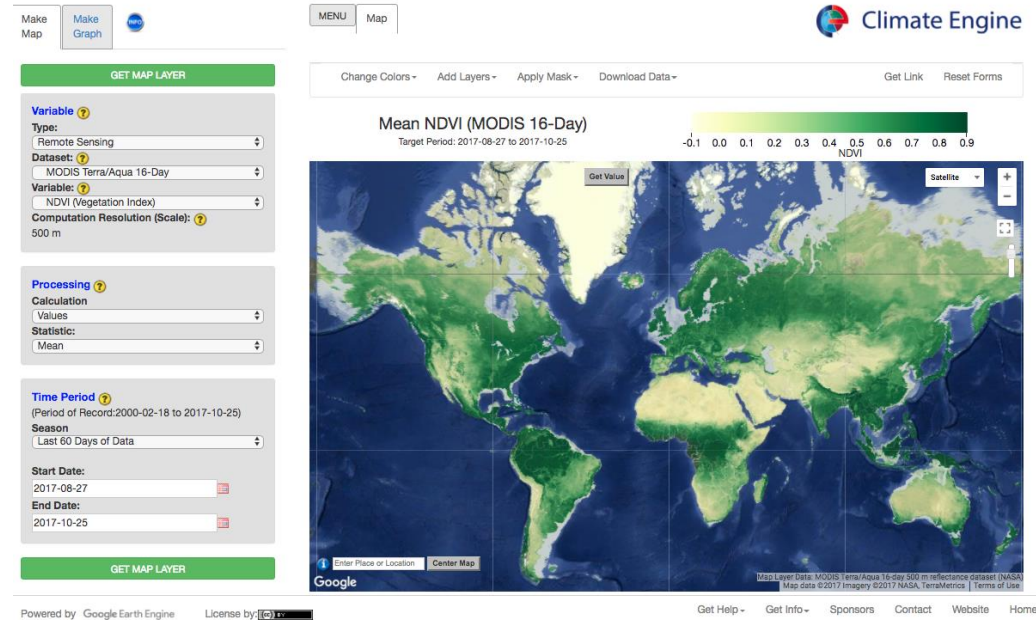


Climate Engine

Katherine Hegewisch
Department of Geography
University of Idaho, Moscow, ID



Motivation

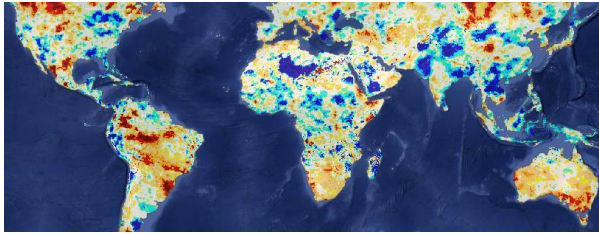
Google's cloud technology is changing how we process/analyze spatial data



Google Cloud Platform

Data Storage

Google Cloud

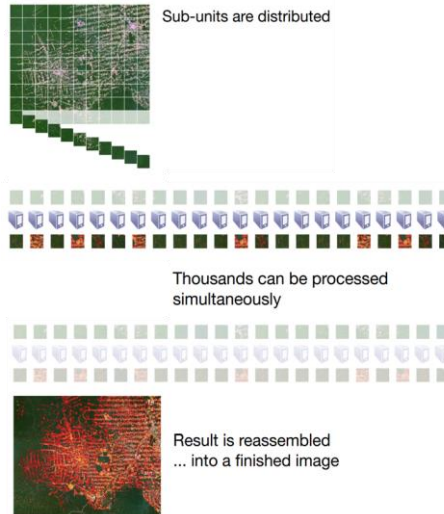


Daily data from global datasets:

