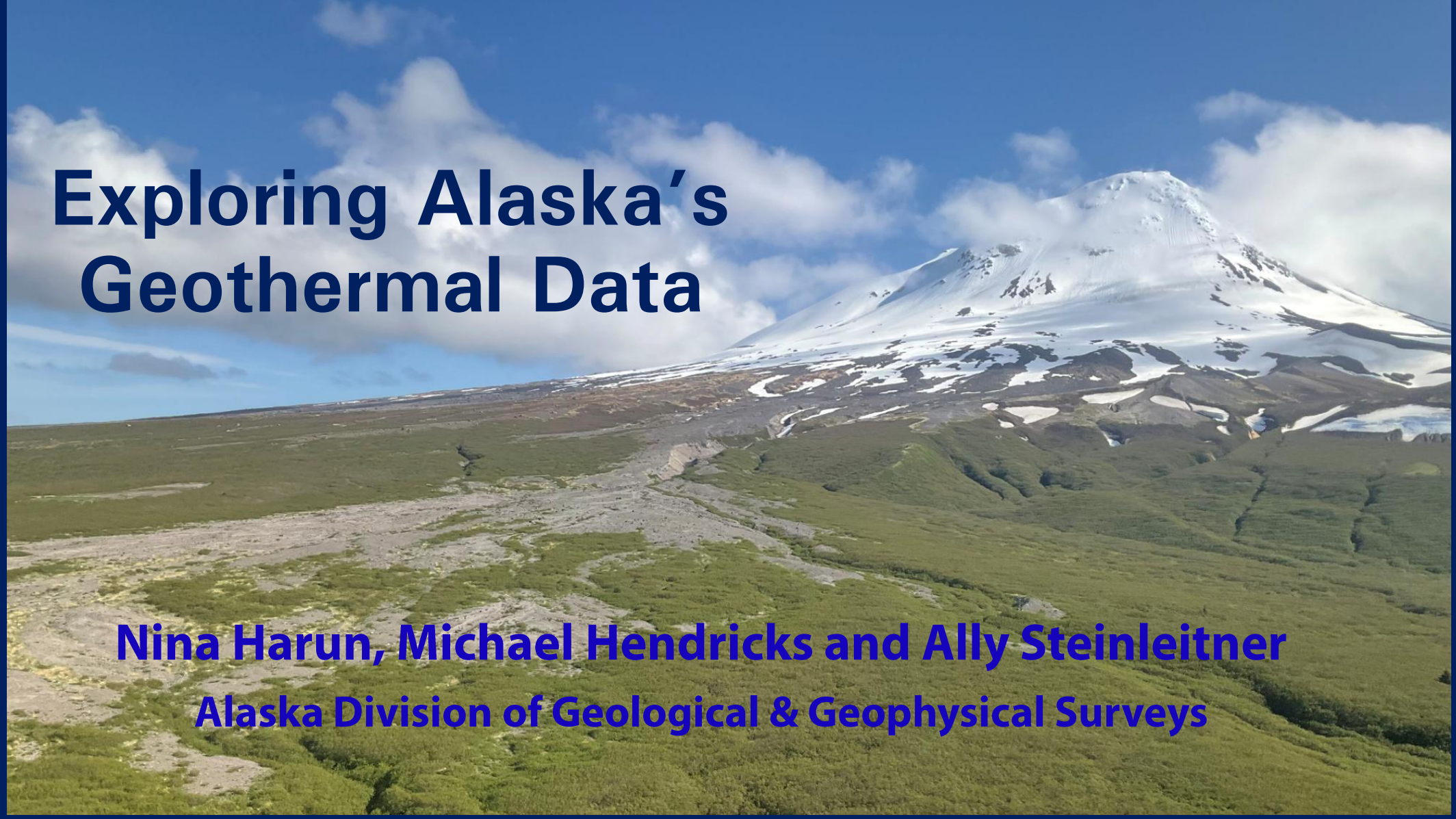
Exploring Alaska's Geothermal Data



Nina Harun, Michael Hendricks and Ally Steinleitner

Alaska Division of Geological & Geophysical Surveys

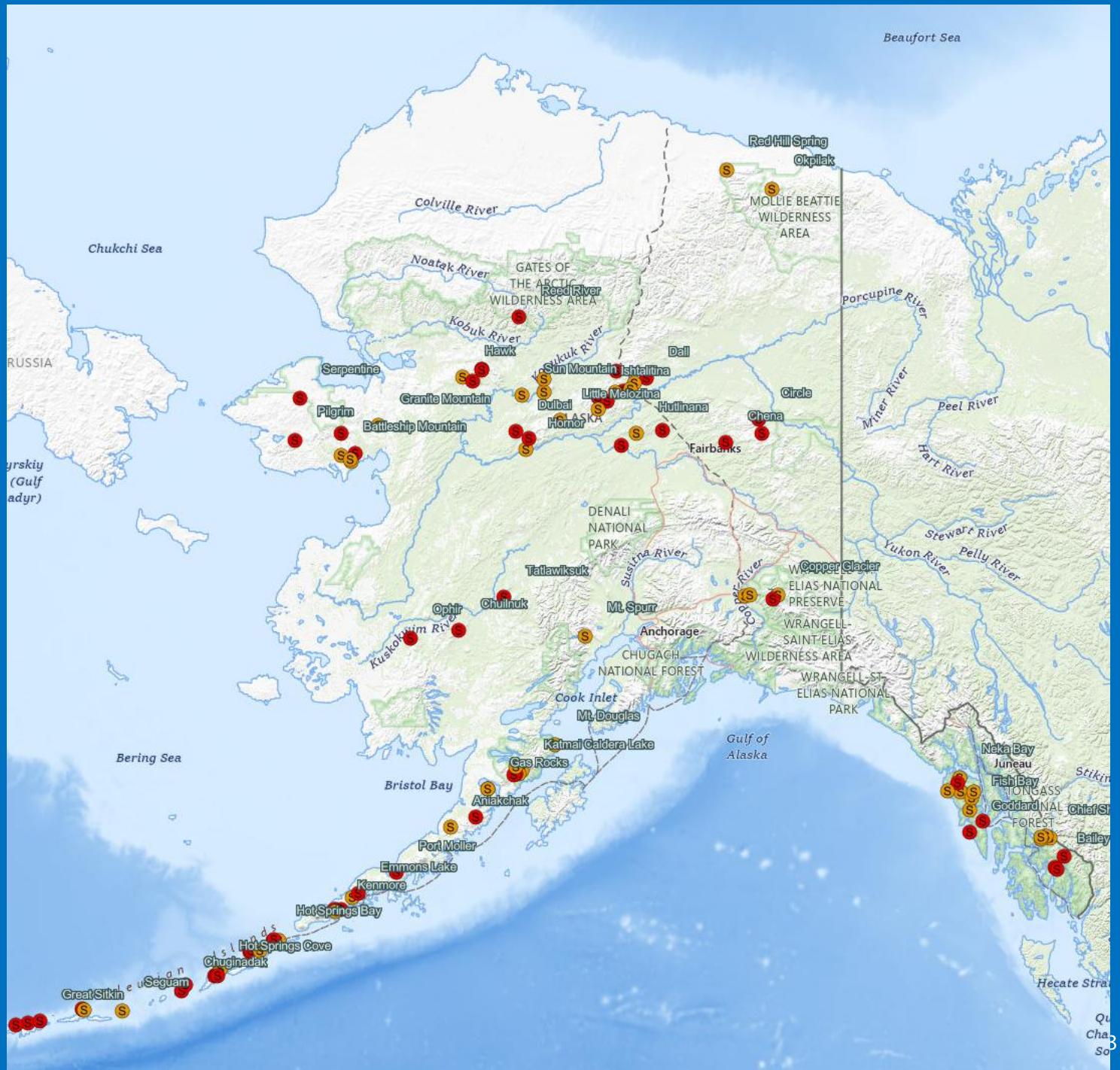
State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys

Alaska is LARGE

Alaska's Geothermal Resources are ABUNDANT and DIVERSE

ALASKA GEOTHERMAL 96 SPRINGS AND FUMAROLES

1. Central interior hot springs
2. Aleutian hot springs and fumaroles
3. Southeast Alaska hot springs



Alaska Geothermal Data Timeline

1917 Waring, Mineral Springs of Alaska, USGS

1979-1992 **DGGS Geothermal Program and UAF GI conduct detailed geothermal studies through Alaska including**:
