USGS
science for a changing world

Celebrating 50 YEARS of Landsat 1972-2022

PECORA 22

OCTOBER 23-28 2022

LANDSAT 'S 50TH ANNIVERSARY

LOOKING BACK & LOOKING AHEAD

THOMAS CECERE

CARTOGRAPHER,

UNITED STATES GEOLOGICAL SURVEY (USGS)

UN COPUOS STSC

FEBRUARY 11, 2022

Original Landsat Risk Takers - 1966

DOI Secretary Stewart Udall

USGS Director William Pecora

"The DOI's (Department of the Interior's) surprise declaration created a storm of political protest from NASA and Defense agencies…*

"…Pecora was convinced that he would be fired as a result."*

"Rumor has it that President Johnson was so angry over the stir that he never spoke with Secretary Udall again."*

CAMDEN, N. J.
COURIER-POST
SEP 21 1966

Eros Satellite Due To Map Resources Of Entire Planet

By EDMUND B. LAMBETH
Courier-Post Bureau

WASHINGTON—Interior Secretary Stewart Udall announced plans yesterday to build a satellite that by 1969 will begin monitoring the natural resources of the Earth.

Dubbed Project EROS (Earth Resources Observation Satellite), the new bird is the first model of a spacecraft that scientists hope will discover mineral deposits, predict volcanoes, spot fish, find underground water, assess crops and perhaps even count people.

The project represents the first significant civilian use of the military spy-in-the-sky sensors that have proven ther value in critical reconnaissance missions such as the 1962 Cuban missile crisis.

Identify Crops

EROS' first assignment will be to map the Earth with television cameras, and identify and gauge the status of crops.

"Future sensing systems," said William T. Pecora, director of the United States Geological Survey, "will employ heat-measuring devices to monitor the Earth's volcanoes and search for sources of geo-thermal power, radar that will 'see' beneath the clouds, and eventually cameras with sufficient resolving power to permit timely updating of our national topographic map series."

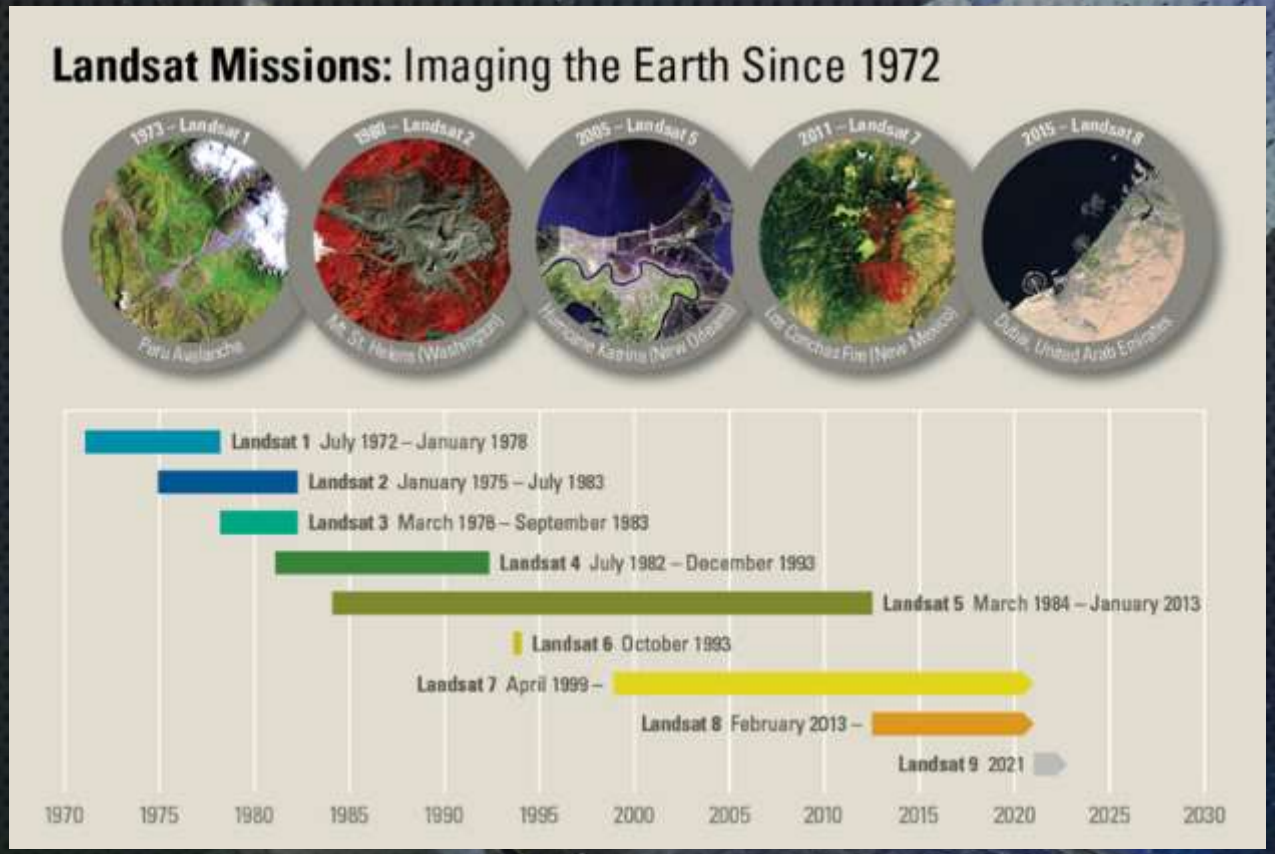
He estimated that it will cost 120 million to launch the spacecraft.

