# A History of Earth Science Applications Regarding Water Management

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# About me!

Graduated from UND in May 2021 with a B.S. in Atmospheric Sciences and Honors with minors in Sustainability Studies and Mathematics

Former STEM Ambassador (2-years)

Current first year law student at Lewis and Clark in Portland, OR

# Earth Sciences History

- **1958:** Originally no Earth Sciences Department, however an applications group existed at Goddard
- **1964-1994:** Nimbus Series
- **1972:** Landsat-1
- **1976:** Space Act revised for authority to conduct stratospheric ozone research
- **1980s:** Planning of the Earth Observation System, approved in FY-91 budget , Space Act revised again

# Earth Sciences History

- **2001:** Earth Sciences Division Applied Sciences Program
- **2005:** SERVIR Program began
- **2009:** ARSET began training on how to use Earth Science data
- **2021:** Earth Systems Observatory

Quantity

Division

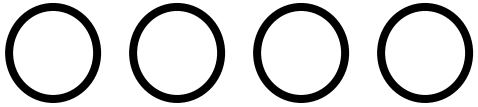
Tools

# Quantity

Division

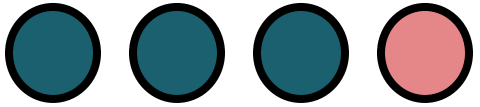
Tools

## Data



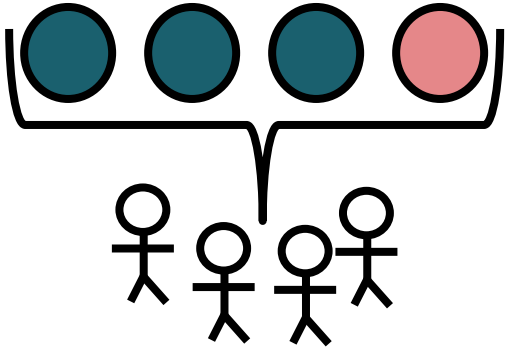
Satellite images

## Information



Satellite images with landmark lines drawn in

## Application



Mapping flood prone areas, and sharing the information with locals

# Landsat-1
## 1972-1978

- Return Beacon Vidicon (RBV)
- Multispectral Scanner (MSS)

https://landsat.gsfc.nasa.gov/landsat-1-3/landsat-1

# Skylab

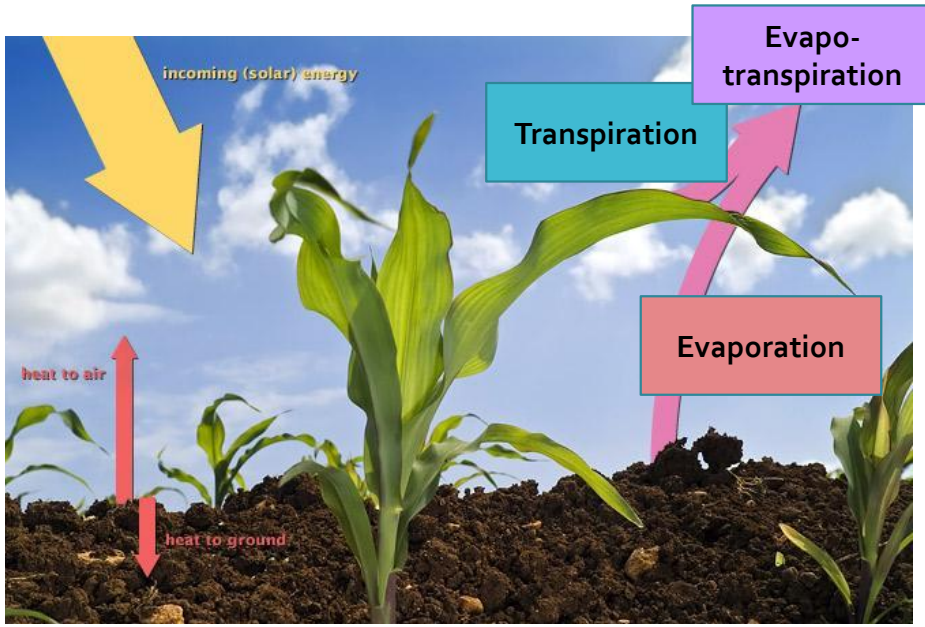
1973-1974

- Soil moisture
- Lake boundaries

https://www.nasa.gov/content/40-years-ago-skylab-paved-way-for-international-space-station