-Aleutians Makushin, Akutan, Mt. Spurr
-Central Alaska geothermal belt
-Pilgrim hot springs
-Southcentral Alaska
MP8 Geothermal Resources of Alaska

2006 **Chena Hot Springs begins generating electricity**

2009-2011 -Ormat explores and drills Mt. Spurr, -------
Akutan Hot Springs Valley exploration and drilling
-Pilgrim exploration and drilling

2010-2014 **DGGS delivers geothermal data to the National Geothermal Data System**

2016 DGGS creates Geothermal Sites of Alaska web app (hot springs data)

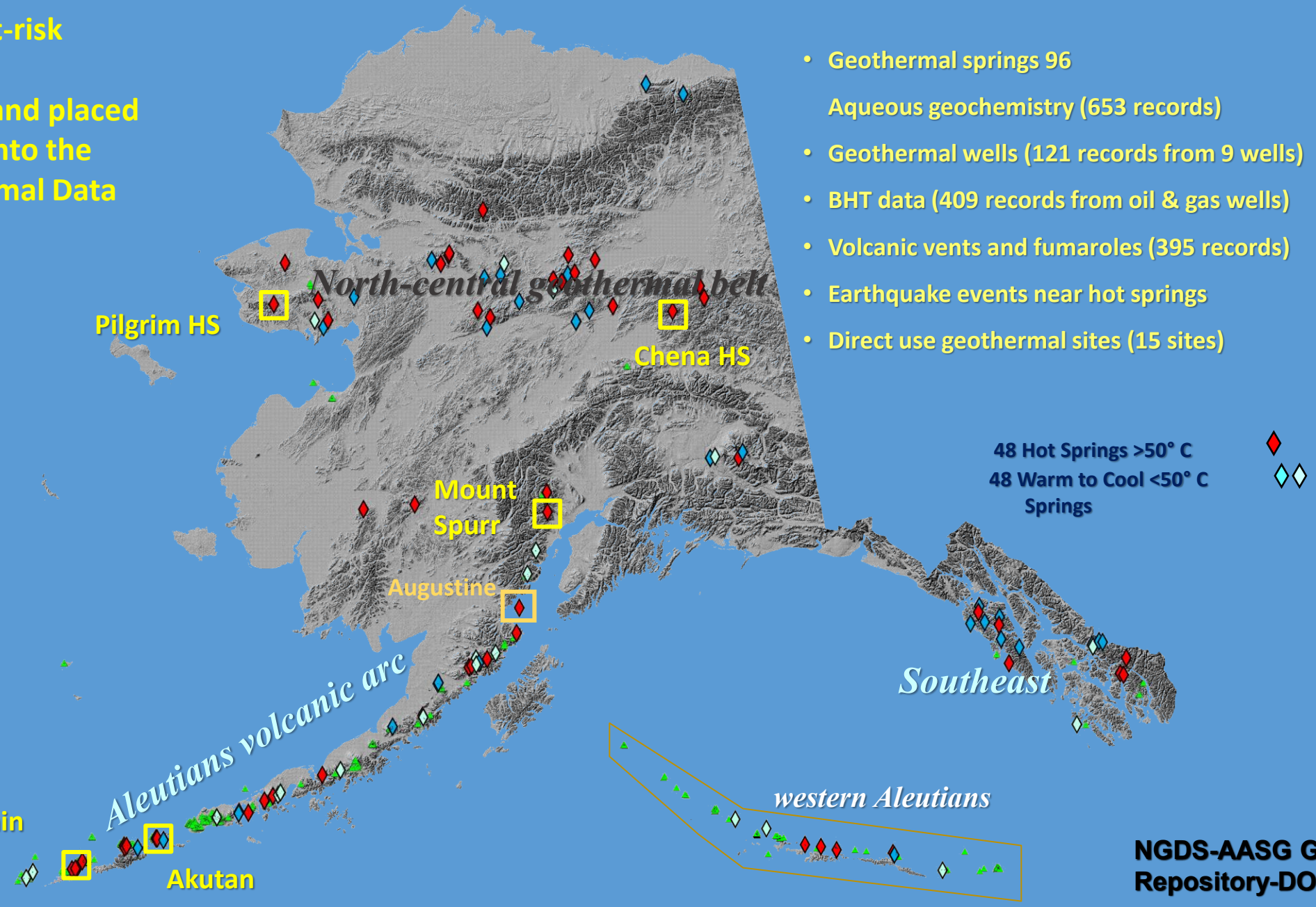
2025 **Augustine lease sale/** DGGS Geothermal Resources Web app