- remote sensing
- climate

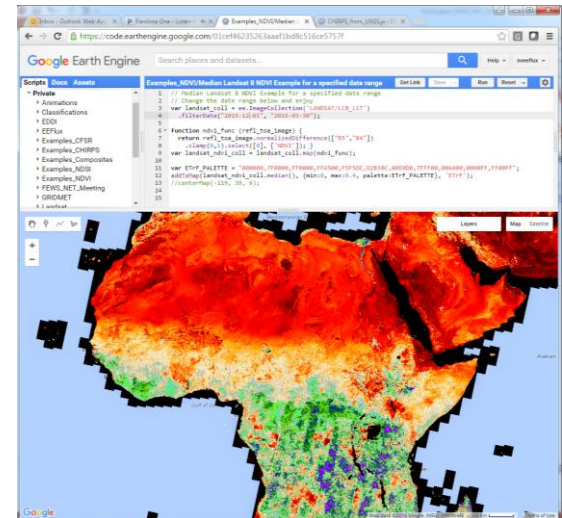
Data Processing

Google Earth Engine



Customized Requests

Google Code Editor



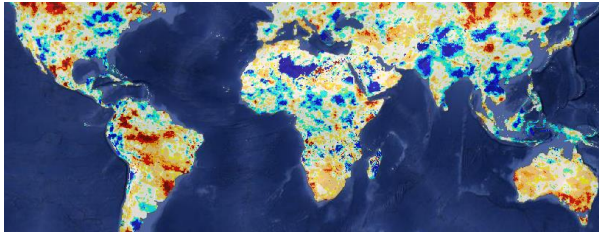
Motivation

Google's cloud technology is changing how we process/analyze spatial data



Data Storage

Google Cloud

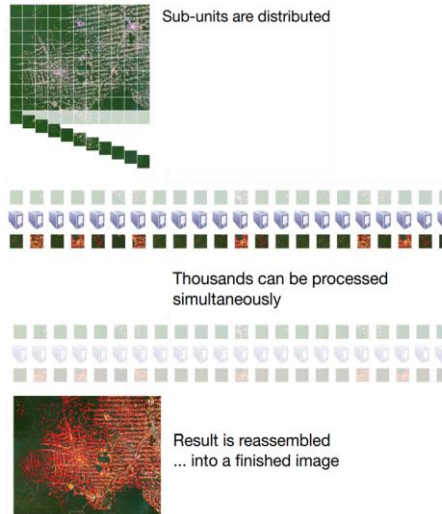


Daily data from global datasets:

