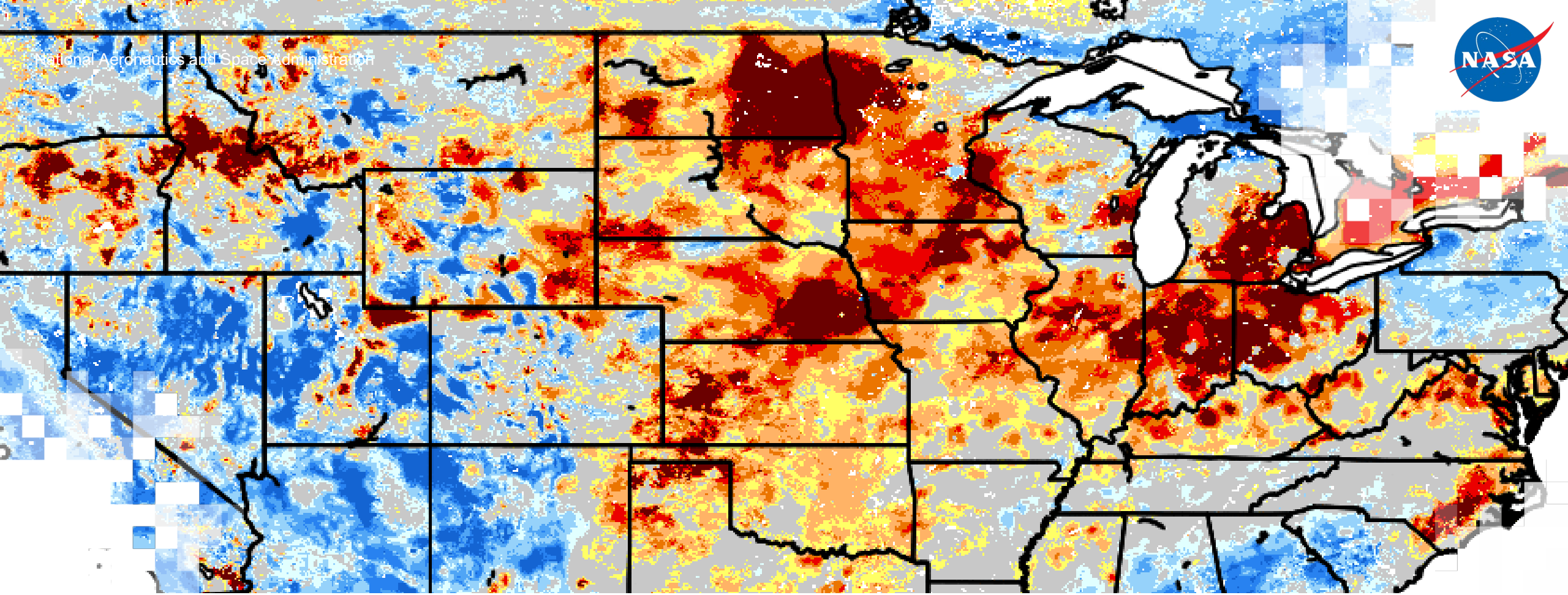
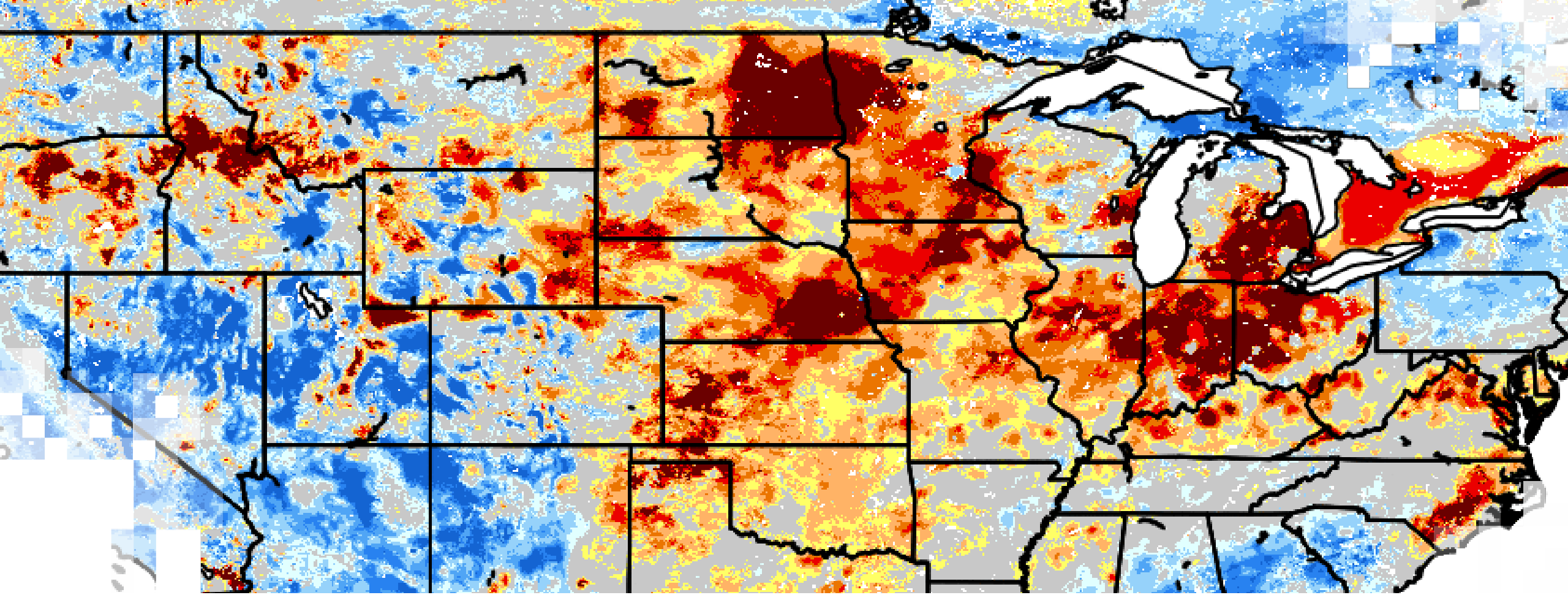


Application of NASA SPoRT-Land Information System (SPoRT-LIS) Soil Moisture Data for Drought

Part 3: Access Data at Organization and Individual Levels

Sean McCartney (NASA/SSAI), Jonathan Case (ENSCO, Inc/NASA SPoRT), Matthew Smith (UAH/ NASA SPoRT), Ryan Wade (UAH/ NASA SPoRT), Chris Hain (NASA SPoRT)