2024–2026 **DGGS geothermal program re-established becomes operational Alaska Geothermal Hub**


Courtesy of Tom DeLong

Alaska Geothermal Database

DGGS compiled at-risk legacy and new exploration data and placed this information into the National Geothermal Data System.



- Geothermal springs 96
  Aqueous geochemistry (653 records)
- Geothermal wells (121 records from 9 wells)
- BHT data (409 records from oil & gas wells)
- Volcanic vents and fumaroles (395 records)
- Earthquake events near hot springs
- Direct use geothermal sites (15 sites)

NGDS-AASG Geothermal Repository-DOE

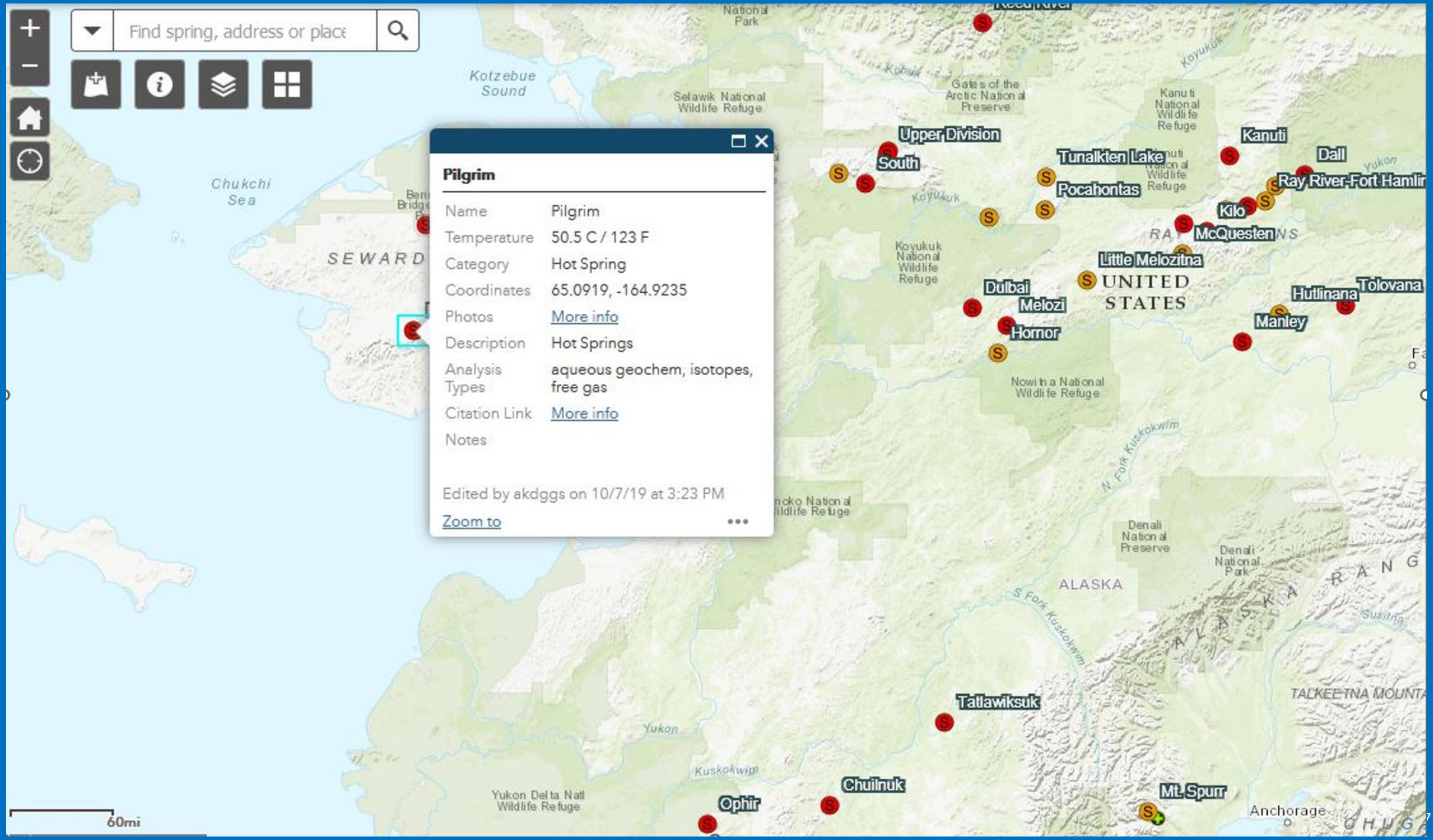
Geothermal Resources of Alaska

Currently Available Data Layers

- Geothermal Springs – temperature, flow rates, use, photos
- Geothermal Well locations
- Current Geothermal leases
- Volcanic vents (AVO)
- Quaternary faults

- Electric transmission lines
- Energy development regions
- Energy infrastructure

Hot Springs at Umnak by Jeff Freymueller (Alaska Volcano Observatory, UAF-Geophysical Institute)