- remote sensing
- climate

Data Processing

Google Earth Engine



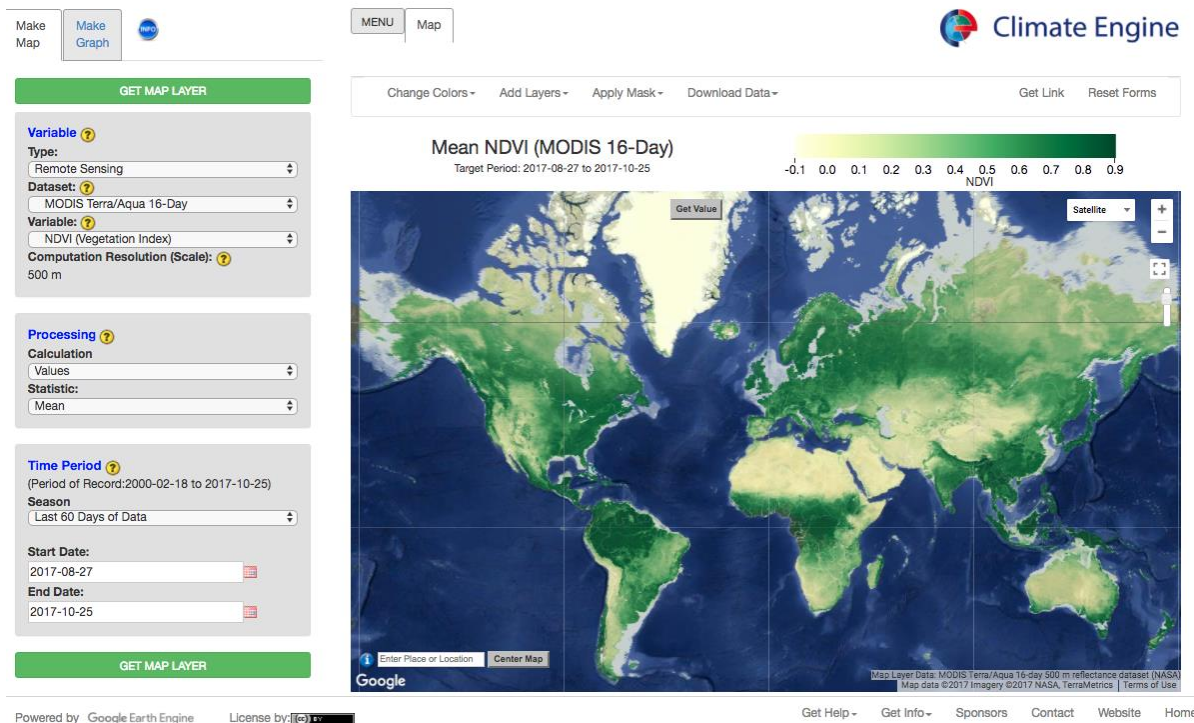
Customized Requests Google Code Editor

This requires programming!



The Climate Engine Tool

Climate Engine is a free web application for visualizing summaries of remote sensing and climate data



Our Team and Sponsors

Our Team



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Our History

- Aug 2014: Google Faculty Research Award
- 2015: funding by Famine Early Warning System Network (FEWSNET - USGS/USAID)
- 2016-2017: funding from lots of other sponsors

Our Sponsors

Google Earth Engine



U.S. Geological Survey & NASA
2012 - 2017 Landsat Science Team



U.S. Geological Survey / USAID
Famine Early Warning Systems
Network - FEWS NET



Bureau of Land Management
Nevada State Office



Western Regional Climate
Center



Great Basin Cooperative
Ecosystem Studies Unit



Regional Approaches to Climate
Change - Pacific Northwest
Agriculture



Climate Impacts Research
Consortium



Southwest Climate Science
Center



Climate Engine Features

Customized requests

Datasets

Variable ?

Type:

Dataset: ? ☒ UI METDATA/gridMET

CFS Reanalysis
CHIRPS Precipitation
MERRA2

Variable: ?

Computation ☒ PPT (Precipitation)

4000 m (1/24)

- Climate
 - DPS (Dew Point Temperature)
 - ETo (ASCE Grass Reference Evapotranspiration)
 - PPT (Precipitation)
 - PPT-ETo (Potential Water Deficit)
 - RMIN (Min Rel. Humidity)
 - RMAX (Max Rel. Humidity)
 - SPH (Specific Humidity)
 - SRAD (Downward Radiation)
 - TMEAN (Mean Temperature)
 - TMIN (Min Temperature)
 - TMAX (Max Temperature)
 - VS (Wind Speed)
- Fire Indices
 - BI (Burning Index)
 - ERC (Energy Release Component)
 - FM100 (100-HR Dead Fuel Moisture)
 - FM1000 (1000-HR Dead Fuel Moisture)
- Drought Indices
 - PDSI (Palm. Drought Sev. Ind.)
 - EDDI (Evap. Demand Drought Index)
 - SPI (Standard. Prec. Index)
 - SPEI (Standard. Prec. Evap. Index)

Calculations

Processing ?

☒ Values

Average Conditions
Difference From Average Conditions
Percent Difference From Average Conditions
Percent Of Average Conditions

Calculation

Statistic:

Mean
Median
Maximum
Minimum
☒ Total

Time Periods

Time Period ?

(Period of Record: 1979-01-01 to 2017-11-10)

Season

Custom Date Range
Entire Period of Record of Dataset
Last 15 Days of Data
Last 30 Days of Data
☒ Last 60 Days of Data
Last 90 Days of Data
Last DJF (Dec-Feb)
Last MAM (Mar-May)
Last JJA (Jun-Aug)
Last SON (Sept-Nov)

Start Date:

End Date:

Sep 2017							October 2017							November 2017						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
					1	2														
3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
24	25	26	27	28	29	30	29	30	31					26	27	28	29	30		

