The Road to Digital Earth Americas

August 19, 2020

Dr. Brian Killough

CEOS Systems Engineering Office
NASA Langley Research Center
757-303-6277
Brian.D.Killough@nasa.gov

How did we get here?

- Lots of free/open satellite data is now available ... thanks to Landsat in 2007 and Sentinels in 2014
- An open source Data Cube concept in Australia was working well ... a common data and algorithm infrastructure that promotes sharing
- Several CEOS Agencies asked ... Why not expand it globally?
- Country prototypes got us started ... Switzerland, Colombia, Vietnam. Now we have 15+ operational country cubes with 100+ interested
- Africa Regional Data Cube (5 countries) ... now Digital Earth Africa
- The Sustainable Development Goals (SDGs) are inspiring countries to use free/open satellite data and tools such as the Open Data Cube

Why Digital Earth Americas?

- A regional solution is more efficient (shared big data and tools) and allows sharing of solutions (algorithms) for common problems.
- Digital Earth Africa has demonstrated it can work for a region ... our goal is a global network of regional data cubes
- Many countries in the Americas region have expressed interest
- The timing is right ... satellite data is free and open in the cloud, but we need to make it easy for users and build capacity!
- The region shares common languages and cultures that will allow it to build a community of users with a low barrier to entry
- DE-Americas could help solve common challenging problems in the region for informed decision-making

How will we build Digital Earth Americas?

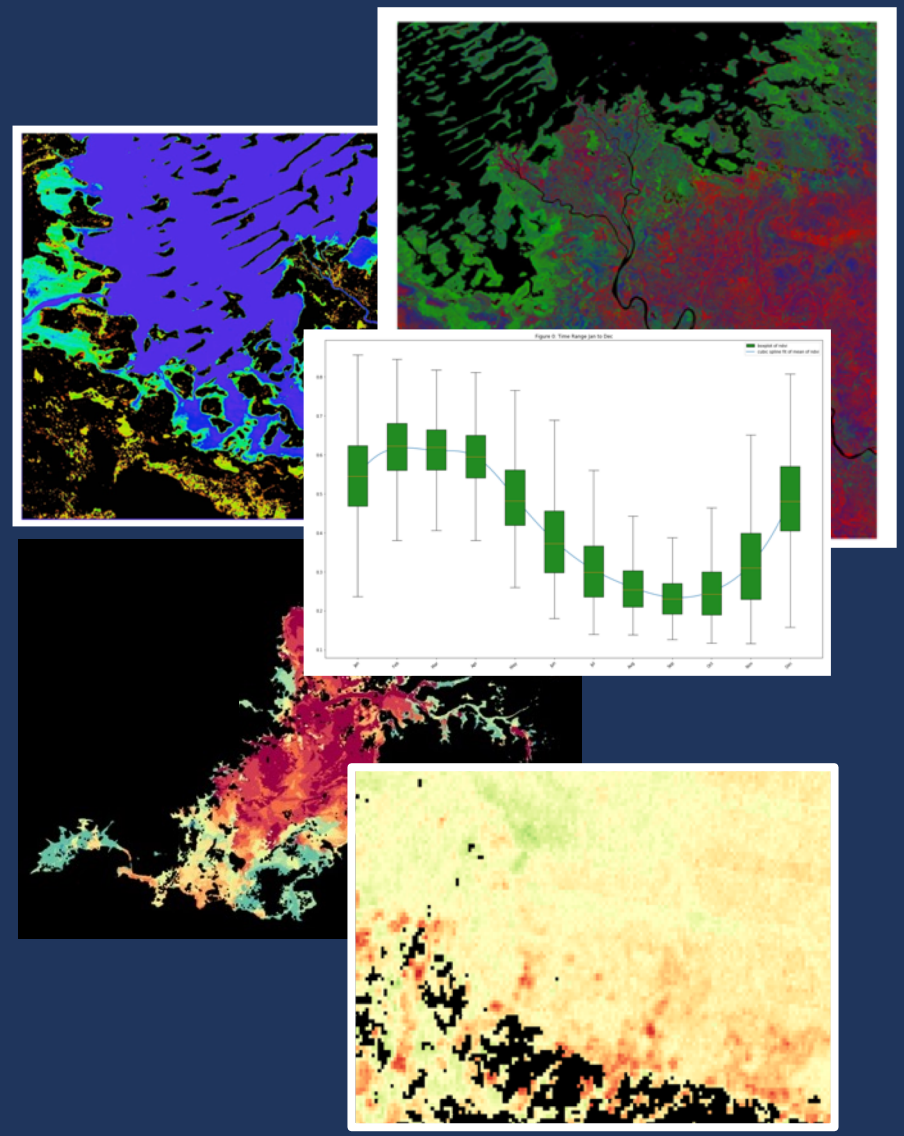
- Use the Open Data Cube infrastructure proven around the world by Australia, Africa and many others