Find spring, address or place
Pilgrim
Name Pilgrim
Temperature 50.5 C / 123 F
Category Hot Spring
Coordinates 65.0919, -164.9235
Photos More info
Description Hot Springs
Analysis Types aqueous geochem, isotopes, free gas
Citation Link More info
Notes
Edited by akdggs on 10/7/19 at 3:23 PM
Zoom to
Kotzebue Sound
Selawik National Wildlife Refuge
Gates of the Arctic National Preserve
Kanuti National Wildlife Refuge
Chukchi Sea
SEWARD
Koyukuk National Wildlife Refuge
Upper Division
South
Tunalkten Lake
Pocahontas
Kanuti
Dall
Ray River-Fort Hamlin
Kilo
McQuesten
Little Melozitna
Dulbai
Melozi
Hornor
UNITED STATES
Hutlinana
Tolovana
Manley
Nowitna National Wildlife Refuge
N. Fork Kuskokwim
Denali National Preserve
Denali National Park
ALASKA
S Fork Kuskokwim
Tatlawiksuk
Yukon
Kuskokwim
Yukon Delta Natl Wildlife Refuge
Chuilnuk
Ophir
Mt. Spurr
Anchorage
60mi

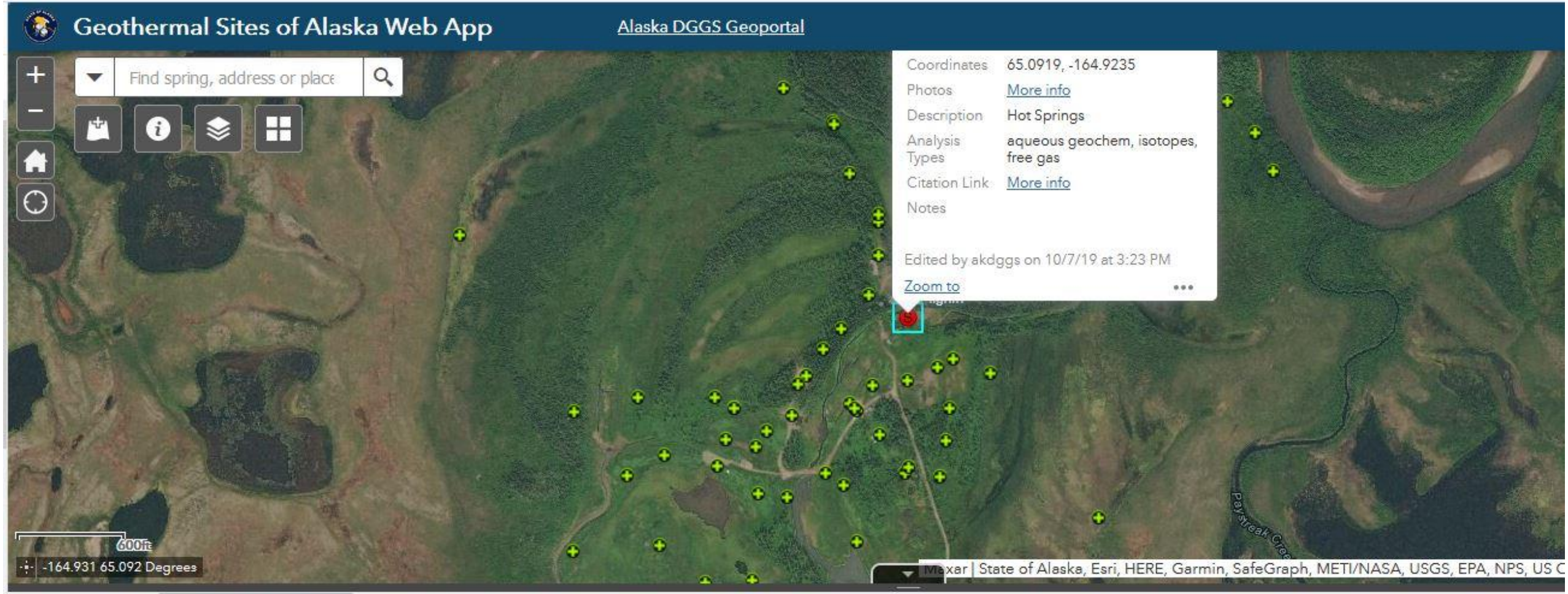
Title
Pilgrim Hot Springs

Credit
Chris Pike, ACEP

Description
Church and hot springs at Pilgrim Hot Springs Seward Peninsula AK, geothermal spring

Taken
9/23/2013

Tagged
hot springs, seward peninsula, geothermal spring, nc-30



Geothermal Springs | Geothermal Well Locations | Volcanoes, Historically Active

Options | Filter by map extent | Zoom to | Clear selection | Refresh

OBJECTID	Well Name	Field
57	PilgrimPS-2	Pilgrim Hot Springs
58	PilgrimPS-3	Pilgrim Hot Springs
59	PilgrimPS-4	Pilgrim Hot Springs
60	PilgrimPS-5	Pilgrim Hot Springs
61	PilgrimMI-2	Pilgrim Hot Springs

Geothermal Resources of Alaska

Additional Data Layers

Geochemisty

- -Aqueous
- -Gas
- -Rock
- -Powell and Cumming diagrams

Aqueous geochemisty

Copy water chemistry data into data field below. Use negative numbers to indicate detection limit. Data will be plotted at detection. Cut & paste or move data but do not delete lines or columns.

