Visualizing Flood, Drought, and Fire from one tool:

The Rapid Image Viewer

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James Coll[1]

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2022 Governor's Conference on the Future of Water in Kansas

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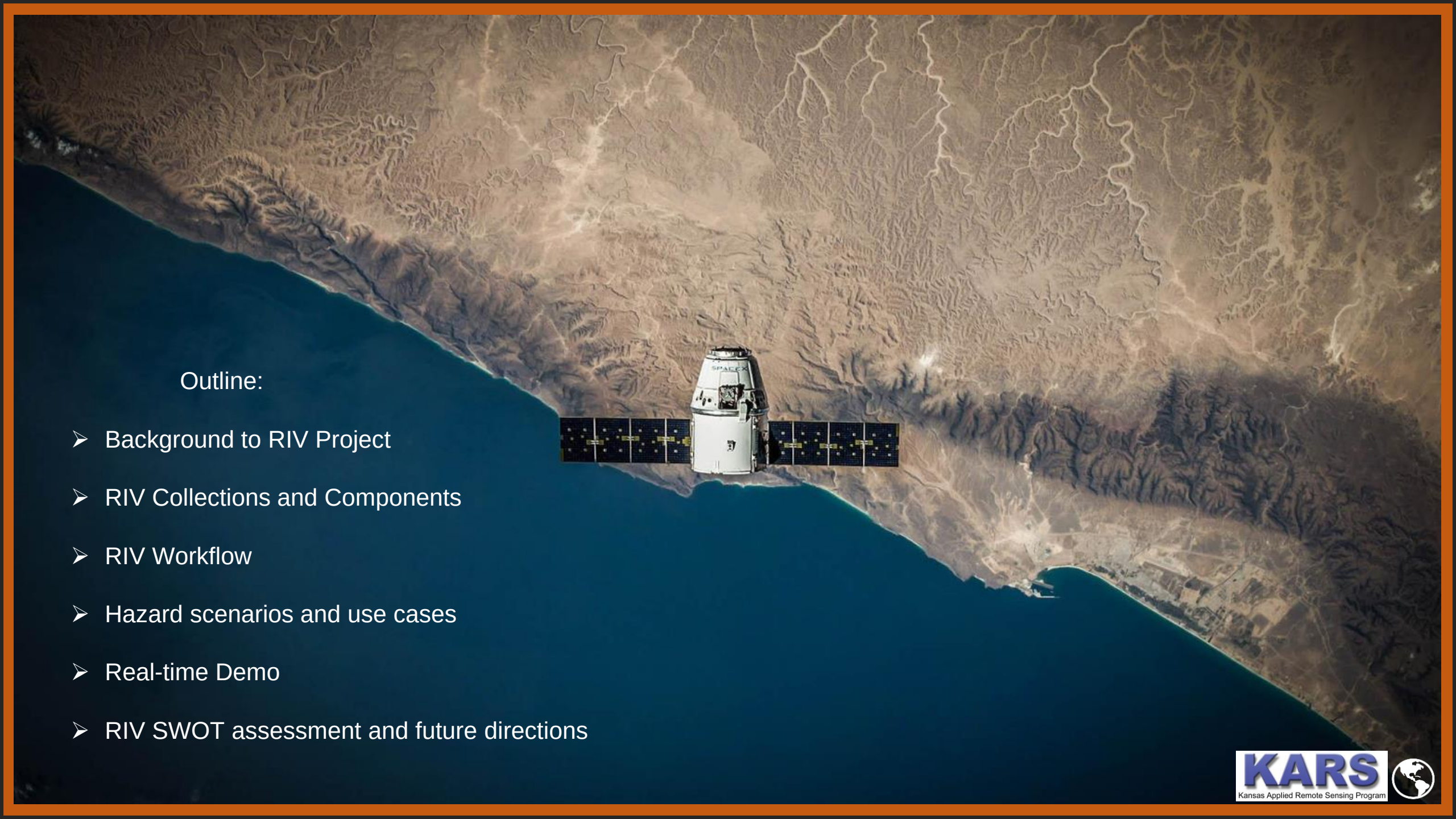

Outline:

- Background to RIV Project
- RIV Collections and Components
- RIV Workflow
- Hazard scenarios and use cases
- Real-time Demo
- RIV SWOT assessment and future directions

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Background

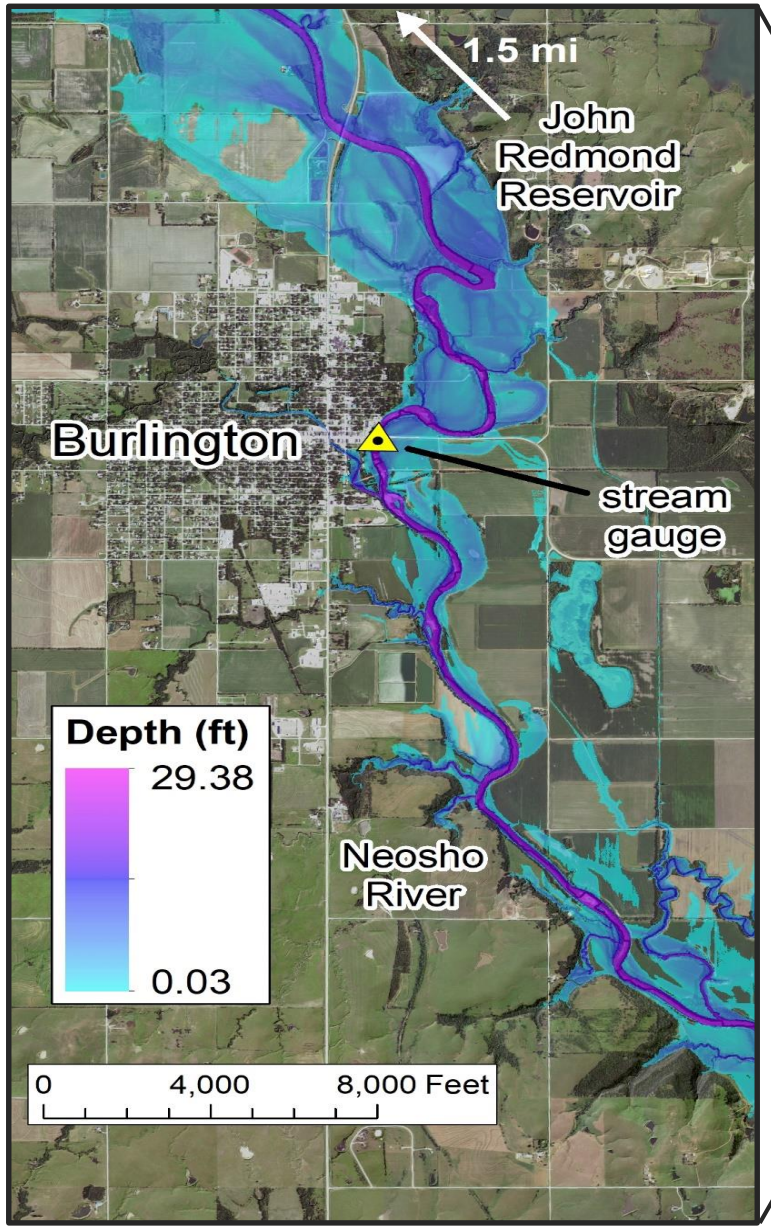
Flood mapping tools rely on remotely sensed images for validation.

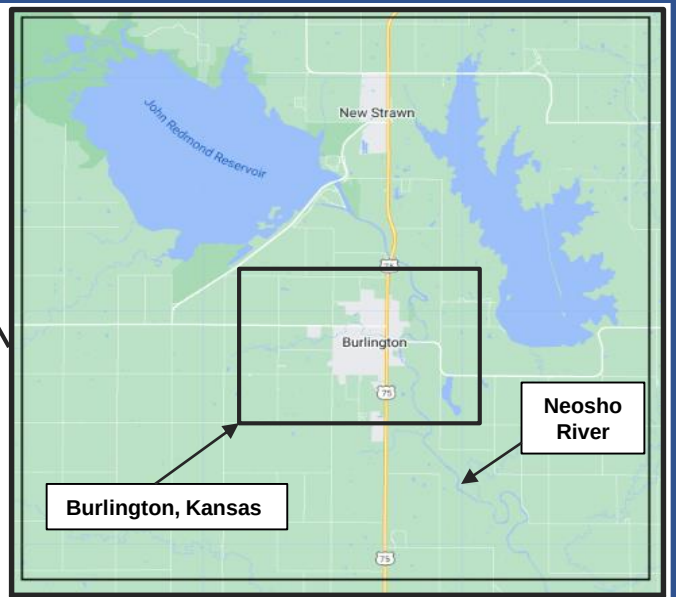
Retrieving remote sensing images can be a hassle needing lots of experience.

