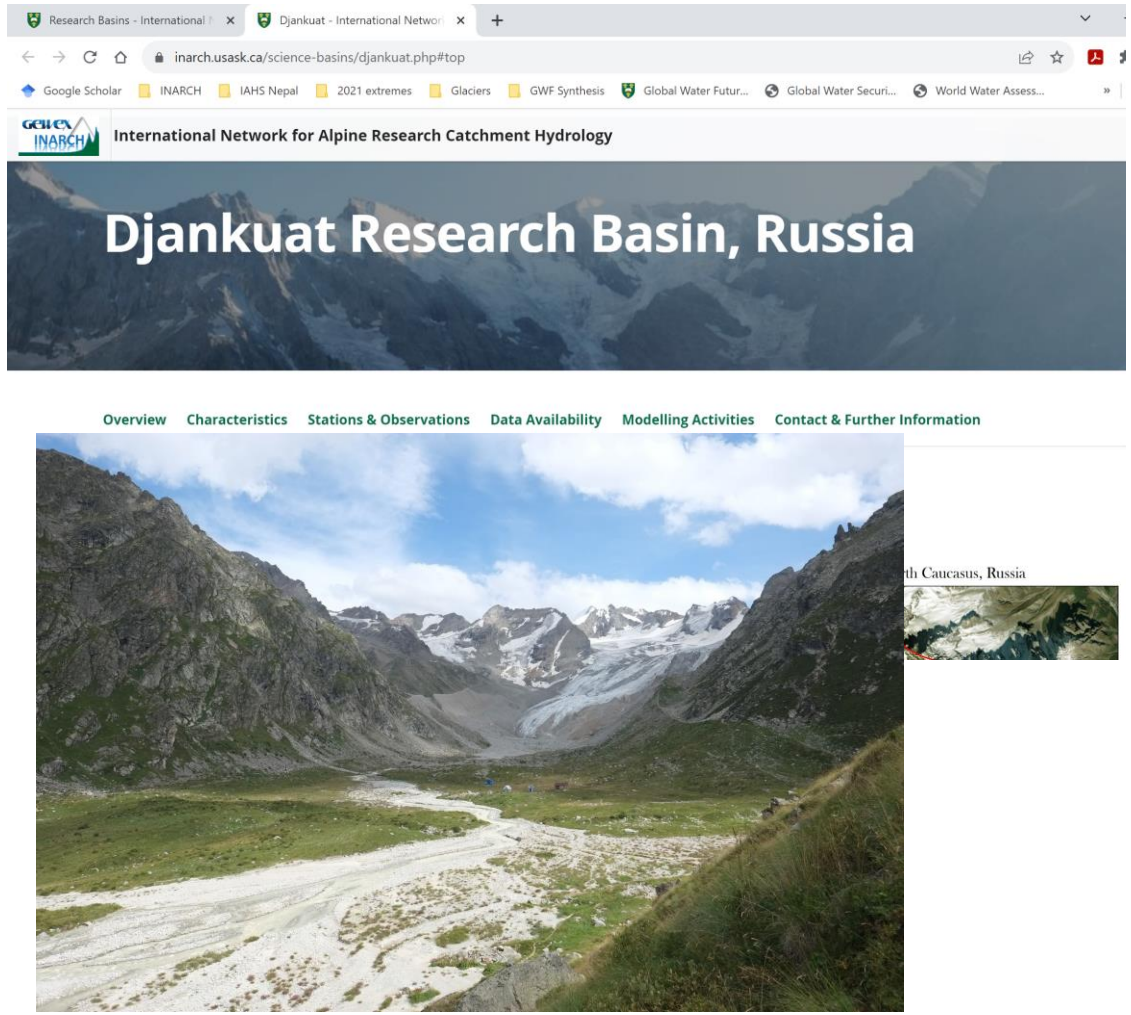
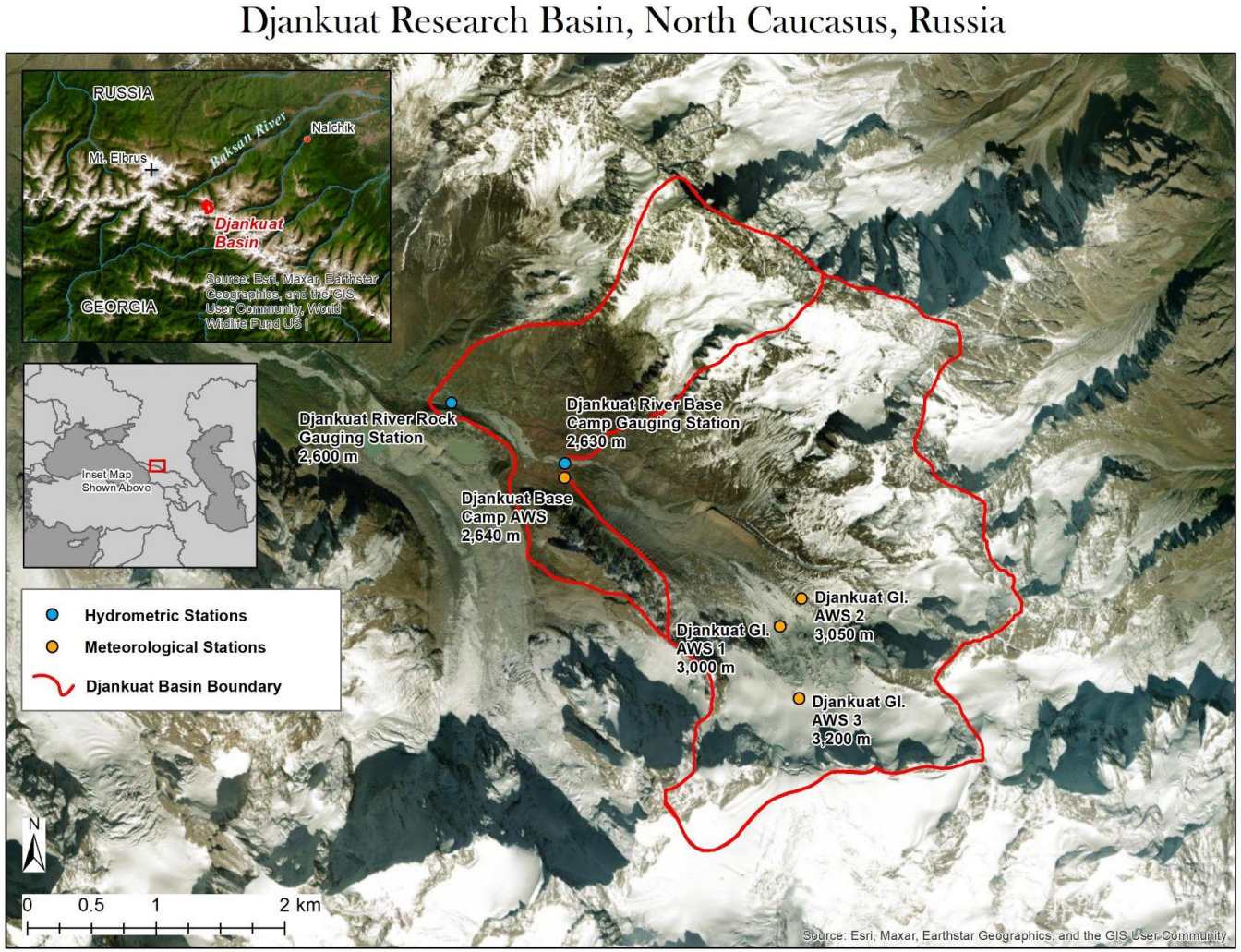
Djankuat Research Basin, Russia
(Ekaterina Rets, Polish Academy of Sciences)