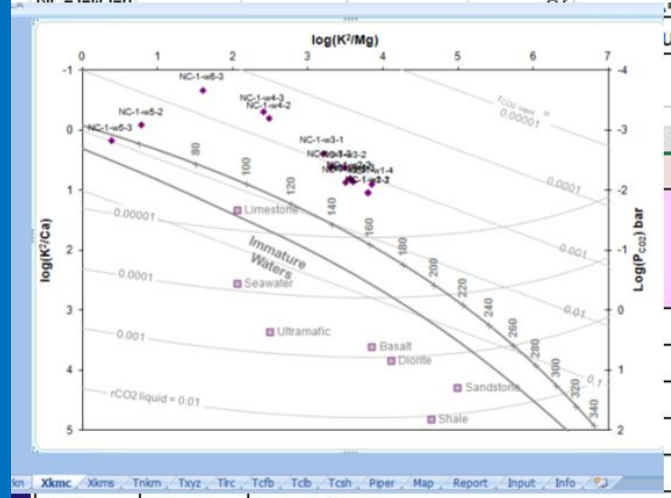
Ternary plot multiplier factors:

CFB Ternary	factor	CLB Ternary	factor	LRC Ternary	factor	CSH Tern	
Cl	1	Cl	1	Li	1	Cl	
F	25	Li	100	Rb	4	SO4	
B	25	B	25	Cs	10	HCO3	

mg/kg

Sample Label	UTM east	UTM north	Elevation	Temp C	Steam Fraction	pH	Li	Na	K	Ca	Mg	SiO2	B	Cl	F	SO4	HCO3	Material Class
NC-1-w6-1				22		9.7	0.1	16	0.5	5		21		4.7	0.2	9	37	Rock
NC-1-w6-2				31		8.3	0.2	29	1.5	23.3	0.6	20	0.07	66	0.2	10	32	Rock
NC-1-w1-2				90		6.4	3.9	1830	75	518	0.9	95	2.5	3590	4.8	16	16	Rock
NC-1-w1-3				98		7.5	4.7	1720	60	511	0.9	94	2.3	3420	4.4	19	30	Rock
NC-1-w1-4				82		7.1	4.3	1560	65	515	0.6	90	2.1	3460	5.3	7	20	Rock

ubareal, ranging from dense plag and cpx phyric crystal mush to sparsely p | 2010-01-01T00:00 | Core | Rock

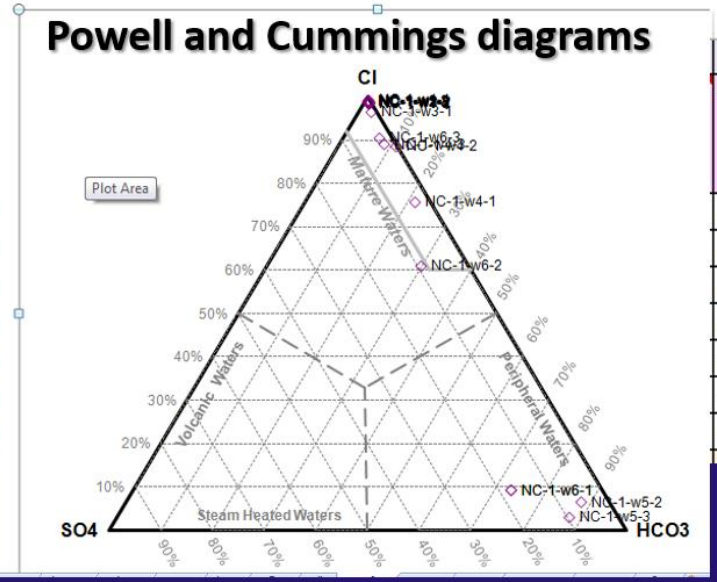


Pilgrim Hot Springs

OtherLocationName	LongDegree
Akutan Volcano | Akutan I	-165.875346
Akutan Volcano | Akutan I	-165.875346
Akutan Volcano | Akutan I	-165.875346
Akutan Volcano | Akutan I	-165.875346
Akutan Volcano | Akutan I	-165.875346
Akutan Volcano | Akutan I	-165.875346
Akutan Volcano | Akutan I	-165.875346