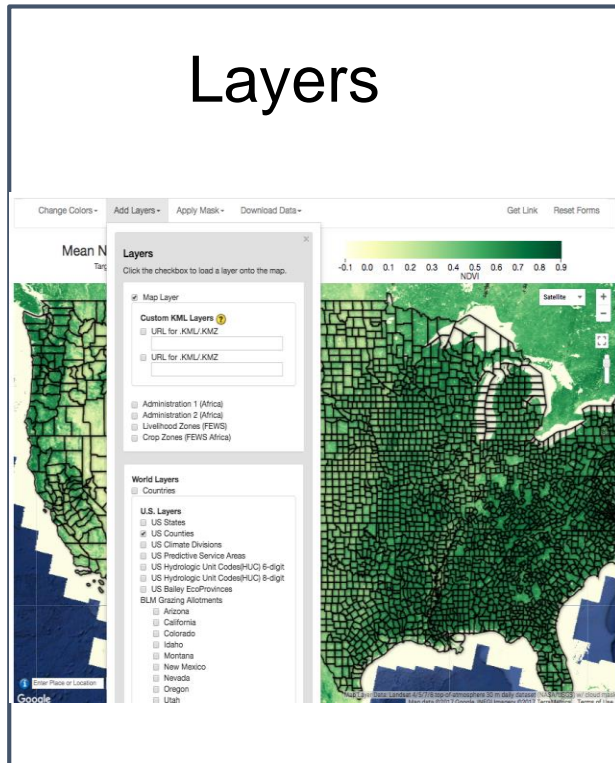
GIS Bells and Whistles

Mapping

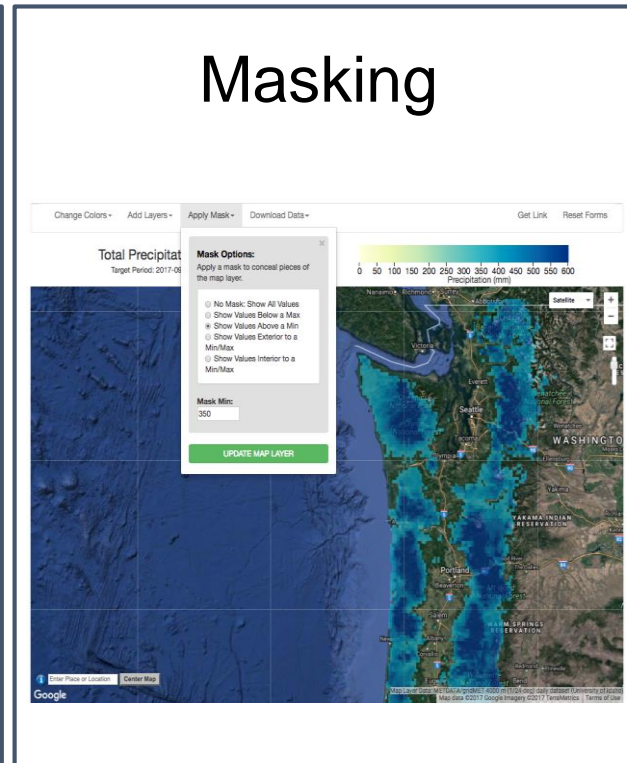
Styling



Layers



Masking



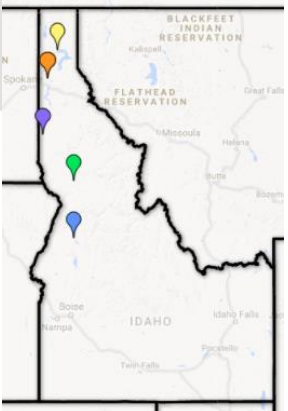
GIS Bells and Whistles

Time Series

Points

GET TIME SERIES

Region: ?
☒ Point
☒ Point
☒ Point
☒ Point
☒ Point



Polygons

How to Create/Update a Polygon ✕

To create area-averaged data over a custom polygon, create/update the polygon: ☒

How to create a polygon:
(1) Click on map
(2) Click locations on map in order of vertices
(3) Click initial vertex to close polygon

