Mapping CO₂ Injectivity Potential Within Available CO2 Underground Storage Window in Sedimentary Rocks Across the United States

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A - Introduction

Carbon Storage and Sequestration (CCS) is a means to achieve President Biden's net zero GHG goal by 2050, which includes at least 1 Gigaton (GT) of carbon dioxide removal (CDR) from the atmosphere.

B - Previous Work

The Department of Energy (DOE) and the U.S. Geological Survey (USGS) have already identified and assessed large and highly favorable geologic formations viable for underground CO2 storage within the U.S.

However, there is a lack of research and understanding of smaller, less favorable potential CO2 storage outside of these previously assessed areas.
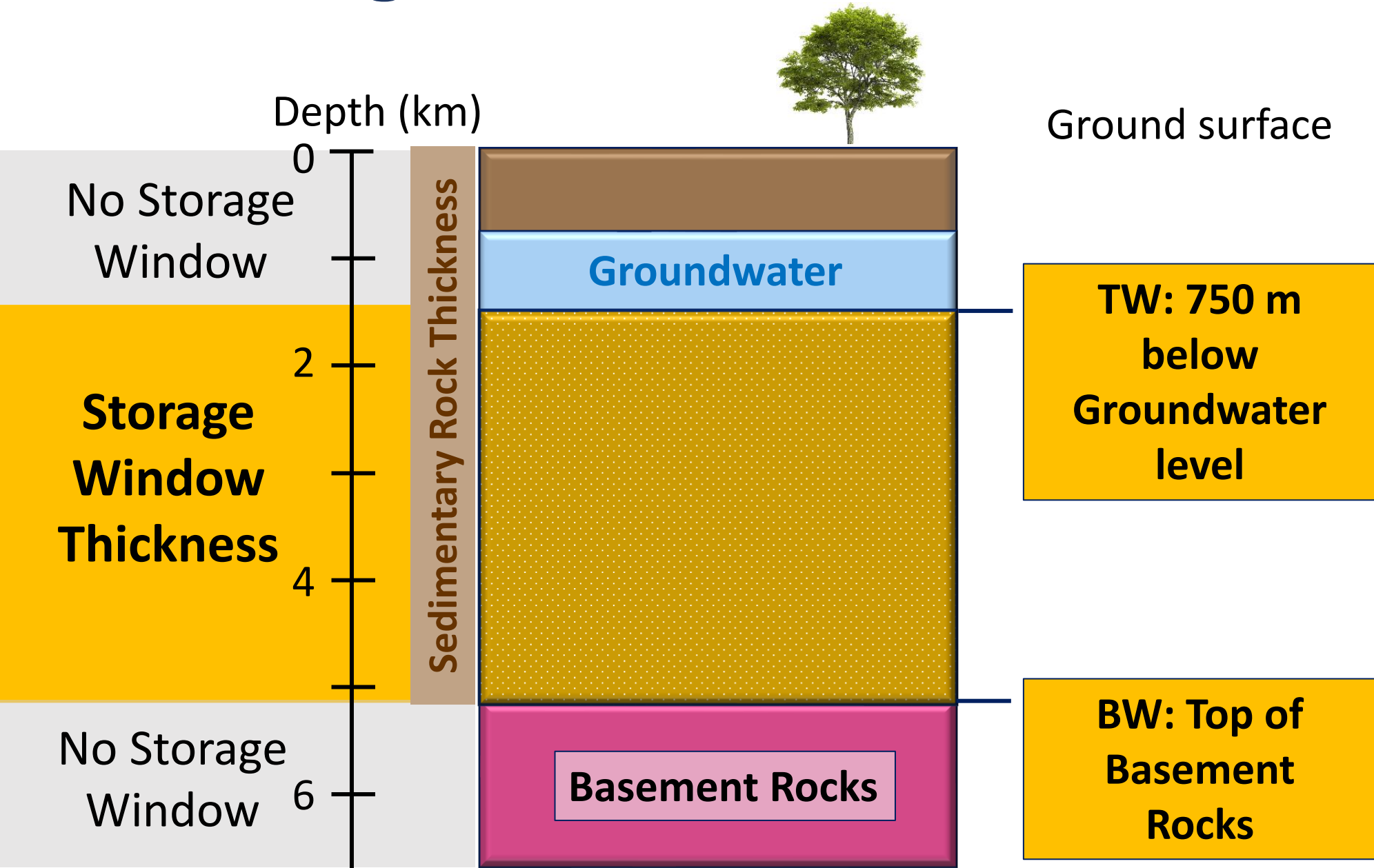
C - Objective

