



GOOGLE EARTH ENGINE SPATIAL ALGORITHMS

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WHAT IS EARTH ENGINE?

Google

Earth Engine:

**Google's Cloud Platform for
Big Earth Data Analytics**

WHAT IS EARTH ENGINE?

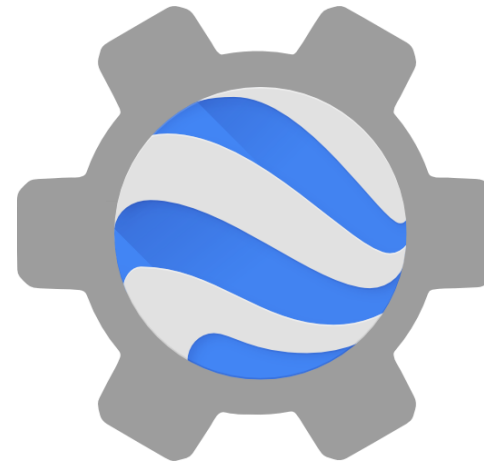
Google Earth



3D Globe Visualization

Rich 3D basemap on which raster and vector data can be overlaid.

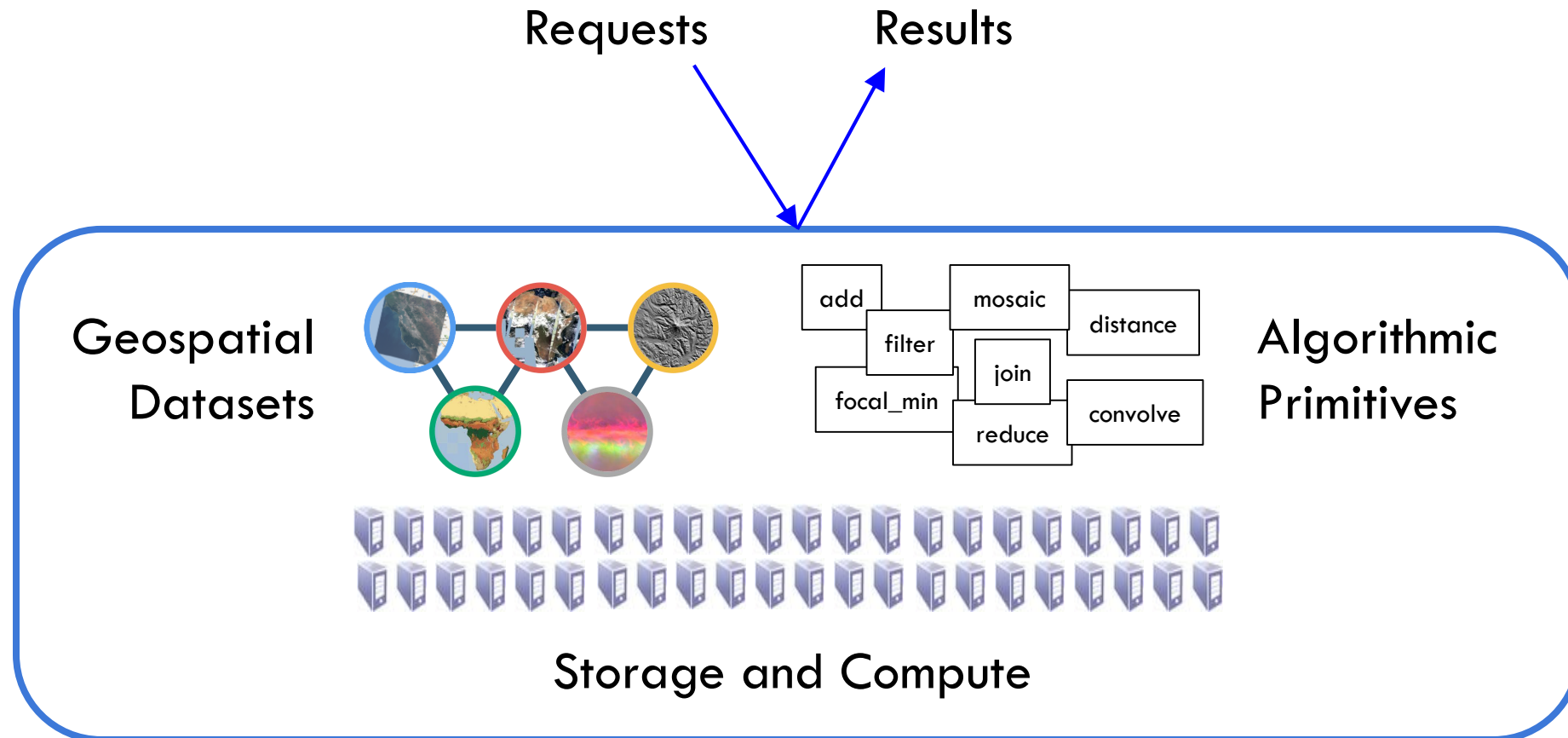
Google Earth Engine



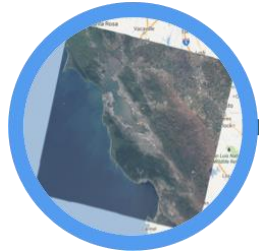
Geospatial Analysis

Enables the processing of massive amounts of raster and vector data, that may results in a variety of outputs such as tiles for 2-D interactive maps, tables, video, or images that can be displayed on Google Earth.

OVERVIEW

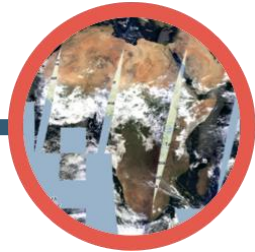


THE EARTH ENGINE PUBLIC DATA CATALOG



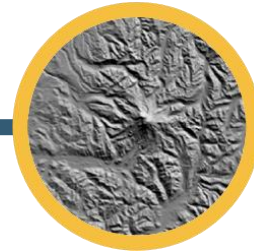
Landsat 4, 5, 7, 8

Raw, TOA, SR, etc.



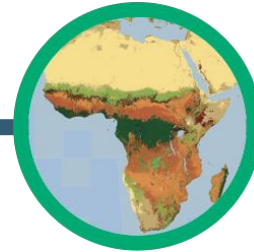
MODIS

Daily, NBAR, LST, etc.



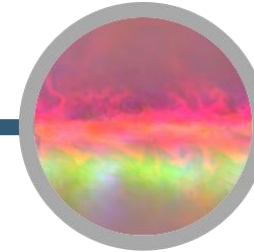
Terrain

SRTM, GTOPO, NED, etc.



Land Cover

GlobCover, NLCD, etc.



Atmospheric

NOAA NCEP, OMI, etc.

