Update on GLIMS and RGI

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Glaciers are changing

- Increasing size and number of glacial lakes
- Hazard potential from glaciers is increasing
- Changing morphology may be changing the relative importance of ablation processes (glacial lakes, ice cliffs, etc.)

→ Glaciers, and glacial features such as changing lakes, should be monitored closely.

Global Terrestrial Network for Glaciers (GTN-G)

Steering Committee

Advisory Board

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Global Land Ice Measurements from Space

World Glacier Monitoring Service

US National Snow and Ice Data Center

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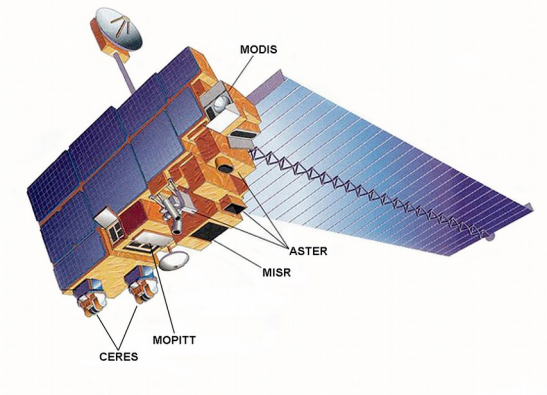
Summary of global glacier databases

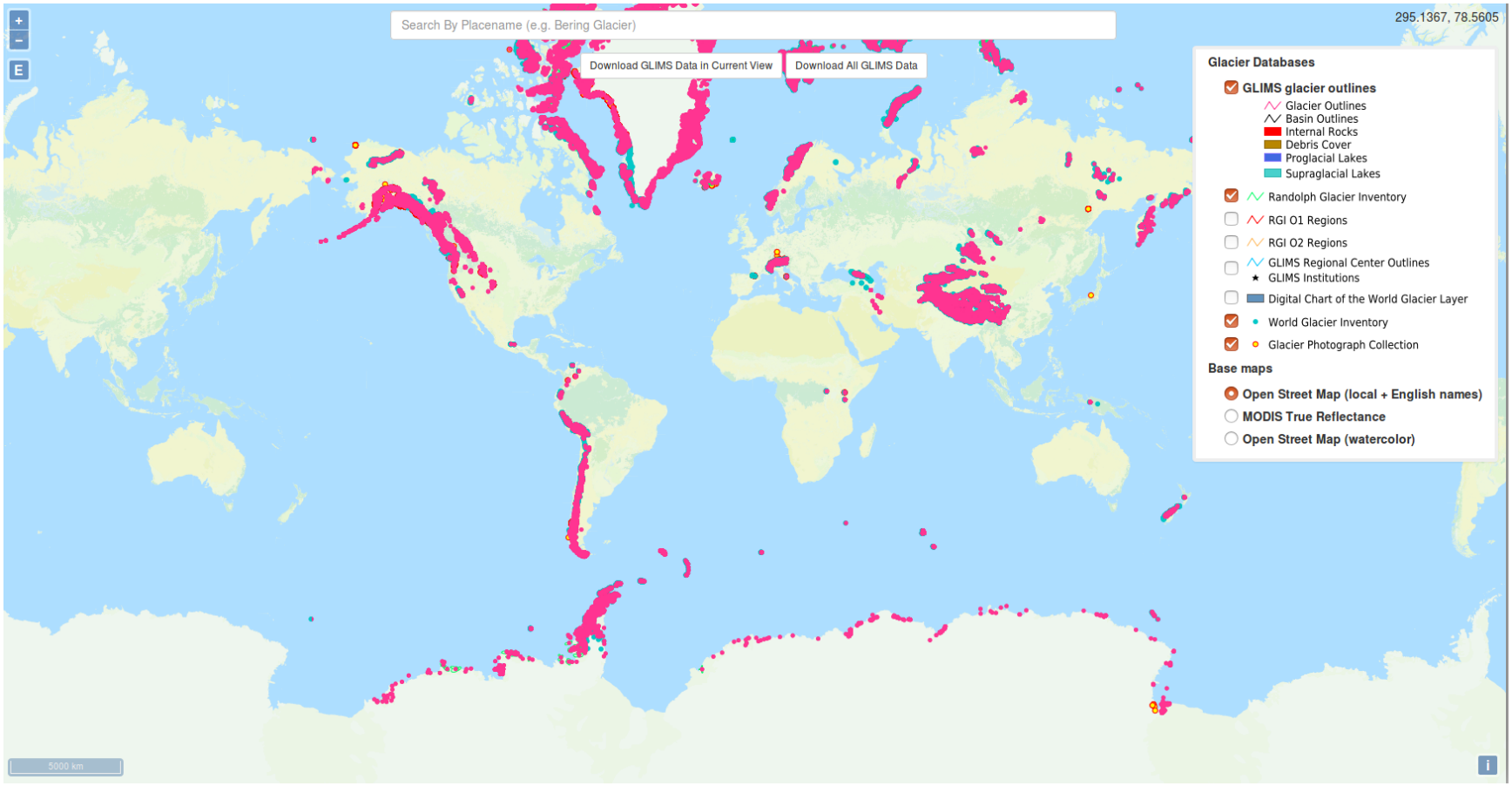
- World Glacier Inventory (WGI): point locations and attributes
- Global Land Ice Measurements from Space Glacier Database (GLIMS): multi-temporal outlines, attributes, provenance
- Randolph Glacier Inventory (RGI): outlines, attributes
- Fluctuations of Glaciers (FoG): time series of mass balance
- Glacier Photograph Collection (GPC): photographs mostly from land and air; some repeat-photography

