

## **Online, Interactive Assessment of Geothermal Energy Potential in the U.S.A.\***

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Search and Discovery Article #80226 (2012)\*\*

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### **Abstract**

Geothermal-relevant geosciences data from all 50 states ([www.stategeothermaldata.org](http://www.stategeothermaldata.org)), federal agencies, national labs, and academic centers are being digitized and linked in a distributed network via the U.S. Department of Energy-funded National Geothermal Data System (NGDS) to foster geothermal energy exploration and development through use of interactive online 'mashups,' data integration, and applications. Emphasis is first to make as much information as possible accessible, with a long range goal to make data interoperable through standardized services and interchange formats.

An initial set of thirty geoscience data content models are in use or under development to define standardized interchange format: aqueous chemistry, borehole temperature data, direct use feature, drill stem test, earthquake hypocenter, fault feature, geologic contact feature, geologic unit feature, thermal/hot spring description, metadata, quaternary fault, volcanic vent description, well header feature, borehole lithology log, crustal stress, gravity, heat flow/temperature gradient, permeability, and feature description data like developed geothermal systems, geologic unit geothermal properties, permeability, production data, rock alteration description, rock chemistry, and thermal conductivity.

Map services are also being developed for isopach maps, aquifer temperature maps, and several states are working on geothermal resource overview maps. Content models are developed preferentially from existing community use in order to encourage widespread adoption and promulgate minimum metadata quality standards. Geoscience data and maps from NGDS participating institutions (USGS, Southern Methodist University, Boise State University Geothermal Data Coalition) are being supplemented with extensive land management and land use resources from the Western Regional Partnership (15 federal agencies and 5 Western states) to provide access to a comprehensive, holistic set of data critical to geothermal energy

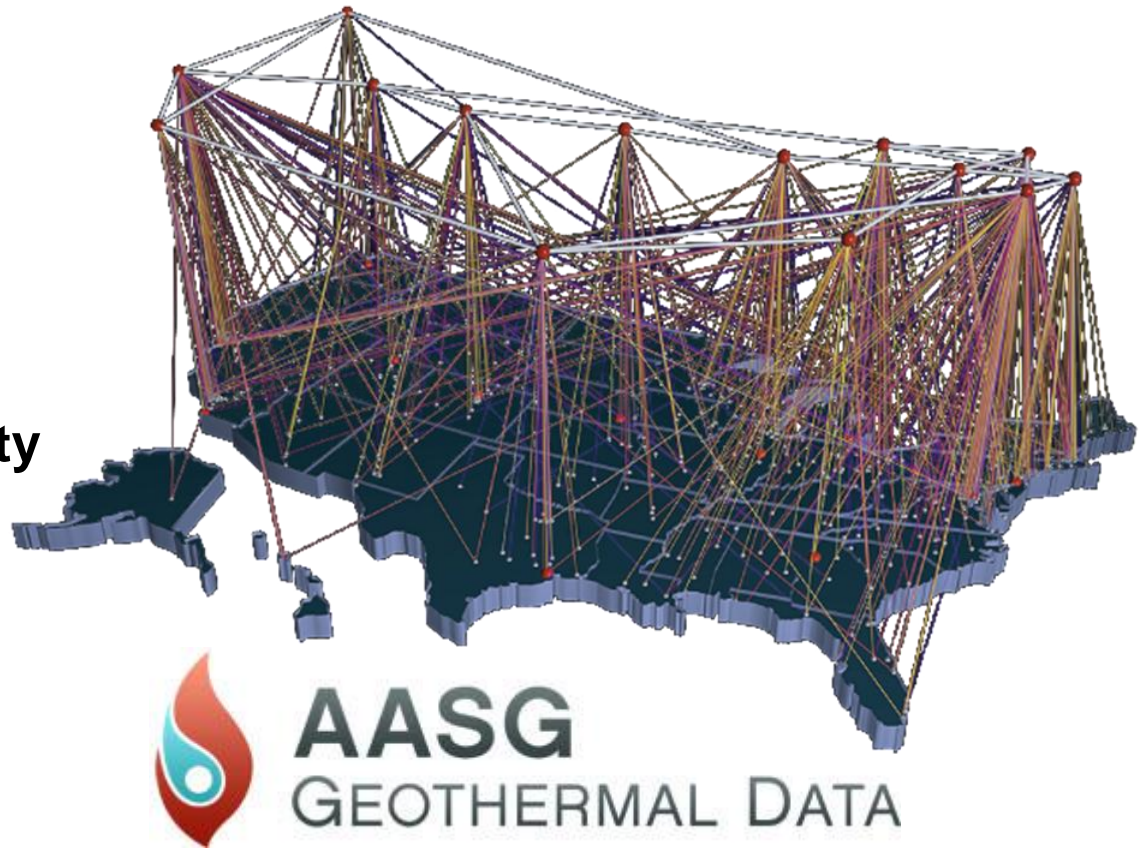
development. As of September 2011, we have over 34,000 records registered in the system catalog, and 234,942 data resources online, along with scores of Web services to deliver integrated data to the desktop for free downloading or online use. The data exchange mechanism is built on the U.S. Geoscience Information Network (USGIN, <http://lab.usgin.org>) protocols and standards developed as a partnership of the Association of American State Geologists and U.S. Geological Survey.

# Online, interactive assessment of geothermal energy potential in the U.S.

[www.stategeothermaldata.org](http://www.stategeothermaldata.org)

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Coleman, Genhan Chen,  
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Pape, and Leah Musil

Arizona Geological Survey



# NGDS: The Challenge of Data



***1,000s of databases  
1,000s of collections  
80,000+ geologic maps***

**Selected data resources in  
State Geological Surveys**

3.5 million wells – oil & gas, water

195,000 well logs

50,000 geothermal wells

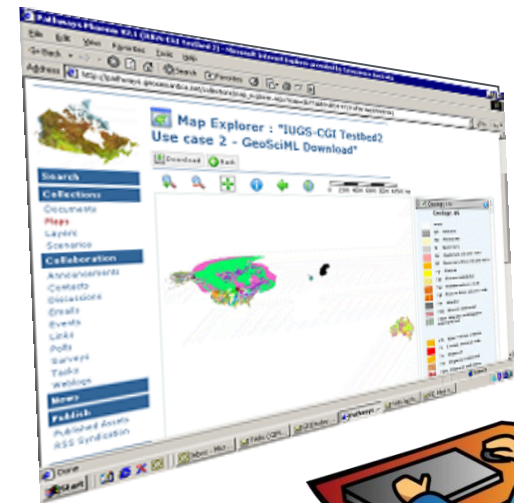
750,000 BHT's

6 Tb existing digital data

>75,000 scanned publications & maps

2.5 million feet of core

600,000 sample logs



# STATE GEOTHERMAL DATA



- **Distributed**
- **Web-based**
- **Interoperable**
- **Open source**
- **Community of Practice**

## Separation of roles:

- Data Producer
  - Manage data content
- Data Provider
  - Server performance
  - Archive and backup
  - Service implementation, schema mapping
- Data Consumer
  - Find resources
  - Extract useful information
  - User interface





# Geothermal Data System

- **Discover** via the Catalog
- **Access** via the Web
- **Explore** using Applications







# Borehole Temperature search results



USGIN Catalog Search

catalog.usgin.org/search/

BETA VERSION -- WORK IN PROGRESS

Search for a location ...