- Use free and open source software solutions to reduce cost and enhance sharing
- Use cloud computing technology for scaling and fast performance ... Jupyter notebooks, Python code

- Use both satellite and non-satellite data. Start with a multi-country prototype and prove it has value
- Utilize partnerships with government, academia and industry to sustain it into the future

How will Digital Earth Americas be used?

- Cloud-filtered Mosaics for QGIS and ArcGIS
- Spectral Indices: NDVI and EVI (phenology), NDBI (urban), Fractional Cover (veg, urban)
- Land Classification: K-Means, Random Forest and Machine Learning
- Water: Australian WOFS (extent), TSM (water quality) , Radar (extent)
- Land Change: Spectral Threshold Anomaly, PyCCD (USGS)
- Other: Rainfall, Soil Moisture, Digital Elevation, Radar (S1, ALOS), Nightlights

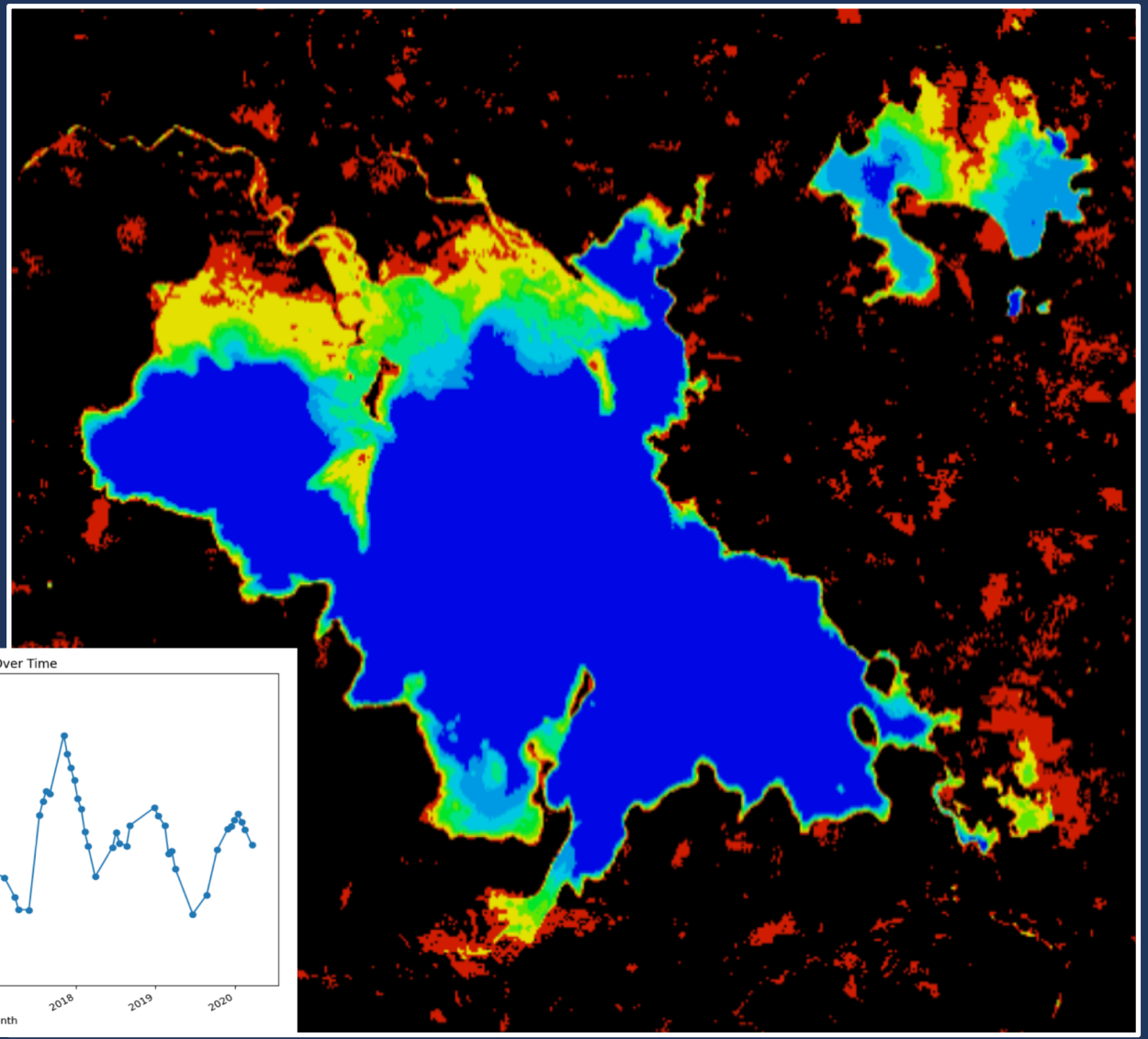


Growing list of open algorithms

Water Extent History - Lago de Guija

This volcanic lake is on the border of Guatemala and El Salvador and has an area of 45 km^2.

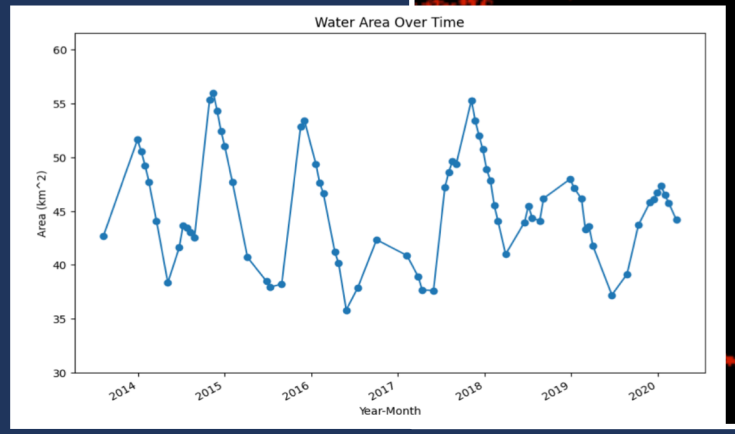
This time-series product shows water extent from 1999 to 2019 (20 years).



Normalized Water Percentage

Water observations / Clear observations

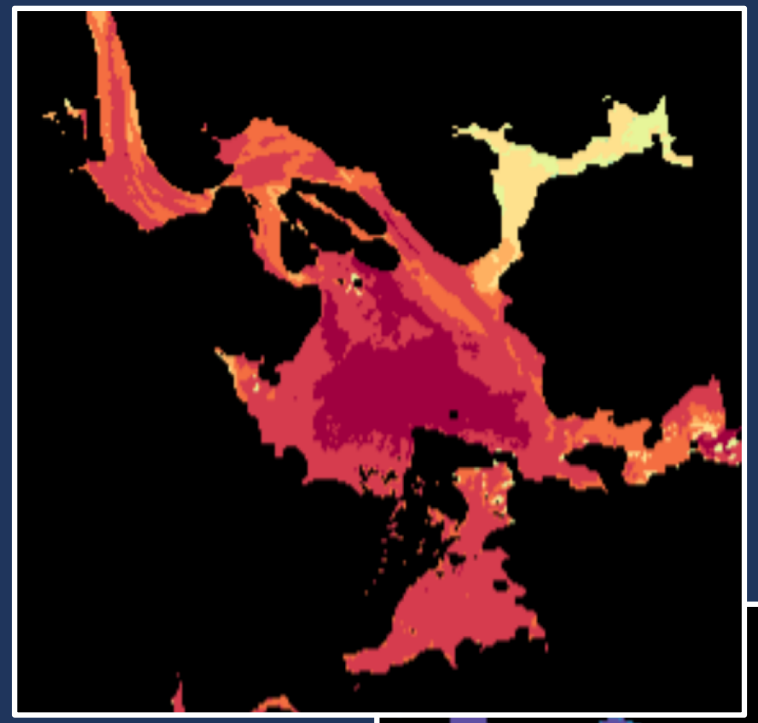
0% - 5%	40% - 55%
5% - 20%	55% - 70%
20% - 30%	70% - 85%
30% - 40%	85% - 100%