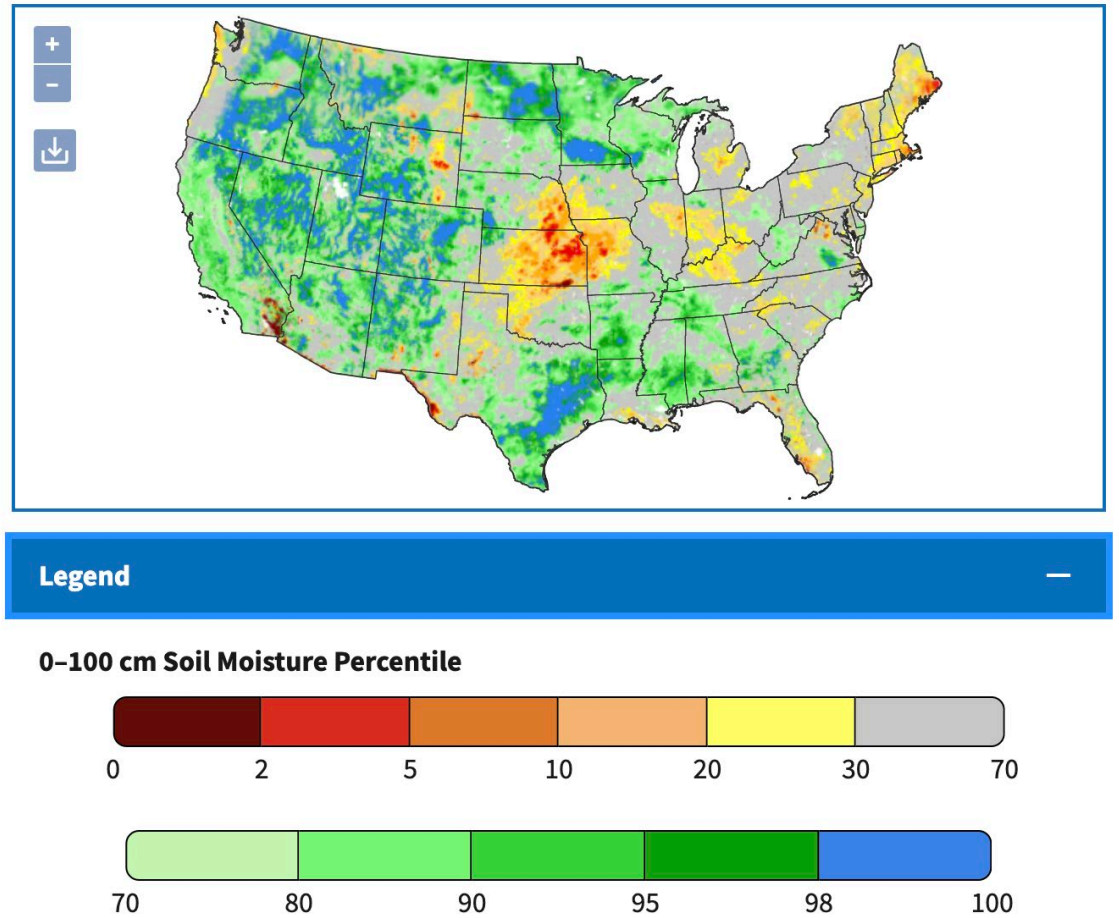
May 31, 2023



Overview

Overview

- An estimated 55 million people globally are affected by droughts every year (WHO).
- Soil moisture plays an important role in drought monitoring.
- Relatively high-resolution gridded soil moisture products improve situational awareness.
- SPoRT-LIS provides unique, real-time soil moisture information at relatively high spatial resolution (~3 km).



Credit: NASA

Training Learning Objectives

A user will be able to apply LIS output to efficiently analyze drought over large spatial areas in conjunction with current practices and to integrate this capability with existing data.

- Identify the NASA/LIS basics regarding the framework, input forcing, static fields, LSM structure, and output most relevant to drought
- Summarize the derived soil moisture percentile products and how these are created
- Apply SPoRT-LIS output and/or derived products to both complement existing data and overcome limitations to monitoring drought over large areas
- Recognize 'best practices' for LIS impact related to drought
- Configure LIS output file for viewing within a GIS-based display tool and for tailored output products and graphics

Prerequisites

- Fundamentals of Remote Sensing, Session 1
- Download and install QGIS and all accompanying software
- Register for a Google Colab via Gmail or Gmail-enabled account
- Basic Python experience beneficial but not required

Training Outline

Part 1

Foundational Understanding of LIS (Static, Forcing, Models, Output)

May 17, 2023

Self-paced Microlesson

Part 2

Early and Established Applications of LIS for Drought Analysis in Operations

May 24, 2023

Self-paced Microlesson

Part 3

Access Data at Organization and Individual Levels

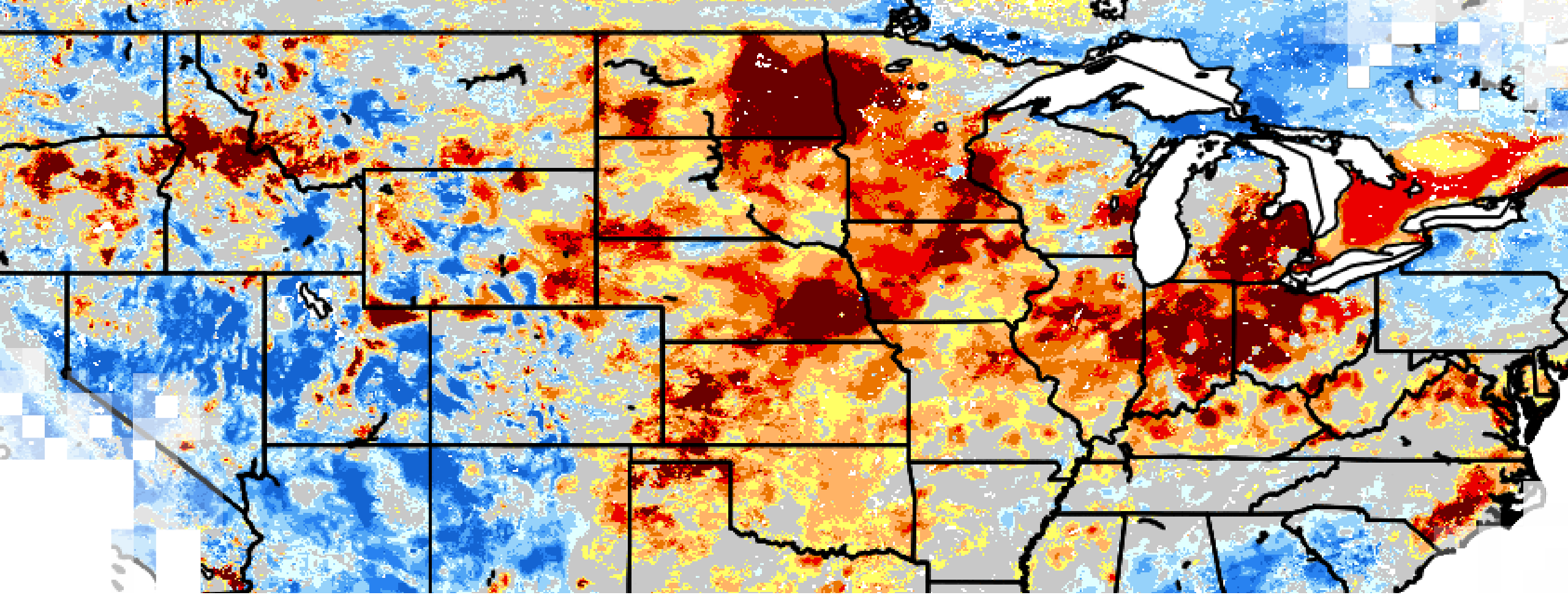
May 31, 2023

Self-paced Microlesson

Homework

Opens May 31 – Due June 14 – Posted on Training Webpage

A certificate of completion will be awarded to those who attend all live sessions and complete the homework assignment before the given due date.