GLIMS and RGI Timeline

- 1994--1999: "GLIMS" created to map glaciers using ASTER data (Hugh Kieffer, Science Team Member)
- 2005: GLIMS database and website go live
- 2012: Tad Pfeffer initiated the creation of the RGI for IPCC AR4 sea level modeling
- 2013: Path to merging RGI with GLIMS formulated
- 2014-2016: NASA funds NSIDC for GLIMS/RGI merge and infrastructure updates
- 2016-? NASA funds NSIDC for GLIMS and HMA data curation
- Late 2016: GLIMS Gaps completely filled using RGI 5.0



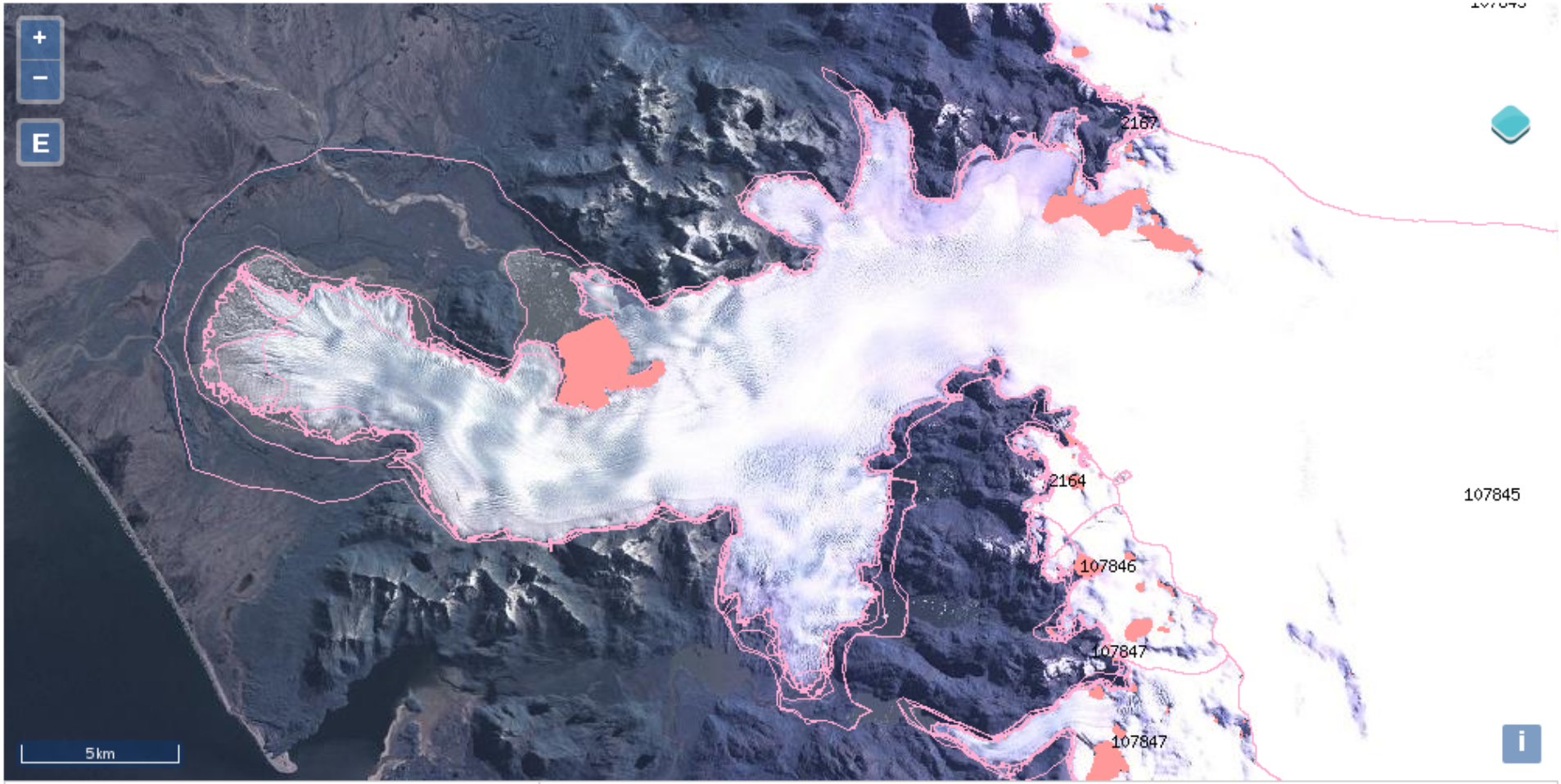
Map of database contents



GLIMS Characteristics

- Globally complete (mostly) set of glacier outlines
- Multi-temporal (more than one outline per glacier from different times)
- Outlines for glaciers, internal rock outcrops, snow lines, centerlines, glacial lakes
- Includes hypsometry for many, but not all, glaciers
- Includes literature references for many glaciers