# Evapo-transpiration

## 2000s

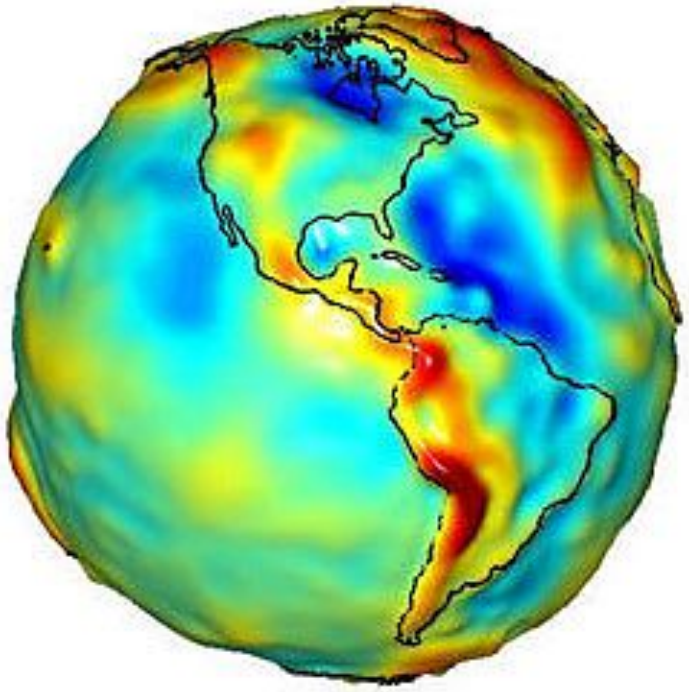



- Use of Landsat thermal sensor
- Attempts since first thermal sensor in 1984
- Continuity of data
- METRIC method
- "analyze how water is used at the same level that water is managed" Tony Morse, METRIC researcher

# GRACE

2002

- Detects small anomalies in gravity between passes
  - Movement of water
- Groundwater depletion
  - Fast rate
  - Traditionally difficult to monitor



https://www.nasa.gov/audience/foreducators/k-4/features/F_Measuring_Gravity_With_Grace.html

Quantity

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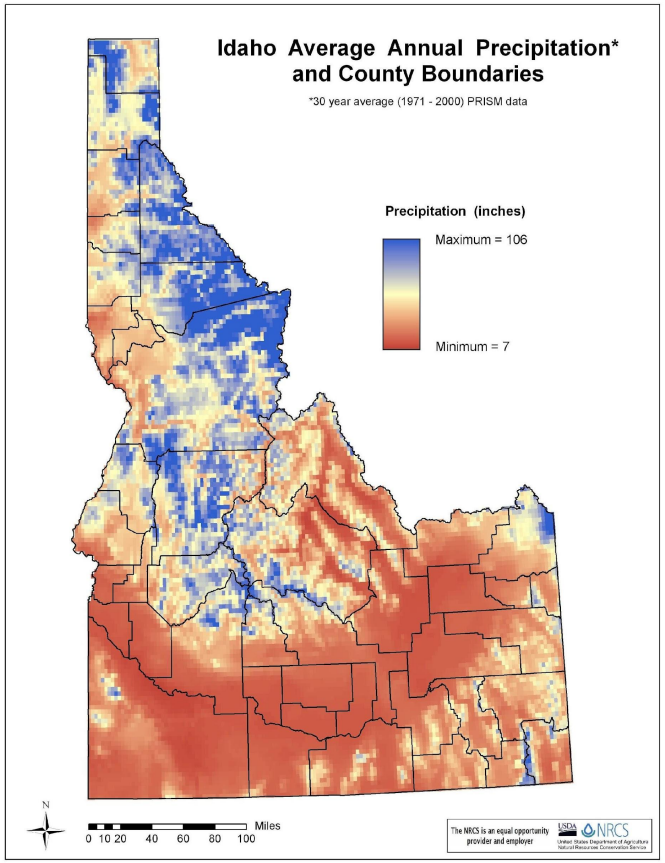
# South Dakota
## 1980s