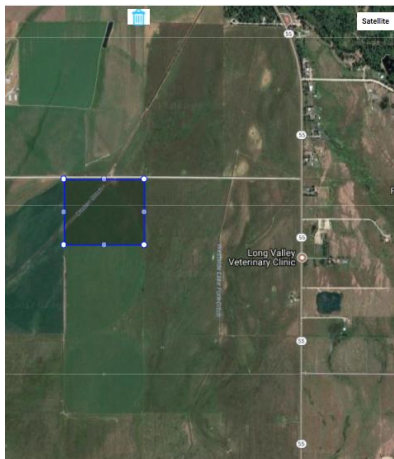
How to delete a polygon:
(1) Click on map

How to name a polygon:
Enter a name for the polygon (to put on graph). Click **UPDATE** button.

Ways to update a polygon:
(1) Drag polygon on map
(2) Drag polygon vertex on map
(3) Modify vertex coordinates here:

☐ Show triangle example

UPDATE



Custom Regions

How to Create/Add a Fusion Table ✕

To create area-averaged data over a custom region, add a custom fusion table. ☐

How to Create a Fusion Table
Create your own from a KML file.
[Tutorial](#) | [Create](#) | [Help](#)


How to Add a Fusion Table
Enter fusion table info and then click **UPDATE**

Fusion Table Id:

Column Name to Import:

☒ Show US counties example

UPDATE



Applications

An agricultural parcel in Nampa, ID



How to Create/Update a Polygon

To create area-averaged data over a custom polygon, create/update the polygon:

How to create a polygon:

- (1) Click on map
- (2) Click locations on map in order of vertices
- (3) Click initial vertex to close polygon

How to delete a polygon:

- (1) Click on map

How to name a polygon:

Enter a name for the polygon (to put on graph). Click UPDATE button.

Ag Plot near Nampa,ID

Ways to update a polygon:

- (1) Drag polygon on map
- (2) Drag polygon vertex on map
- (3) Modify vertex coordinates here:

-116.652491,43.459647,
-116.64305,43.466375

☐ Show triangle example

UPDATE

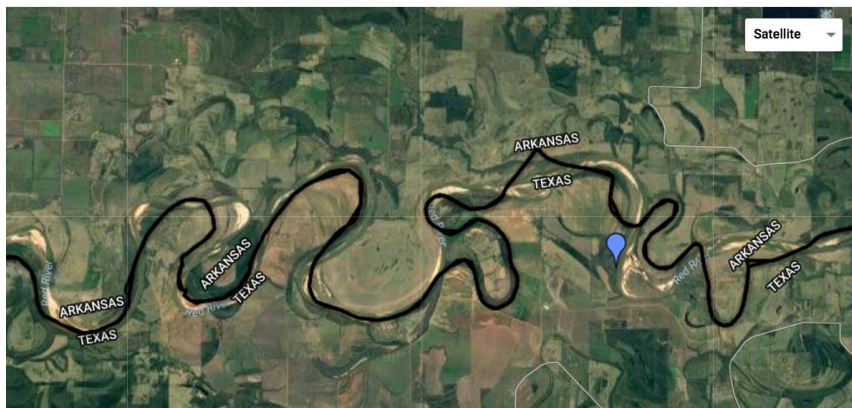
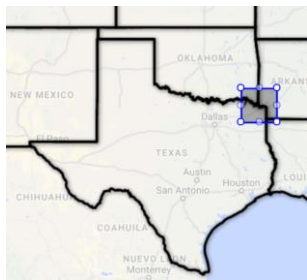
Get Help - Get Info - Sponsors Contact Website Home