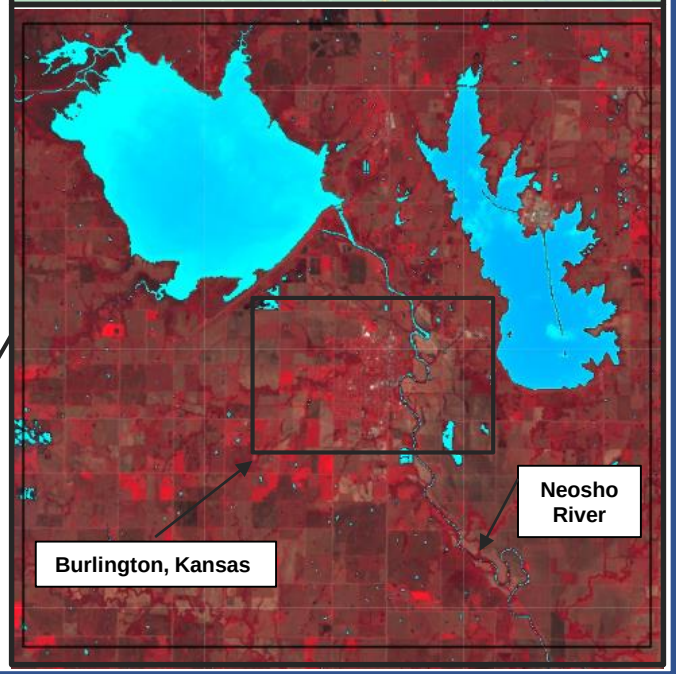
The need for a tool that supports rapid visualization, monitoring, and download of remote sensing images is necessary for environmental researches.

The Rapid Image Viewer (RIV), thus helps breach that gap. RIV supports research related to flood, drought, and fire.

FLDPLN Map update for Lower Neosho around Burlington, including planned release from John Redmond (5/22/19) compared with RIV product.
(2019 Great Flood of the Midwest).







RIV Collections and Components

Datasets	Sensor Type	Resolution Scale	Spatial Resolution (meters)	Start Date	End Date
National Agricultural Imagery Program (NAIP)	Optical	High	1	2002-06-15	2020-12-17
Sentinel-1	Radar	High - medium	10	2014 -09-11	Present
Sentinel-2	Optical	High	10	2015-06-27	Present
Sentinel-3	Optical	Coarse	300	2016-10-18	Present
Landsat-9	Optical	Medium	30	2021-09-09	Present
Landsat-8	Optical	Medium	30	2013-03-13	Present
Landsat-7	Optical	Medium	30	1999-04-15	Present
Landsat-5	Optical	Medium	30	1984-03-01	1993-12-31
MODIS Aqua	Optical	Coarse	250	2001-01-01	Present
MODIS Terra	Optical	Coarse	250	2001-01-01	Present

- True color image band combinations (RGB).
- False Color Image band combination (NRG-bands).
- Normalized difference water Index (NDWI).
- Segmented Image (for water edge identification).

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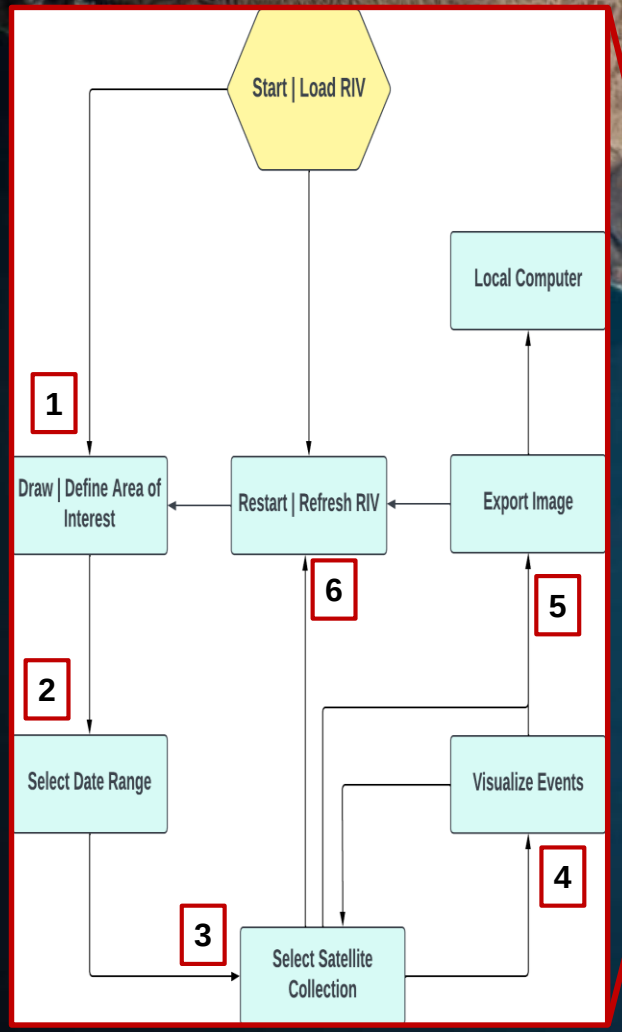
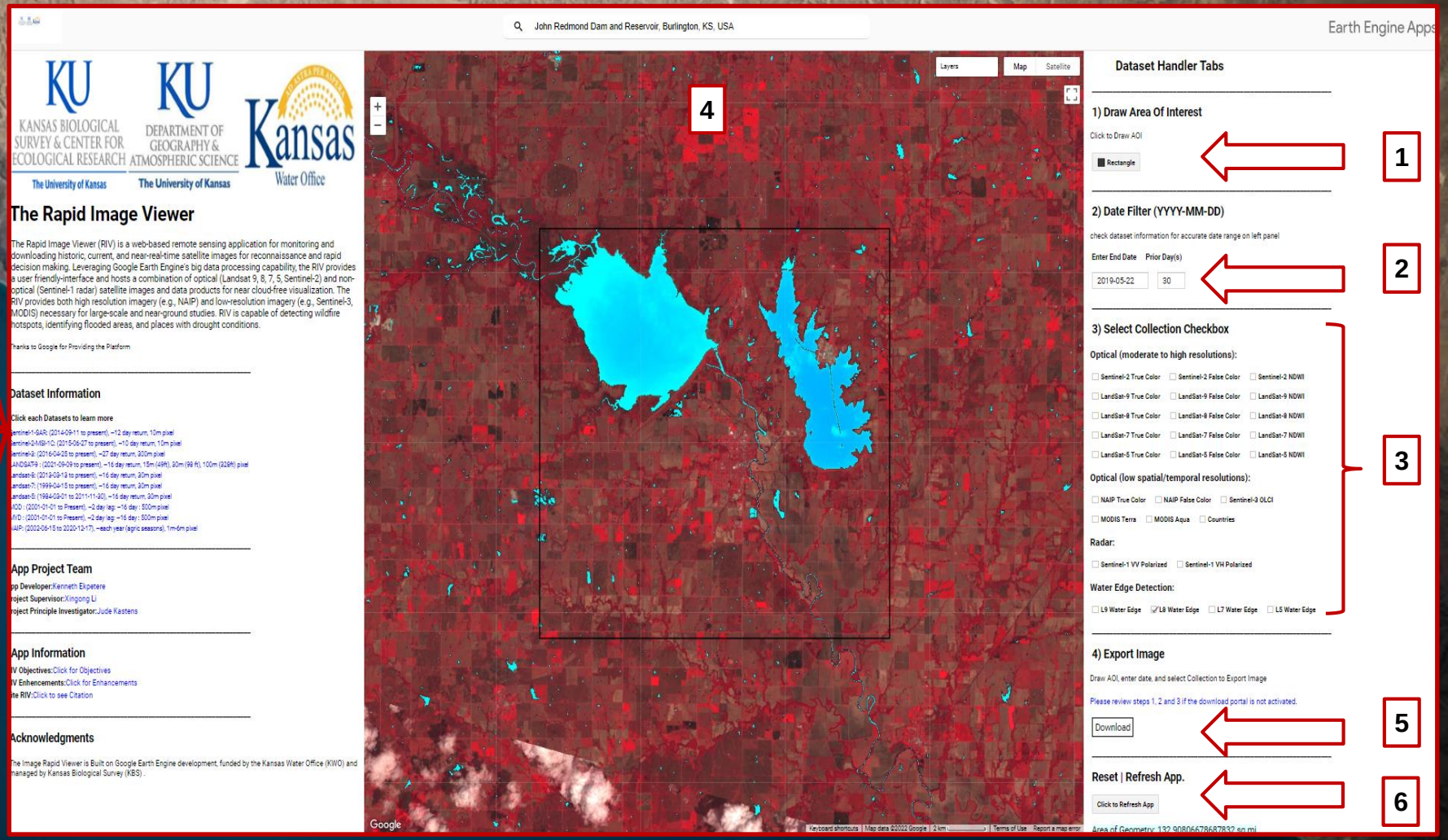
RIV Workflow