GLIMS is multi-temporal

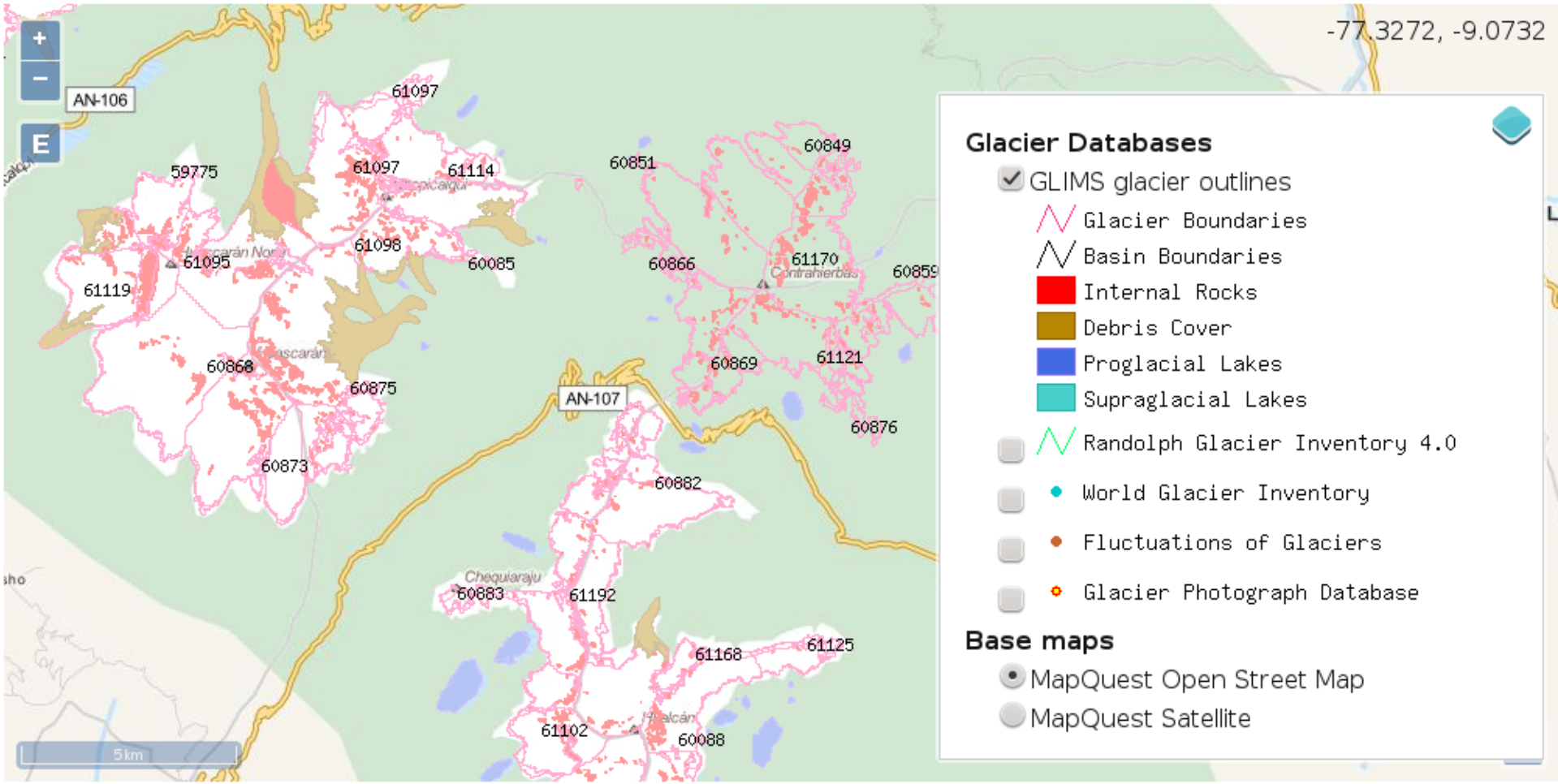


GLIMS Glacier Outlines

Download Selected Glacier Outlines

Glacier Name	Glacier ID	Line Type	Acquisition Date	Analysis ID	RC Institution	Date Available	More Info
San Quintin	G286485E46923S	glac_bound	2001-03-11 00:00:00	2160	Universidad de Chile	2005-12-20 19:43:58	More...
San Quintin	G286485E46923S	glac_bound	2007-09-06 00:00:00	101165	Aberystwyth University	2012-08-24 08:41:13	More...
San Quintin	G286485E46923S	glac_bound	2001-08-04 00:00:00	101828	Aberystwyth University	2012-08-24 09:46:10	More...
San Quintin	G286485E46923S	glac_bound	1974-06-30 00:00:00	102323	Aberystwyth University	2012-08-24 09:56:48	More...
San Quintin	G286485E46923S	glac_bound	1870-01-01 00:00:00	102456	Aberystwyth University	2012-08-24 10:15:37	More...
San Quintin	G286485E46923S	glac_bound	1986-01-14 00:00:00	107845	Aberystwyth University	2012-08-24 08:36:48	More...