Map Contents

- Overlays
  - Search Result Footprints
- Base Layers
  - Google Terrain

Search the USGIN Catalog

Search: Borehole Temperature WMS

Draw Area of Interest ☐ Use map extent to limit results

Search Results (29450)

**Kentucky Borehole Temperature WMS**

Abstract Maximum temperatures recorded on borehole geophysical logs usually from drilled oil and gas wells in Kentucky.

Zoom To Lock Remove Add to Map Add to ArcMap Details

**California Borehole Temperatures, AASG Geothermal WMS**

Borehole Temperatures for wells throughout the state of California

Zoom To Lock Remove Add to Map Add to ArcMap Details

**West Virginia Borehole Temperatures, AASG Geothermal WMS**

Borehole Temperatures throughout the state of West Virginia

Zoom To Lock Remove Add to Map Add to ArcMap Details

**AASG Geothermal Data Borehole Temperature Observation template v1.0**

This spreadsheet indicates the content requested for temperature measurement data obtained from boreholes for the AASG geothermal data project. Typically bottomhole temperatures are recorded from log headers, and this information will be provided through a borehole temperature observation service. The HeaderURI for a particular borehole (well for simple wells) is the cross-referencing link (foreign key) used to associate the header record, well logs, temperature measurements, and other information from a particular borehole.

Zoom To Lock Remove Download Details

Showing 1 - 10 of 29450 results



# Zoom to and add to map – KY BHTs

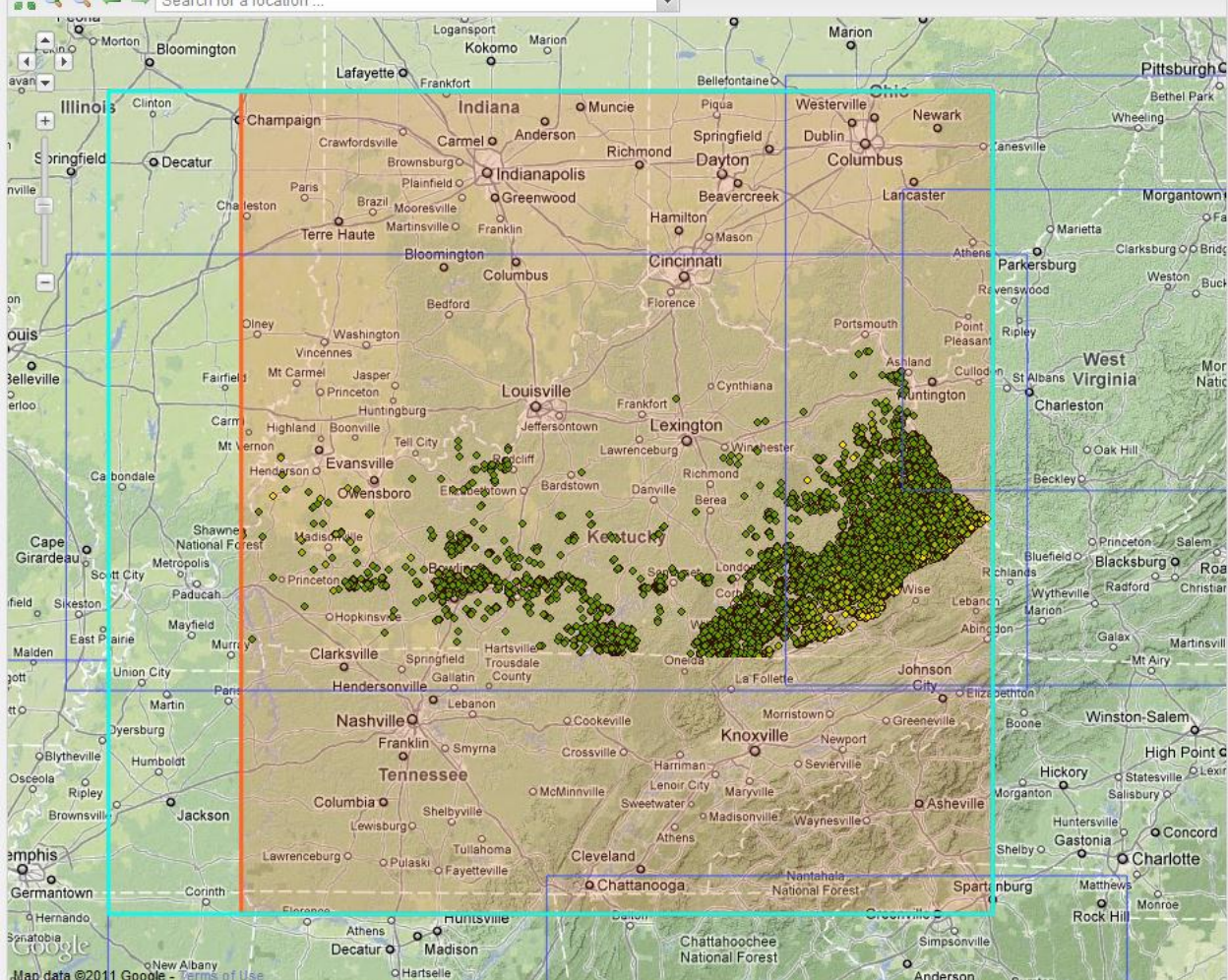


USGIN Catalog Search

catalog.usgin.org/search/

BETA VERSION -- WORK IN PROGRESS

Search for a location ...