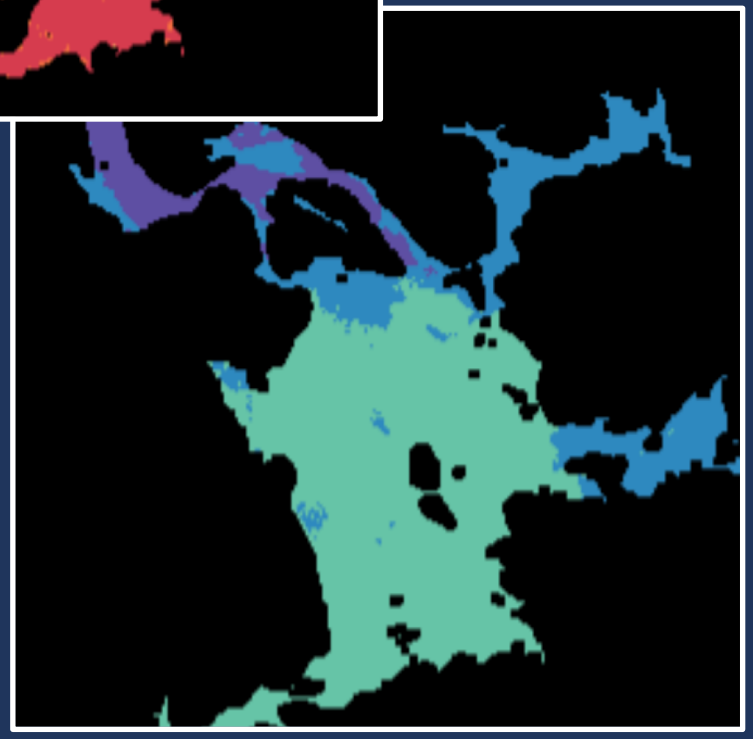
Water Quality

Rio Lempa - El Salvador
Total Suspended Sediment (TSS)

Sediment level variability can be studied to understand the impacts of land change on water quality