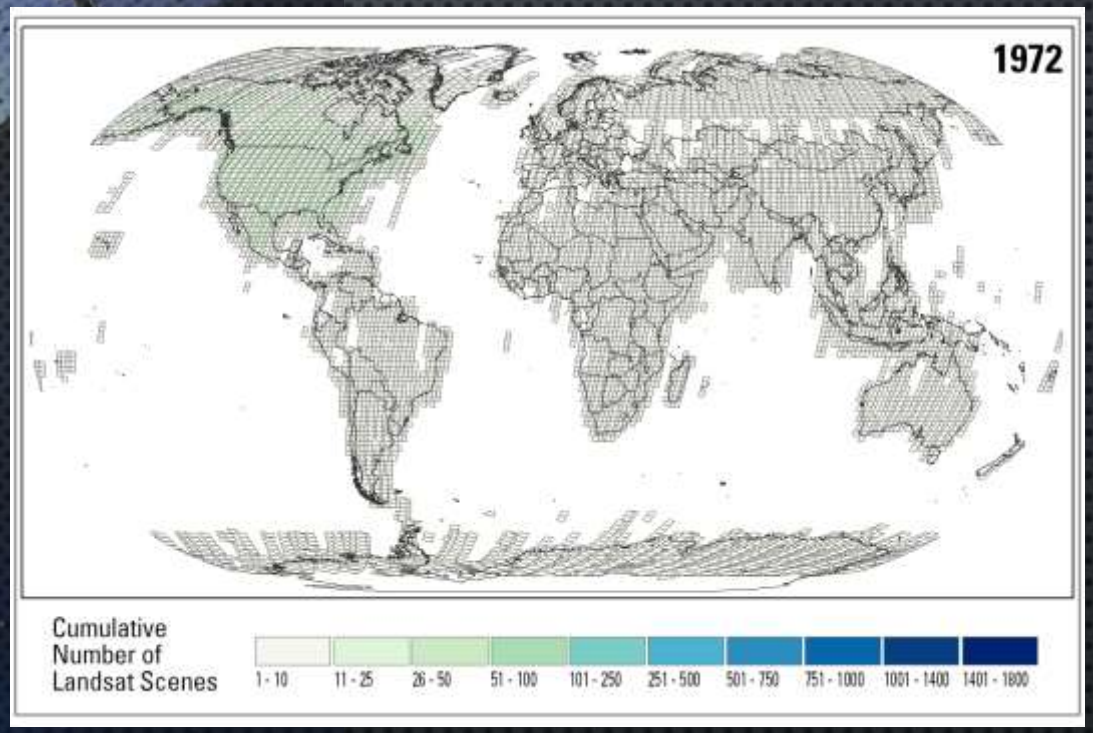
USGS

*Landsat Legacy Project Team, *Landsat's Enduring Legacy*, ASPRS, 2017, (page 21).

NASA – USGS Partnership

NASA Satellite Development & Launch
USGS Satellite Operations & Data Distribution





- ~5 DECADES OF LAND COVER, LAND USE, AND VEGETATION INFORMATION
- LARGE AREA COVERAGE FOR GLOBAL, CONTINENTAL AND REGIONAL STUDIES
- THE MOST CITED LAND-IMAGING SATELLITE IN PEER-REVIEWED SCIENTIFIC LITERATURE, AND THE CITATION RATE IS INCREASING