A few comments from Tobias Jonas

- Good news (I would hope) is that we have decided to assemble an ESSD paper on data for Dischma (special INARCH issue, which I believe is still open) with
  - Runoff data from the Dischma catchment
  - NWP data downscaled to at least 100m res. needed to drive snow models (at snowdrift permitting scales)
  - Validation data (available ALS flights, snow station data, and so on)
- This will hopefully motivate others to work on Dischma, and collaborate with us in the context of COPE

Next steps

- We have inventories/updates of activities at basins, measurements, drones & sensors, and models
- We now need to begin to assemble the data
  - Need to consider intended use of the data
    - For statistical analysis of the measurements, then need measurements from the observing stations with only a very basic QA/QC to remove erroneous values. Gaps are left intact as missing data.
    - For running a hydrological model forced by the observations, need gap filled datasets and how the gaps are filled is very important.
  - For models we will want U, Udir, T, RH, P, Kin, and Lin as observed variables.
  - Ideally, we will want both gap filled and original observational datasets for INARCH.
  - Also, we will want diagnostic variables such as streamflow, soil moisture, snow depth & density (SWE), icemelt, surface temperature, and longwave out for model testing and for further description of the hydrometeorology, where this is available.

Next steps

- Model comparisons on basins – not necessarily formal intercomparisons of SWE as has been done in the past, but comparing the results of diagnostic modelling to better understand why models produce various behaviours and to see if models benchmark various known aspects and regimes of the coupled atmospheric-cryospheric-hydrological system