October 2019
High Sediment
After Summer Rainy Season

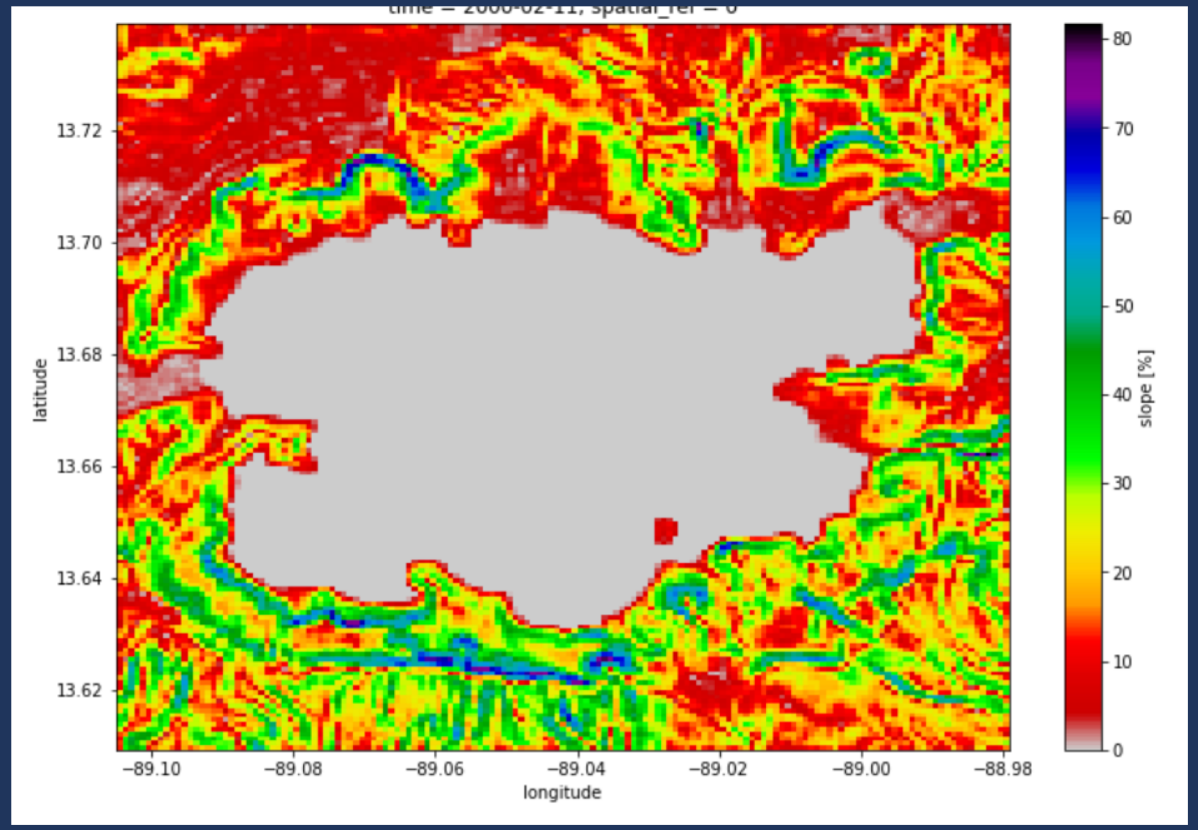


January 2019
Low Sediment
During Dry Winter Season

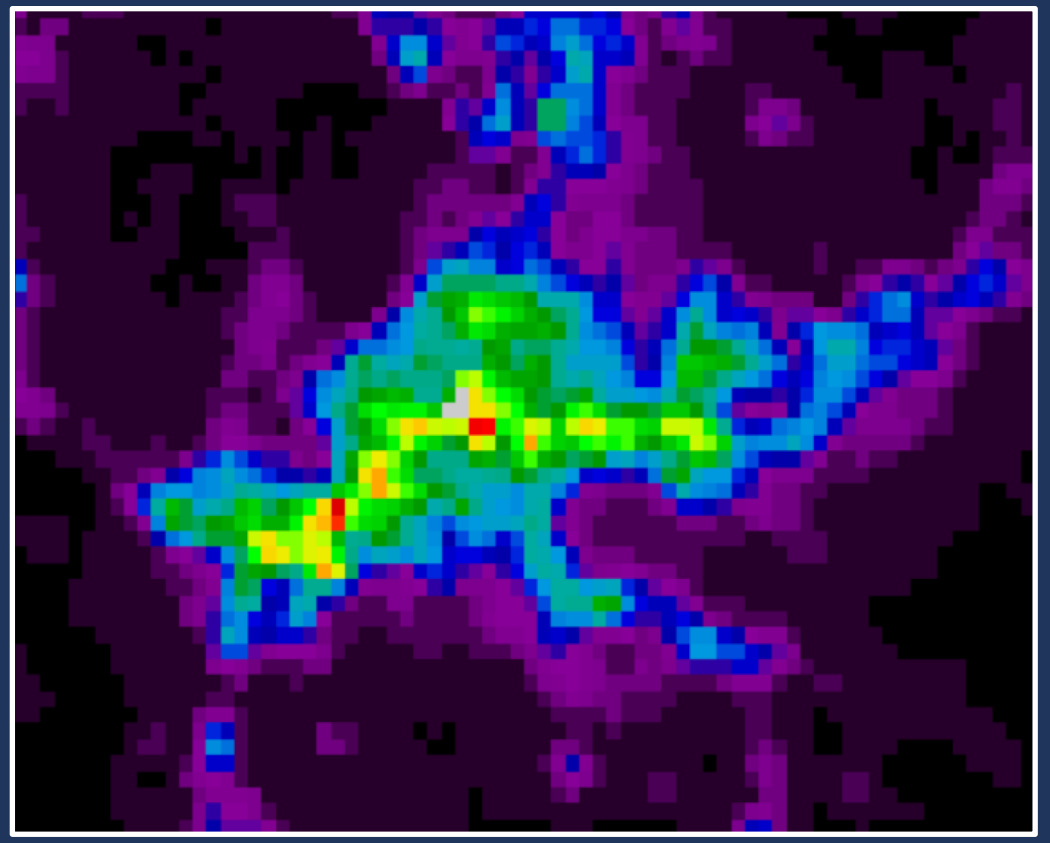
Maximum Sediment Levels

- Red — High
- Yellow/Orange — Medium
- Blue/Green — Low