Rock	Basalt	basalt flows
Rock	Basalt	basalt flows and lithic basalt

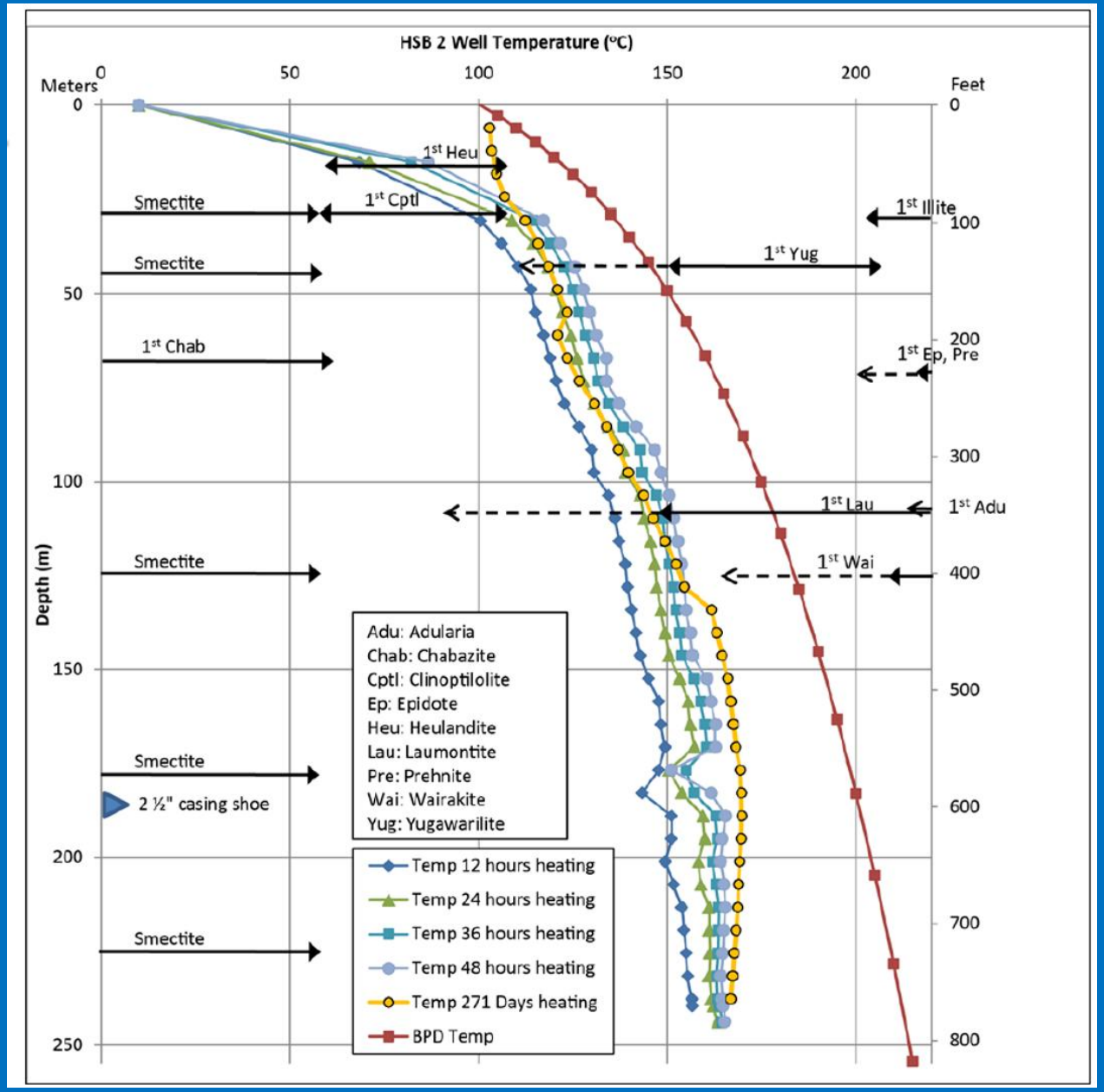
Powell and Cummings diagrams



Geothermal Resources of Alaska

Additional Data Layers

- Bottom Hole Temperature Wells (oil and gas)
- Bottom Hole Temperature (other wells)
- Geothermal Temperature Logs
- Core Descriptions
- Geologic maps