Part 3: Access Data at Organization and Individual Levels

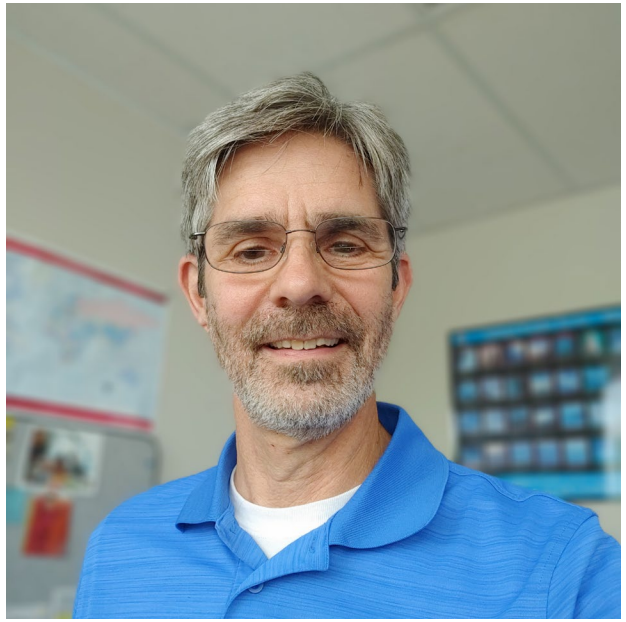
Part 3 Trainers

Jonathan Case

Research Meteorologist, NASA SPoRT

Matthew Smith

Research Scientist, NASA SPoRT



Ryan Wade

Research Scientist, NASA SPoRT

Chris Hain

Project Lead, NASA SPoRT

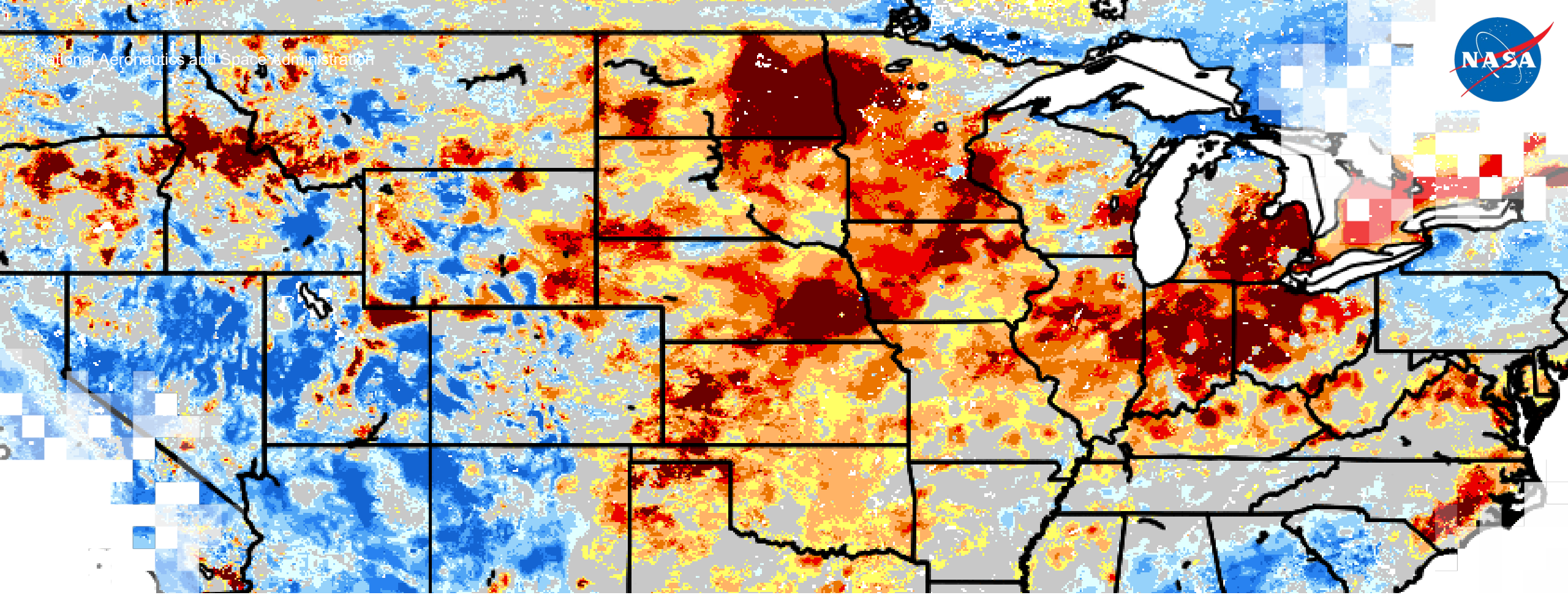
Part 3 Objectives

By the end of Part 3, participants will be able to:

- Access SPoRT-LIS CONUS and East Africa Output via SPoRT Web Viewer
- Acquire and Display SPoRT-LIS CONUS GEOTIFF via QGIS
- Read and display outputs for SPoRT-LIS tailored to user needs and custom domains using Google Colab/Jupyter

How to Ask Questions

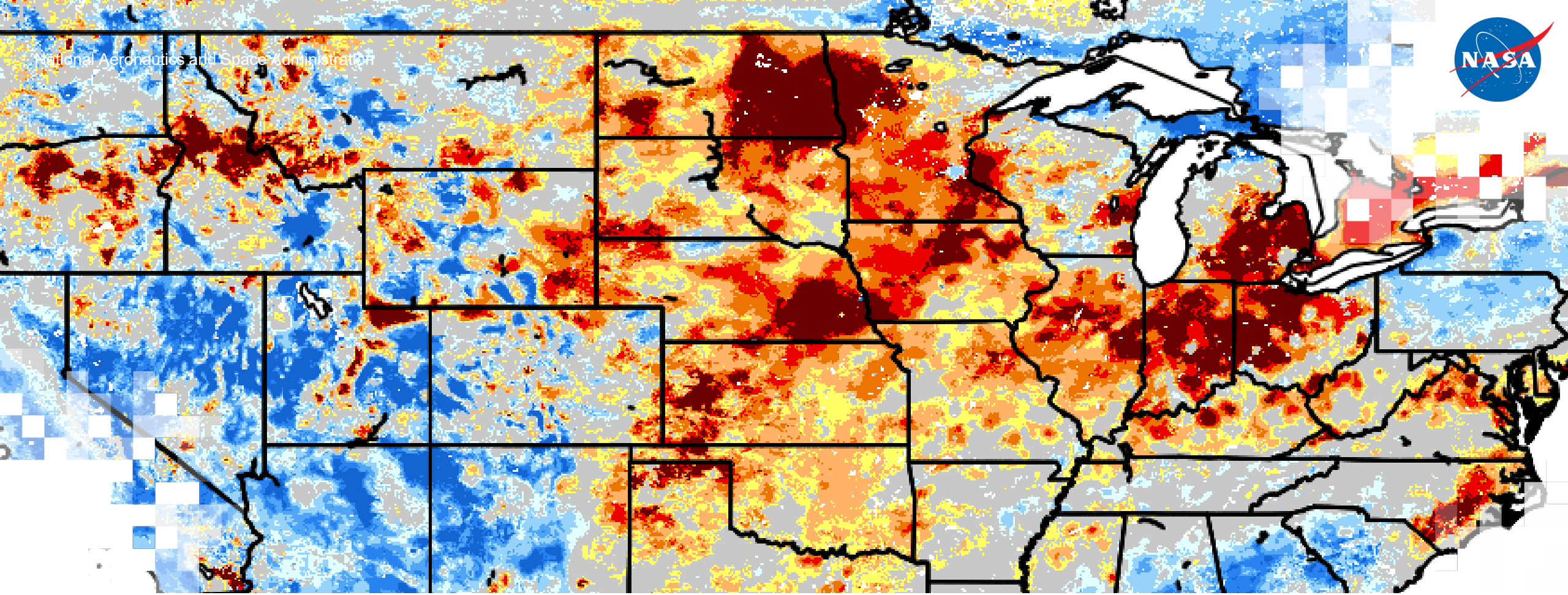
- Please put your questions in the Questions box and we will address them at the end of the webinar.
- Feel free to enter your questions as we go. We will try to get to all of the questions during the Q&A session after the webinar.
- The remainder of the questions will be answered in the Q&A document, which will be posted to the training website about a week after the training.