More datasets from Google ... with Open Data Cube



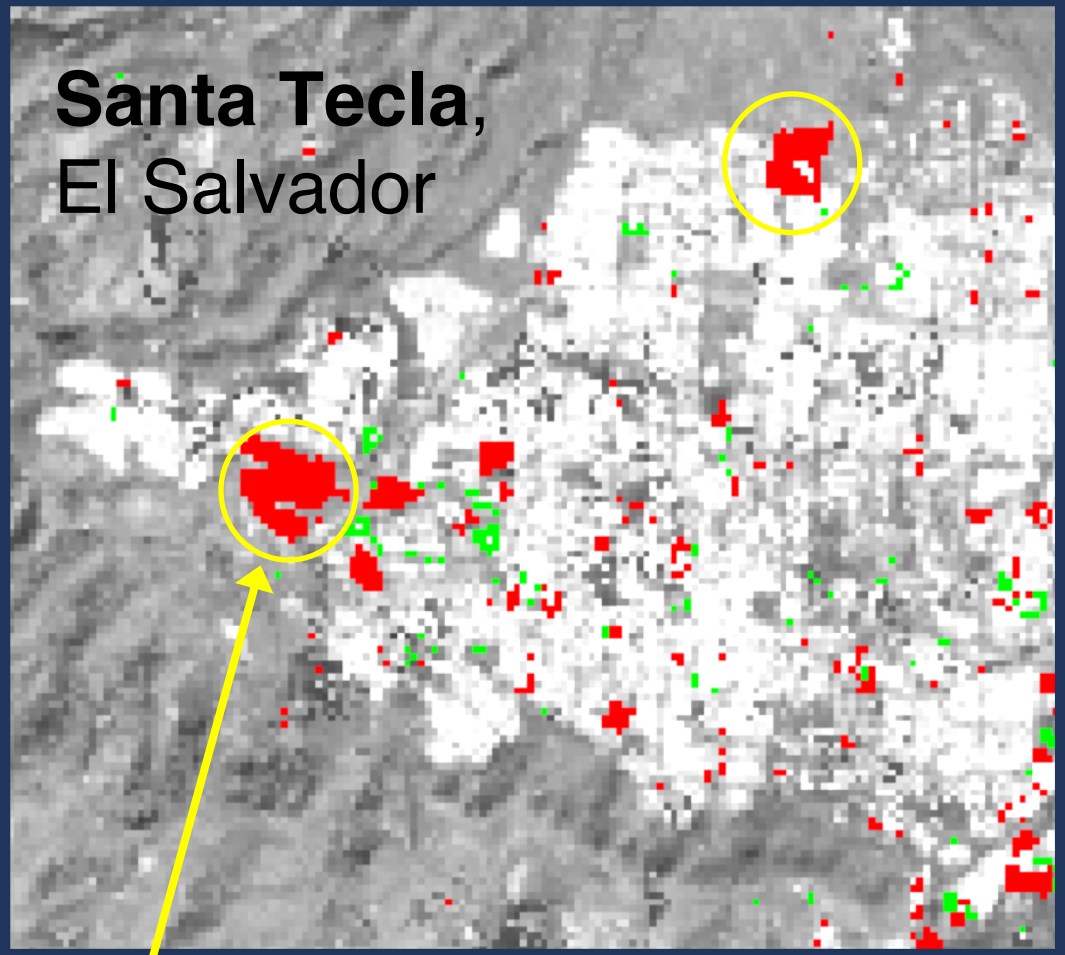
SRTM Digital Elevation Slope (Feb 2000)
Lake Ilopongo, El Salvador
This deep crater lake is surrounded by mountains. High slope areas with low vegetation could be high risk regions for landslides