Map Contents

- Overlays
  - BoreholeTemperature
  - Search Result Footprints
- Base Layers
  - Google Terrain

Search the USGIN Catalog

Search: Borehole Temperature WMS

Draw Area of Interest ☐ Use map extent to limit results

Search Results (29450)

**Kentucky Borehole Temperature WMS**

Abstract Maximum temperatures recorded on borehole geophysical logs usually from drilled oil and gas wells in Kentucky.

[Zoom To](#) [Lock](#) [Remove](#) [Add to Map](#) [Add to ArcMap](#) [Details](#)

**California Borehole Temperatures, AASG Geothermal WMS**

Borehole Temperatures for wells throughout the state of California

[Zoom To](#) [Lock](#) [Remove](#) [Add to Map](#) [Add to ArcMap](#) [Details](#)

**West Virginia Borehole Temperatures, AASG Geothermal WMS**

Borehole Temperatures throughout the state of West Virginia

[Zoom To](#) [Lock](#) [Remove](#) [Add to Map](#) [Add to ArcMap](#) [Details](#)

**AASG Geothermal Data Borehole Temperature Observation template v1.0**

This spreadsheet indicates the content requested for temperature measurement data obtained from boreholes for the AASG geothermal data project. Typically bottomhole temperatures are recorded from log headers, and this information will be provided through a borehole temperature observation service. The HeaderURI for a particular borehole (well for simple wells) is the cross-referencing link (foreign key) used to associate the header record, well logs, temperature measurements, and other information from a particular borehole.

[Zoom To](#) [Lock](#) [Remove](#) [Download](#) [Details](#)

Showing 1 - 10 of 29450 results



# Zoom to and add to map – CA BHTs

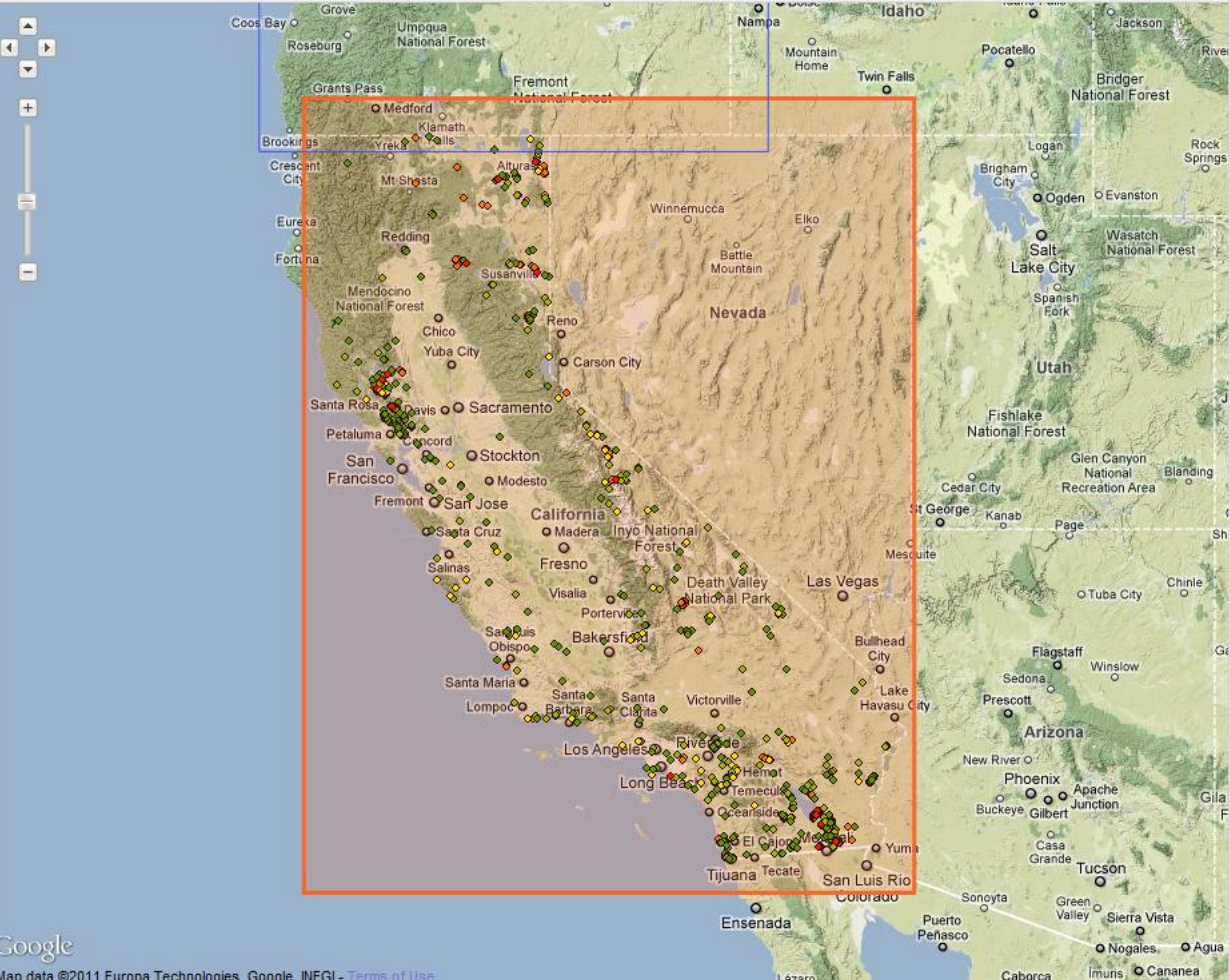


USGIN Catalog Search

catalog.usgin.org/search/

BETA VERSION -- WORK IN PROGRESS

Search for a location ...



Map Contents

- Overlays
  - BoreholeTemperature
  - BoreholeTemperature
  - Search Result Footprints
- Base Layers
  - Google Terrain

Search the USGIN Catalog

Search: Borehole Temperature WMS

Draw Area of Interest Use map extent to limit results

Search Results (29450)

**Kentucky Borehole Temperature WMS**

Abstract Maximum temperatures recorded on borehole geophysical logs usually from drilled oil and gas wells in Kentucky.

Zoom To Lock Remove Add to Map Add to ArcMap Details

**California Borehole Temperatures, AASG Geothermal WMS**

Borehole Temperatures for wells throughout the state of California

Zoom To Lock Remove Add to Map Add to ArcMap Details

**West Virginia Borehole Temperatures, AASG Geothermal WMS**

Borehole Temperatures throughout the state of West Virginia

Zoom To Lock Remove Add to Map Add to ArcMap Details

**AASG Geothermal Data Borehole Temperature Observation template v1.0**

This spreadsheet indicates the content requested for temperature measurement data obtained from boreholes for the AASG geothermal data project. Typically bottomhole temperatures are recorded from log headers, and this information will be provided through a borehole temperature observation service. The HeaderURI for a particular borehole (well for simple wells) is the cross-referencing link (foreign key) used to associate the header record, well logs, temperature measurements, and other information from a particular borehole.