DEMO: Display of SPoRT-LIS CONUS Output via SPoRT Web Viewer

Jonathan Case (ENSCO, Inc/NASA SPoRT)

May 31, 2023



Viewing Near-Real Time SPoRT-LIS CONUS Files

Matt Smith – University of Alabama in Huntsville, Information Technology and Systems Center – NASA SPoRT

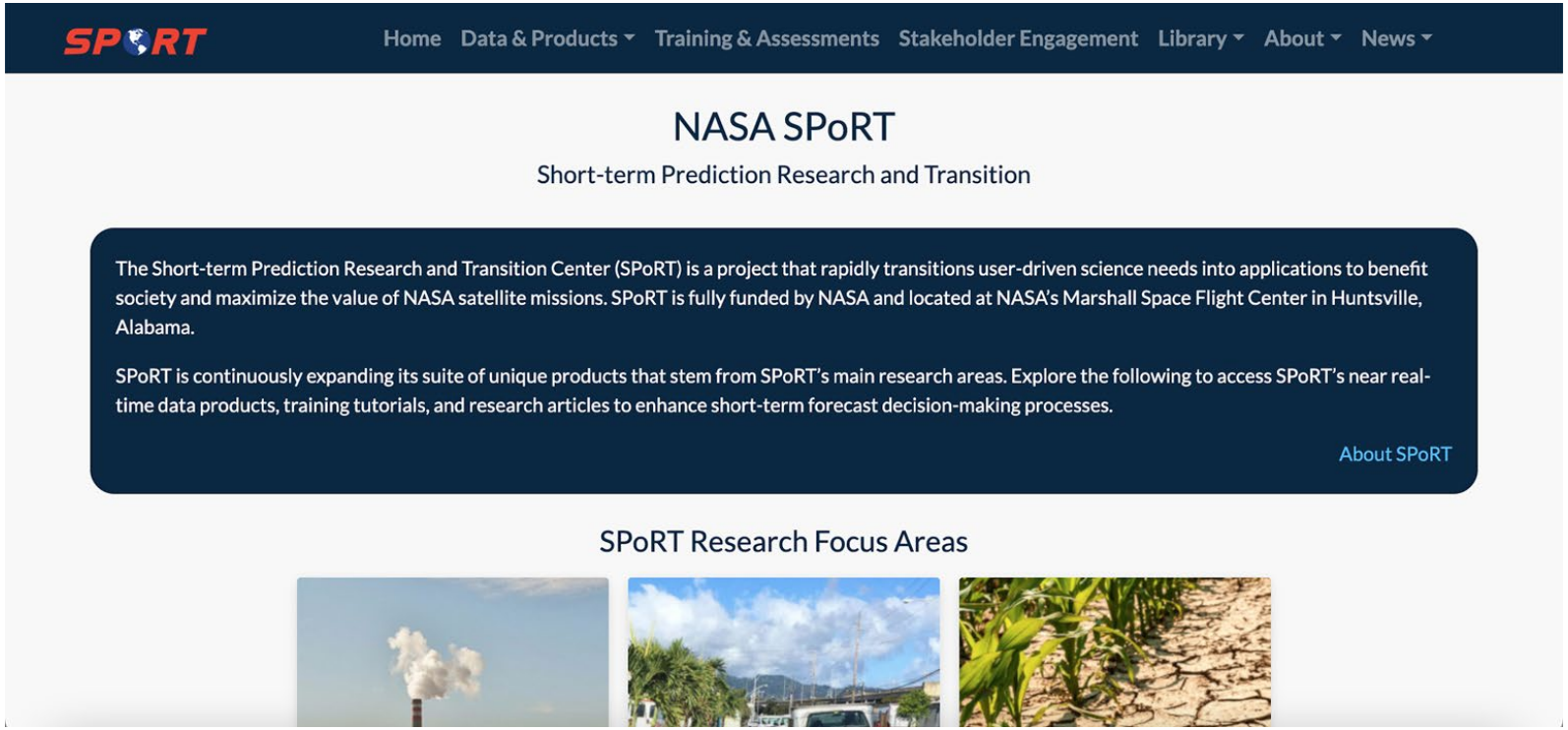
May 31, 2023

Viewing Near-Real Time SPoRT-LIS CONUS Files

- Where can I get LIS data files?
- How can I explore LIS GeoTIFF files on my own?

Viewing Near-Real Time SPoRT-LIS CONUS Files

- Imagery available at the NASA SPoRT Website
  - https://weather.ndc.nasa.gov/sport



Note: This is NASA SPoRT's server for various datasets made available for public use. The URL may change – so, if you have trouble finding it, go to the main SPoRT site https://weather.nsstc.nasa.gov/sport and, within the ***Data & Products*** tab, select the ***Data Access*** link.

Viewing Near-Real Time SPoRT-LIS CONUS Files

- **NASA SPoRT File Server:**
  - https://geo.nsstc.nasa.gov/SPoRT/modeling/lis

- **GRIB2 for AWIPS:**
  - https://geo.ndc.nasa.gov/SPoRT/modeling/lis/conus3km/awips
  - Variables: Specifically selected for AWIPS
  - Instructions available (email msfc-dl-sport-support@mail.nasa.gov)
  - Purged after 1 week

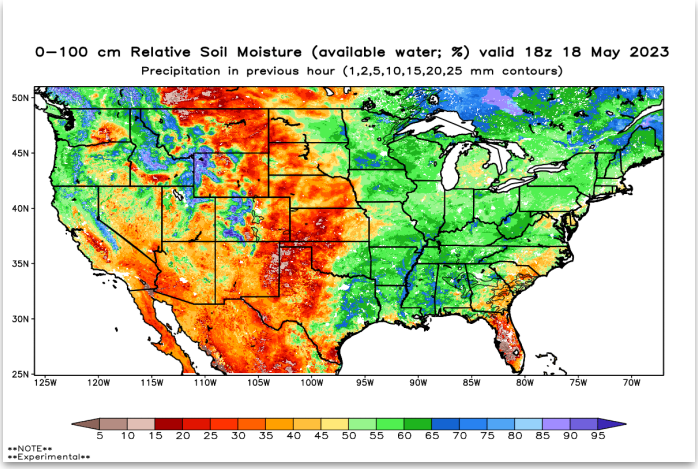
Note: This is NASA SPoRT's server for various datasets made available for public use. The URL may change – so, if you have trouble finding it, go to the main SPoRT site https://weather.nsstc.nasa.gov/sport and, within the ***Data & Products*** tab, select the ***Data Access*** link.