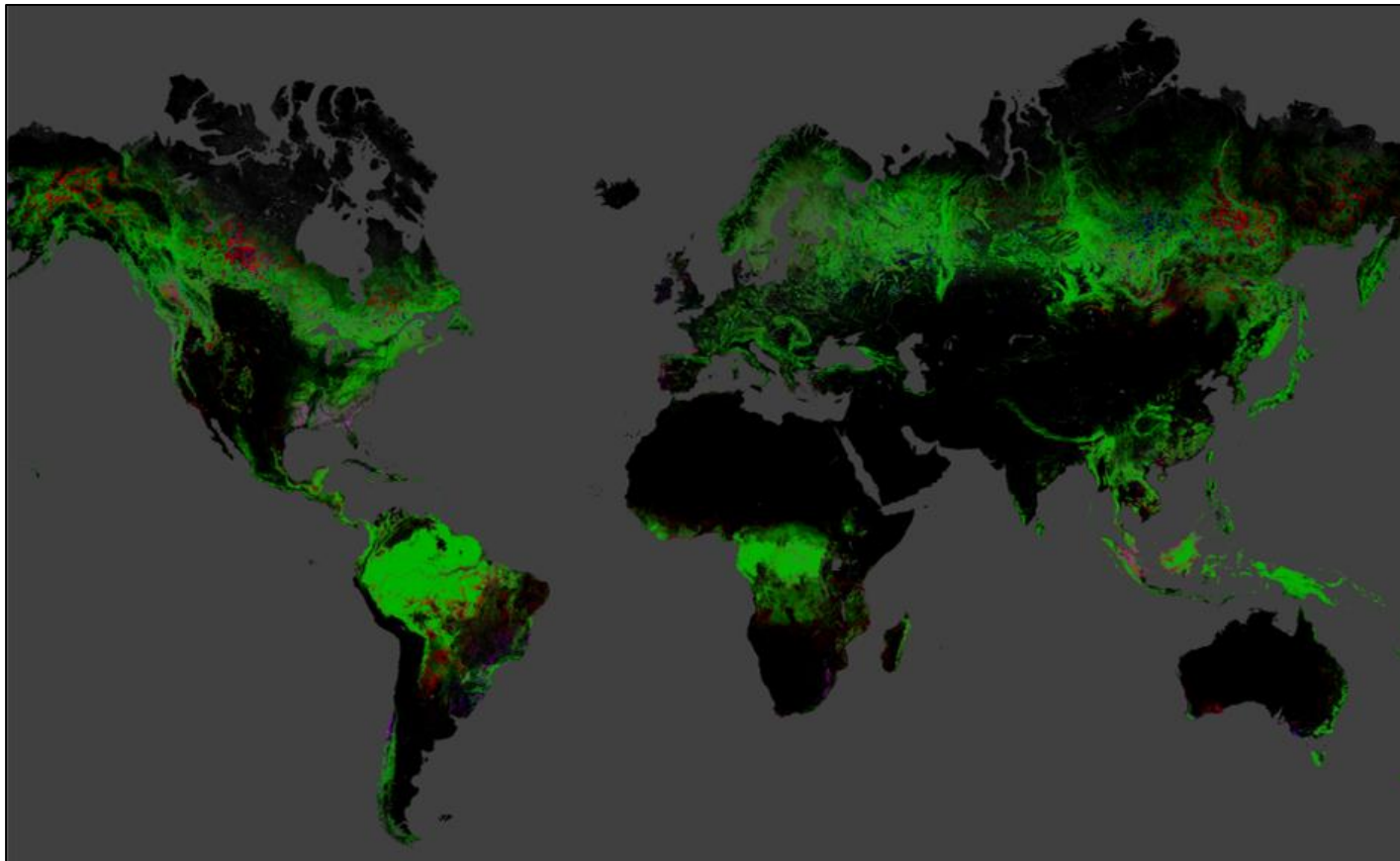
- > 200 public datasets
- > 5 million images
- > 4000 new images every day
- > 5 petabytes of data