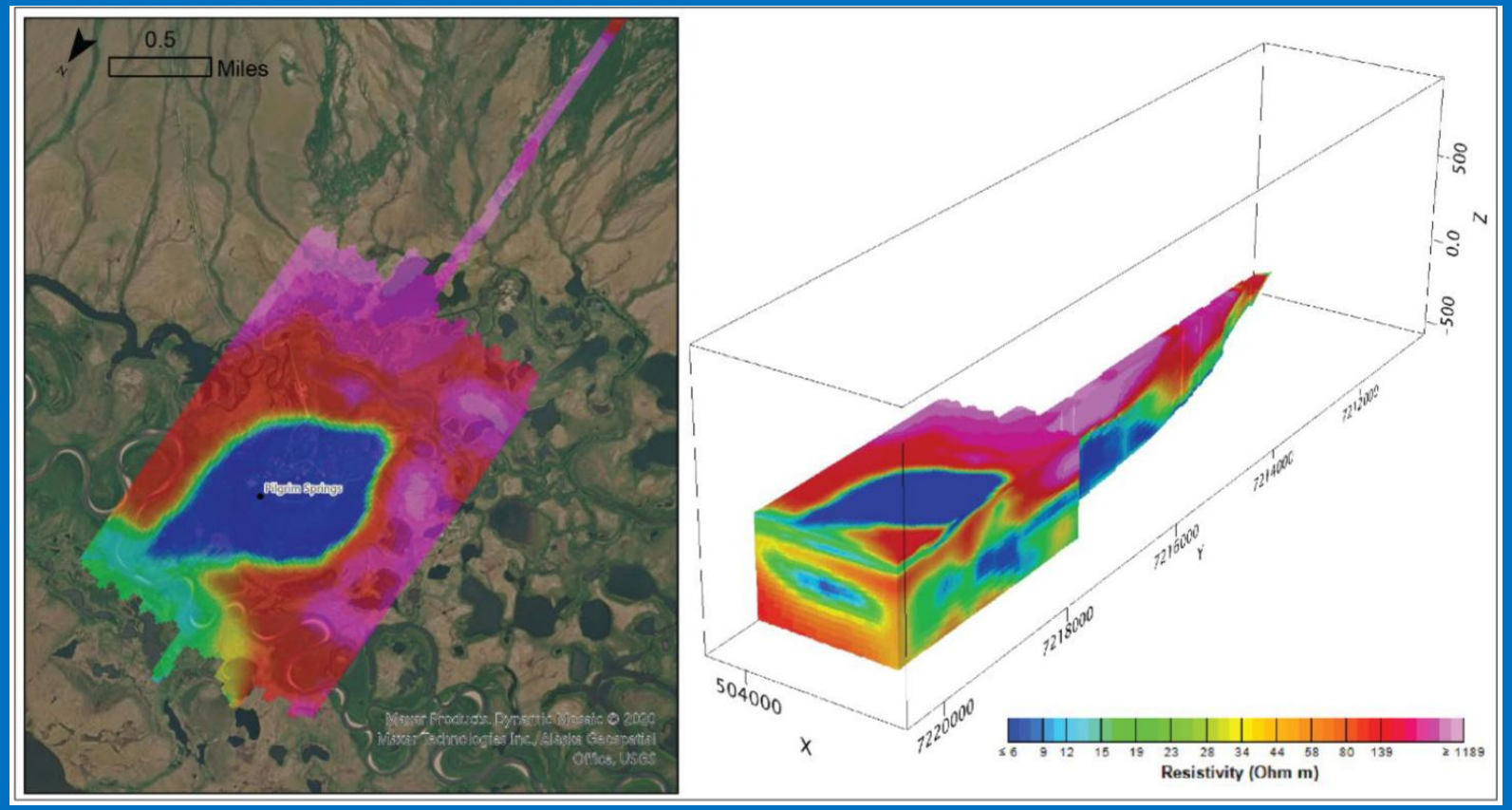
RECENTLY RELEASED GEOPHYSICAL DATA

PILGRIM HOT SPRINGS AIRBORNE ELECTROMAGNETIC SURVEY, SEWARD PENINSULA, ALASKA

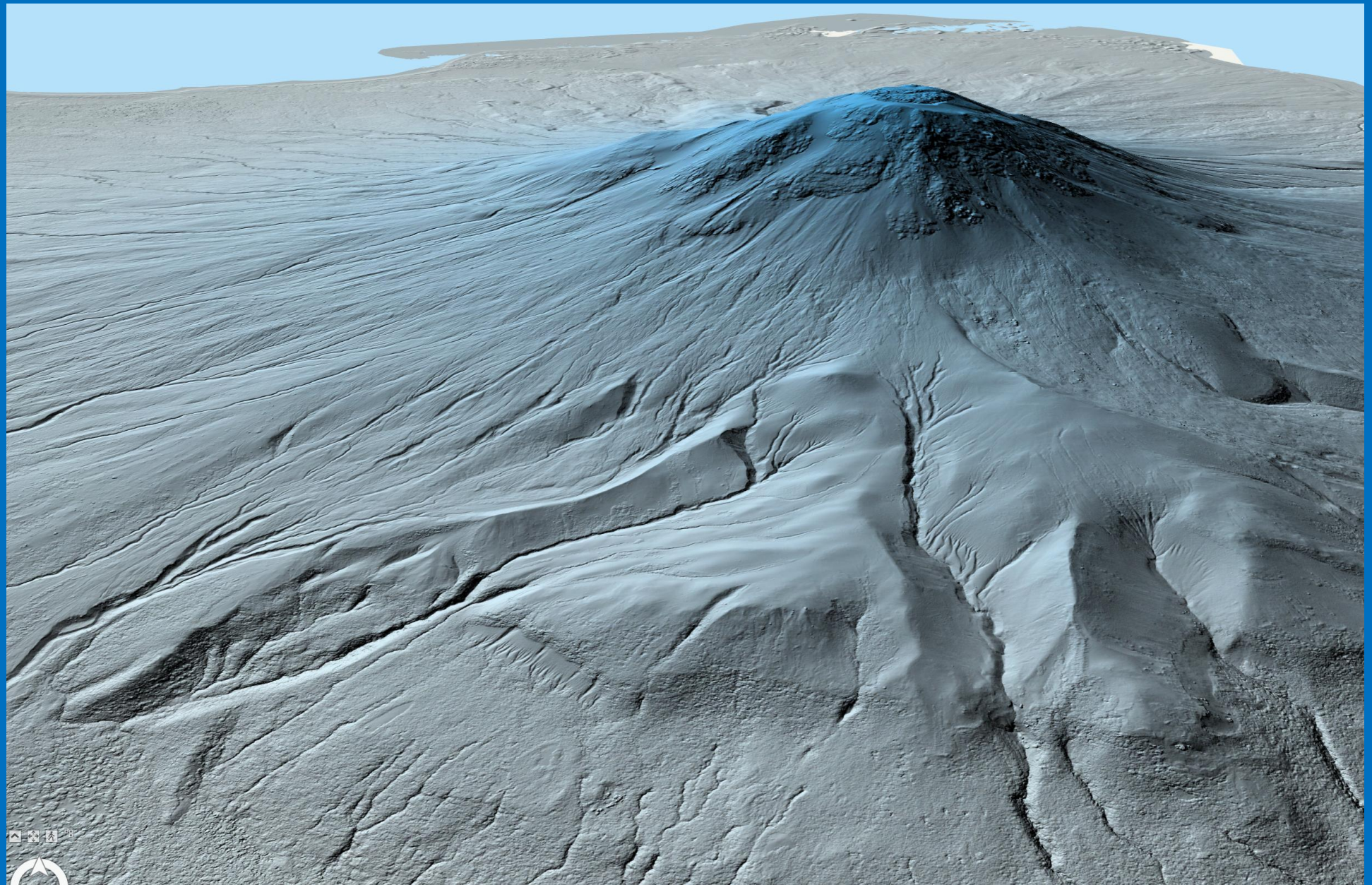
Eric I. Petersen, Logan A. Fusso, Abraham M. Emond, SkyTEM Canada Incorporated, Aqua Geo Frameworks LLC, and John C. Eichelberger