Viewing Near-Real Time SPoRT-LIS CONUS Files

- **NASA SPoRT File Server:**
  - https://geo.nsstc.nasa.gov/SPoRT/modeling/lis

png & 2 GeoTIFFs ('float' and 'bytescaled')

- https://geo.ndc.nasa.gov/SPoRT/modeling/lis/conus3km/geotiff
- Variables
  - Green Vegetation Fraction (GVF)
  - Volumetric Soil Moisture (VSM) 0-10cm
  - Relative Soil Moisture (RSM) 0-10cm
  - RSM 0-200cm
  - RSM 0-200cm differences
    - 1-week
    - 2-week
  - Soil Moisture percentiles
    - RSM 0-200cm (County climatology)
    - Cumulative Layered percentiles (Gridpoint climatology)
- Purged after 2 weeks



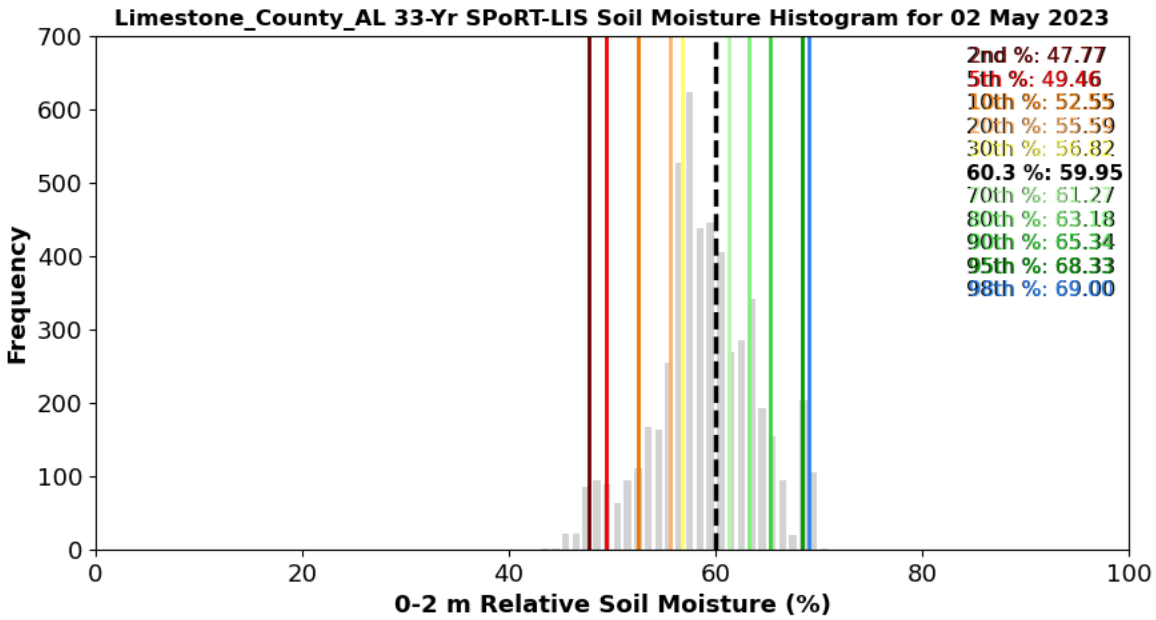
Note: This is NASA SPoRT's server for various datasets made available for public use. The URL may change – so, if you have trouble finding it, go to the main SPoRT site https://weather.nsstc.nasa.gov/sport and, within the ***Data & Products*** tab, select the ***Data Access*** link.

Viewing Near-Real Time SPoRT-LIS CONUS Files

- **NASA SPoRT File Server:**
  - https://geo.nsstc.nasa.gov/SPoRT/modeling/lis

Soil Moisture Histograms for Select Counties

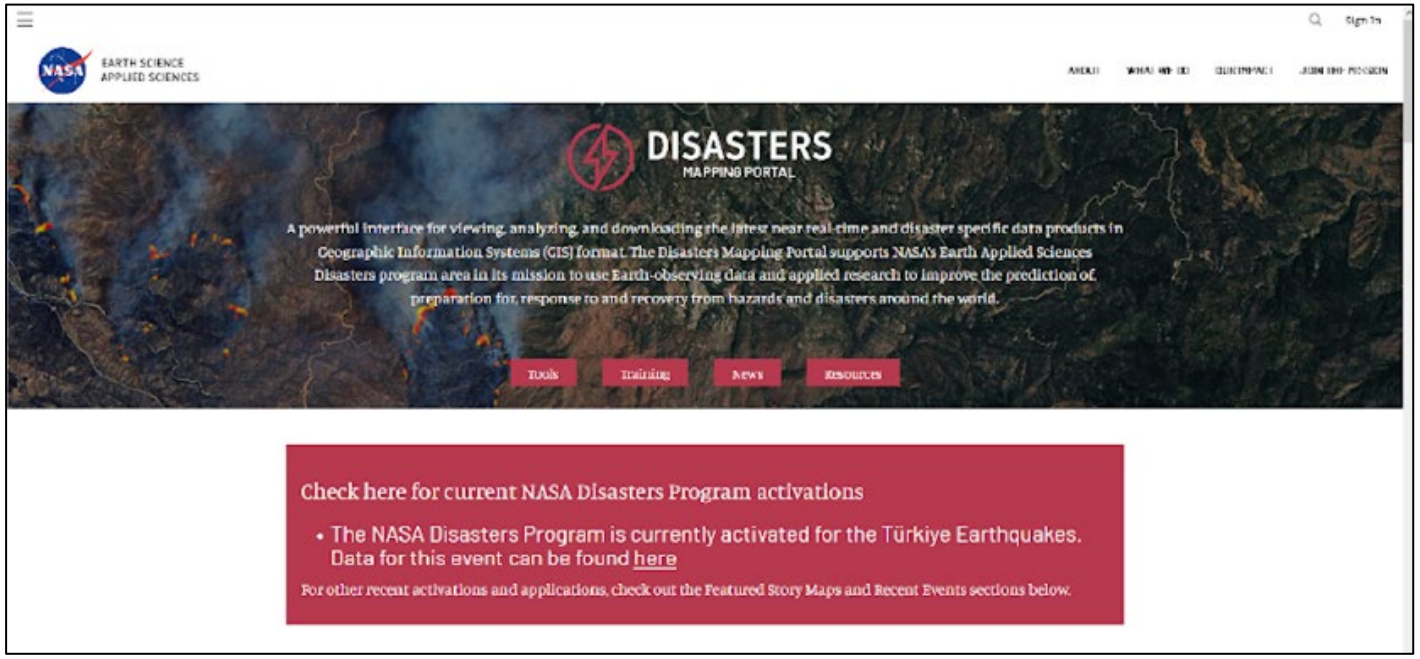
- Variable: 0-2m Relative Soil Moisture
- Lengths: 30-, 60-, & 90- days
- https://geo.ndc.nasa.gov/SPoRT/modeling/lis/conus3km/histograms
- 33 counties in CA, AL, TX, NC, & 7 other states



Note: This is NASA SPoRT's server for various datasets made available for public use. The URL may change – so, if you have trouble finding it, go to the main SPoRT site https://weather.nsstc.nasa.gov/sport and, within the ***Data & Products*** tab, select the ***Data Access*** link.