Zoom To Lock Remove Download Details

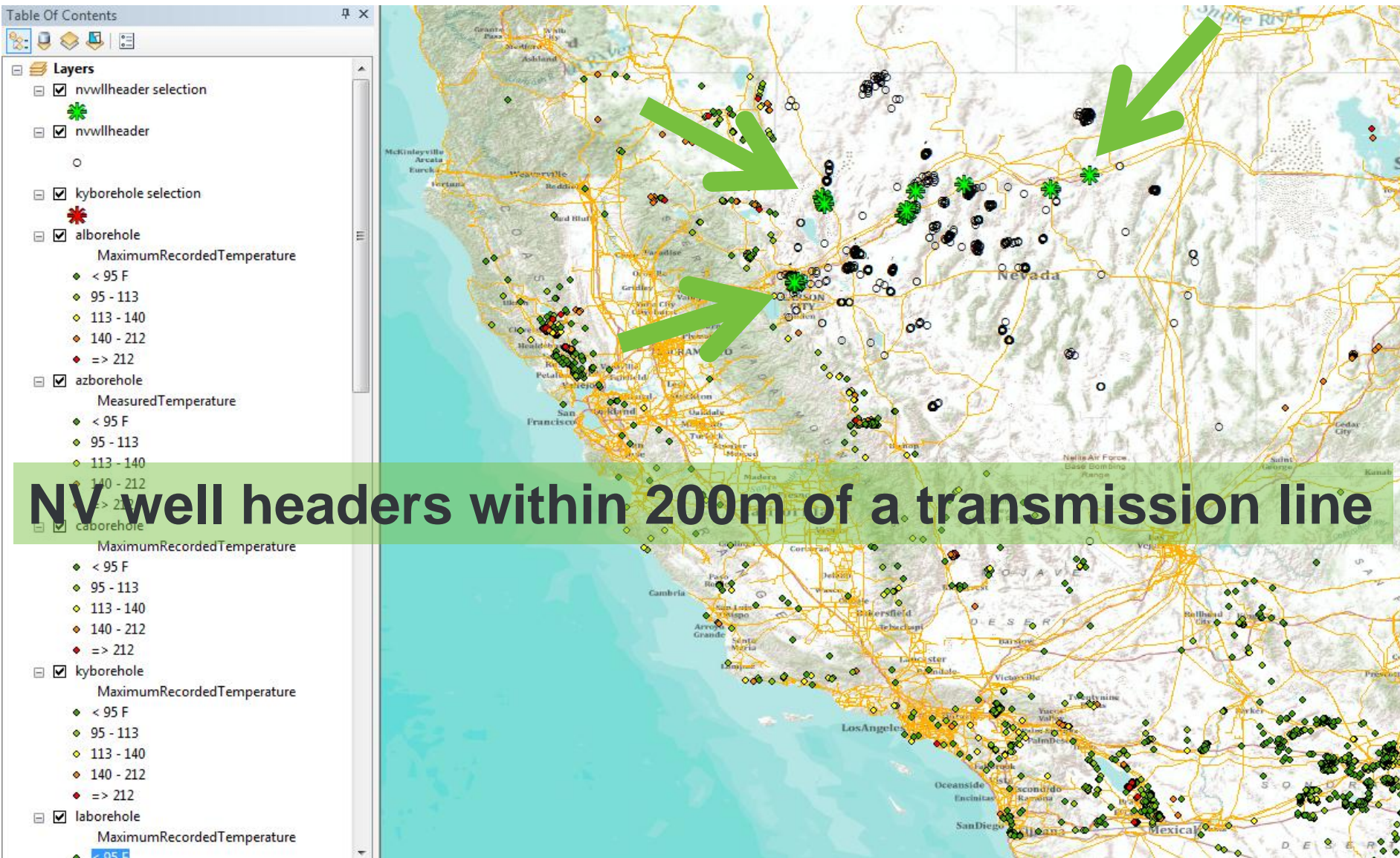
Showing 1 - 10 of 29450 results

Google

Map data ©2011 Europa Technologies, Google, INEGI - Terms of Use



# Exploring the Data in our Application – Well Headers in Nevada using ArcGIS





Kettenhofen 1 Well

ObservationURI <http://resources.usgcn.org/uri-qin/cadoqqr/bhtemp/Kettenhofen-Well-2454/>