- DATA ARCHIVE CONTAINS 300 BILLION KM^2
- ADDS 40 MILLION KM^2 PER DAY

USGS

NASA

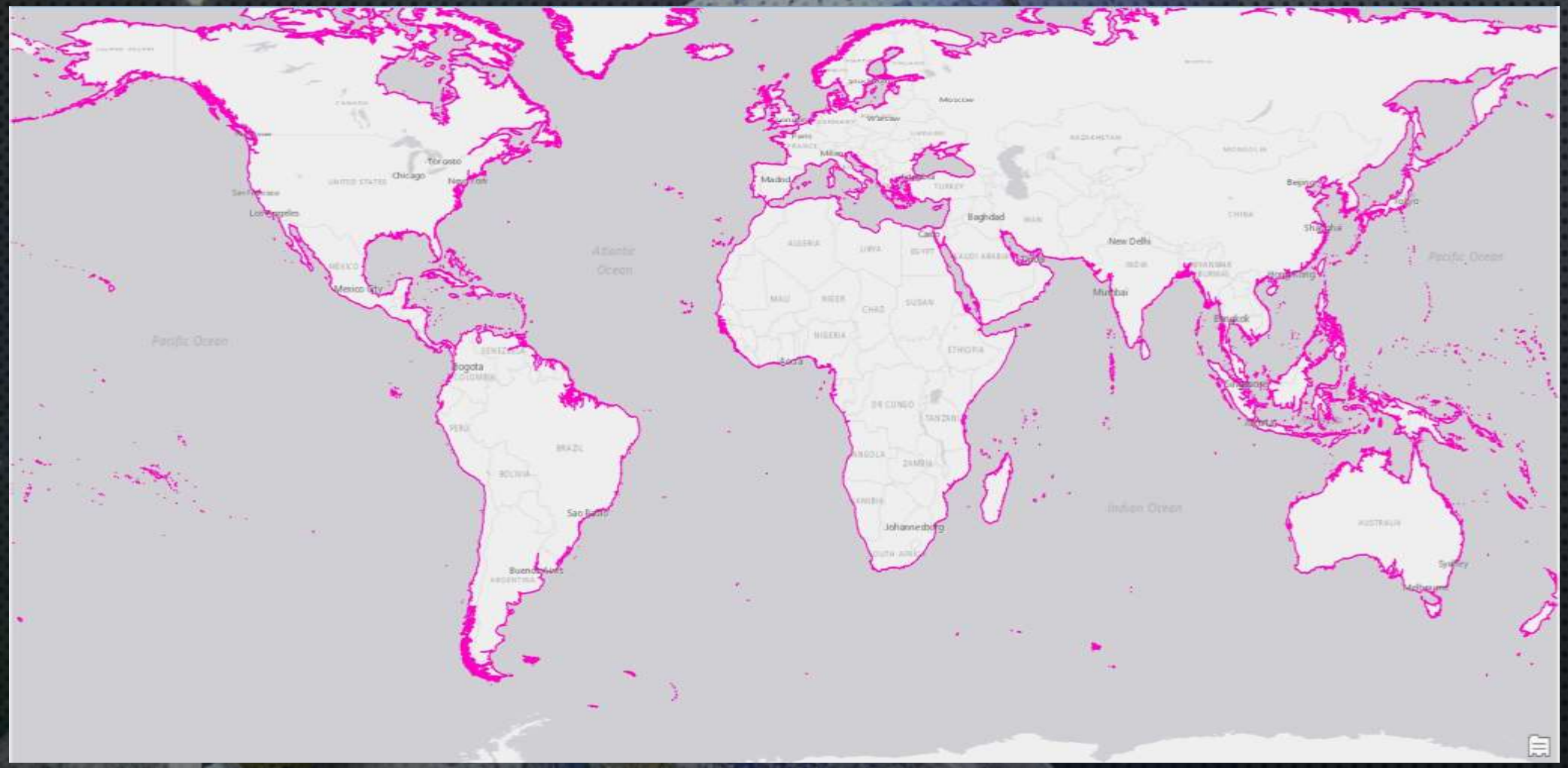
Current **Landsat** International Cooperator **Network**

11 Active L7 Stations / 16 Active L8 Stations

L7 = Landsat 7
L8 = Landsat 8
IGS = International Ground Station
LGN = Landsat Ground Network