Viewing Near-Real Time SPoRT-LIS CONUS Files

- **NASA Disasters Mapping Portal:**
  - GeoTIFFs: https://maps.disasters.nasa.gov/arcgis/home



Note: This is the NASA Disasters server for various datasets made available for public use. It is possible that the URL may change – so, if you have trouble finding it, go to the main NASA Disasters site: https://appliedsciences.nasa.gov/what-we-do/disasters and select the ***Data & Tools*** link, and then select **Disasters**. Finally, select the **Disasters Mapping Portal**.

Viewing Near-Real Time SPoRT-LIS CONUS Files

- **How can I explore GeoTIFFs on my own?**
  - Write your own software
    - **Python** (Arcpy, GeoPandas, GDAL/OGR, rasterio, georaster, etc.)
    - C++ (GDAL C++)
    - IDL, JavaScript, etc.
    - Google Colab, Google Earth Engine
  - Use a GIS software package
    - Proprietary software (ESRI products, etc.)
    - Open-source software (**QGIS**, MapBox, Google Earth Pro, etc.)

QGIS demonstration with GeoTIFFs from SPoRT, AHPS, & Disasters Mapping Portal REST Service)

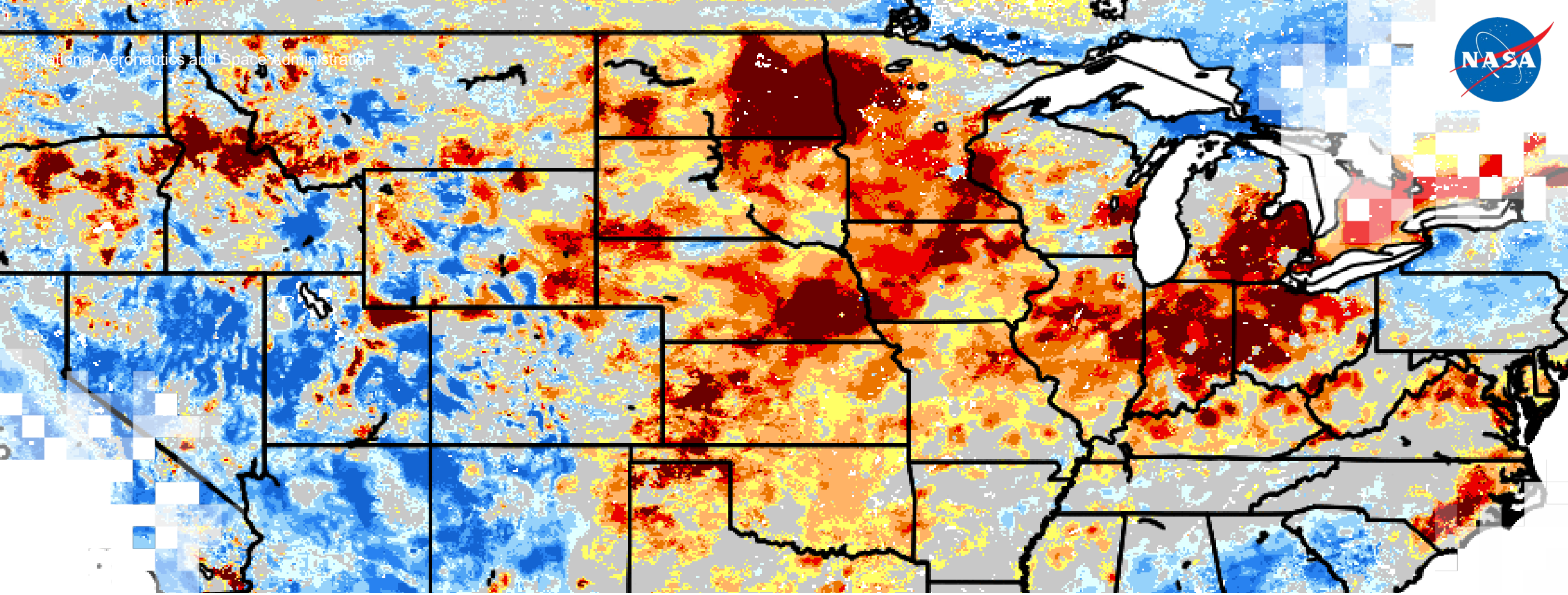
Advanced Hydrologic Prediction Service: https://water.weather.gov/precip/download.php

Viewing Near-Real Time SPoRT-LIS CONUS Files

- NASA/GHRC DAAC
  - Global Hydrometeorology Resource Center Distributed Active Archive Center
  - https://ghrc.nsstc.nasa.gov/home

SPoRT plans to have all LIS-CONUS data archived at the GHRC DAAC *by the end of CY2023*.

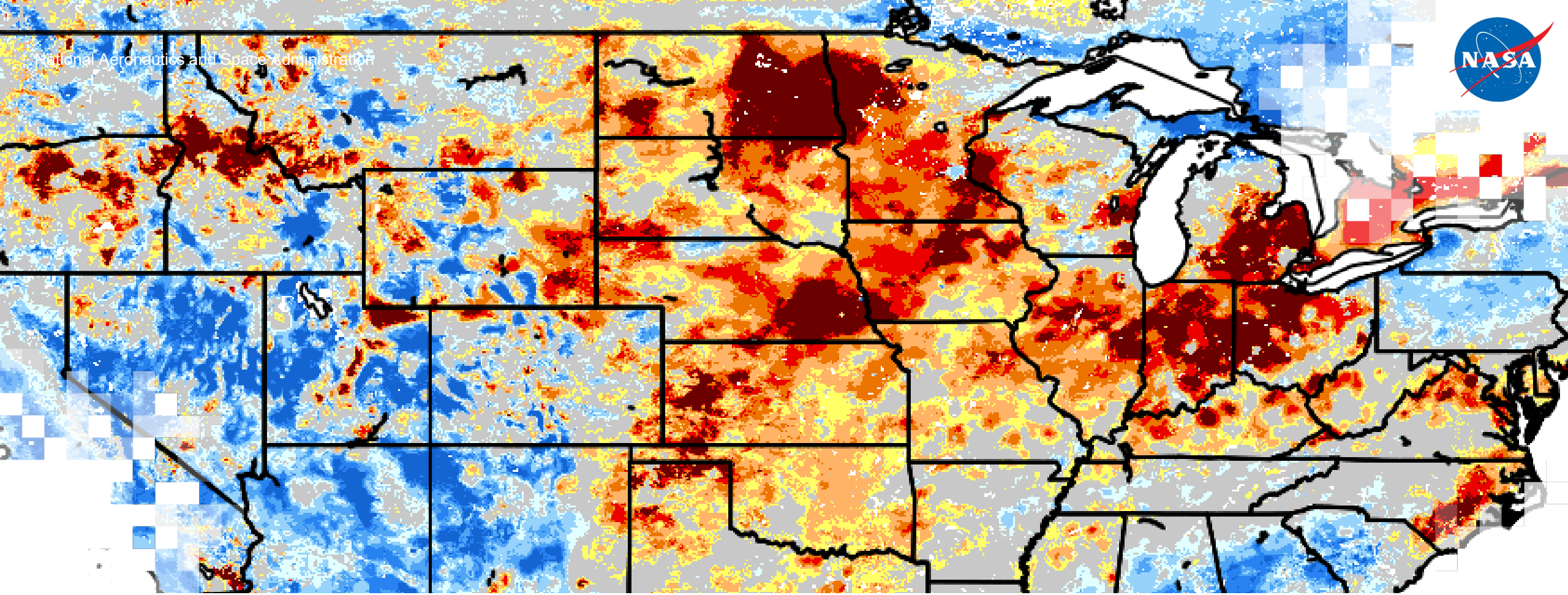
- Raw output data (GRIB)
  - Daily: January 1981 – 2009
  - Twice Daily: 2010 – March 2015
  - Hourly: April 2015 – present
- AWIPS-formatted (GRIB2): April 2015 – present
- Climatology, once daily files (GRIB): 1981 – 2013
- Percentiles (GRIB2): 2000 – present