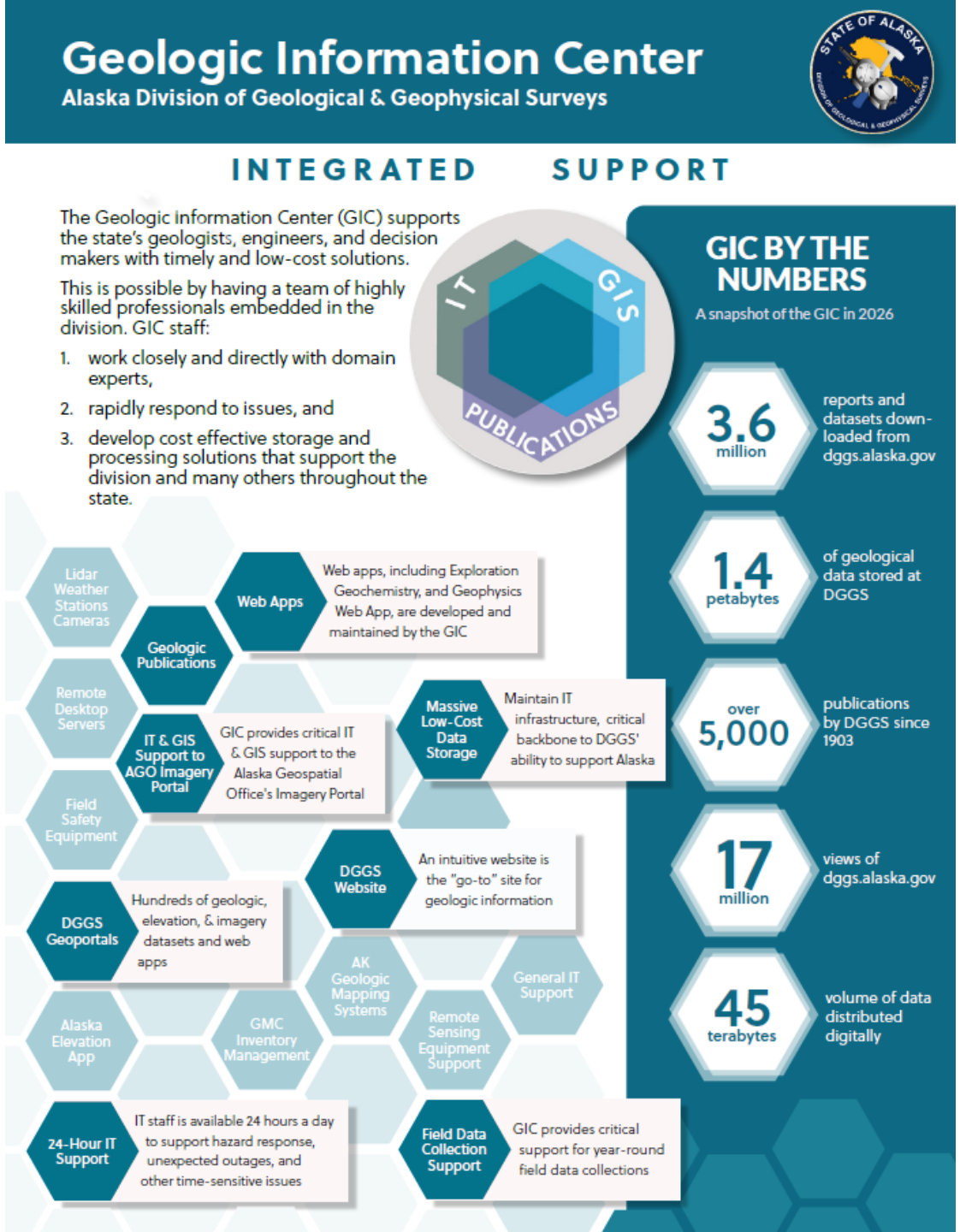
Geophysical Report 2025-1

3D model of subsurface resistivity at Pilgrim Hot Springs. Left: resistivity slice at -20 m elevation mapped over the Pilgrim Hot Springs area; low resistivity region in blue is indicative of near-surface thawed area resulting from geothermal springs. Right: perspective view of 3D resistivity voxel with 2x vertical exaggeration; this model can be used to map thaw zones and constrain subsurface geologic structure.



NEW DATA LIDAR





- Provides publication, GIS, and IT support services that provide access to geologic information related to Alaska's vast resources such a geothermal.
- We publish, host, and distribute large volumes of data which facilitates collaborations with federal and other state organizations.
- The wide range of published services helps to:
  - Better inform decisions
  - Encourage investment, exploration, and development
  - Beneficial fiscal impact to Alaska's economy, worth billions of dollars.
- The quality of DGGS's Alaska geological database is highly rated by the Fraser Institute's Annual Survey of Mining Companies.

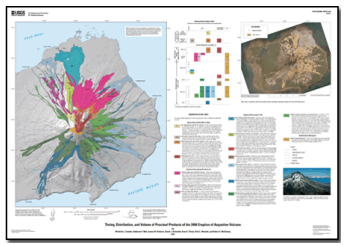
AK Geothermal Data Resources

- AK DGGS Web Site - https://dggs.alaska.gov
- AK DGGS Geothermal Program Hub Page -https://dggs.alaska.gov/energy/geothermal.html
- AK DGGS Publications - https://dggs.alaska.gov/pubs
- Geologic Mapping & Data - https://dggs.alaska.gov/pubs/project/1607
- Geophysics Data - https://dggs.alaska.gov/geophysics/get-data.html
- AK Geologic Materials Center - https://dggs.alaska.gov/gmc
- Alaska Volcano Observatory (AVO) - https://avo.alaska.edu

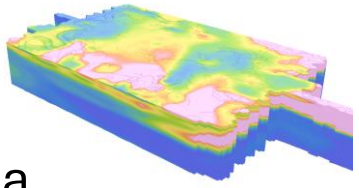
- State of Alaska GIS Hub - https://akgeoportal.alaska.gov
- AK DGGS Geoportal - https://geoportal.dggs.dnr.alaska.gov/portal
- AK DGGS Interactive Web Maps and Apps
  - AK DGGS Map Index Web App - https://maps.dggs.alaska.gov/mapindex
  - Seismic Hazards of Alaska Web App - https://maps.dggs.alaska.gov/seismic_hazards
  - AK Geophysical Surveys Web App - https://maps.dggs.alaska.gov/gp
- State of Alaska SkyHub - https://skyhub.alaska.gov

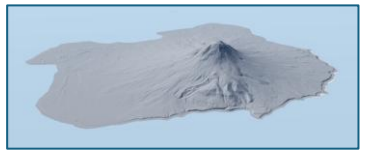
AK Geothermal Data Future Goals

- Increase Data Availability
  - Well data: bottom hole temps, temp logs, core descriptions.
  - Geochemistry data: publication, downloadable, in web app
  - Additional geothermal photos available in photo web app
  - Publish Augustine volcano geologic maps in modern GeMS format
    - USGS P 1769 - Timing, distribution, and volume of proximal products of the 2006 eruption of Augustine Volcano, chapter 8
    - USGS P 1762 - Volcanic processes and geology of Augustine Volcano, Alaska
  - Publish new geophysical surveys



- Improve User Experience
  - Update geothermal resources of Alaska Web App
  - Update Geothermal Data Hub site
  - Update curated list of geothermal publications
  - Create 2D and 3D visualization web apps for key focus area, such as: Augustine, Spurr, Pilgrim, etc.





The DGGS Geothermal Program is up and running and working with university and industry partners to collect critical geology and geophysical data to reduce risk for geothermal exploration.

Akutan Hot Springs, photo by Game Mcgimsey, AVO