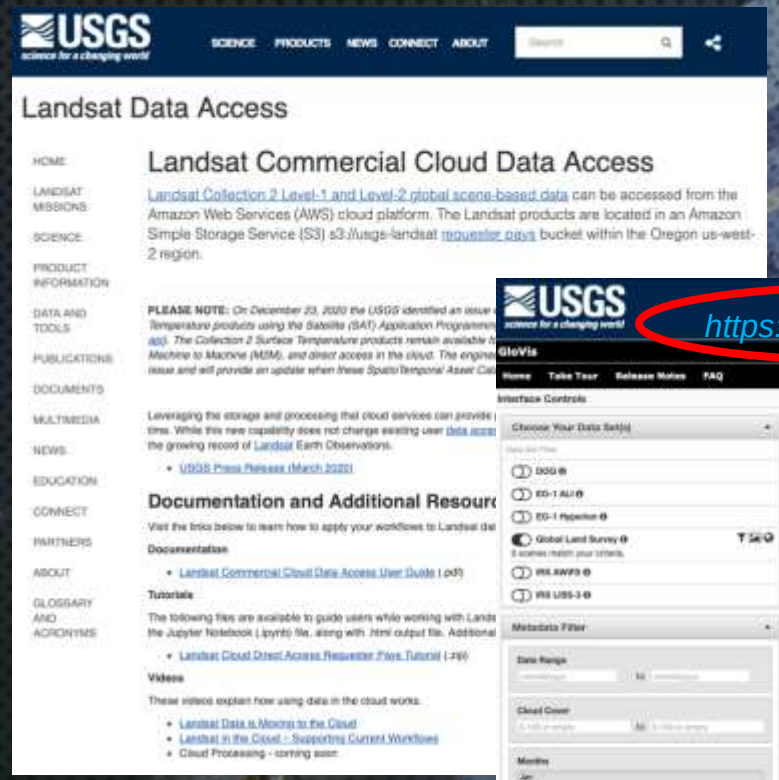
USGS

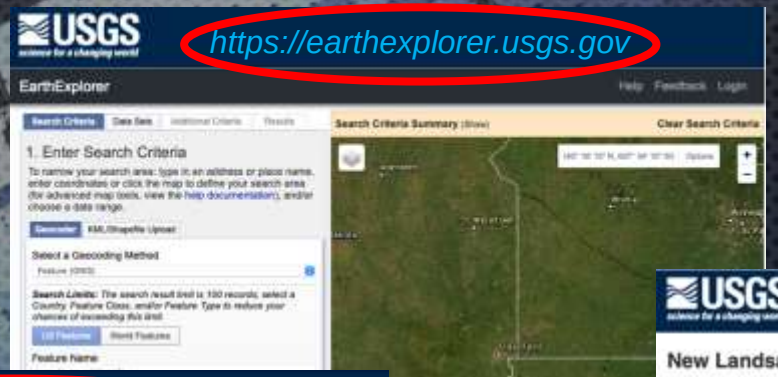
Global Landsat Data Enables Global Coastline Depictions

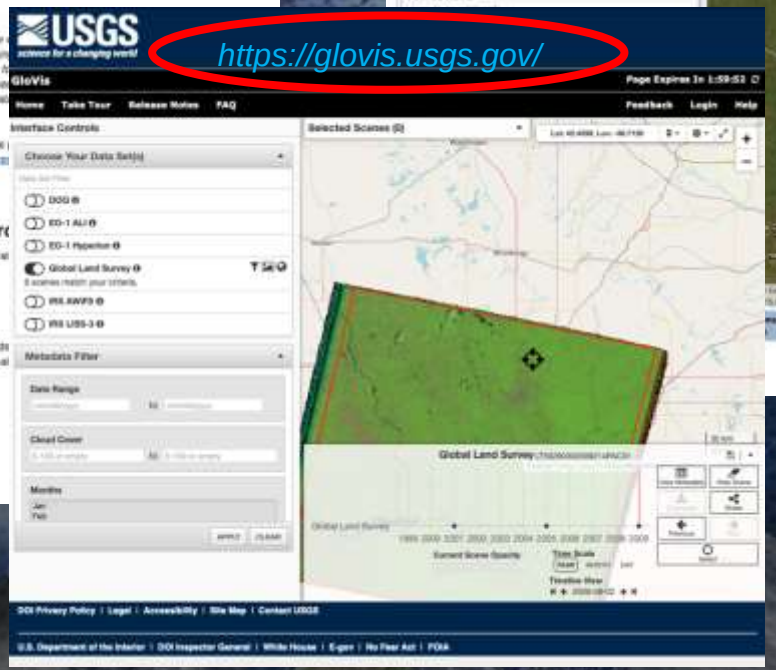


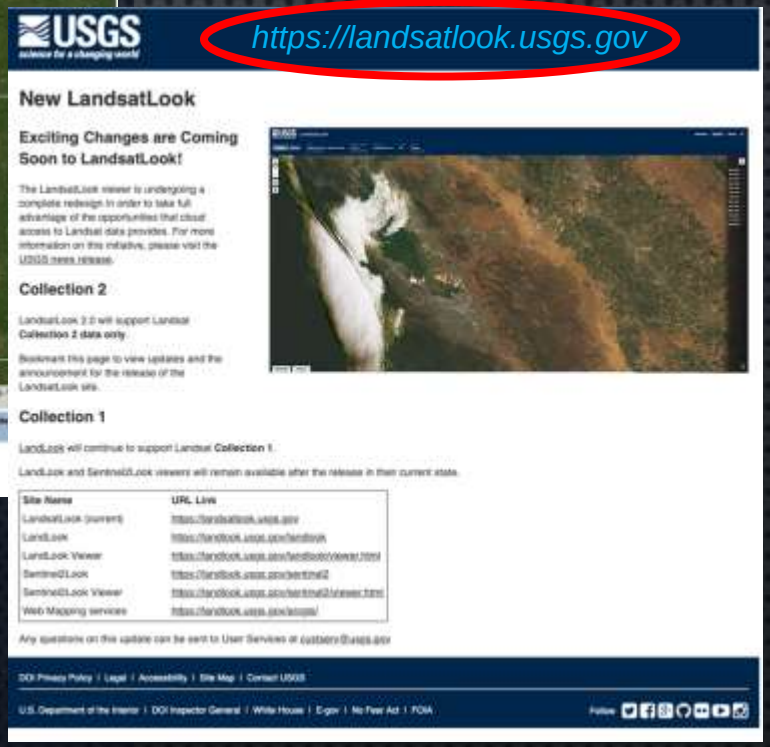
Global Coastline Explorer Tool - https://rmgsc.cr.usgs.gov/gce/

