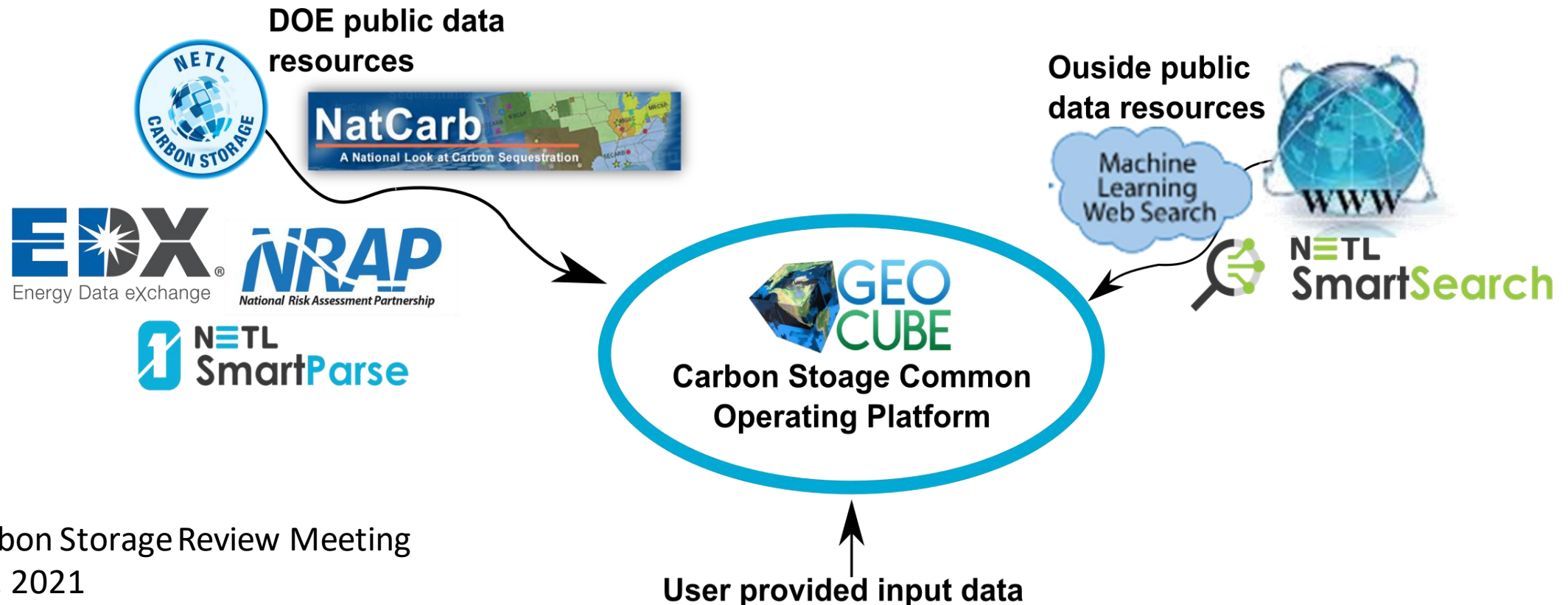


Carbon Storage Data Integration, Visualization and Application via EDX and GeoCube

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¹NETL, ²MATRIC, ³NETL Site Contractor



Leveraging EDX Computing for Carbon Storage Data

- There is a need to **preserve and efficiently access** resources to drive the **next generation** of R&D **while ensuring compliance** with DOE regulations

- Focus shifted in 2016 to preserve and curate carbon storage data products, both public and private through the EDX

- Since then, **millions of dollars** in R&D products have been preserved and made **publicly available** from carbon storage efforts



Big Data

Open Carbon Storage Data Collection

Data sources include:

- National carbon sequestration database – NATCARB
- Carbon Storage open database collection
- Regional Carbon Sequestration Partnership data
- Field projects like FutureGen 2.0 and CarbonSAFE
- National Risk Assessment Partnership data, models, tools

Data Types:

- Geospatial (shapefiles and rasters)
- Well logs
- Seismic data
- Text-based resources
- Tools, models
- Data catalogs
- Both surface and subsurface geology