- Belle Fourche River
  - 90% of flow belonged to SD stakeholders
  - Illegally diverted
- Lower James River Watershed
  - 550 problem areas

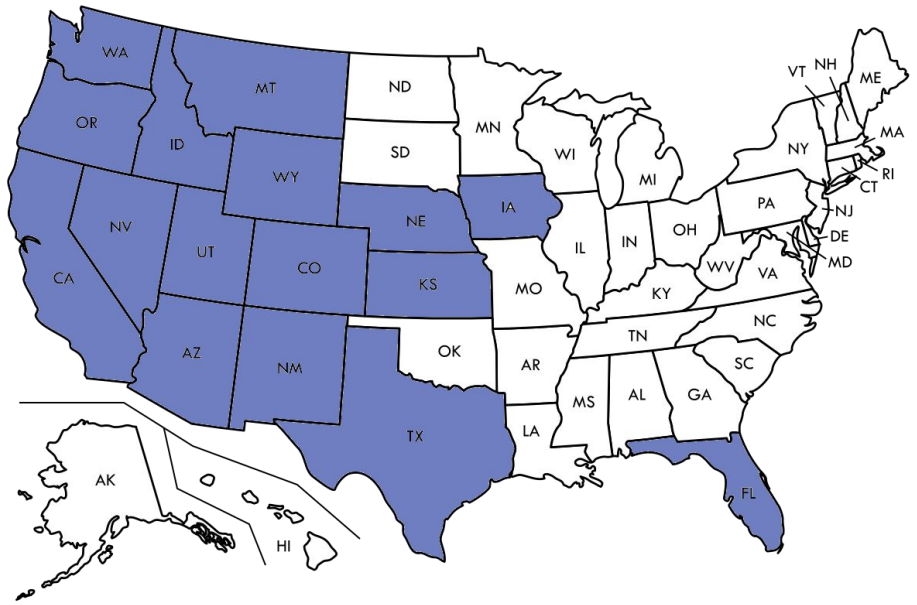
# METRIC and the IDWR

- Idaho Department of Water Resources (IDWR)
- Within the state 98% of the consumptive use of water is used to irrigate 3.4 million acres of agricultural land
- "It would be difficult for the department to work effectively without satellite data, including Landsat and especially the thermal band." Linda Davis, Water Resource Information (GIS) Section Manager at IDWR.
- "first in time is first in right"
- Delivery call, curtailment, water buyback



# METRIC in other states

- Since its development, 15 other states in the western U.S. now use the METRIC method
- Iowa, Nebraska, Florida, Texas, Kansas, New Mexico, Arizona, California, Colorado, Utah, Wyoming, Montana, Oregon, Washington, Nevada