As part of a new national, county-level assessment of the potential of carbon dioxide removal (CDR) and storage in the U.S., we produced a map showing the distribution of prospective storage in sedimentary rock formations across the U.S.
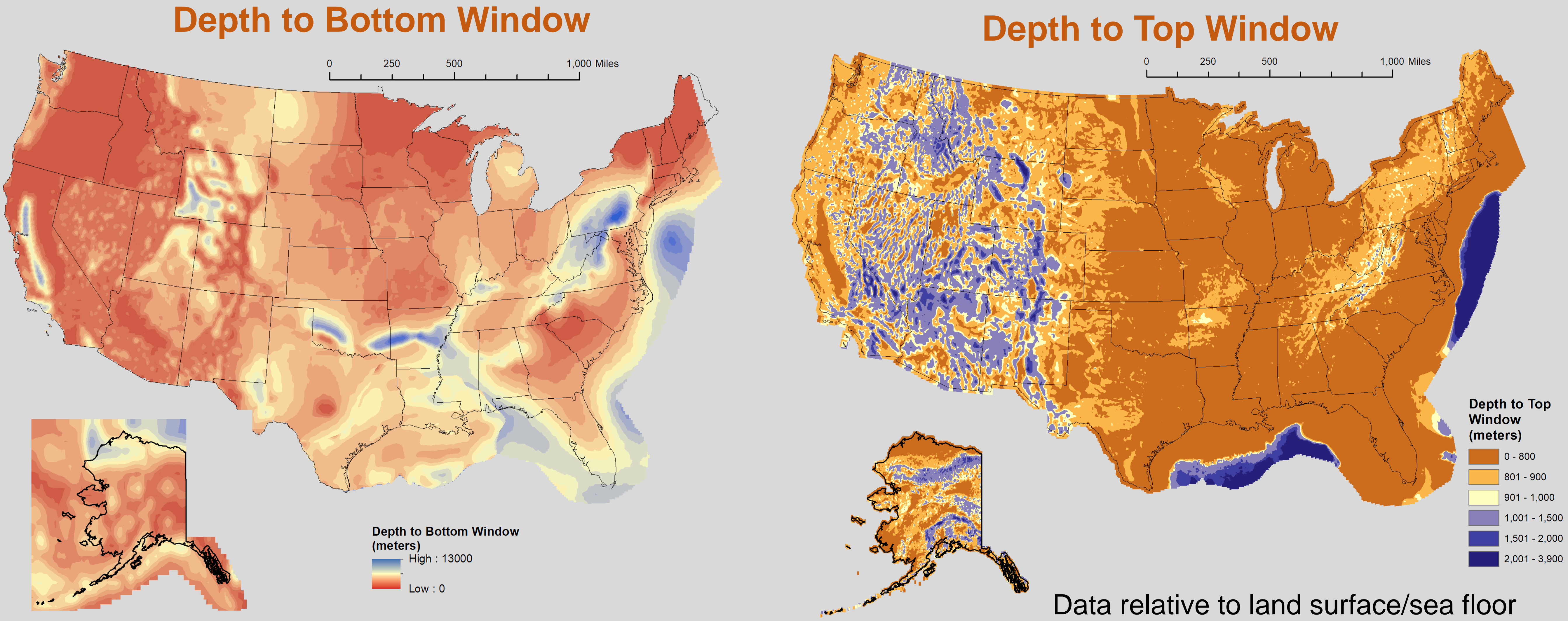
Whereas previous maps simply showed thicknesses of sedimentary rock, we have refined that by defining a new concept that we term **Storage Window Thickness.**
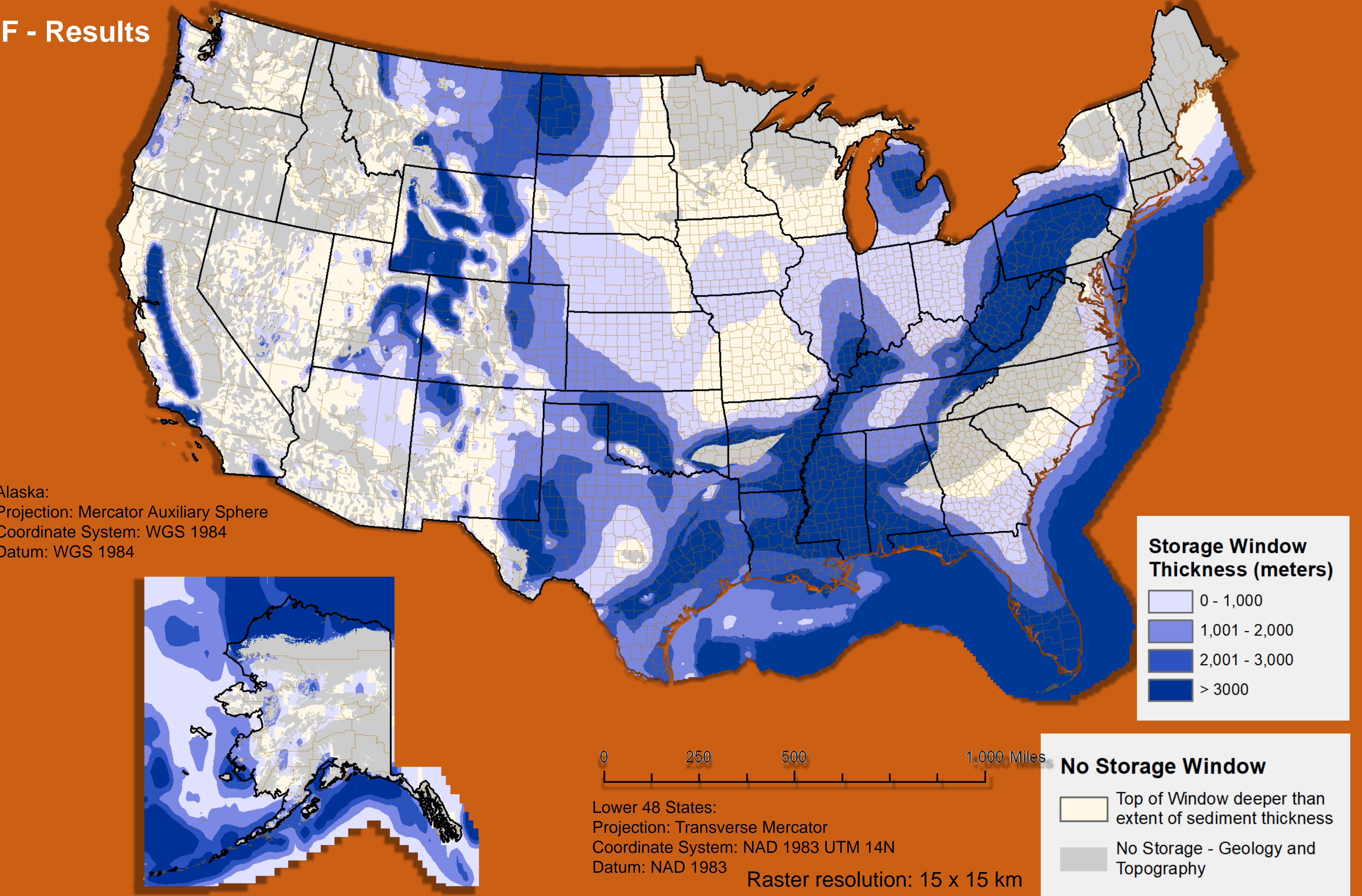
D – Approach