https://kars.geoplatform.ku.edu/pages/e0bbb6ddfa7b444b9741cc42222817d4

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Hazard Scenario

1a. Flood

2019 Great Flood of the Midwest

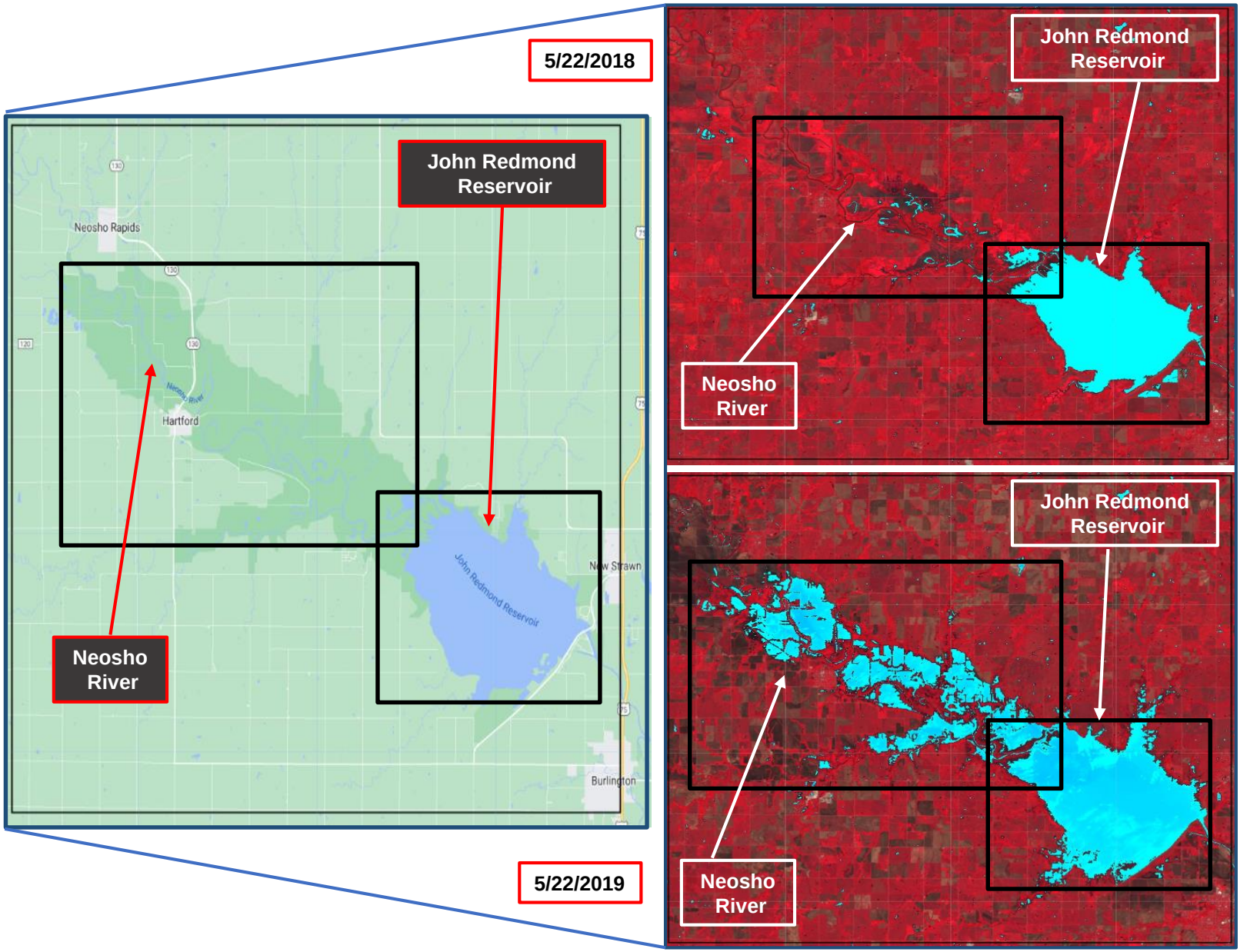
The flood impacted nearly 14 million people in the Midwest.

Over $2.9 billion in property damage.

Flooding in the upper Neosho River and water increase in John Redmond Reservoir (5/22/19).

Over 50% increase in water extent.

Impacted many small towns and cities along the rivers (Neosho Rapids, Hartford, Burlington, New Strawn, to mention a few).



Hazard Scenario

1b. Flood

2019 Great Flood of the Midwest

1

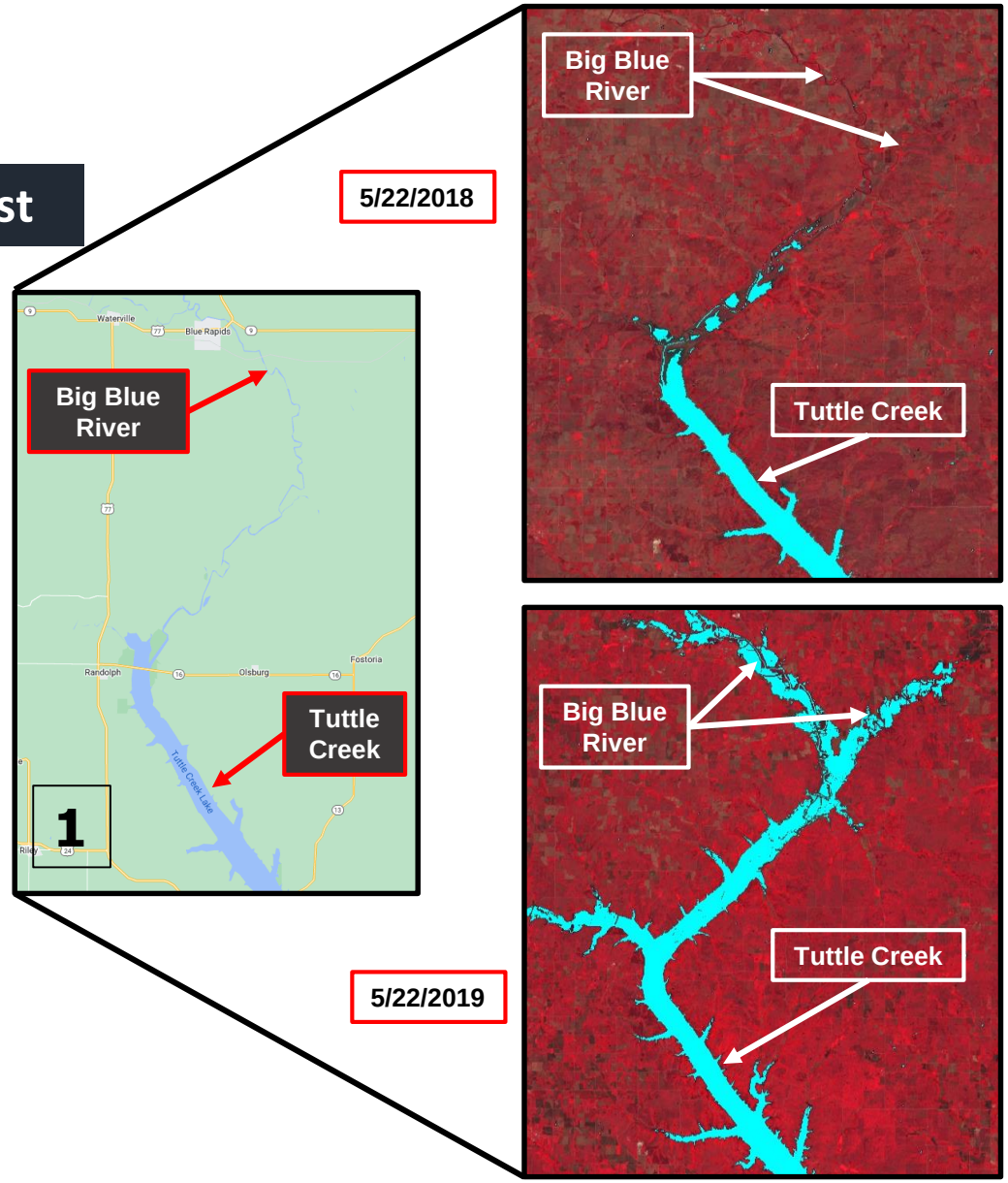
Tuttle creek rose by 29.56 ft to nearly 1,200 ft above sea level (U.S. Army Corps of Engineering).