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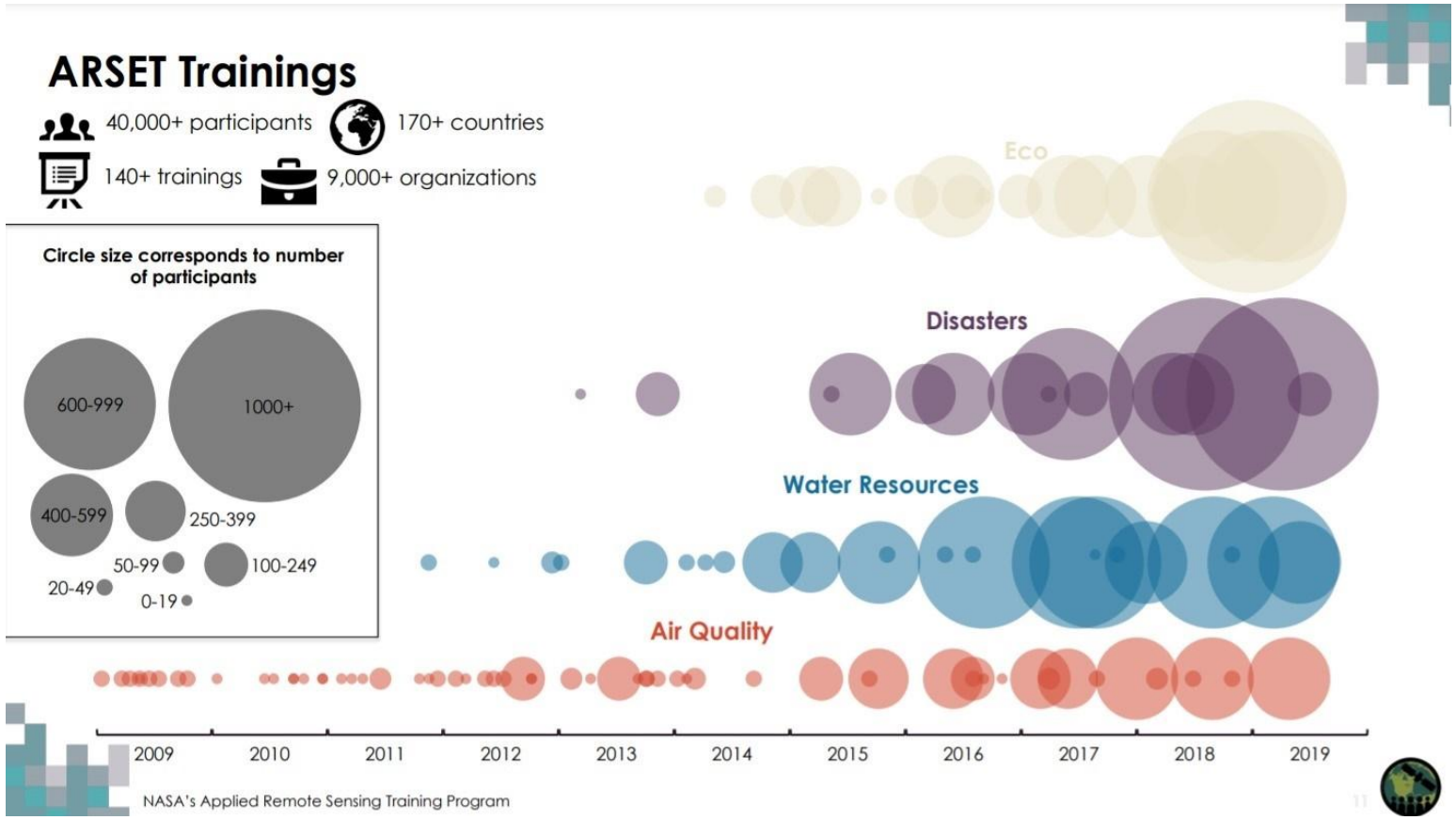