USAGE AND EXAMPLES

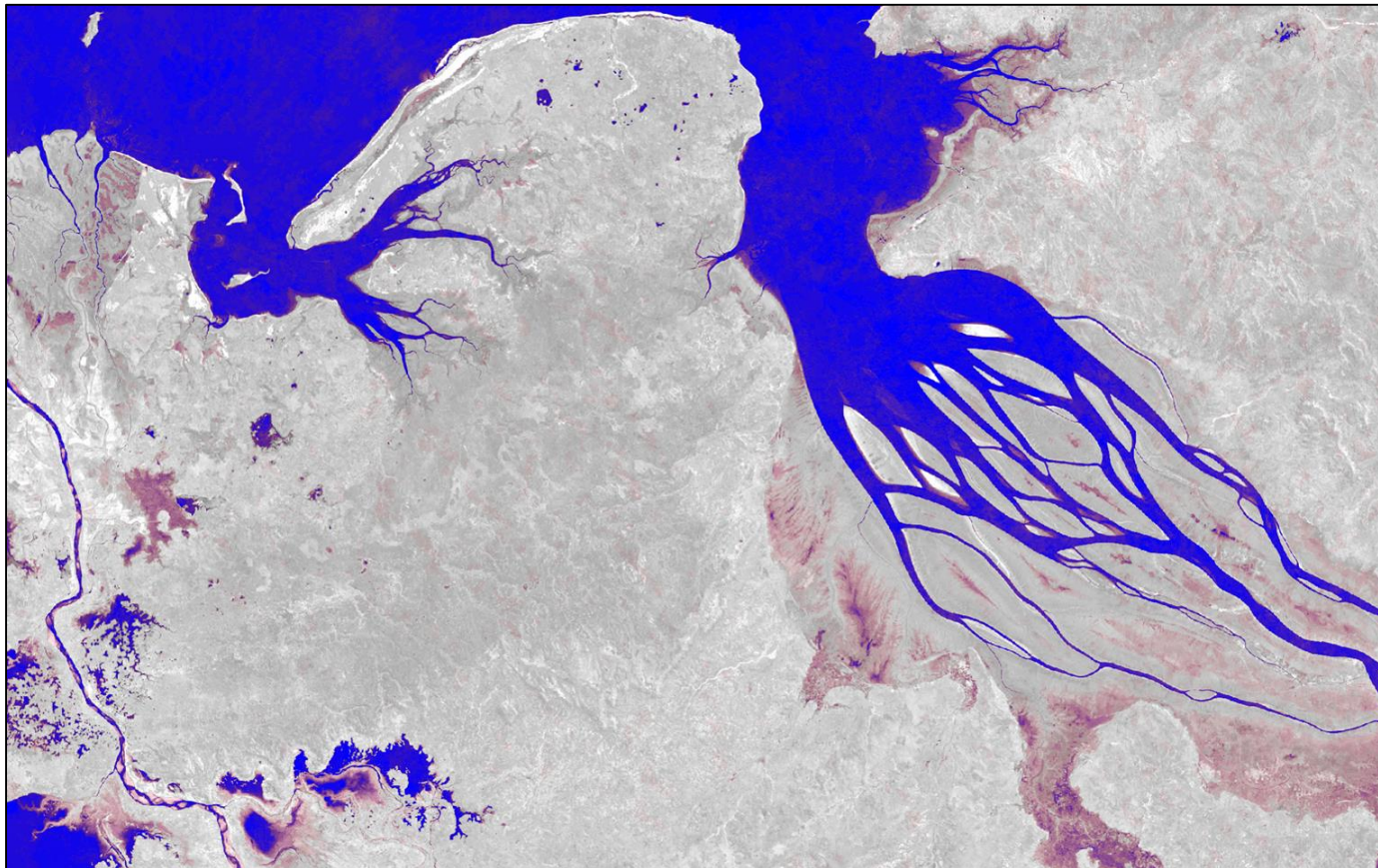
Showcases
Online demonstrations

GLOBAL FOREST EXTENT AND CHANGE