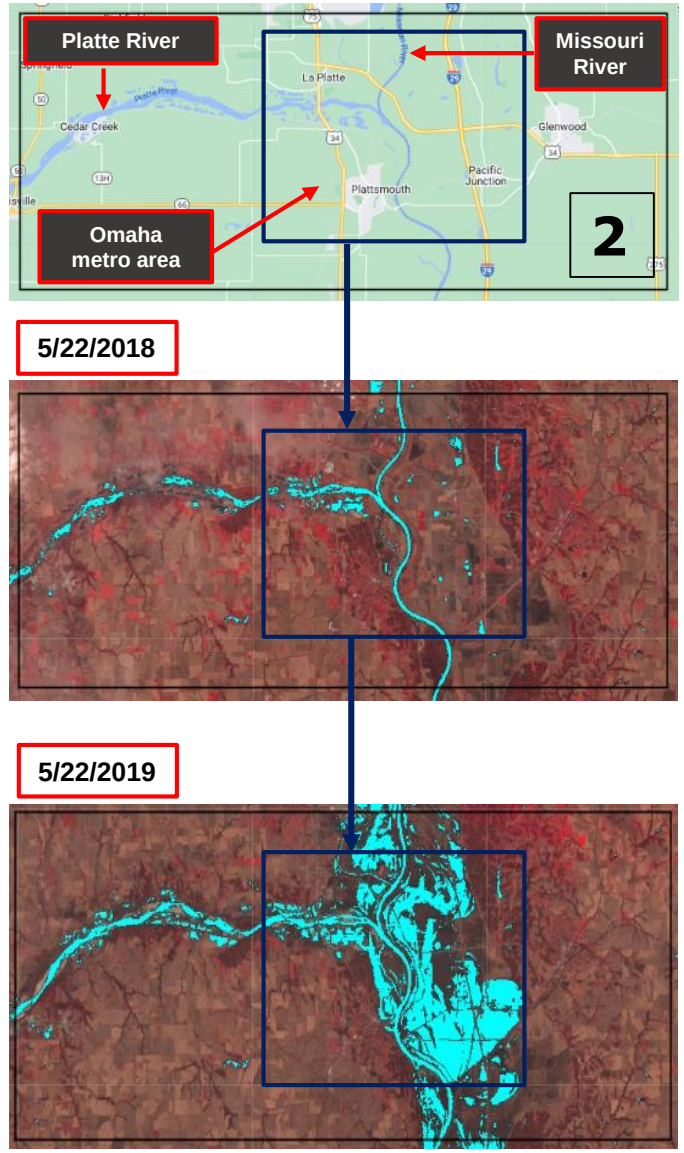
2

Flooding of Omoha metro area (Plattsmouth, Glenwood).

Flooding in Missouri River Basin.

Over $1.3 billion in property damage from ¾ of 93 counties in Nebraska.





Hazard Scenario

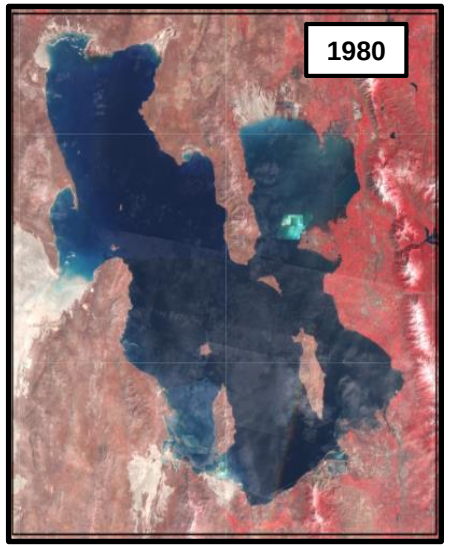
2a. Drought

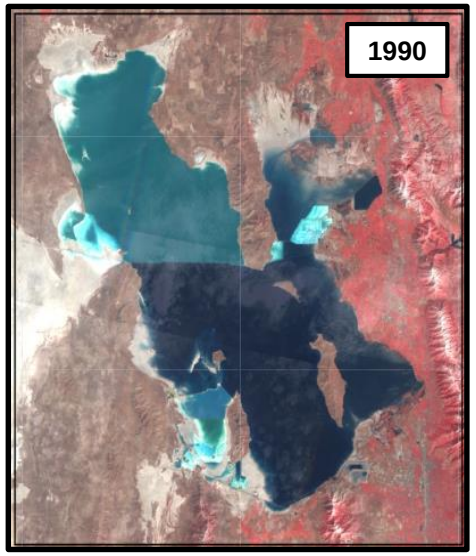
Long-term Drought Impact on Lake Area Extent

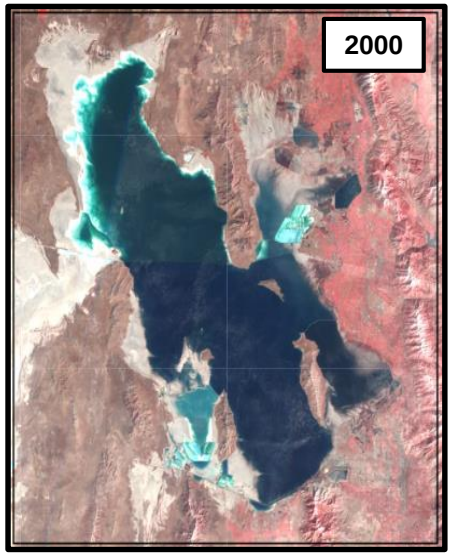
Decline in Great-Salt Lake from 1980 to 2020.

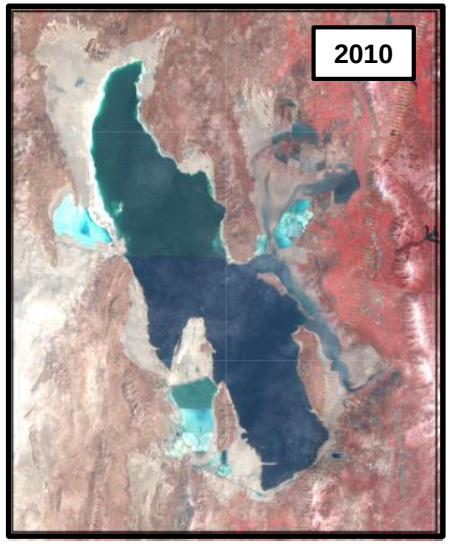
Nearly 50% decline in GSL area extent.

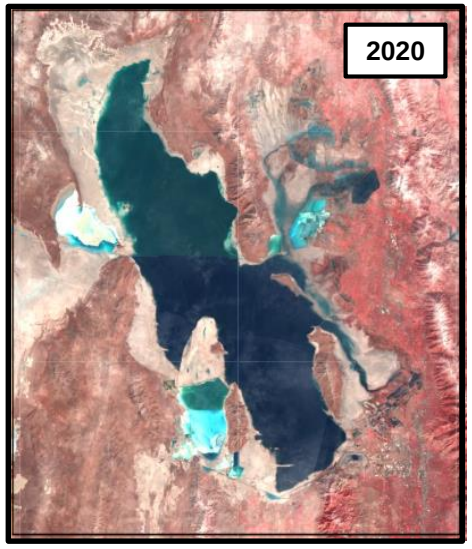
Decreased from 7,000 km.sq in 1980's to below 3,500 km.sq in 2020's.