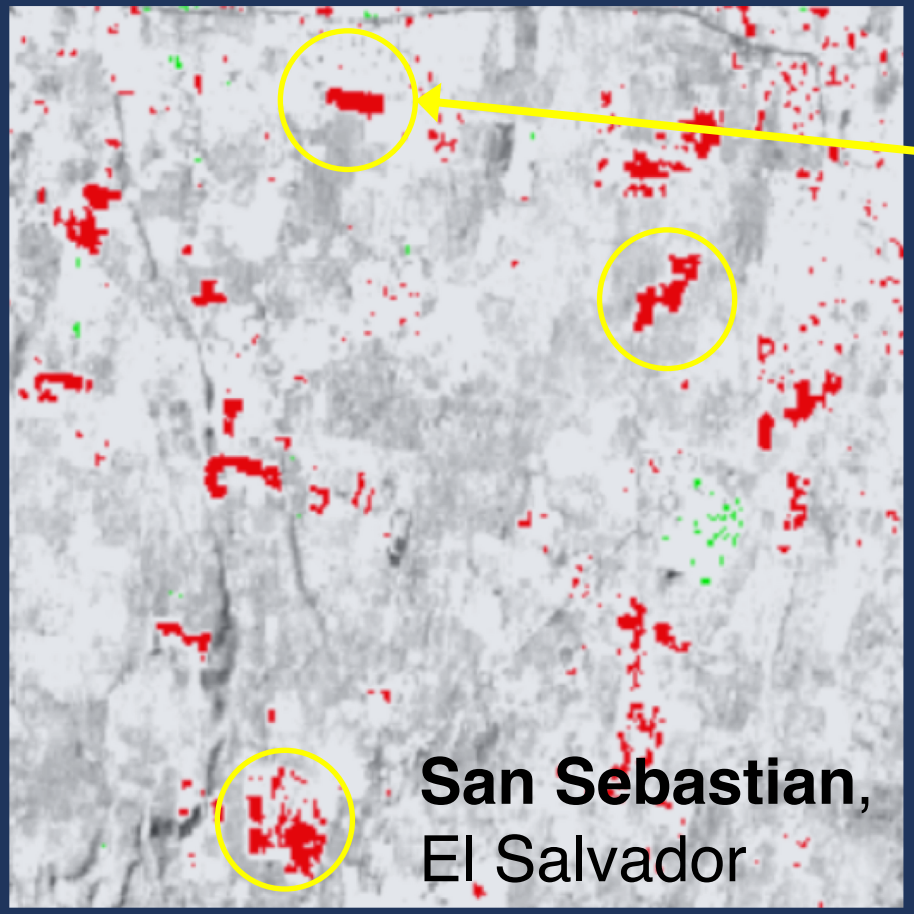
VIIRS Nightlights (Jan 2020)
San Salvador, El Salvador
This provides a coarse view of urban extent