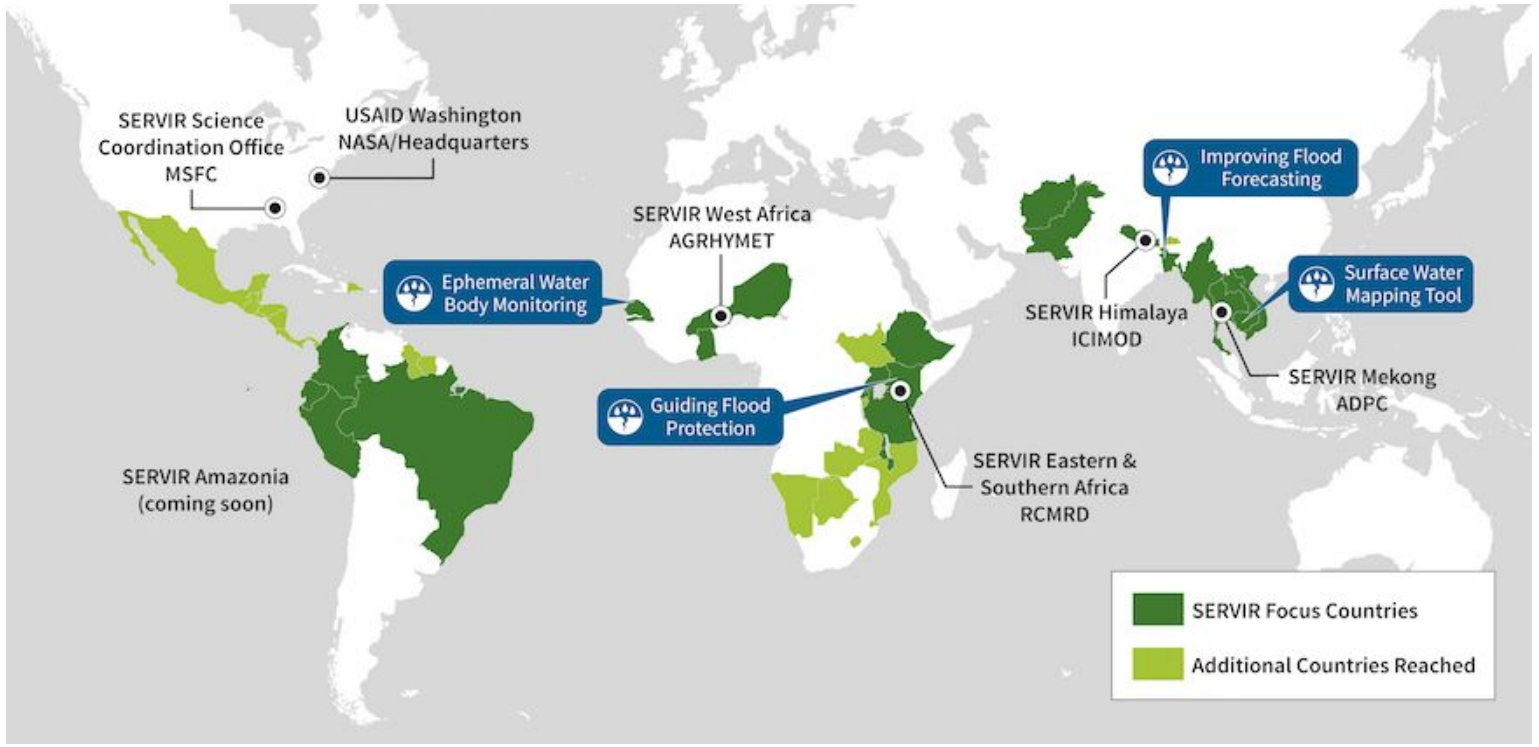
# Applied Remote Sensing Training