Free and Open Data Access: USGS Web Tools









USGS

GLOBAL SURVEY MISSION

30m VSWIR / 100m TIR
11 band MSI / 12 bit
705km sun synch orbit
185km swath

~1 TB / day

USGS NASA

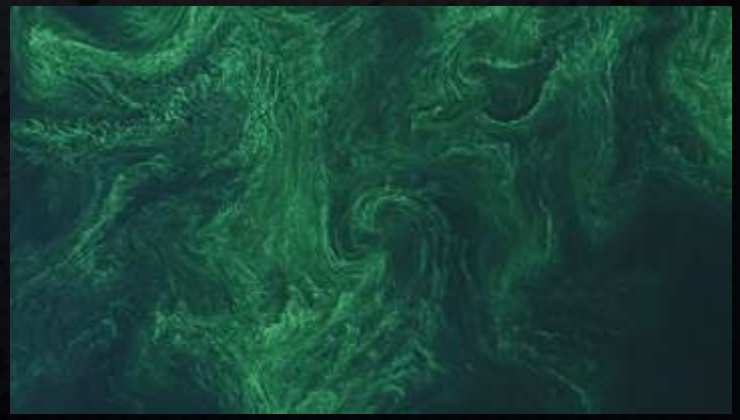
Landsat is Essential to Understanding Landscape Change

Celebrating 50 YEARS of Landsat 1972-2022

APPLICATIONS INCLUDE:

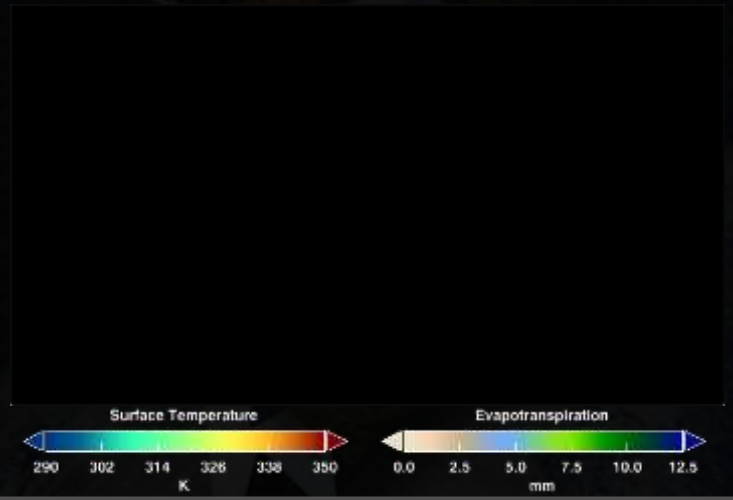
- IMPACTS OF CLIMATE CHANGE
- QUANTIFYING GLOBAL FOREST CHANGE
- MANAGING WATER CONSUMPTION, MANAGEMENT & HUMAN HEALTH
- SUPPORTING DISASTER MITIGATION & RECOVERY EFFORTS