DEMO: Viewing Near-Real Time SPoRT-LIS CONUS Files

Matt Smith – University of Alabama in Huntsville, Information Technology and Systems Center – NASA SPoRT

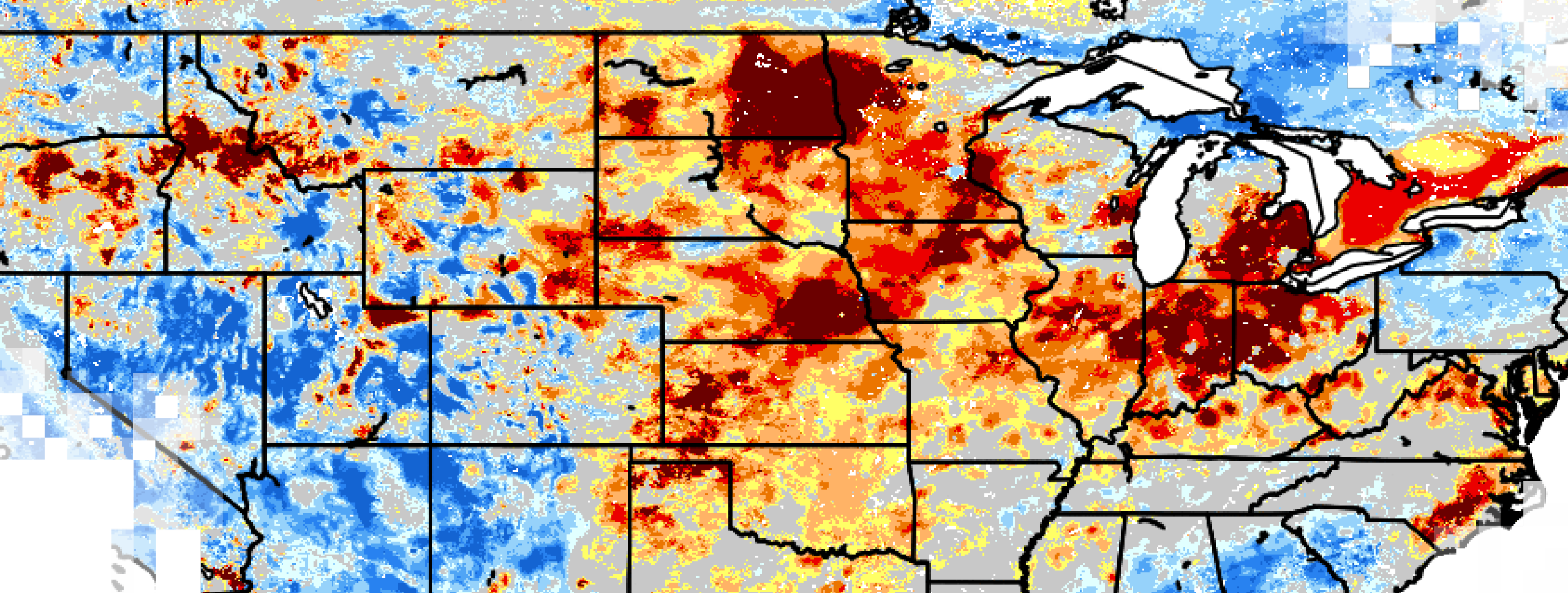
May 31, 2023



DEMO: Display and Differencing of SPoRT-LIS within Google Colab/Jupyter

Ryan Wade (UAH/NASA SPoRT)

May 31, 2023



Part 3

Summary

Course Conclusions – Application of SPORT-LIS for Drought

1. The **NASA LIS Modeling Suite is used globally** by a wide variety of user and research groups for many applications related to land surface processes, streamflow, ground water, and data assimilation, with direct application to drought.
2. The SPoRT configuration of the LIS (SPoRT-LIS) uses the **Noah LSM forced by NLDAS-2** for a 1981-2013 climatological period, and GDAS+MRMS precipitation forcing in near real time.
3. SPoRT-LIS is unique in that it incorporates daily **satellite-derived GVF for near real-time vegetation** coverage and health, as opposed to a monthly static climatological estimate.
4. The SPoRT-LIS output provides soil moisture over the entire **contiguous U.S. at 3 km resolution** within layered depths to 2 m. The analyses are updated 4x/day in real-time, with hourly output frequency.
5. **Soil moisture percentiles product historical context** of current soil moisture values relative to the **1981-2013** climatological period.
6. The 0-200 cm relative soil moisture **percentiles compared favorably to the U.S. Drought Monitor** drought designations where soil moisture deficits strongly correlate with episodes of drought.
7. **SPoRT-LIS has experimental forecasts of soil moisture** percentiles out to 14 days using the U.S. GFS forecast model as forcing, updated daily in real time.
8. Real-time LIS applications managed by SPoRT are provided in several output data formats for the Continental U.S., Alaska, and the Caribbean, but there are **also LIS instances that cover Africa and Southeast Asia for research activities**.