# SERVIR Program

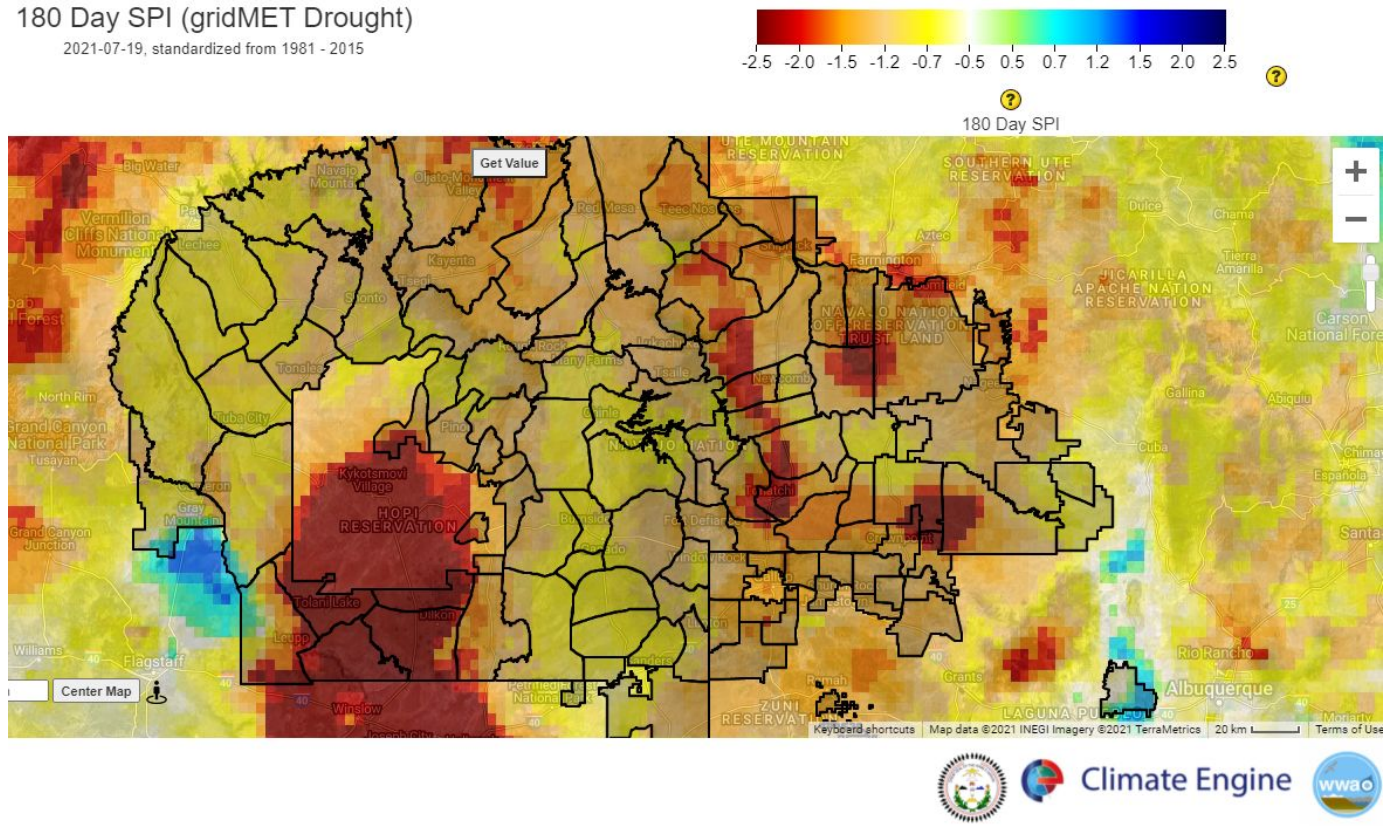
- Started with 1 hub in Mesoamerica, now 7 around the world
- Work with local centers and USAID to learn what communities need and how NASA data can help
- First time some countries are using data than was first developed decades ago
  - Landsat in Mesoamerica




https://www.servirglobal.net/Global/Articles/Article/2668/water-resources-and-hydroclimatic-disasters-service-area

# Western Water Applications Office

- WWAO
- 2020 – Navajo Nation Drought Project
- Web-based portal for assessing drought conditions called the Drought Severity Evaluation Tool (DSET)



# Crop Condition and Soil Moisture Analytics

- Crop-CASMA, launched in early 2021
- NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) and Soil Moisture Active Passive (SMAP) missions
- Data on a county-scale instead of a state-scale

# Conclusion

# Take-aways

- Virtual silver-linings
- Great environment with great co-workers
- Article in the NASA Newsletter

NEWS &NOTES

National Aeronautics and Space Administration

Volume 38, Numbers 2 & 3

Second & Third Quarters 2021

## FROM THE ACTING CHIEF HISTORIAN

To say that the last year presented many challenges might be the understatement of a lifetime. As we continued our work in the telework environment, we adjusted to new networking tools, limited access to our collections, and fresh approaches to public history in the virtual world. Despite a mountain of obstacles, we in the NASA History Division

## SKYLAB'S VIEW OF HURRICANE AVA

By Erin Doyle

On 25 May 1973, the first of three crewed missions to Skylab launched. The 28-day mission aboard America's first space station had many scientific goals. The astronauts conducted research through medical studies, solar astronomy, spacewalks, and Earth science experiments. One of the mission's goals was to determine the feasibility of using remote sensing techniques to measure global patterns of ocean surface wave conditions

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# Questions?