WellName Kettenhofen 1 Well

APINo

HeaderURI <http://resources.usgcn.org/uri-qin/cadoqqr/well/ID:38.9492.122.7517/>

OtherID

OtherName

BoreholeName

Operator

LeaseOwner

LeaseNo

SpudDate

EndedDrillingDate

WellType Production

Status

StatusDate

Function

Field Clear Lake

County LAK

State CA

PLSS\_Meridians

TWP

RGE

Section\_

SectionPart

Parcel

UTM\_E

UTM\_N

UTMDatumZone

LatDegree 38.9492

LongDegree -122.7517

SRS NAD 1983

LocationUncertaintyStatement

DrillerTotalDepth 2385

WellboreShape

TrueVerticalDepth

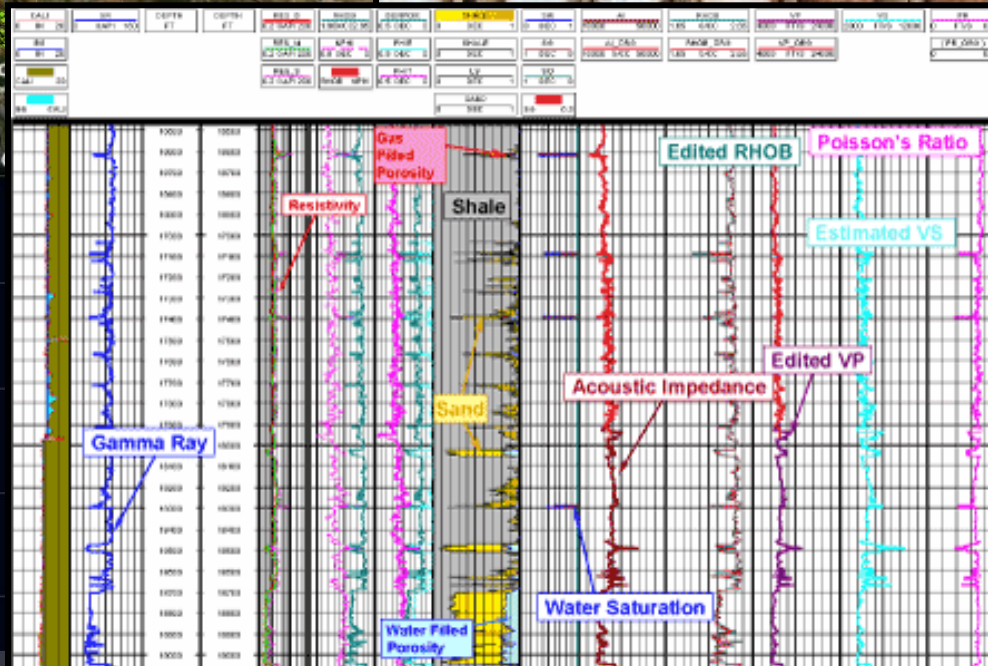
LengthUnits ft

ElevationGL

BitDiameterCollar

BitDiameterTD