Harmful Algal Bloom - Lake Erie



Urban Heat Map - New York City

Irrigated Farm Lands - New Mexico



Tropical Forest Loss - South America

Disaster Recovery

USGS

Landsat – Monitoring Climate Change

Glacial Retreat Fills Alaska Lake

Summer Pools Appear in Antarctica

Antarctica's Newest Island

World of Change: Columbia Glacier Alaska

Celebrating 50 YEARS of Landsat 1972-2022

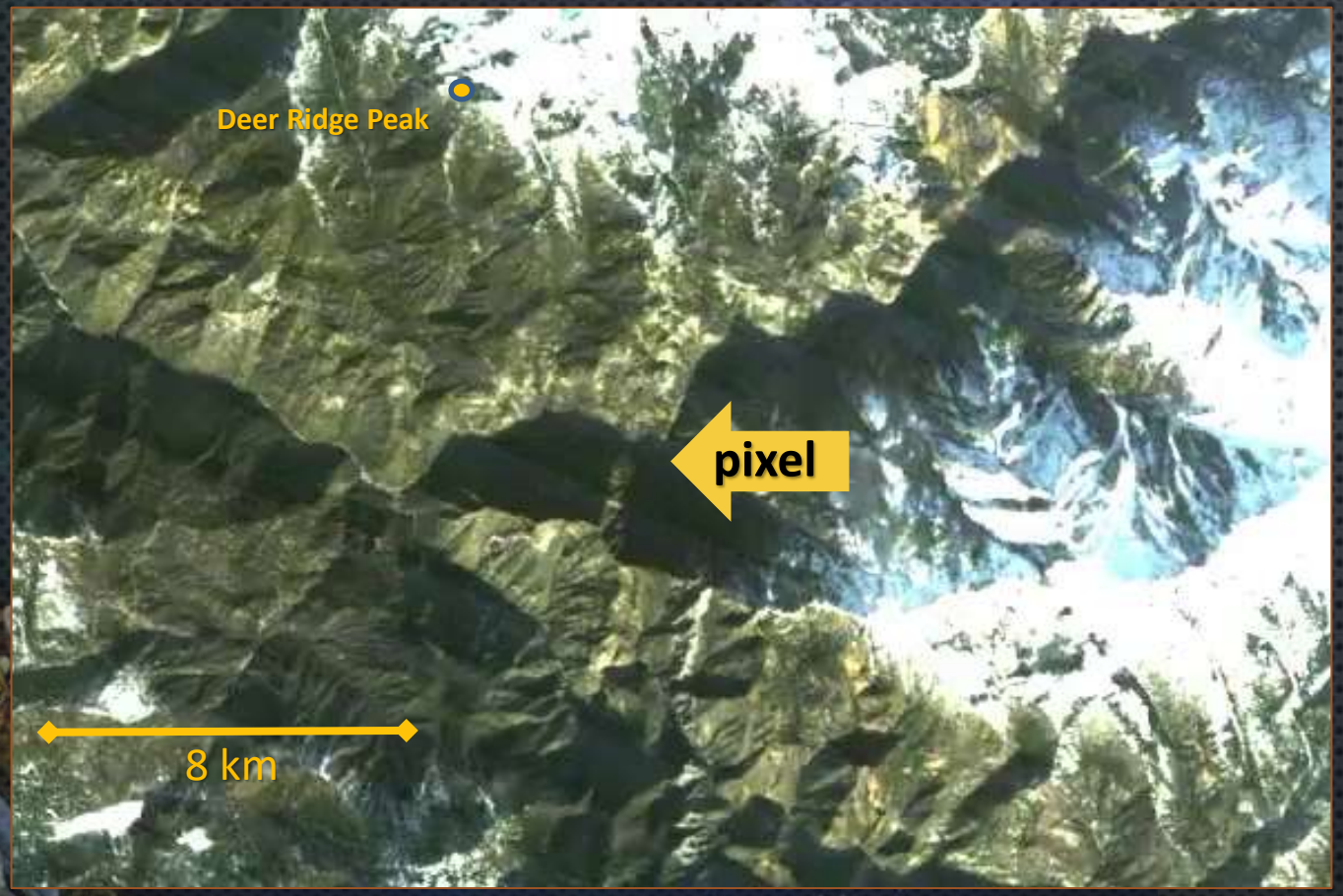
Landsat Analysis Ready Data (ARD)

Celebrating 50 YEARS of Landsat 1972-2022

USGS

Dwyer, J., Roy, D., Sauer, B., et al.. Analysis Ready Data: Enabling Analysis of the Landsat Archive. *Remote Sens*. 10(9), 1363, 2018.