Land Change

Detection of vegetation loss (RED) and vegetation gain (GREEN) from 2014 to 2019

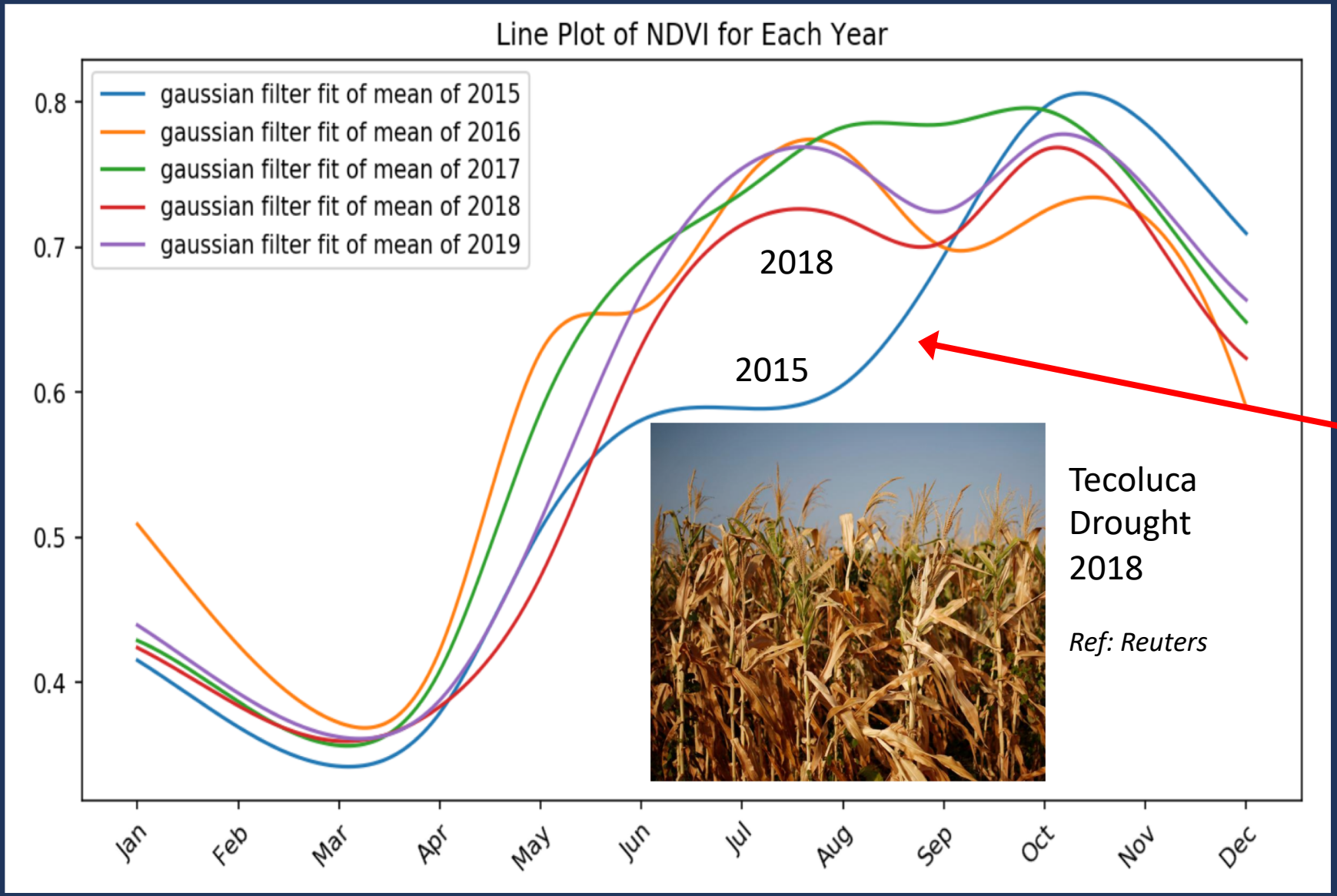


Urban Expansion



Deforested regions converted to agriculture

Agriculture Phenology



Tecoluca Drought 2018

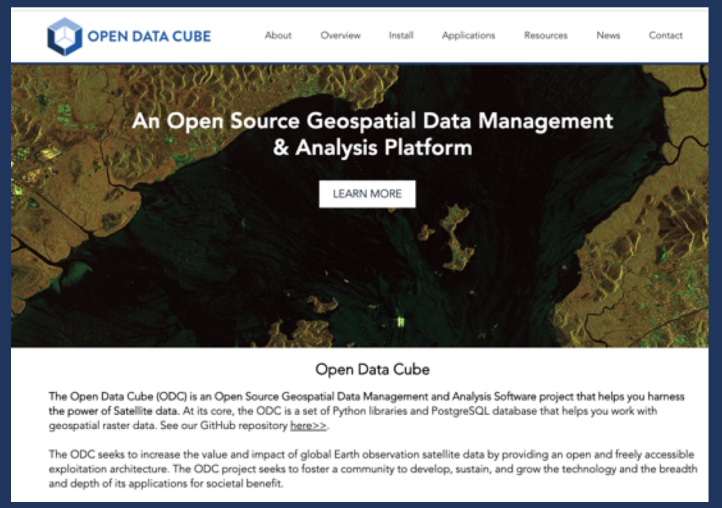
Ref: Reuters

Drought Periods in 2015 and 2018 near Tecoluca, El Salvador

Small-scale farmers can track annual growth (phenology) to understand differences in productivity due to changes in rainfall

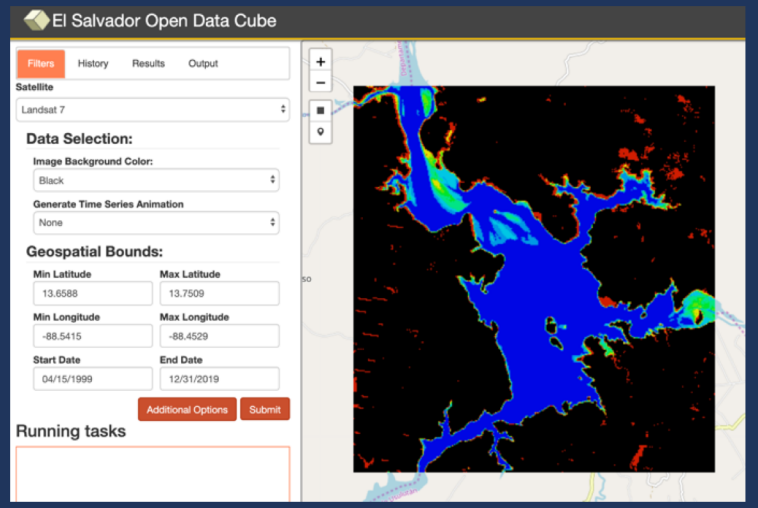
Where can I find more information?

Open Data Cube Website:
https://opendatacube.org



El Salvador User Interface:
https://tinyurl.com/salvadorcubeui

El Salvador Jupyter Notebook Demos:
Amazon (AWS) and Google (Earth Engine)
Contact Brian Killough (NASA) for access information



Muchas Gracias !