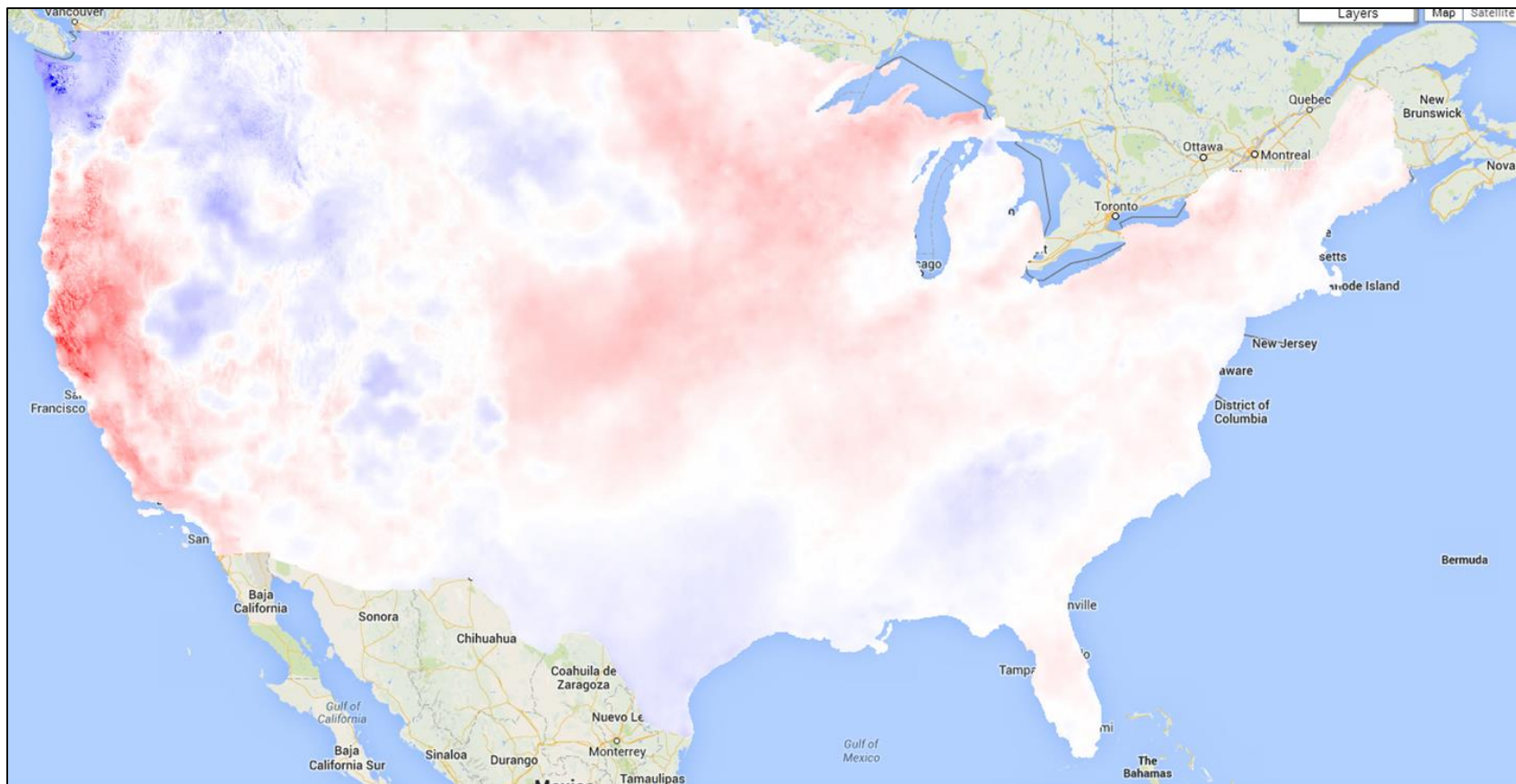
Source: Source: Hansen, Potapov, Moore, Hancher et al. , Science, 15 November 2013