ARD used to characterize land *change through time*



Sierra Mountains, Central California

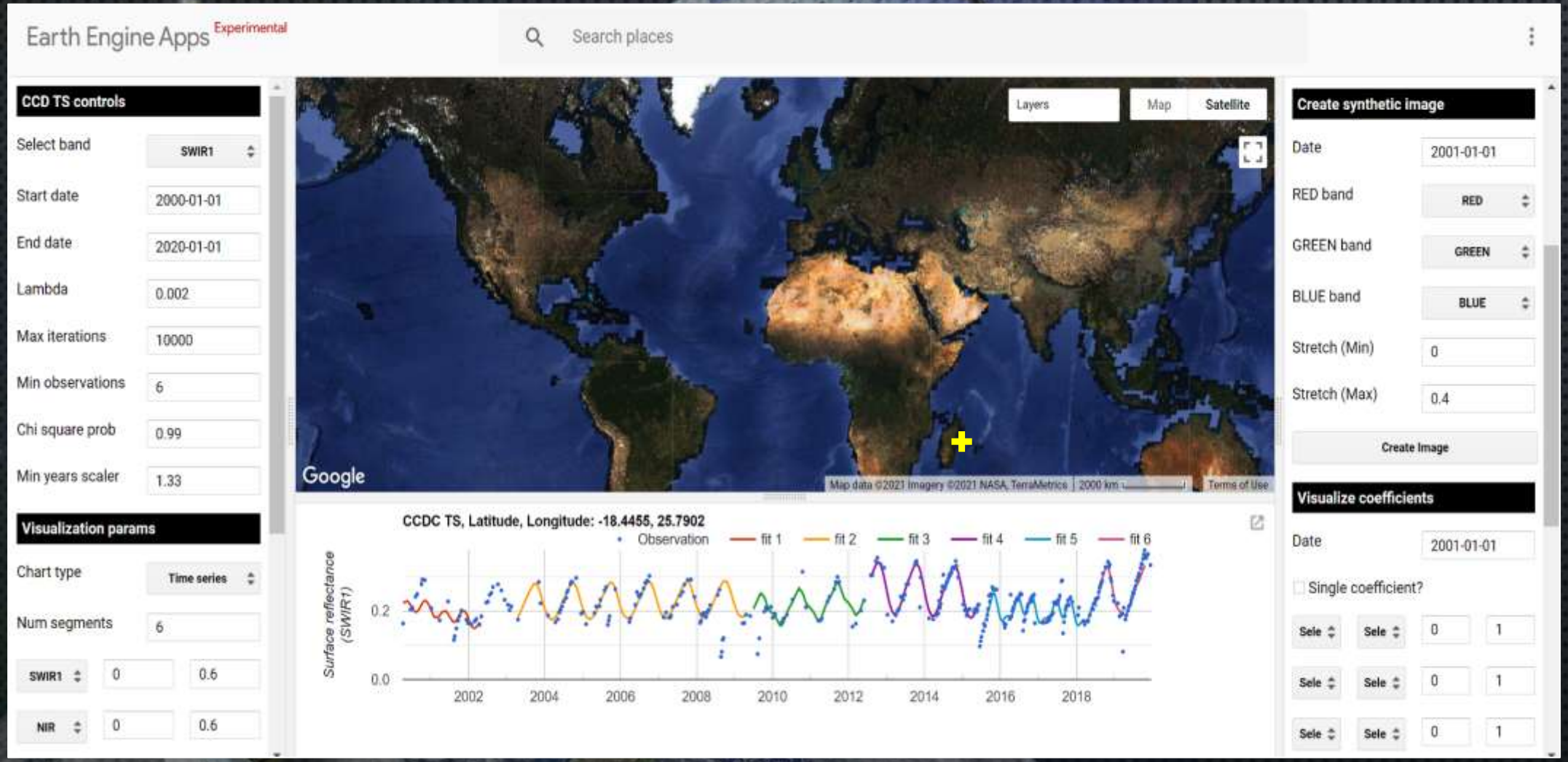
Landsat Images (surface reflectance)

Observation date
1983/01/18

Acknowledgement: H. Tollerud, EROS

Pixel trajectory

Land change monitoring a global scale

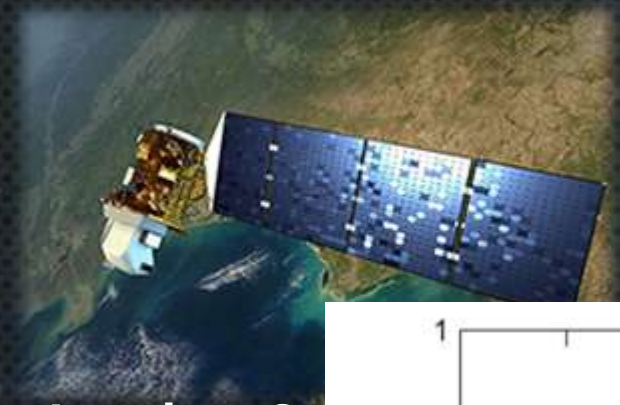


Reference: Arévalo, P., Bullock, E.L., Woodcock, C.E., & Olofsson, P. (2020). A suite of tools for continuous change monitoring in Google Earth Engine. *Frontiers in Climate, 2.*