Carbon storage data computing resources

Data discovery, acquisition, movement, storage

DOE funded project data



Data curation, publishing, preservation



Collection of outside-EDX resources



Data integration, exploration, curation, analysis, optimization

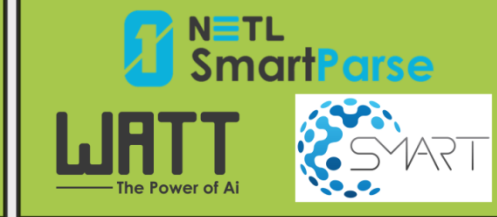
Data exploration and curation



Tools



Machine learning & natural language processing



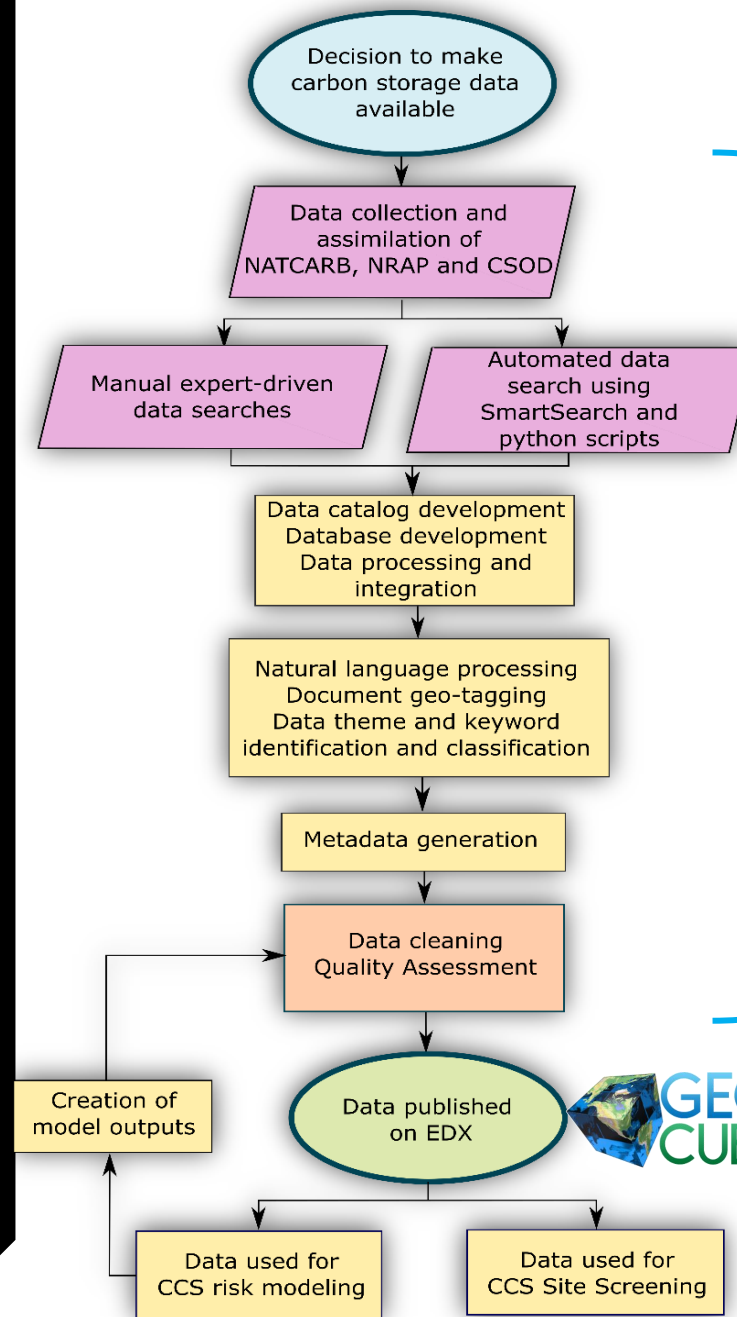
- 85+ TB source data and growing
- 3455+ resources
 - 872 Published EDX resources
 - 632.7 GB of Published EDX resources
- 1800+ text-based resources on EDX
- Data curated into Groups on EDX

215+ geospatial data records to be integrated into GeoCube in FY2022

The life cycle of data from collection to release to utilization

Challenge: Efficiently collecting, moving, storing, transforming, integrating and labeling data to make data more discoverable, searchable, and easy to reuse