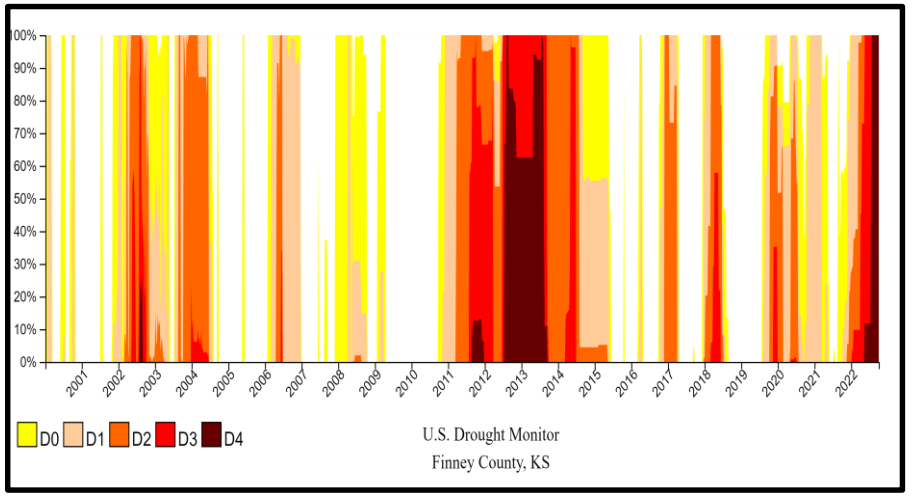


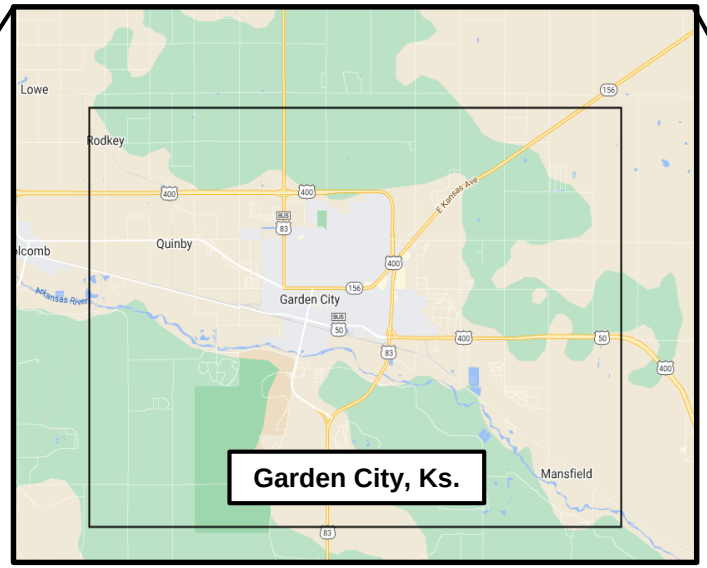
Hazard Scenario

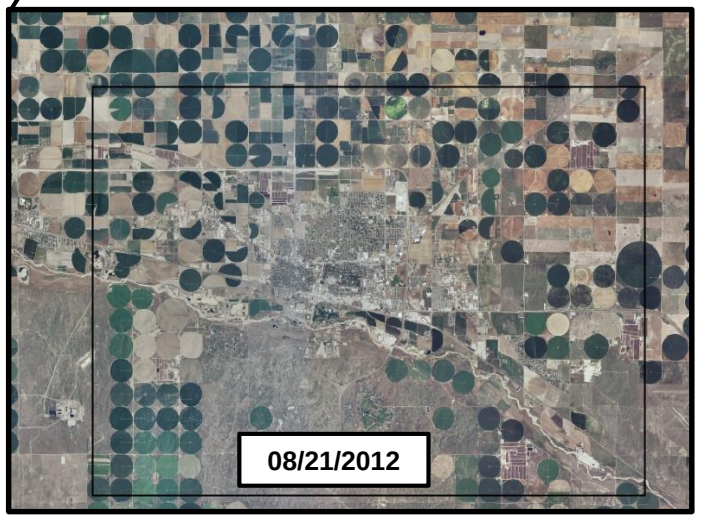
2b. Drought

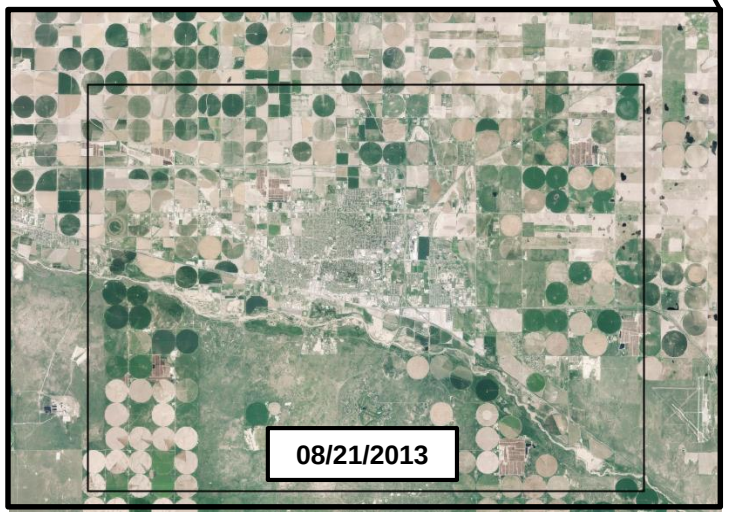
Drought Impact on Crops. (August 21, 2013) Farmlands in Garden City, Finney county, Kansas.

- D4 – Exceptional Drought.
- Impacted 34.6 % of Kansas.
- Severe Impact on crops and aquatic species.









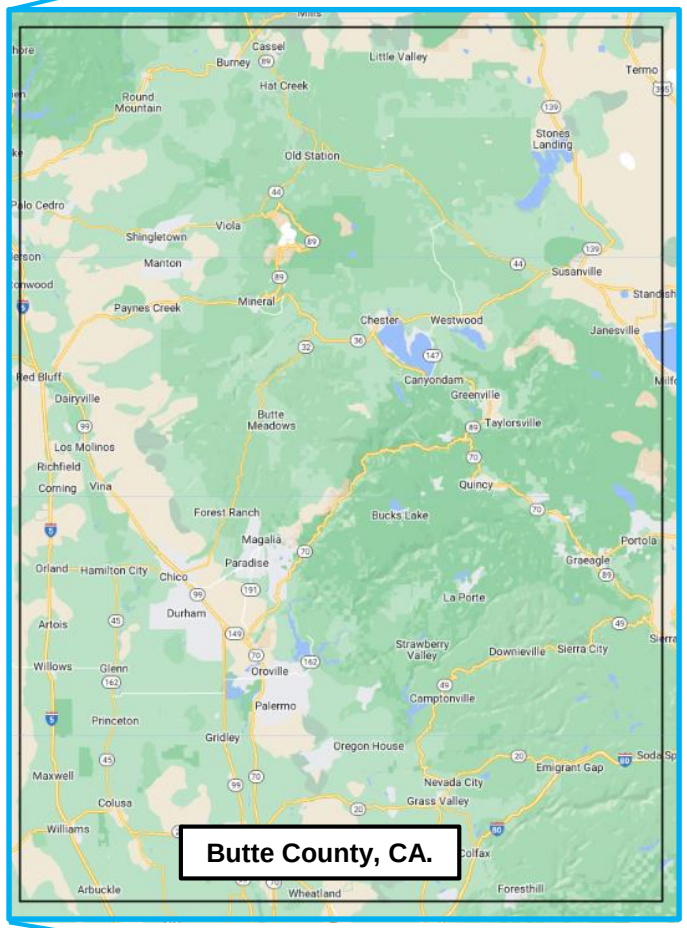
Hazard Scenario

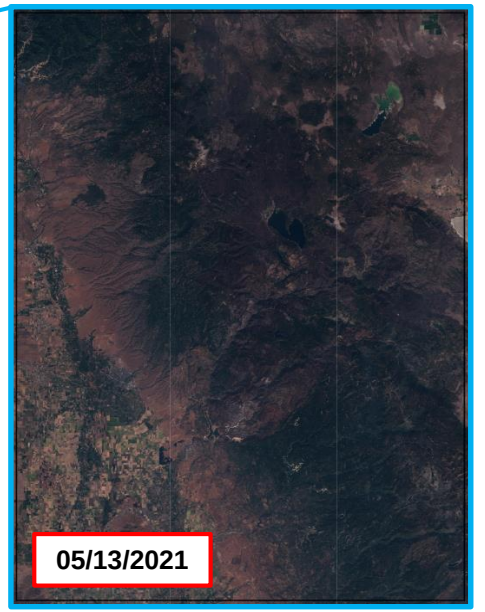
3a. Wildfire

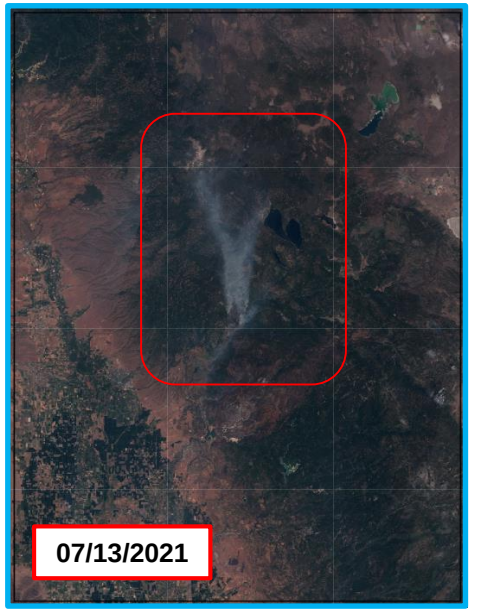
2021 Wildfire in California

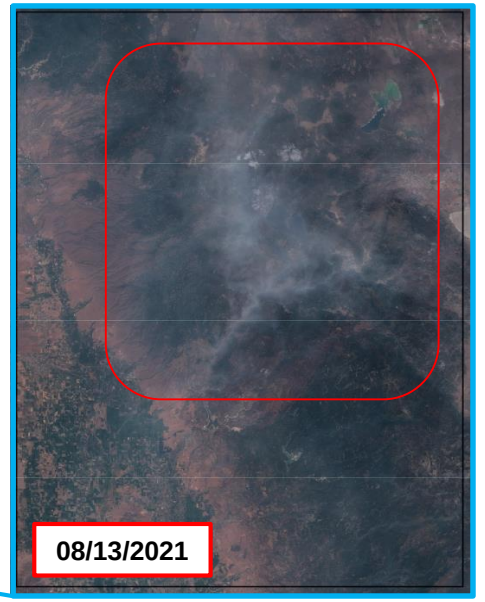
- Nicknamed the Dixie Fire of CA.
- Started July 13, 2021, up to October 25, 2021.
- Burned over 963,837 acres.
- Impacted several counties (Butte, Plumas, Lassen, Shasta, and Tehama).
- Largest single wildfire in CA. and second largest wildfire overall.
- First known wildfire to cross the crest of the Sierra Nevada.
- Cost over $637.4 million to fight.