Storage Window Thickness

Depth (km)
Ground surface
No Storage Window
Groundwater
Storage Window Thickness
Sedimentary Rock Thickness
TW: 750 m below Groundwater level
No Storage Window
Basement Rocks
BW: Top of Basement Rocks

D – Approach (cont'd)

Depth to Bottom Window

0   250   500   1,000 Miles

Depth to Bottom Window (meters)
High : 13000
Low : 0

Depth to Top Window

0   250   500   1,000 Miles

Depth to Top Window (meters)
0 - 800
801 - 900
901 - 1,000
1,001 - 1,500
1,501 - 2,000
2,001 - 3,900

Data relative to land surface/sea floor

F - Results

Alaska:
Projection: Mercator Auxiliary Sphere
Coordinate System: WGS 1984
Datum: WGS 1984

Storage Window Thickness (meters)
0 - 1,000
1,001 - 2,000
2,001 - 3,000
> 3000

0   250   500   1,000 Miles

No Storage Window
Top of Window deeper than extent of sediment thickness
No Storage - Geology and Topography

Lower 48 States:
Projection: Transverse Mercator
Coordinate System: NAD 1983 UTM 14N
Datum: NAD 1983

Raster resolution: 15 x 15 km

E – Data Processing

The Sedimentary Storage Window Thickness (SWT) map is the result of the compilation and editing of preexisting spatial data. The main calculation is as follows:

$$SWT = \text{depth to bottom of window} - \text{depth to top of window}$$

Where:

Depth to Bottom Window:
1) U.S. Sediment Thickness Data[5,7,8]
2) Depth to Overpressure[1] (only in GOM)

Depth to Top Window:
1) Depth to top of groundwater[2] + 750 m

$$SWT = + \text{(Storage, Blue shades)}$$
$$SWT = - \text{(no Storage, white areas)}$$

No Storage Window Thickness

1) Geologic Constraints[3,11]
- Precambrian outcrops
- Metamorphic, Igneous Rock
- Glaciers

2) Topographic Constrains[4,610]
- No rugged terrain
- No steep elevation

3) Negative Result of SWT calculation

G – Conclusion

Preliminary results show greater storage potential in states like Arizona, New Mexico, and South Dakota than previously assessed.

H – Future Work

Refinement of top and bottom window boundaries:
- Top window: depth to base of USDW (10K ppm)
- Bottom window: Depth to Overpressure

For more information, download spatial data, and list of citations, please scan QR code (redirected to GitHub page)