Morkner, P., Bauer, J., Creason, C., Sabbatino, M., Wingo, P., Greenburg, R., Walker, S., Yeates, B., and Rose, K., *in review*, Distilling Data to Drive Carbon Storage Insights, journal: *Computers & Geoscience*



Collection



- SmartSearch and web scraping
- Expert-driven research
- EDX submissions

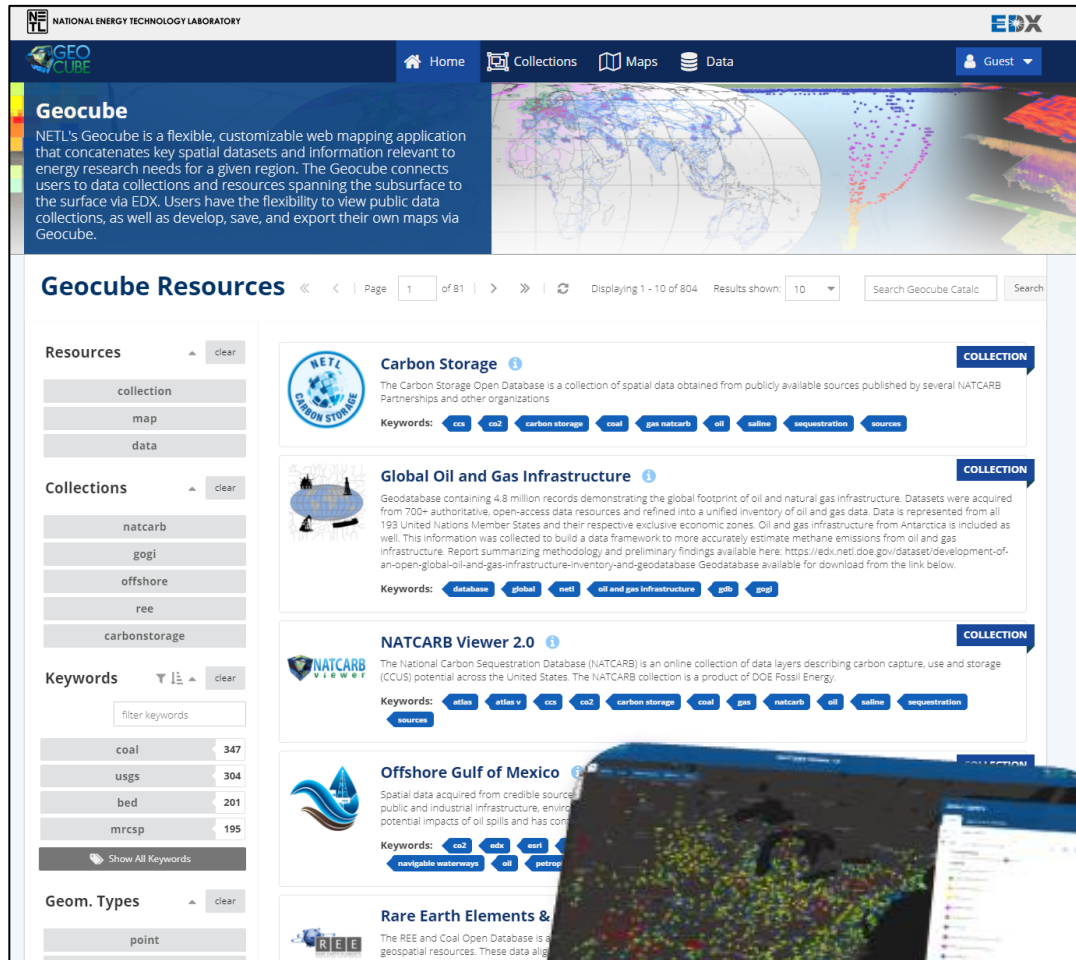
Metadata development and capture

- Cataloging
- ReadMe file development
- Natural language processing for keywords, topic modeling, geographic association

Cleaning and Quality Assessment

- Data ranking
- Data assessment method scoring

Then data can be published and reused for CS applications such as modeling, simulations and site screening



- Support discovery, access and use of geospatial data & analytical tools
- Growing catalog of geospatial resources available
 - From traditional formats as well as EDX processing to unlock additional place-based insights for EDX resources
- Serves as a Priority DOE Geospatial Data Repository
 - Aligns with geospatial management practices outlined in 2021-2025 DOE Geospatial Data Management Strategy, FGDC guidelines, and 2018 GDA covered agency requirements

GeoCube is currently under development to bring new, state-of-the-art web technologies and mapping features to its users

GeoCube Maps: Know Your Place!