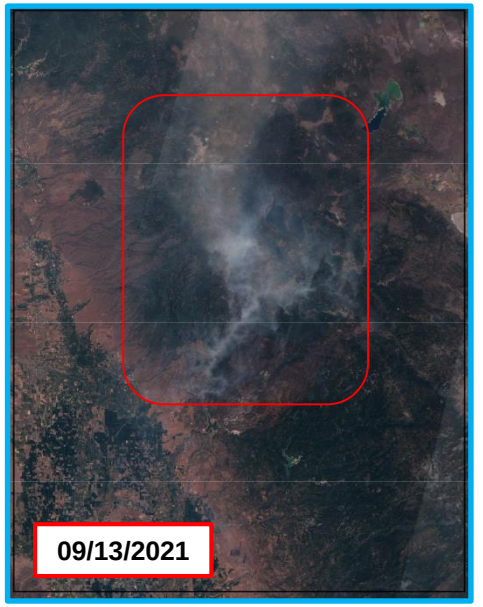
Source: [CalFire]









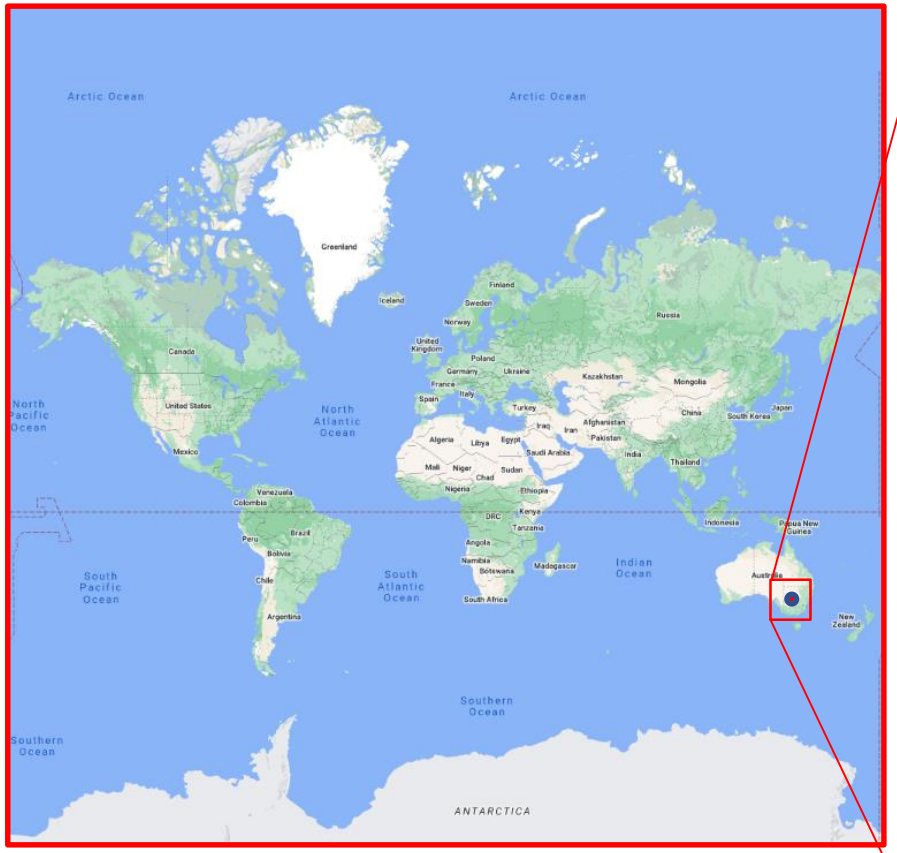


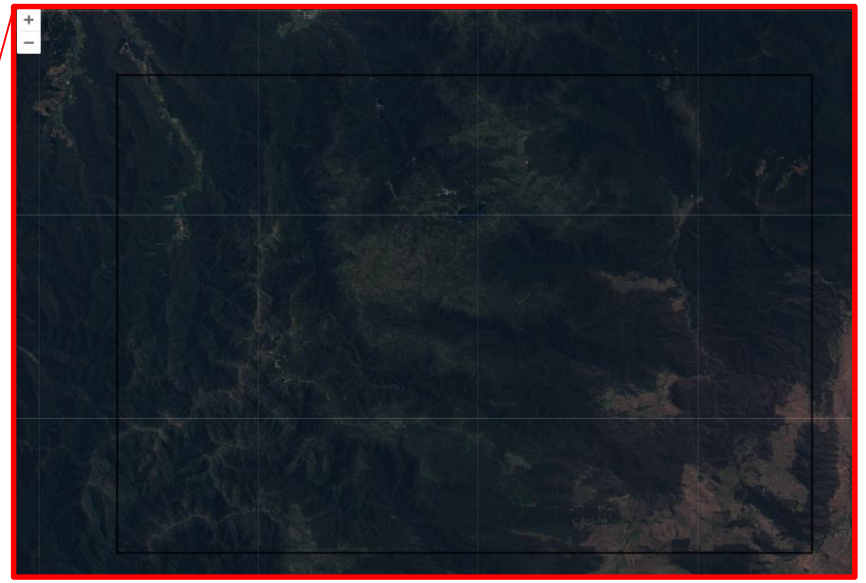
Hazard Scenario

3b. Wildfire

2020 Wildfire in Victoria Region, Australia.

- Triggered by the 2019 droughts in Australia.
- Decimated over a billion animal.
- Killed 75 people (20 fire fighters).
- Caused air pollution, and vegetation depletion.
- Direct impact on climate change.
- Cost between $4 billion - $5 billion.

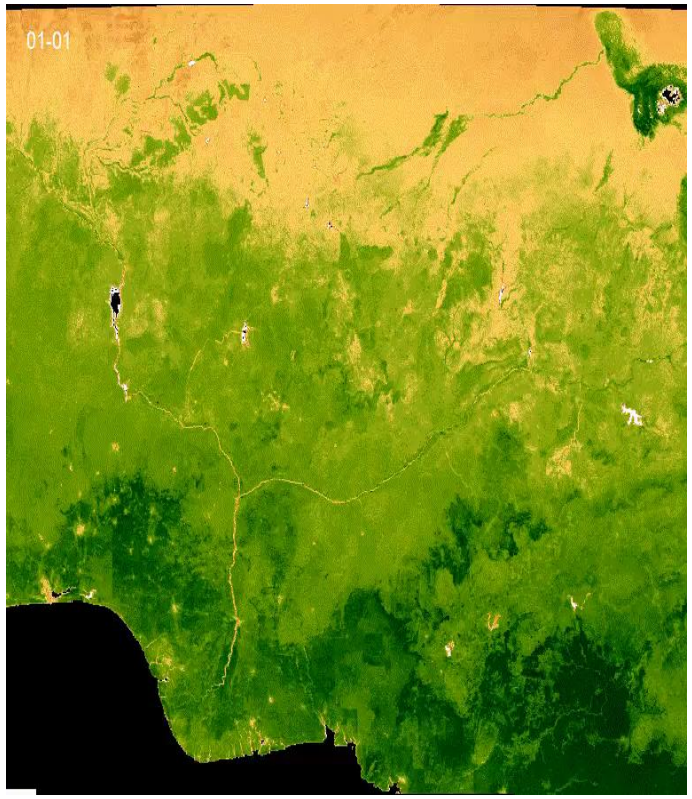




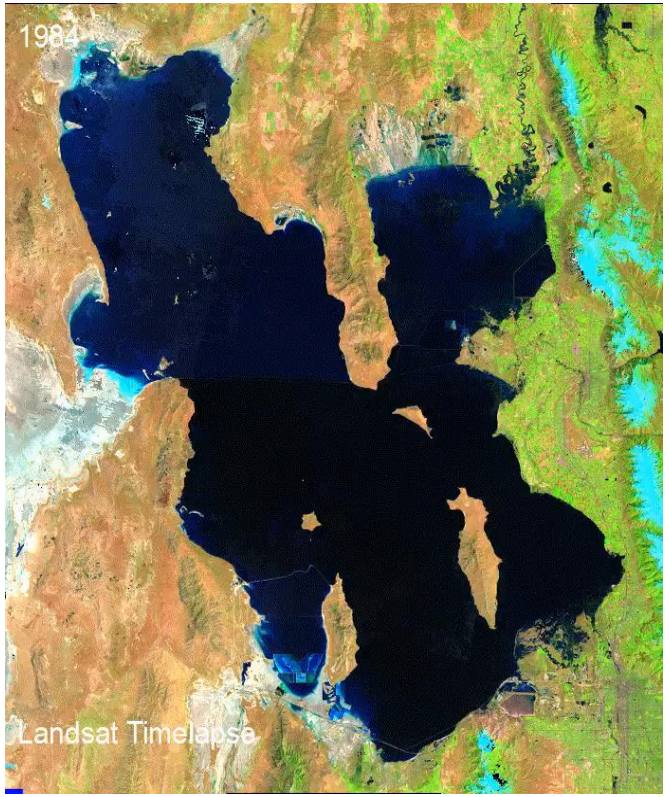
Other Areas Of RIV Applications

4. Global Monitoring

Vegetation Change (Nigeria)



Lake Area Change (Utah, USA)



Lekki Expansion (Nigeria)

RIV SWOT ASSESSMENT

S

Strengths

- Fast and easy to use.
- No programming skill.
- Daily update.
- Work online, no app download needed.
- Variety of collections.
- Applicable to various fields.

W

Weaknesses

- Require knowledge of remote sensing.
- Workflow must be maintained.
- Daily reload to update collections.
- Require Internet connection.
- Users cannot access script.

SWOT
ANALYSIS

O

Opportunities

- Global coverage.
- Daily update.
- Many fields of applications.
- Retrieves past and current images.
- Multiple users at a time.