Position 37°21'18"N 118°56'44"W



Individual features in live datasets may be queried for attributes





**Nevada Bureau of  
Mines & Geology  
(UNR)**

**Illinois State  
Geological Survey  
(UIUC)**

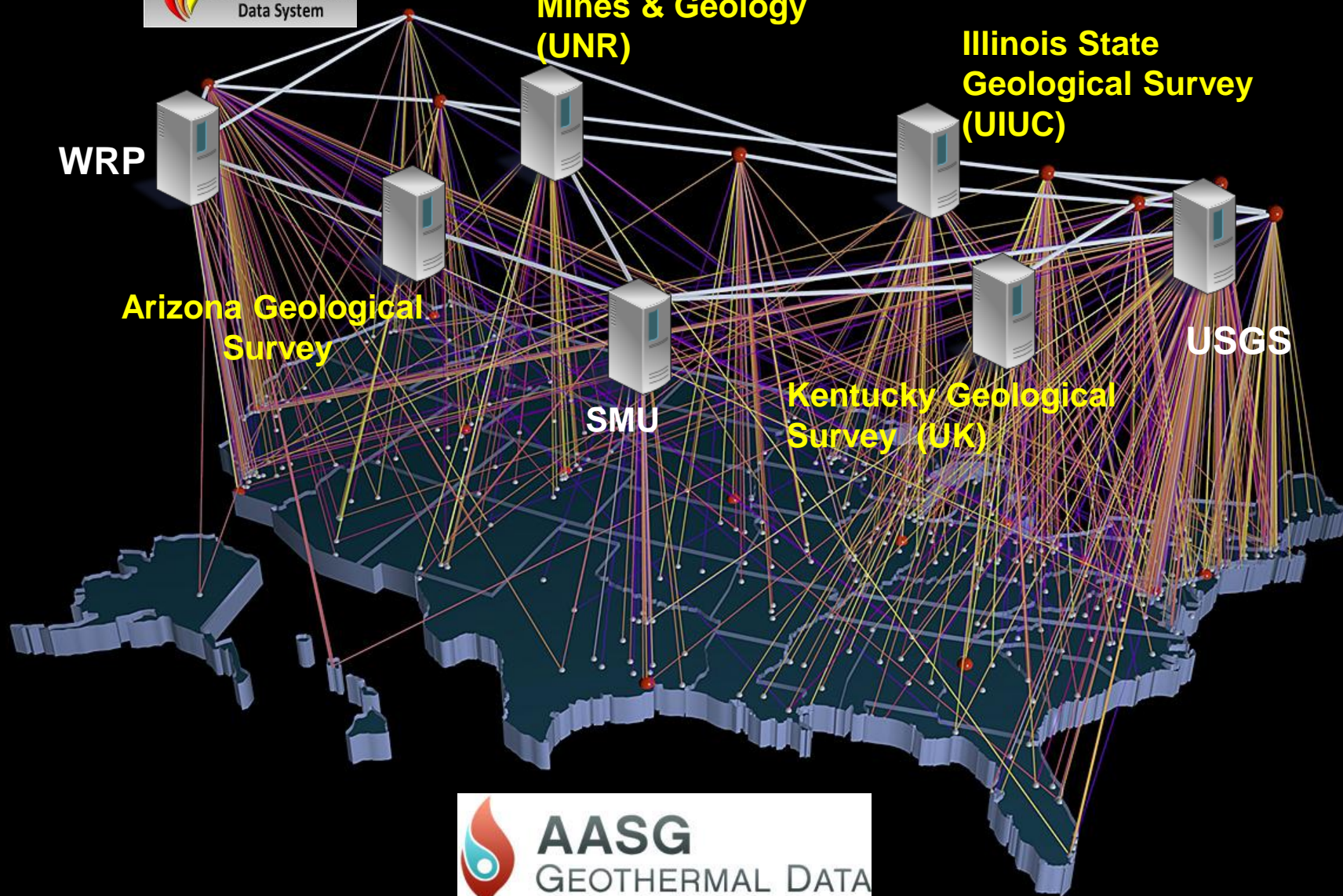
**WRP**

**Arizona Geological  
Survey**

**SMU**

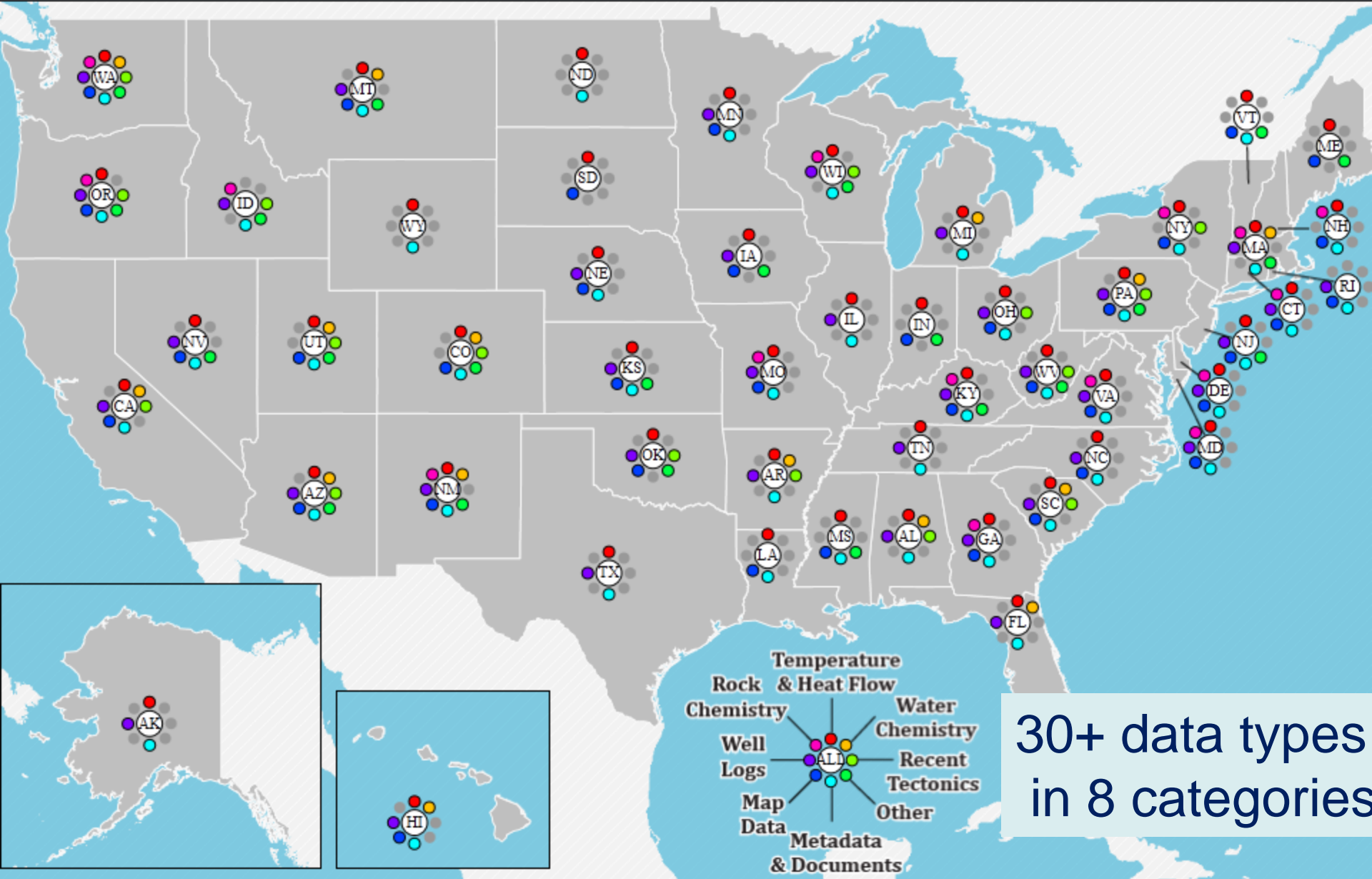
**Kentucky Geological  
Survey (UK)**

**USGS**



# Data sets from states

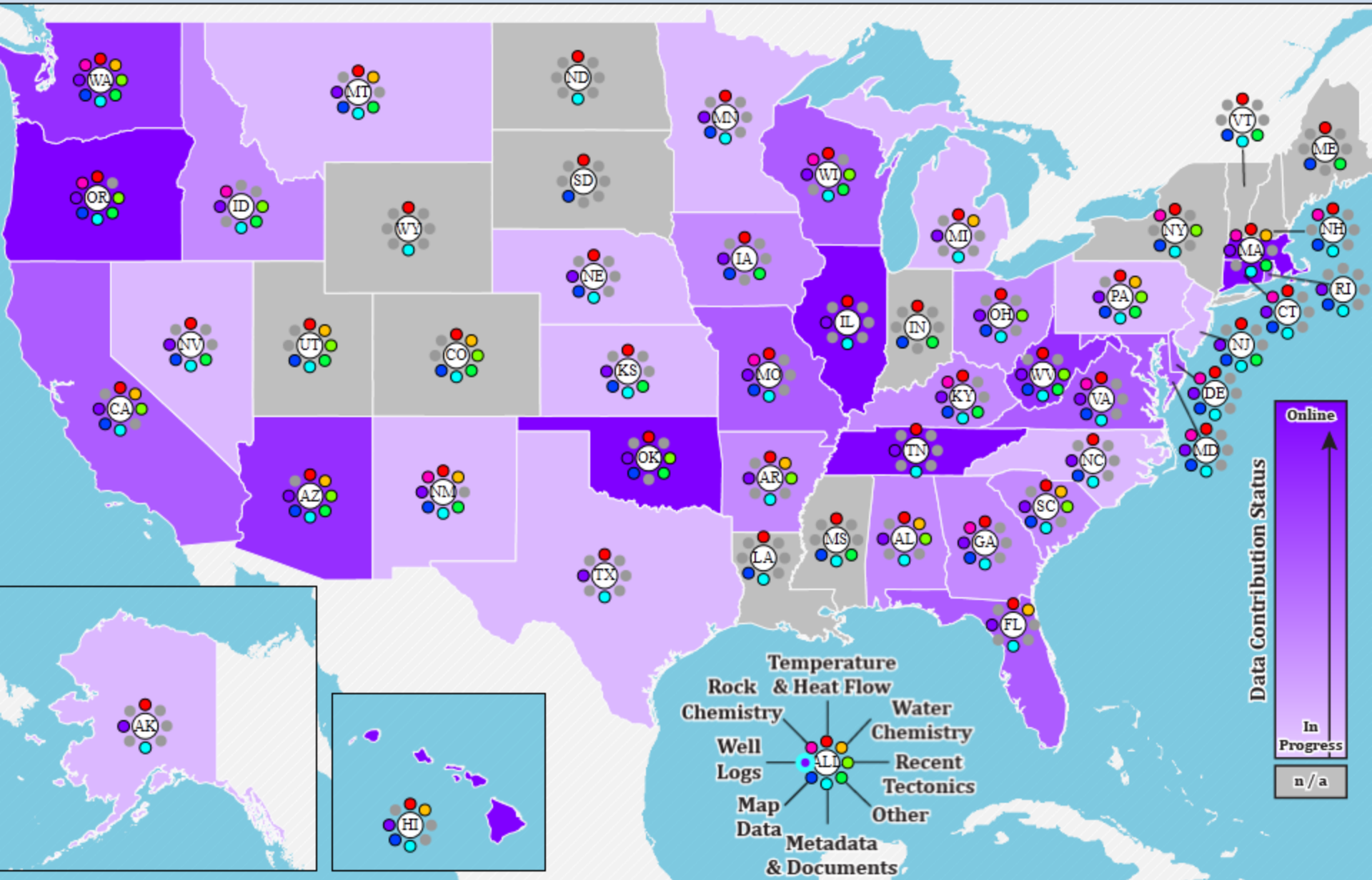
Use this map to: [Compare Progress Across All States](#) | [View Datasets Anticipated and Available from a Specific State](#) | [View Detailed Information About a Specific State's Datasets](#)