Intuitively find, visualize, filter, and extract key spatial datasets and features



- **Filter map features** based on attribute values
- **Download layers** based on current map extent or custom drawn region of interest
- **Add third party layers** via REST service URL, WMS URL, or local GeoJSON file
- **Save custom maps** with valid EDX account login



NATIONAL
ENERGY
TECHNOLOGY
LABORATORY

[HOME](#)
[CATALOG](#)
[TOOLS](#)

Search Our Catalog

Filters

Location

Use one of the options below to filter results by location.

☐ Map extent
 ☒ Draw

☐ Geographic region

☒ Continent
 ☐ Country

☐ State
 ☐ Ocean

☐ Sea

☐ Select continent

Keywords

Collections

☒ Carbon Storage
 ☐ Global Oil and Gas Infrastructure
 ☐ Natcarb
 ☐ Offshore Gulf of Mexico
 ☐ Rare Earth Elements & Open Coal Database

Draw an area of interest on the map by clicking once in three or more locations to create a polygon. Double click to complete drawing.

DEACTIVATE

Catalog Resources

Sort by name: **Name (A-Z)** Results shown: **10**

[VIEW BY COLLECTIONS](#)
[VIEW BY LAYERS](#)

Active Or Temporary Inactive Surface Mines Ohio

Locations of active or temporarily inactive mines in eastern Ohio, typically coal, clay and/or limestone mines.

[DETAILS](#)
[DOWNLOAD](#)

Keywords

☒ Active
 ☐ Temporarily
 ☐ Temporary
 ☐ Inactive
 ☐ Surface
 ☐ Mine
 ☐ MRCSF
 ☐ Ohio
 ☐ Coal
 ☐ Clay
 ☐ Limestone

Active Wells Ohio At 144448 Scale

Active oil and gas wells in Ohio including gas storage at a 144448 scale

[DETAILS](#)
[DOWNLOAD](#)