Annual variability in Sept-Nov rains

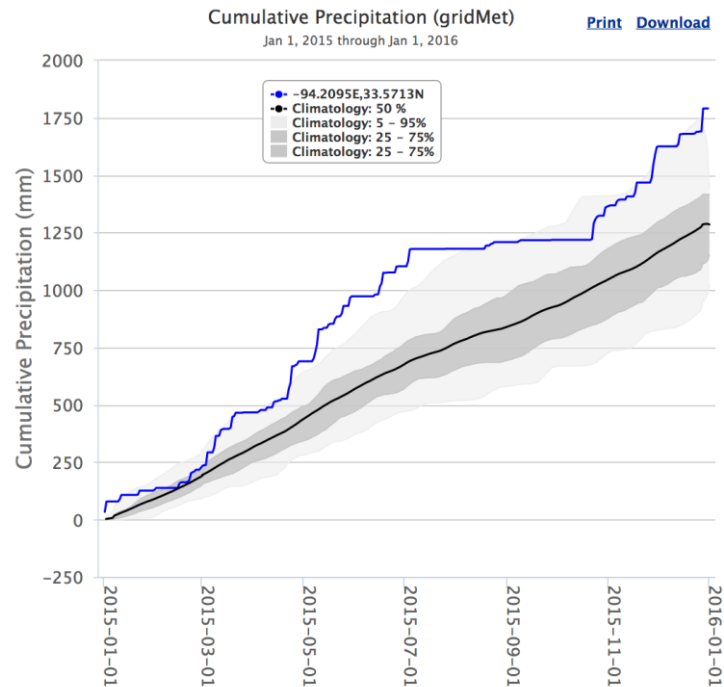


Applications

A location along
the Red River in
Texas

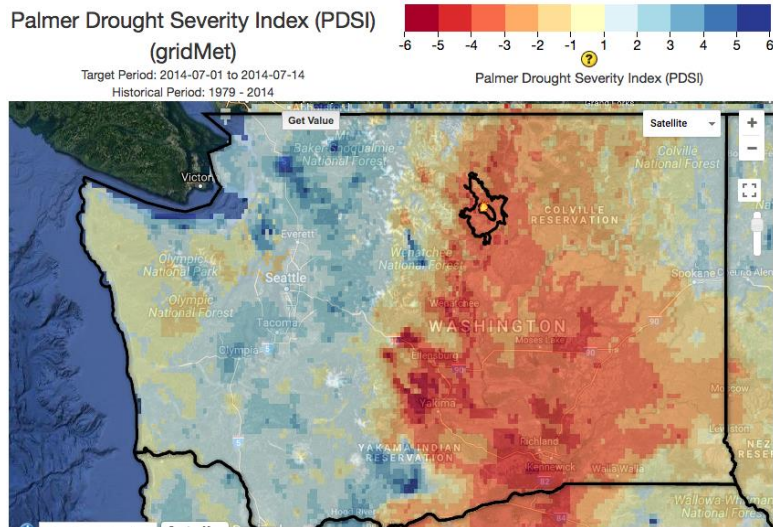


Cumulative Precipitation in 2015:
2 flooding events and a flash drought



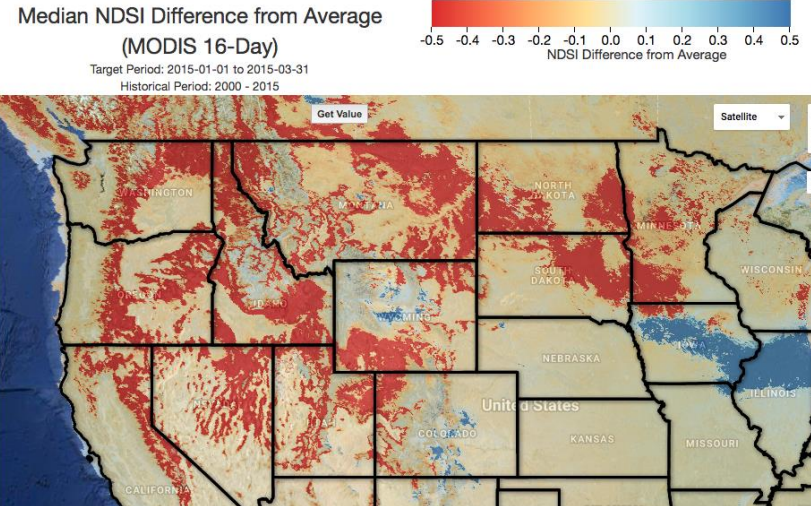
Applications

Fire



2014 Carleton Complex Fire:
dry soil moisture conditions

Snow



2015 Snow Drought:
normalized snow index

ClimateEngine.org

khegewisch@uidaho.edu