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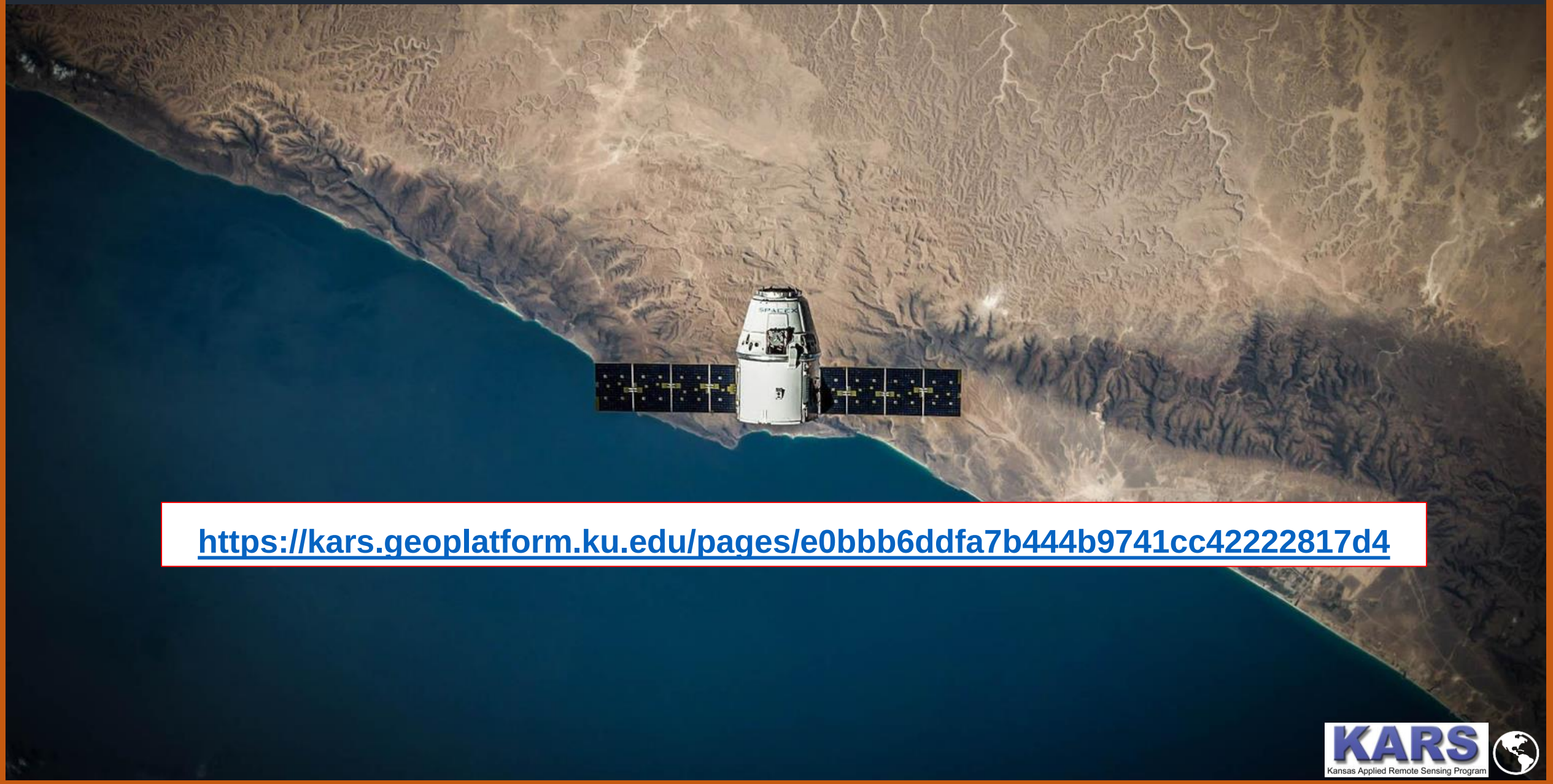
Threats

- Require GEE platform to mount.
- Host platform policy changes.
- No offline capability.

Real-time Demo



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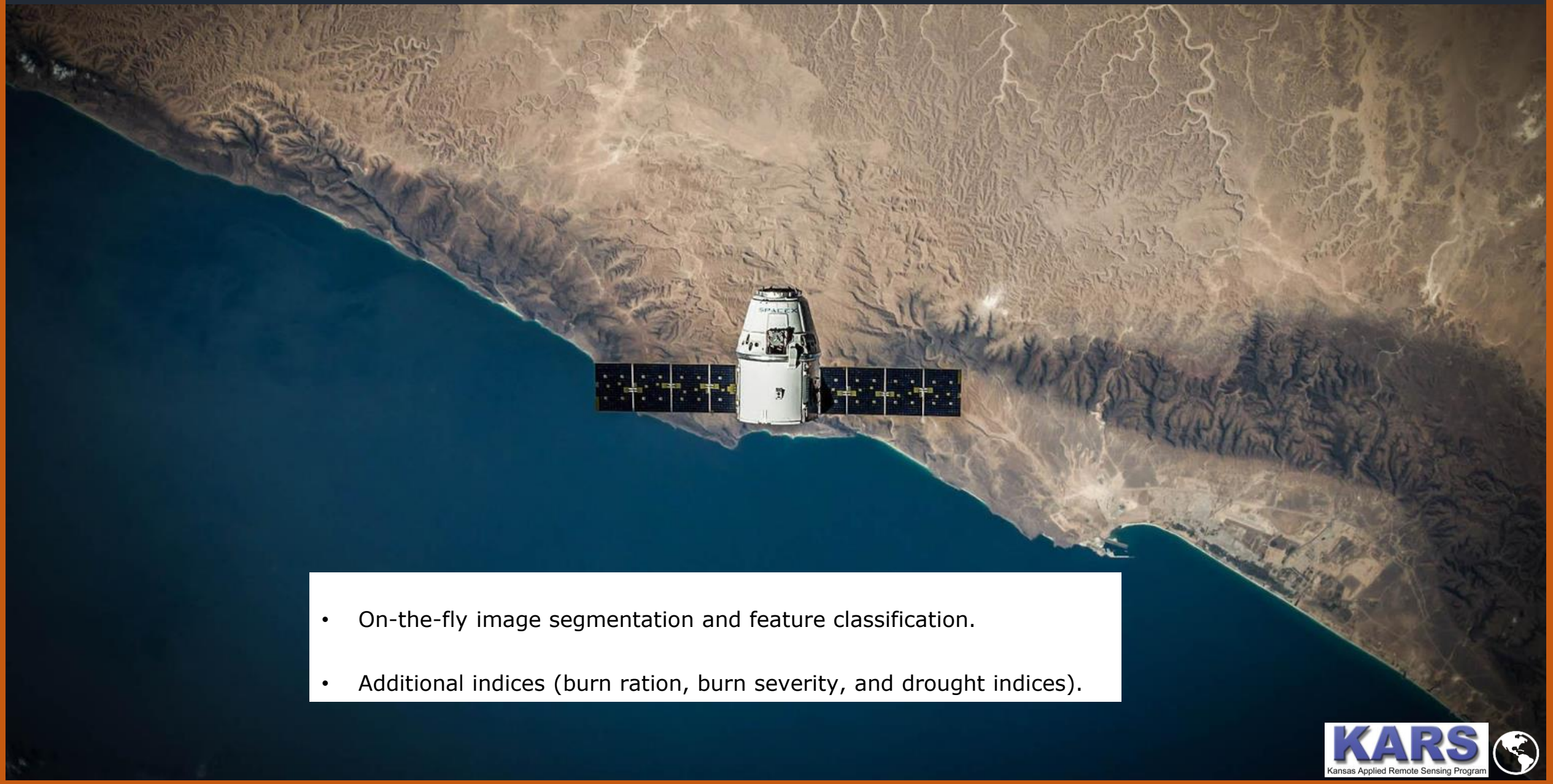
Future Direction



- On-the-fly image segmentation and feature classification.
- Additional indices (burn ration, burn severity, and drought indices).