Cross-sensor *interoperability* of observations

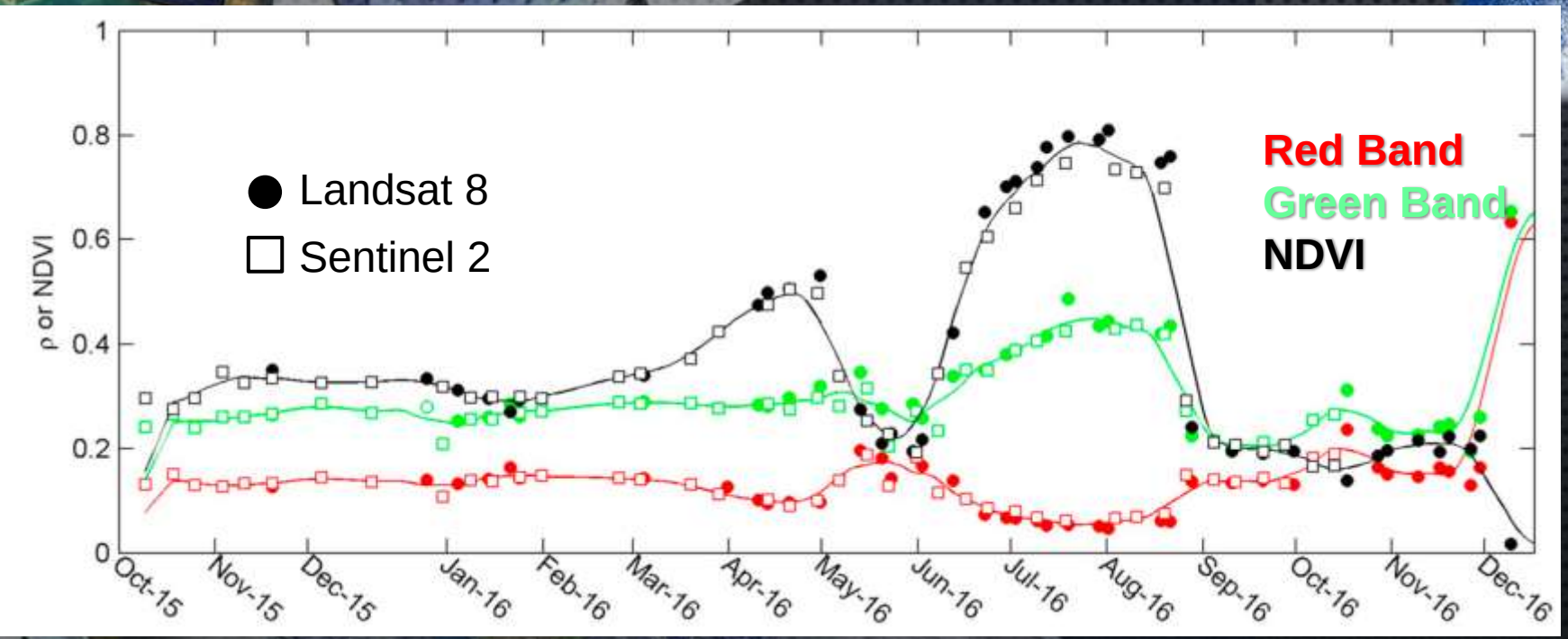
Celebrating 50 YEARS of Landsat 1972-2022

Harmonized Landsat/Sentinel (HLS)



Landsat 8 (USGS)

Sentinel 2 (ESA)



Claverie, M., Ju, J., Masek, J., Dungan, J., Vermote, E., et al. The Harmonized Landsat and Sentinel-2 surface reflectance data set. *Remote Sens. Environ*. 2018.

USGS

NASA

Sustainable Land Imaging (**NASA - DOI/USGS**)

Celebrating 50 YEARS of Landsat 1972-2022

Landsat 7

1999 - present

Landsat 8

2013 - present

Landsat 9

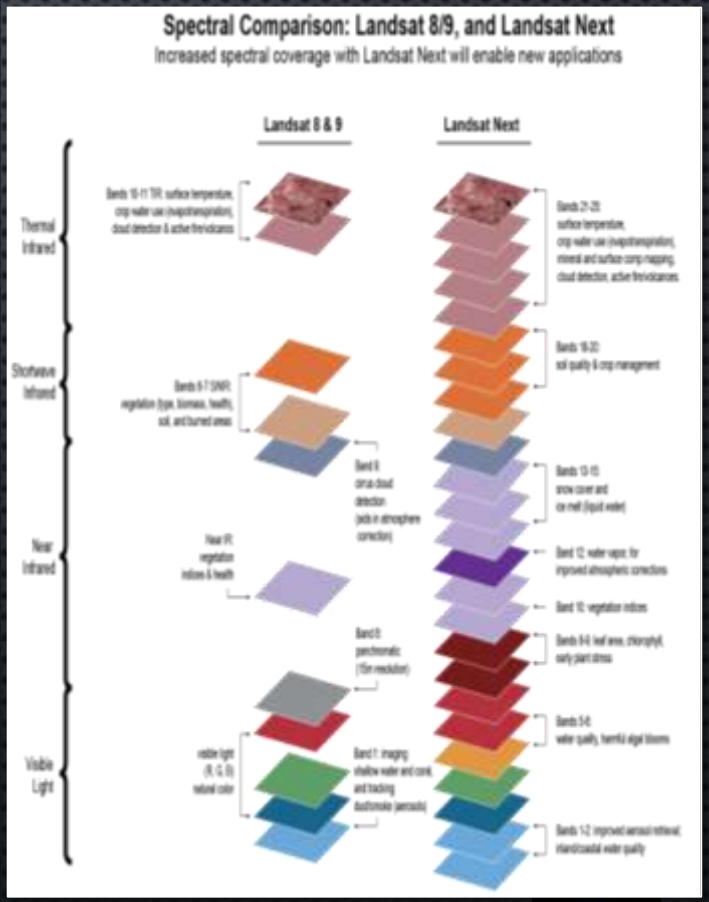
2022 -

OSAM-1 (On-orbit Servicing, Assembly, and Manufacturing)

Mid-2020s

Sustainable Land Imaging

Landsat Next



Late-2020s

USGS

NASA