GLOBAL SURFACE WATER



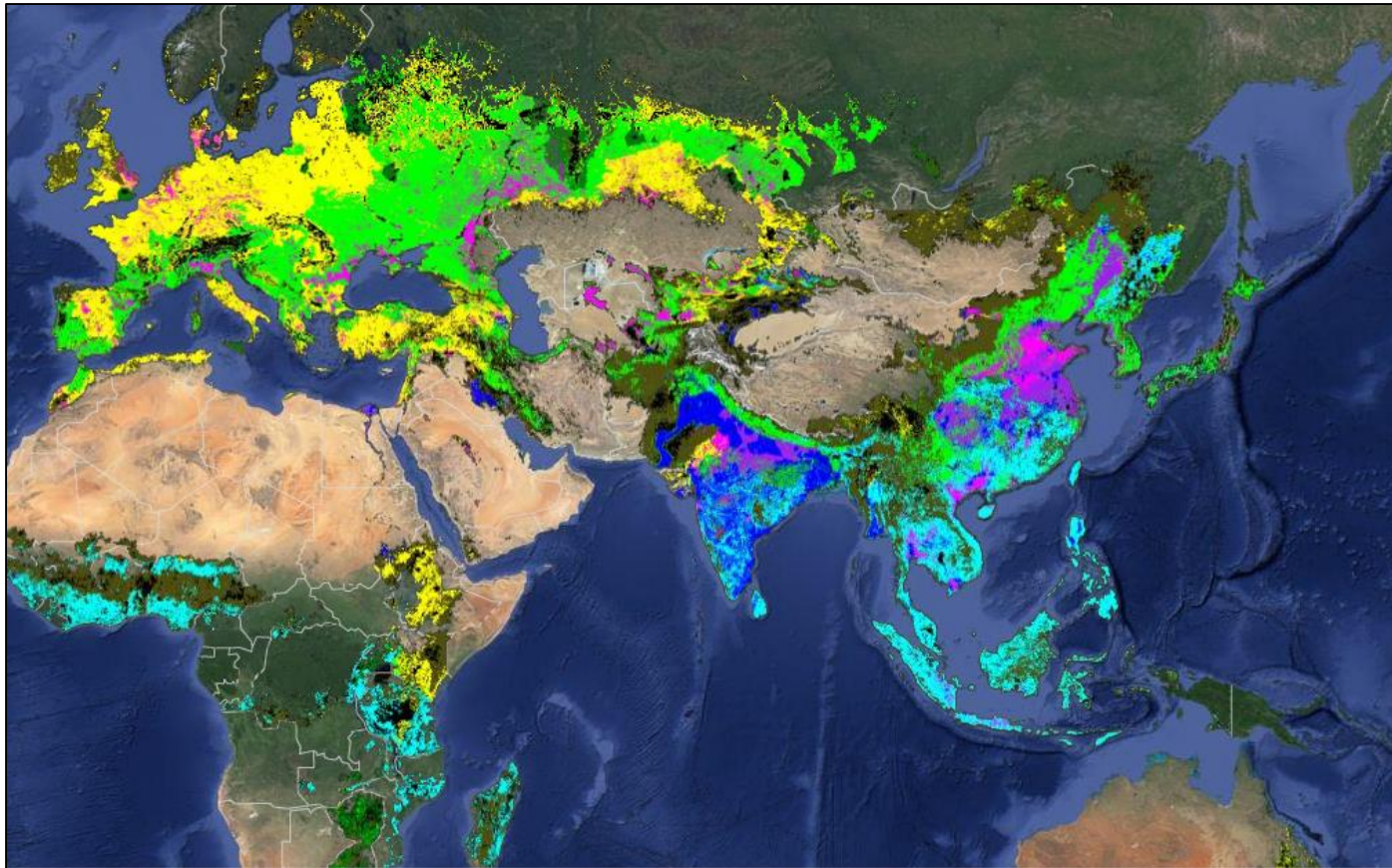
Source: Pekel, Belward, Cotton & Gorelick, 2015