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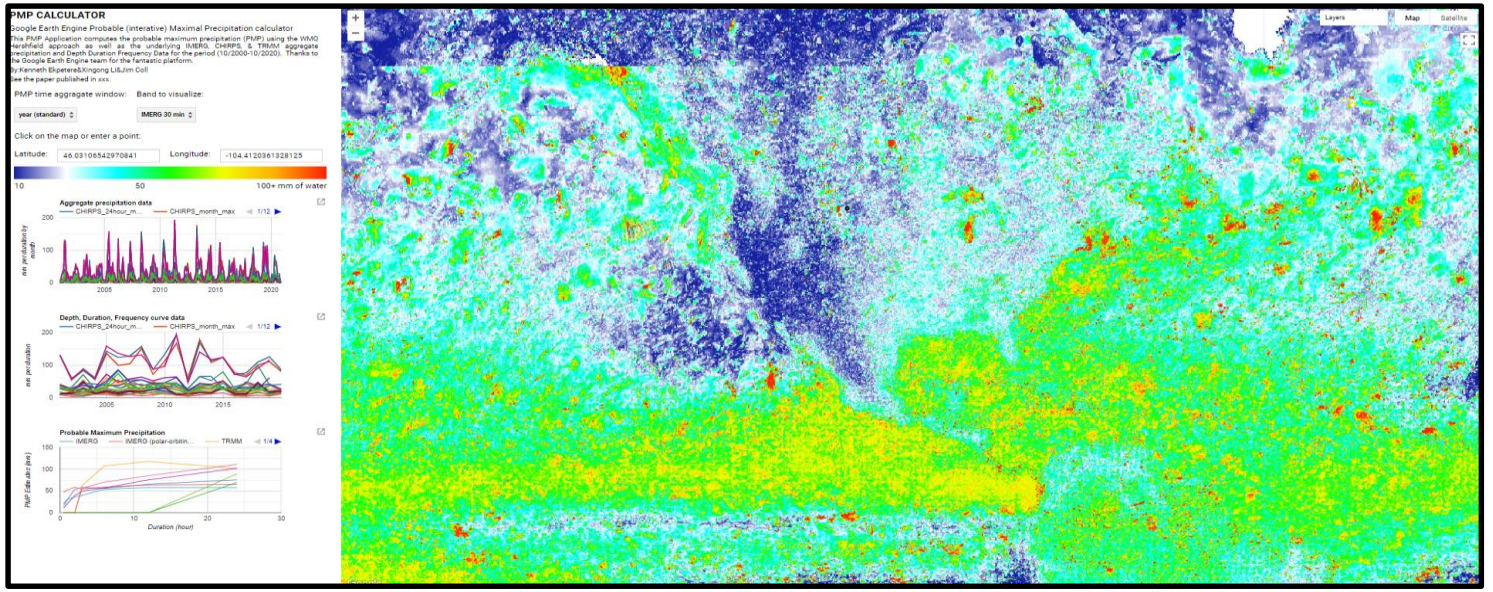
Additional Tools from the developer

PMP Calculator

https://cartoviews.users.earthengine.app/view/pmp-calculator

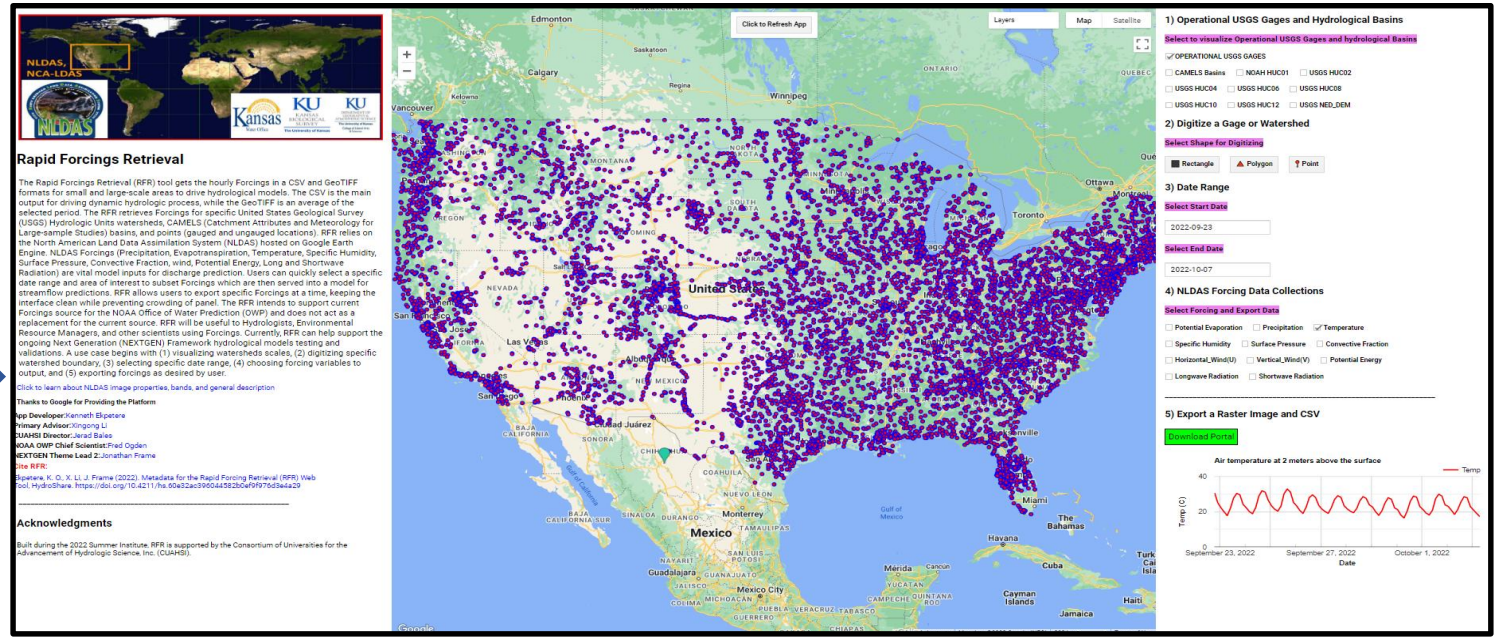
- PMP and Maximum Flood Risk Mapping.



Rapid Forcing Retrieval

https://cartoviews.users.earthengine.app/view/rapid-forcings-retrieval

- Hydrological modeling components.



Acknowledgement

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Questions

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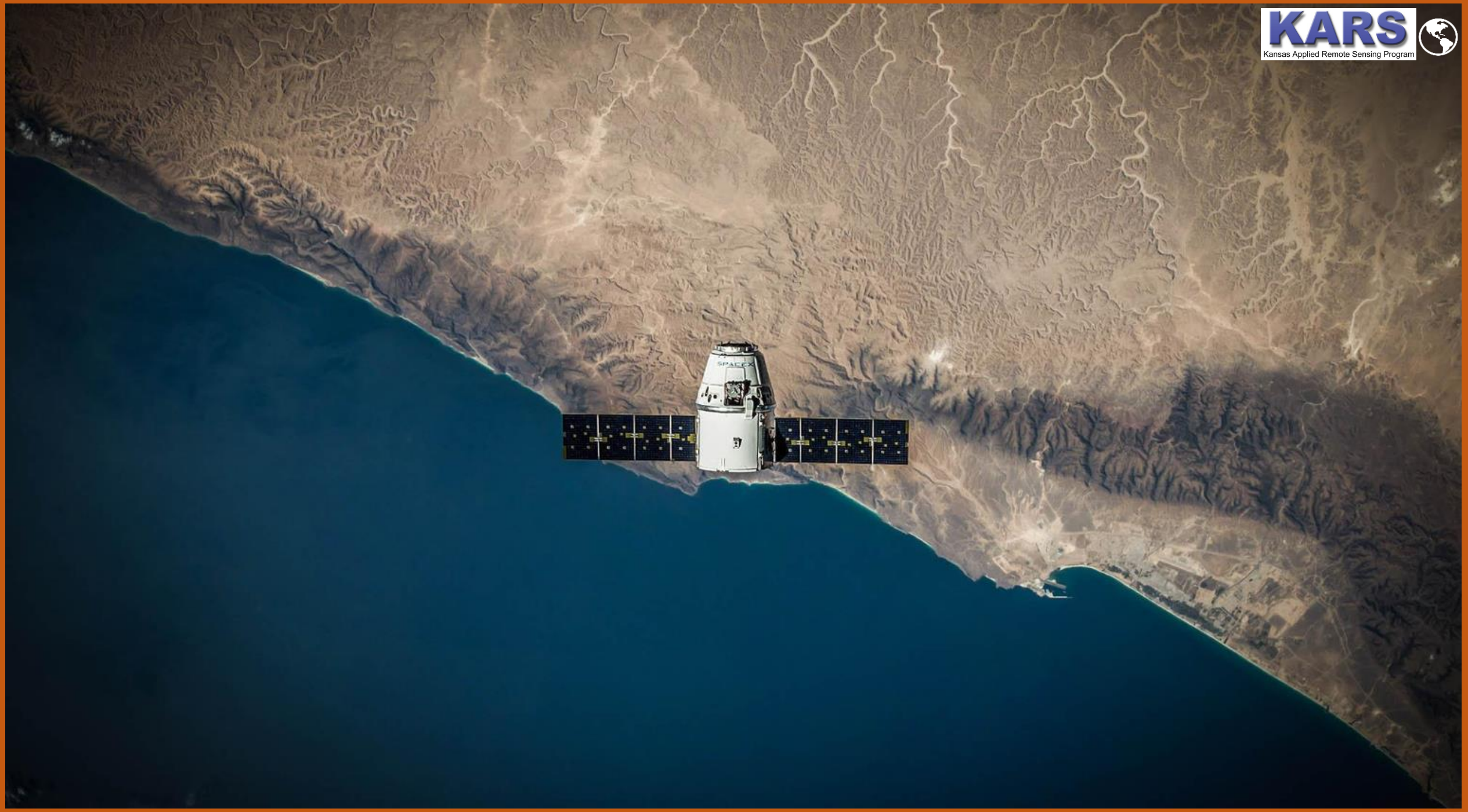
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SPACEX