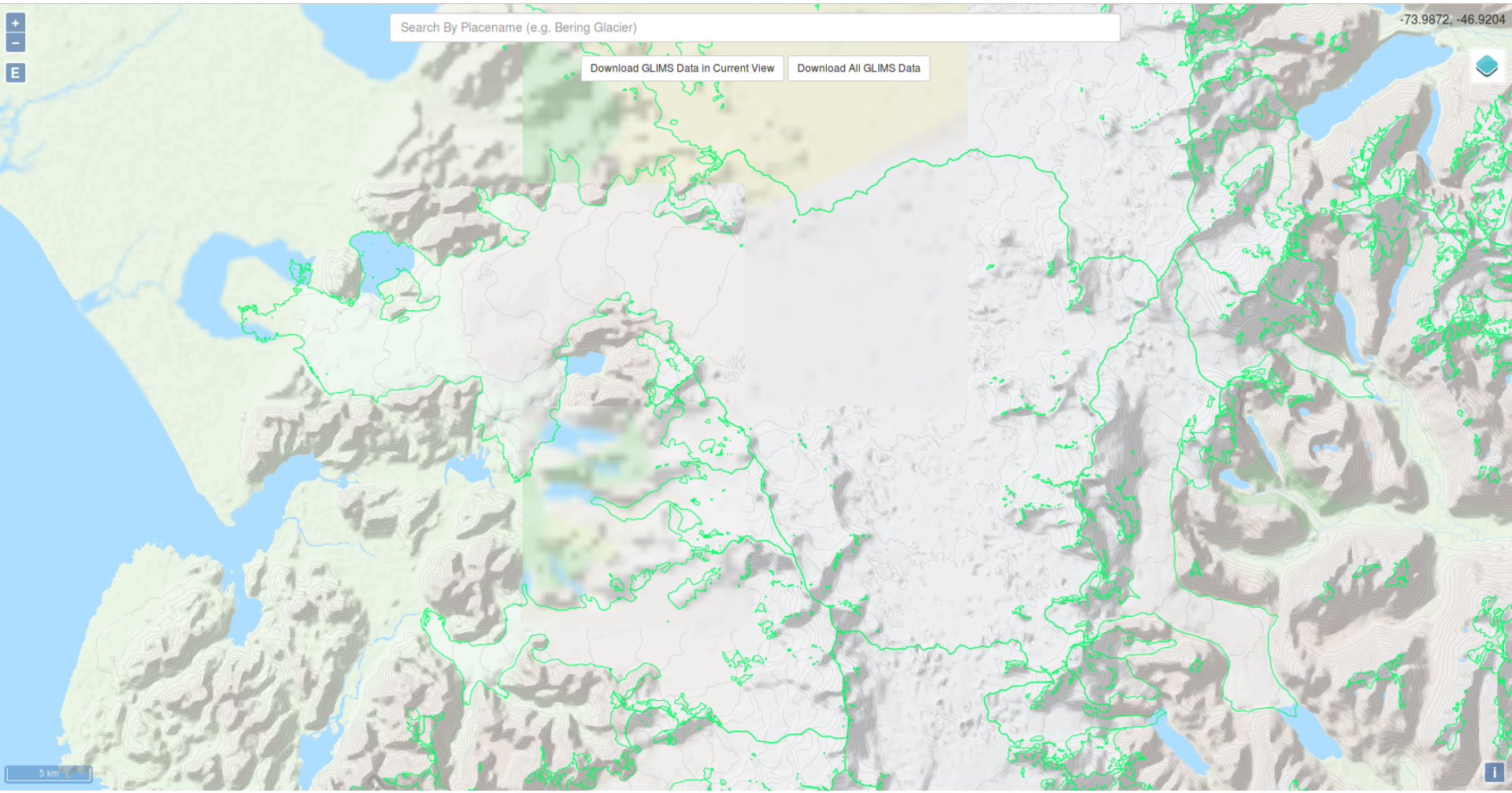
GLIMS contains rich data



RGI Characteristics

- Globally complete (mostly)
- Snapshot in time
- Single outline and attributes per glacier
- Includes hypsometry for all glaciers
- Source not always precisely known
- Current version is RGI 5.0
- RGI 6.0 is due out soon.
  - Has improved coverage of the conterminous US, Scandinavia and Iran.
  - Most glaciers will have exact dates.
  - The flag attributes RGIFlag and GlacType were reorganized.
  - Surging codes have been added from Sevestre and Benn (2015)

RGI is a snapshot (one outline per glacier)



Use cases for GLIMS

- Examining changes in glacier extent
- Needing to know the precise origin of outlines
- Wanting a global view with mostly similar quality
- ~~Wanting hypsometry for every glacier~~ (planned for future)
- ~~Wanting nunataks represented by holes~~ (choice planned for future)