REAL-TIME DROUGHT MONITORING



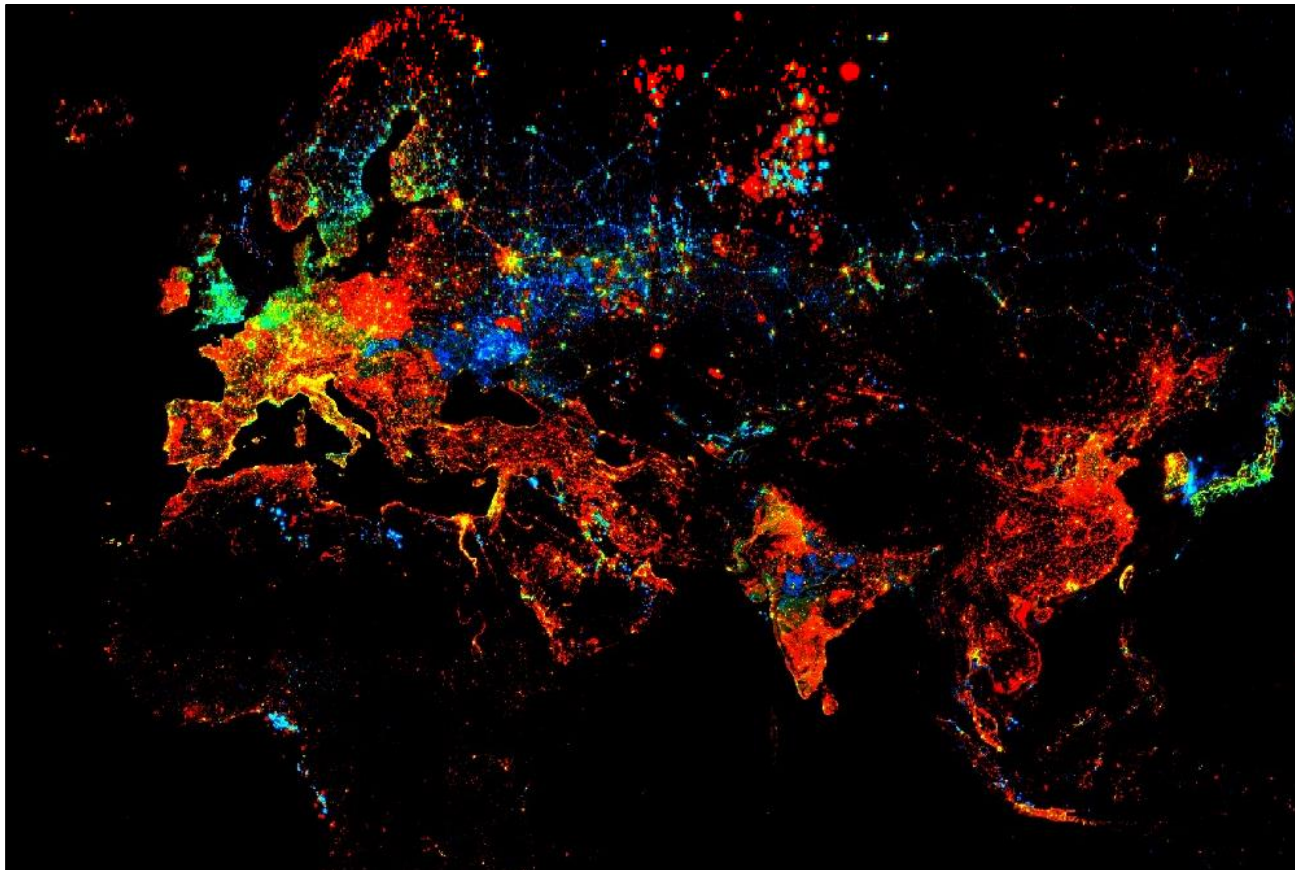
Source: *Desert Research Institute - Justin Huntington and Charles Morton*