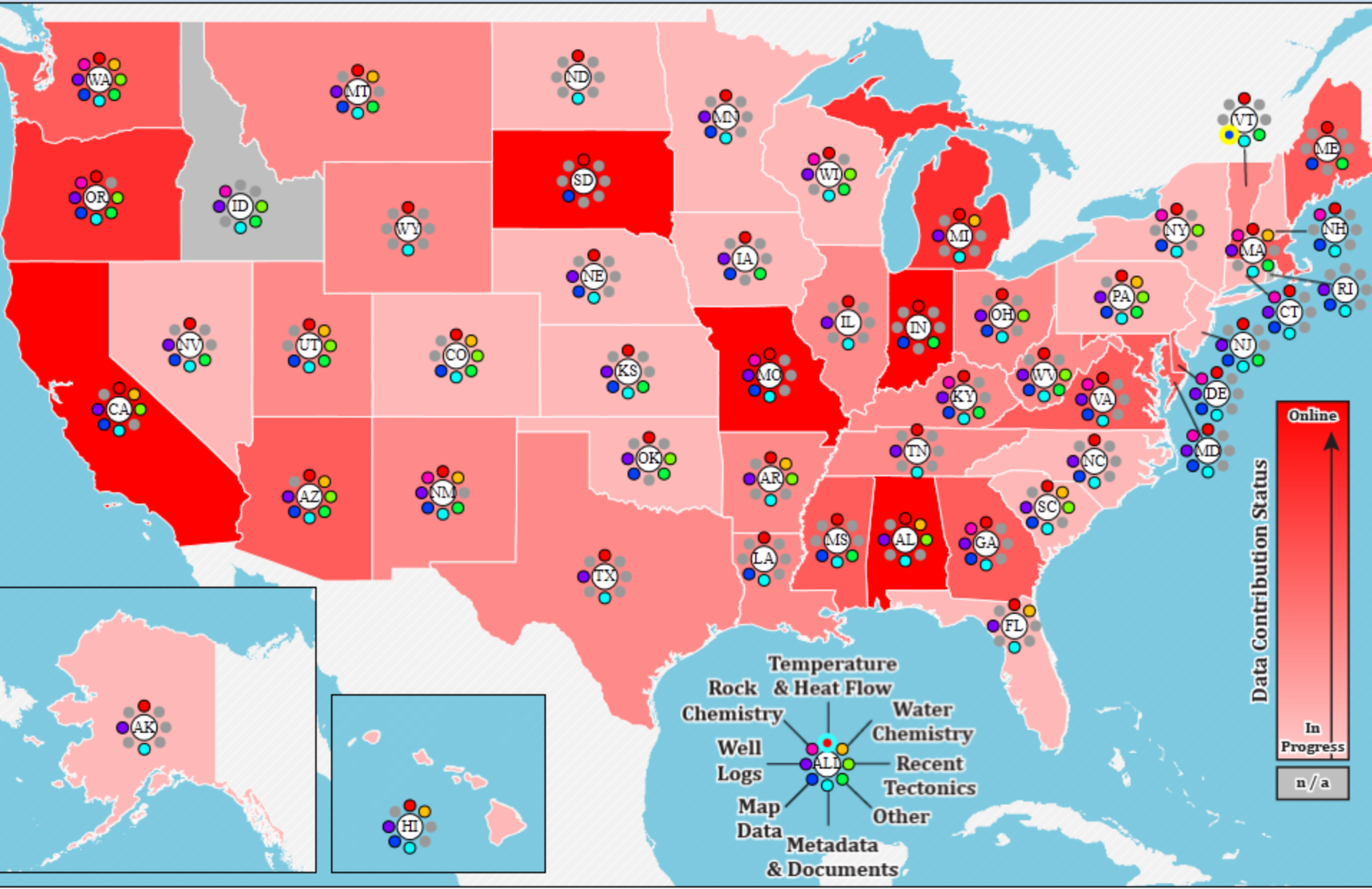
# Well Logs

Use this map to: [Compare Progress Across All States](#) | [View Datasets Anticipated and Available from a Specific State](#) | [View Detailed Information About a Specific State's Datasets](#)