Use cases for RGI

- ~~Examining changes in glacier extent~~
- ~~Needing to know the precise origin of outlines~~ (RGI <= 5.0)
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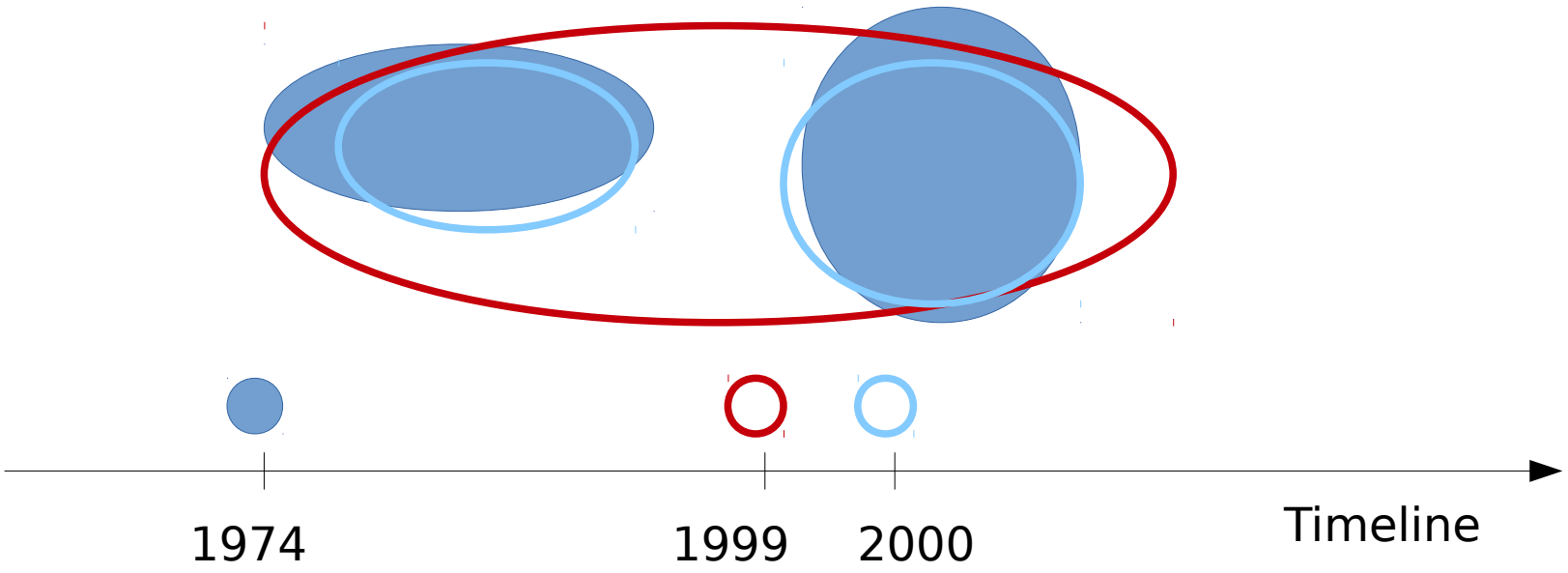
Handling multi-temporal data

Want to be able to:

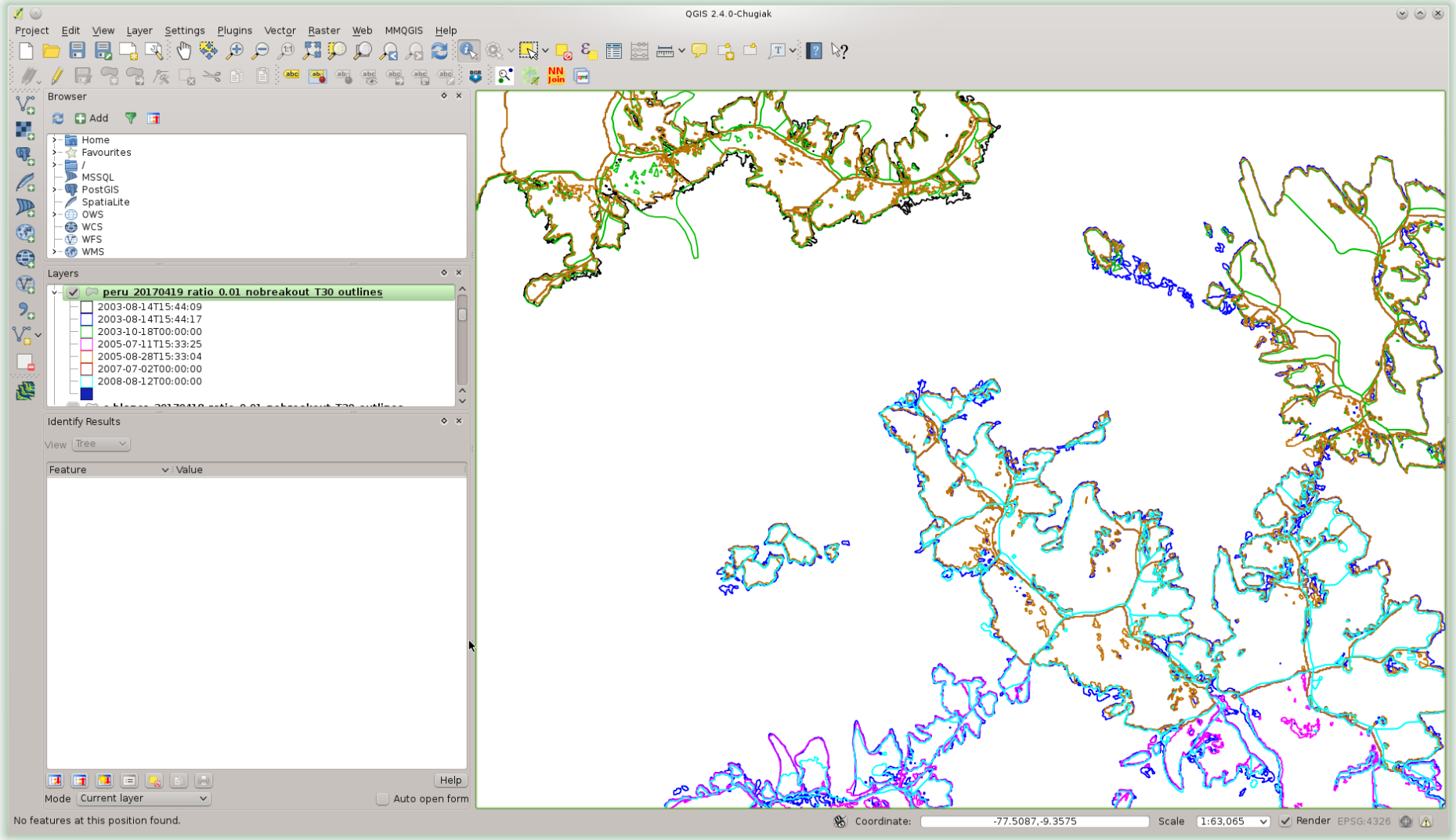
- Get map of world's glaciers at time T.
- Must avoid double-counting of area, glacier number for any representative map

New Data Model

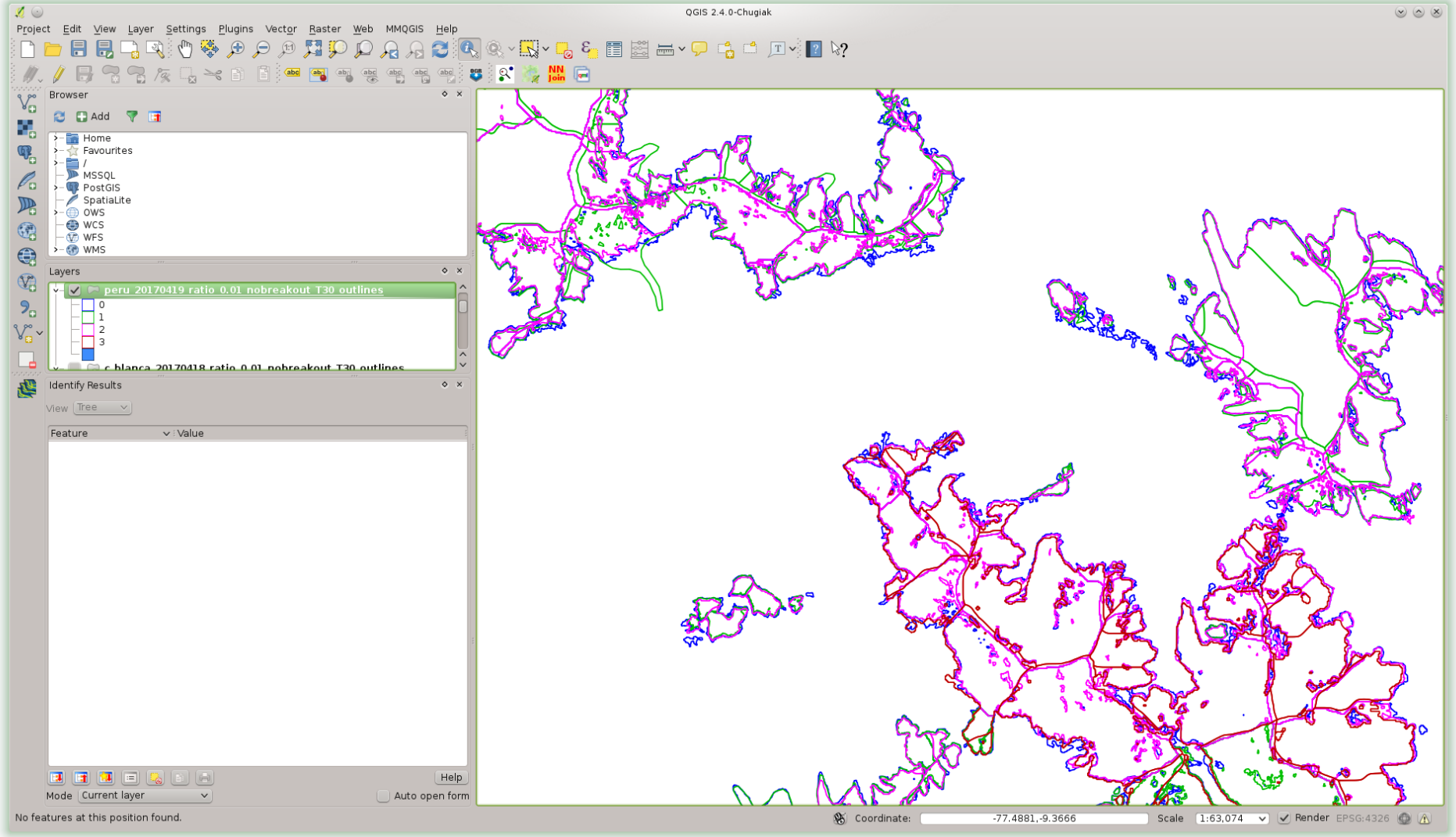
- Outlines covering same body of ice a grouped
- Outlines within a group are separated into layers, each representing the state of the ice extent at different time