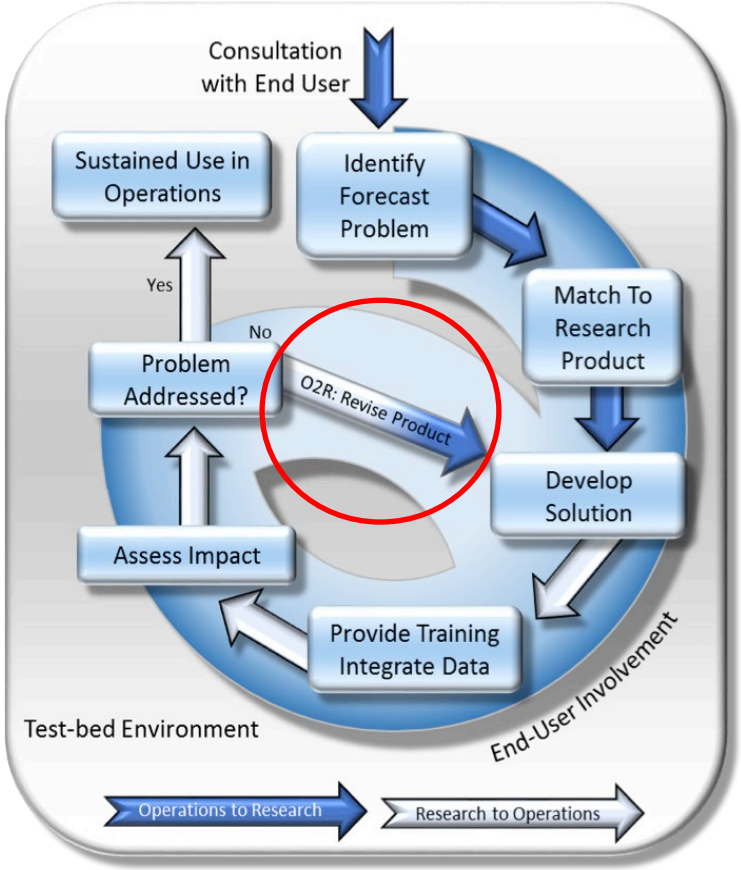
SPoRT-LIS Contributors

Many thanks to all of these collaborators and partners over the last 10+ years

- Sujay Kumar and the GSFC LIS Team
  - Collaborations to support the SPoRT-LIS instance over a decade
  - Course presenter
- Kris White (NWS HUN & SPoRT)
  - Promoting SPoRT-LIS both inside NWS and to outside agencies
  - Course presenter and developer
  - Case example contributor
  - Supporting R2O/O2R
- Richard Heim and authors of USDM
  - Course presenter; example cases
  - User/Promoter of SPoRT-LIS
- Corey Davis (NC Climate Office, Applied Climatologist)
  - Course presenter
  - Contributor of training exercise
  - User/Promoter of SPoRT-LIS
- Barrett Smith (NWS Raleigh WFO, Service Hydrologist)
  - Course presenter
  - Contributor of training exercise
  - User/Promoter of SPoRT-LIS
- Existing Collaborators & Users of SPoRT-LIS
  - Numerous users and agencies that have contributed to research areas

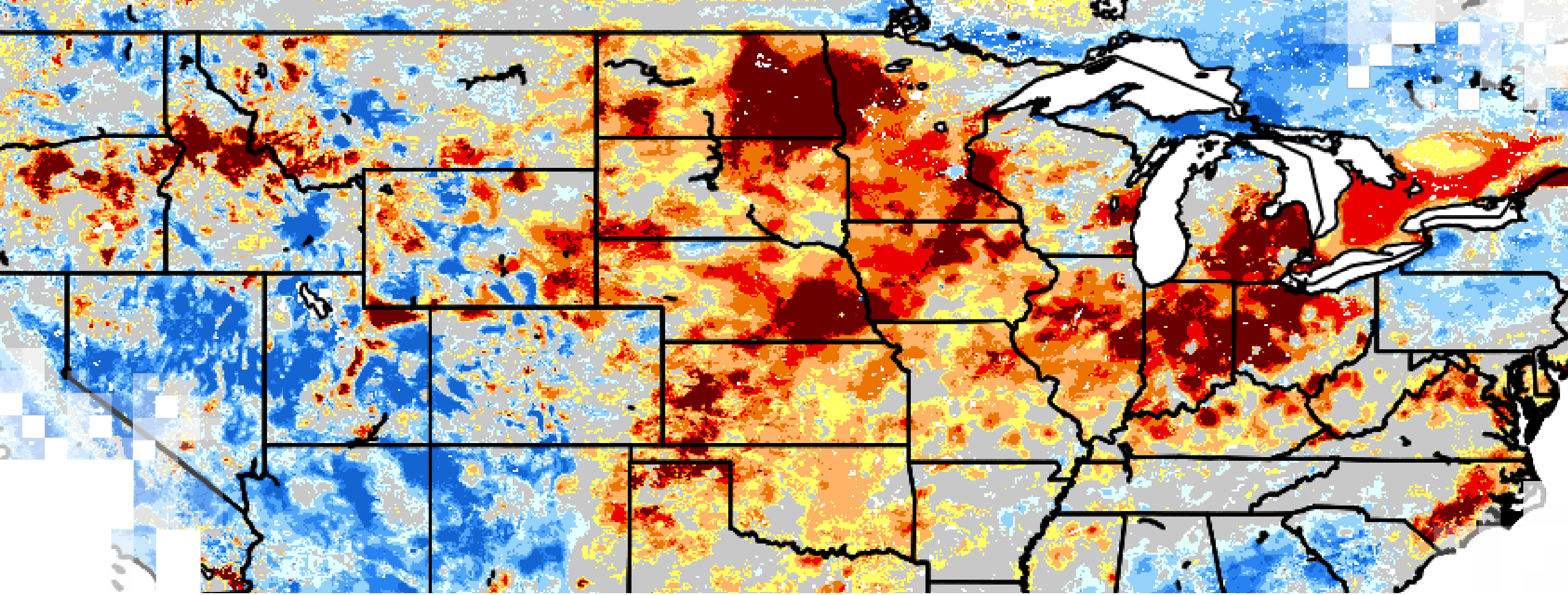
A Look to the Future….

- SPoRT is continually working to improve the SPoRT-LIS modeling system to provide better tools and capabilities to our downstream stakeholders:



SPoRT's "operation-to-research" process takes what we can learn from stakeholders and how they use our data to provide improvements and refinements.

Future SPoRT-LIS development is driven by the community needs and we need your feedback!



NASA SPoRT: https://weather.ndc.nasa.gov/sport/

Contact: christopher.hain@nasa.gov
Support: msfc-dl-sport-support@mail.nasa.gov

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Stakeholder Engagement Specialist & Communications Lead – UAH/MSFC/SPoRT

Robert Junod

Research Scientist – Alabama Assistant State Climatologist /UAH/MSFC/SPoRT

Lori A. Schultz

NASA Disasters Program

NASA MSFC Remote Sensing Applications

Amy McCalister

Developer of training lessons for Session 1

Support/QC of training lessons for Session 2

Chris Schultz

Organization/Coordination of course

Homework and Certificates

- **Homework:**
  - One homework assignment
  - Access from the training webpage
  - Answers must be submitted via Google Forms
  - **Due by 14 June 2023**

- **Certificate of Completion:**
  - Attend all three live webinars (attendance is recorded automatically)
  - Complete the homework assignment by the deadline
  - You will receive a certificate via email approximately two months after completion of the course.

Contact Information

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- Chris Hain
  - christopher.hain@nasa.gov

https://weather.ndc.nasa.gov/sport/

- ARSET Website
- Follow us on Twitter!
  - @NASAARSET
- ARSET YouTube

Visit our Sibling Programs:

- DEVELOP
- SERVIR

Thank You!