Keywords

Understanding The Data



< BACK

LAYER: Co2 Sources 2012 Tons Of Co2

DOWNLOAD

INFO

ATTRIBUTES

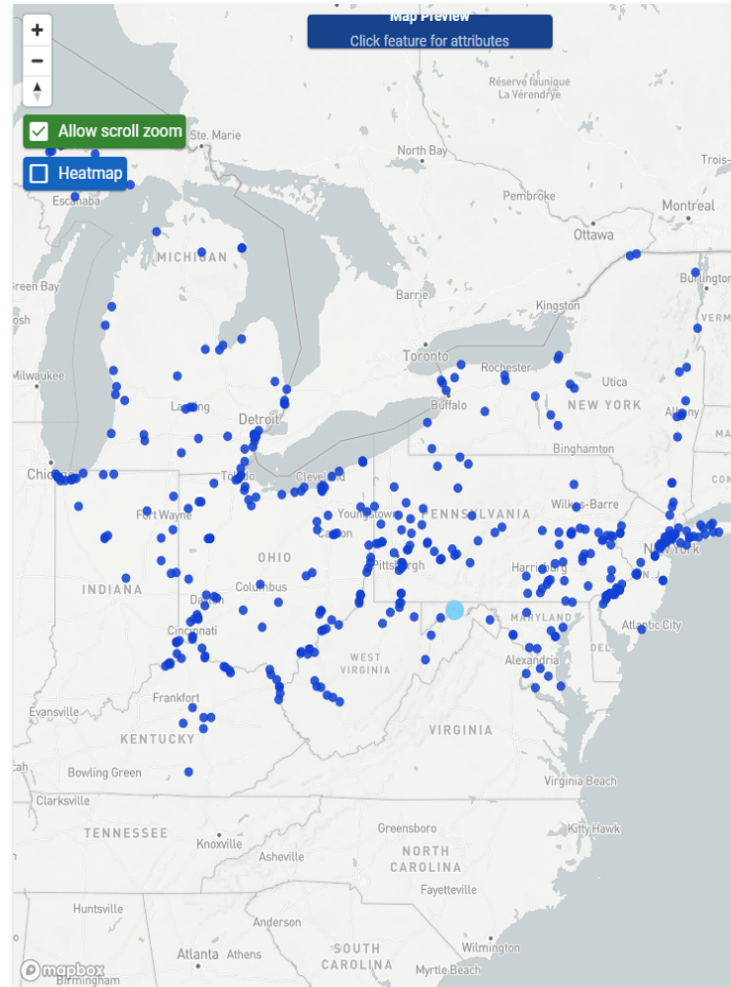
CHARTS

Search

Actions	objectid	city	fuel	partnershi	oris	source_nam	operator	address	state_prov	state_pr_1
	1	NEW YORK		Midwest Regional Carbon Sequestration Partnership	0	59TH STREET		850 12TH AVE		NEW YO
	2	NEW YORK		Midwest Regional Carbon Sequestration Partnership	0	74TH STREET		506 E 75TH ST		NEW YO
	3	MONACA		Midwest Regional Carbon Sequestration Partnership	0	AES BEAVER VALLEY LLC		394 FRANKFORT RD		PENNSYLV
	4	CUMBERLAND		Midwest Regional Carbon Sequestration Partnership	0	AES WARRIOR RUN		11600 MEXICO FARMS RD SE		MARYLA
	5	RICHMOND		Midwest Regional Carbon Sequestration Partnership	0	AGC FLAT GLASS N AMERICA INC		201 DUNCANNON LANE		KENTUC
	6	CATLETTSBURG		Midwest Regional Carbon Sequestration Partnership	0	AIR PRODUCTS & CHEMICALS INC - CATLETTSBURG HYDROGEN		11631 US Route 23		KENTUC



Zoom to feature



Investigate data via metadata, attributes, heatmaps, and charting

EDX Hosted Tools

Discover and interact with EDX hosted geospatial related tools

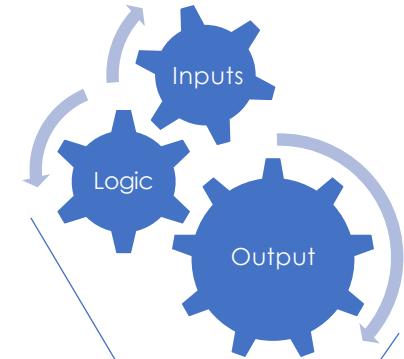
The screenshot shows the GeoCube Tools homepage. It features a search bar and a grid of tool cards. Each card includes a logo, a title, a brief description, and a 'REQUEST TOOL INTEGRATION' button. Tools visible include CO2-SCREEN, Cumulative Spatial Impact Layers, DREAM 2.0/NRAP, Finite Element Heat and Mass Transfer Code, and Non-Intrusive Uncertainty Quantification.

Tool Outputs

The screenshot displays the 'Big Run 2 Results' page. It has two tabs: 'OUTPUTS' and 'PARAMETERS'. Under 'OUTPUTS', there are checkboxes for 'Summary Report', 'Efficiency distribution', 'Microscopic displacement distribution', 'Storage resource distribution (Signatures of CO2)', 'Total height distribution (Meters)', and 'Total porosity distribution (%)'. The 'Microscopic displacement distribution' is selected, showing a bar chart. The chart has a y-axis from 0.0 to 5.0 and an x-axis with values from 0 to 100. A tooltip indicates 'Frequency: 4 Value: 0.5667'.

Visualize, interact with, and export tool output data

Request Your Tool to be Integrated into GeoCube for Public/Private Access



This screenshot is similar to the first one, showing the GeoCube Tools homepage. A blue callout box with the text 'Your tool here!!!' is overlaid on the right side, pointing towards the tool cards. The 'REQUEST TOOL INTEGRATION' button is highlighted on the CO2-SCREEN card.

Carbon Storage program investments into data curation and management has led to the development of GeoCube to support finding, visualizing and downloading relevant Geospatial research products which benefits ongoing and future carbon storage research. This has led to:

- A better understanding of CS relevant open- **data density** – and scope to meet data gaps
- Improved access through the integration of CS data resources on EDX into **GeoCube** for further searchability with spatial searches and keyword searches
- Applications of available geospatial data by groups such as the National Risk Assessment Partnership, universities, and industry
- Increasing numbers of CS data inquiries that have been easily addressed through GeoCube data access



Thank you!

NETL RESOURCES

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