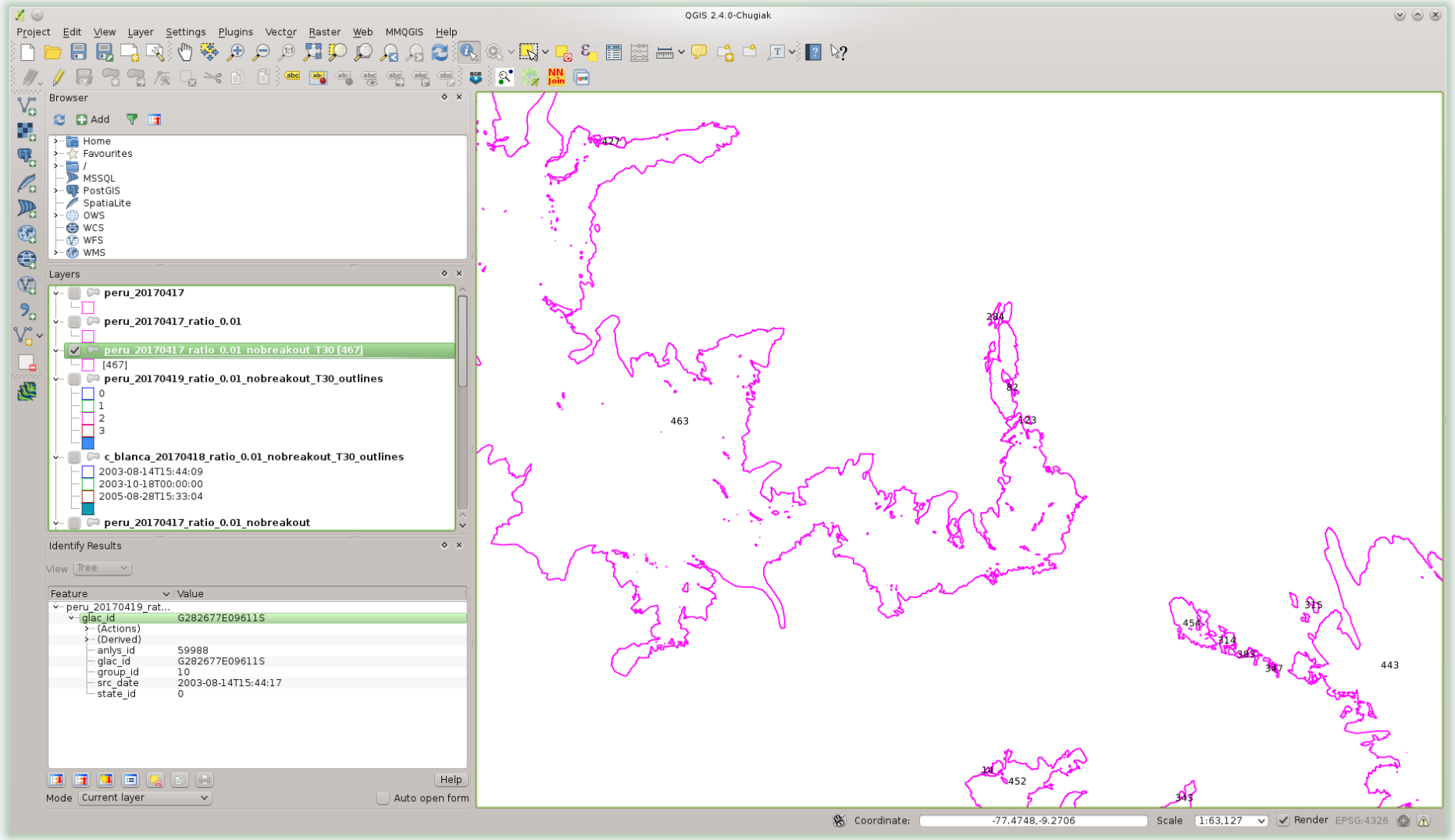
Test case: Glacier outlines in Peru, colored by source date