# Temperature & Heat Flow

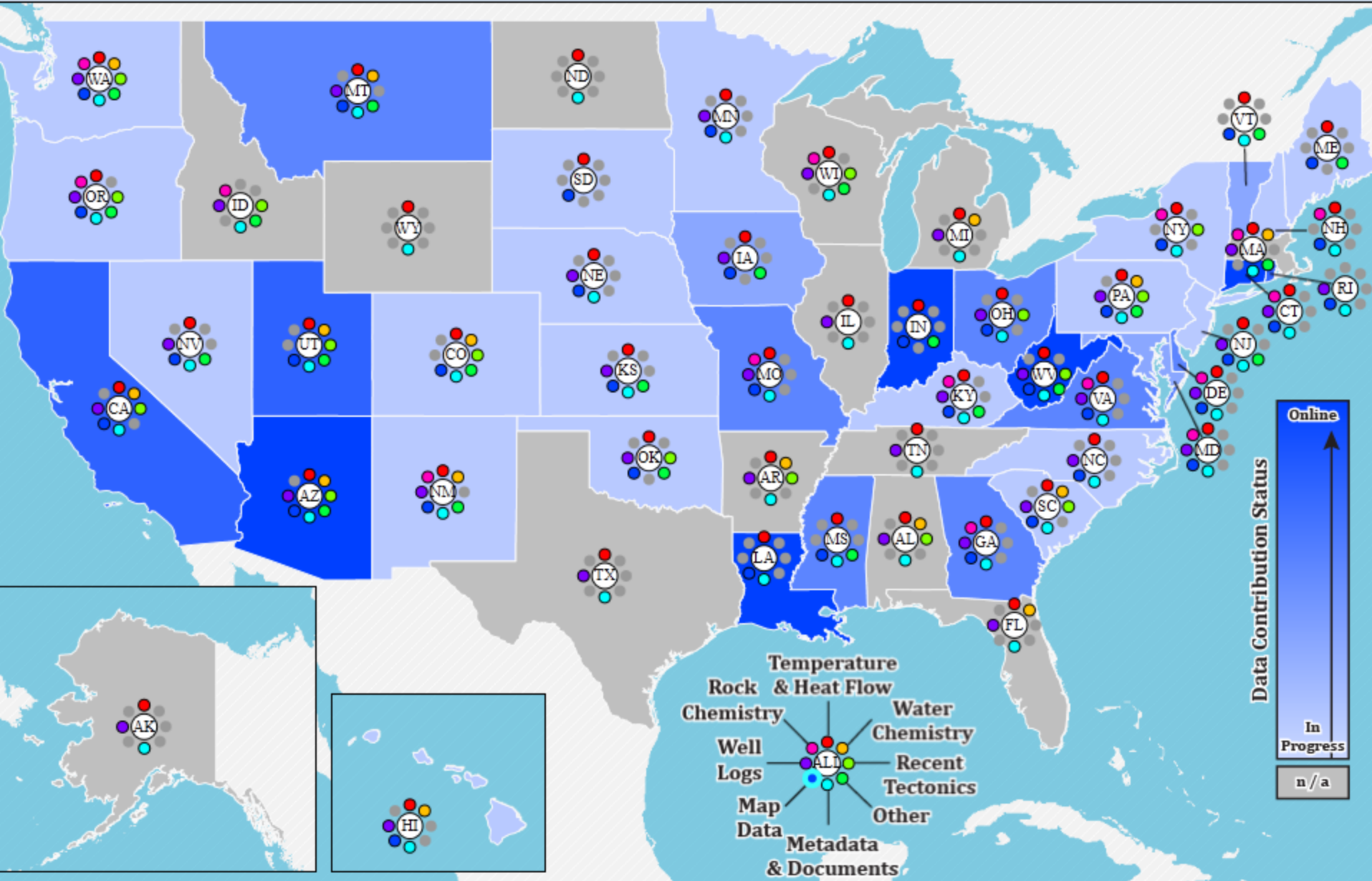
Use this map to: [Compare Progress Across All States](#) | [View Datasets Anticipated and Available from a Specific State](#) | [View Detailed Information About a Specific State's Datasets](#)





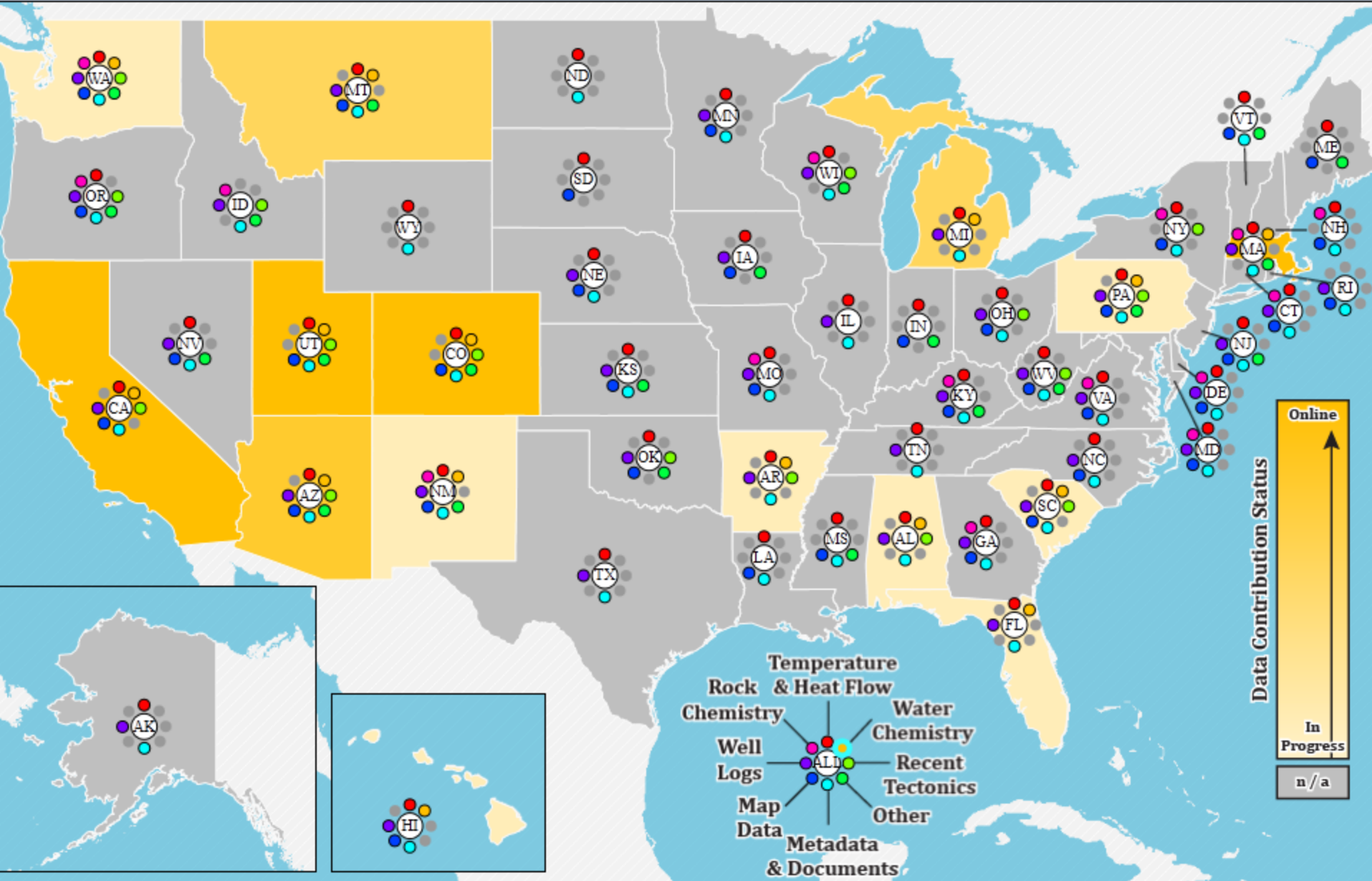
# Map Data

Use this map to: [Compare Progress Across All States](#) | [View Datasets Anticipated and Available from a Specific State](#) | [View Detailed Information About a Specific State's Datasets](#)



# Water Chemistry

Use this map to: [Compare Progress Across All States](#) | [View Datasets Anticipated and Available from a Specific State](#) | [View Detailed Information About a Specific State's Datasets](#)





# Coming to your desktop ....a U.S. geothermal data system