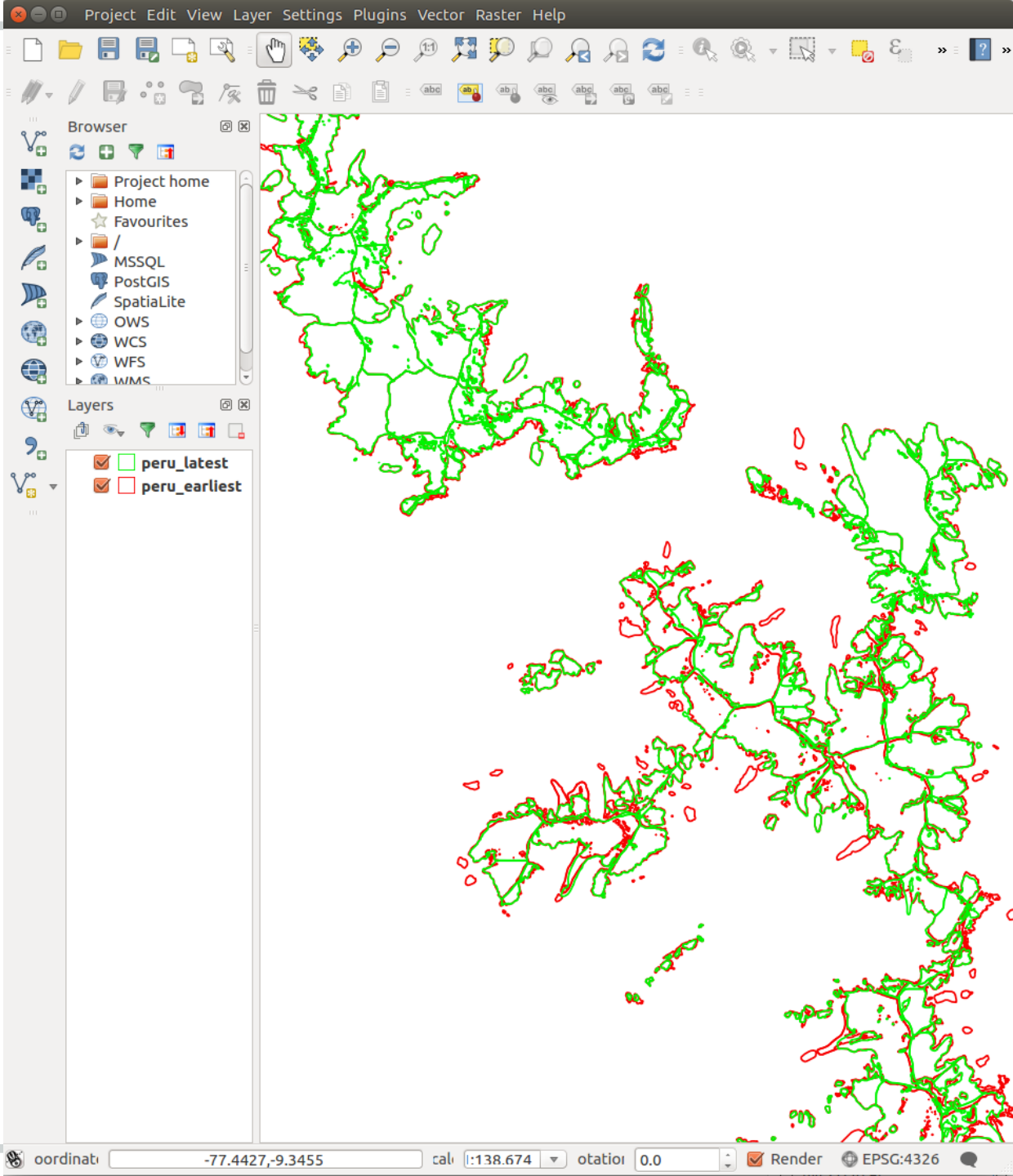
Test case: Glacier outlines in Peru, colored by state ID



Glacier Groups



Latest and Earliest maps of area



Expanded monitoring (future tasks)

- Add mapping of glacial lakes to workflow (to better understand lakes' role in ablation, hazards)
- Systematically map snow lines
- Systematically extract topographic parameters such as centerlines, elevation statistics, area-elevation distributions (hypsometry)
- Systematically map debris cover and glacier velocity fields
- The GLIMS Glacier Database can already accommodate all these data types

Summary

- Global Terrestrial Network for Glaciers (GTN-G: NSIDC, WGMS, GLIMS) hosts six glaciers databases
- RGI 5.0 has been merged into GLIMS, making GLIMS globally complete
- GLIMS is multi-temporal. Good for (global) studies of glacier change
- RGI is a snapshot map of glaciers, good for consistent global view at one time
- Nearing completion on implementing new data model for better handling of multi-temporal data
- Working on lots of ideas for improving GLIMS

http://www.glims.org


GLIMS Workshop 11-13 August, 2017
Boulder, Colorado
(just before IGS Symposium)

Thank you

And from the greater GLIMS/GTN-G/CHARIS community:

धन्यवाद, Спасибо, ありがとう , Tak, Takk, Gracias, Merci, Danke, متشكرم, Þakka þér, Terima kasih, Grazie, Рақмет сізге, сипос, rahmat, 谢谢