GLOBAL CROP MAP



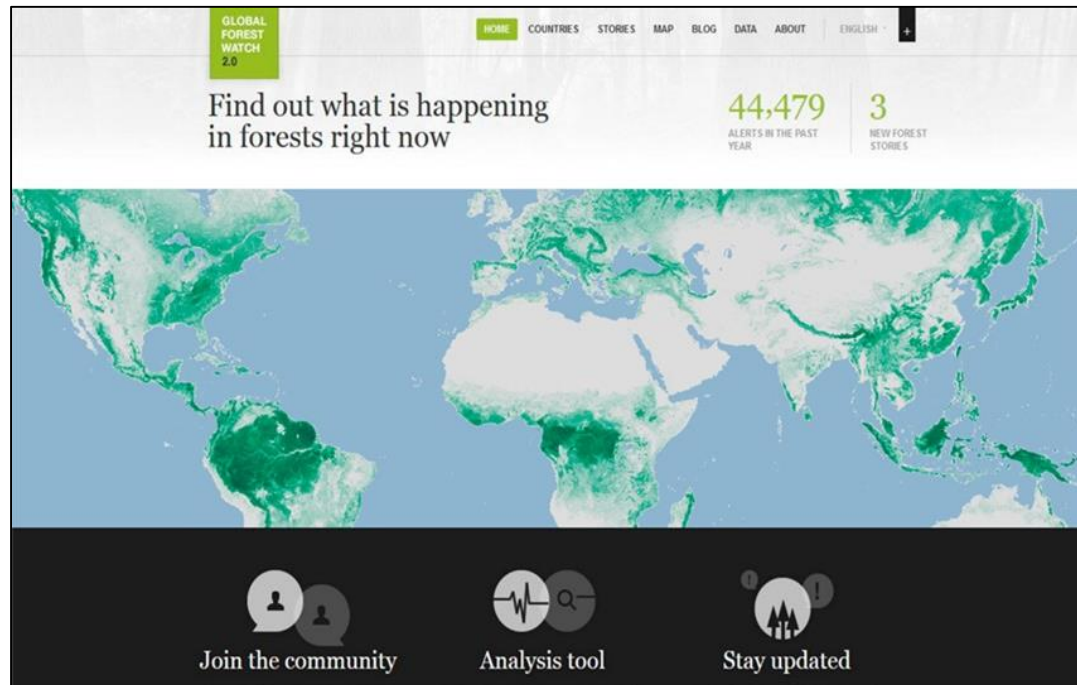
Source: Prasad Thenkabai, Jun Xiong, USGS

GLOBAL DEVELOPMENT

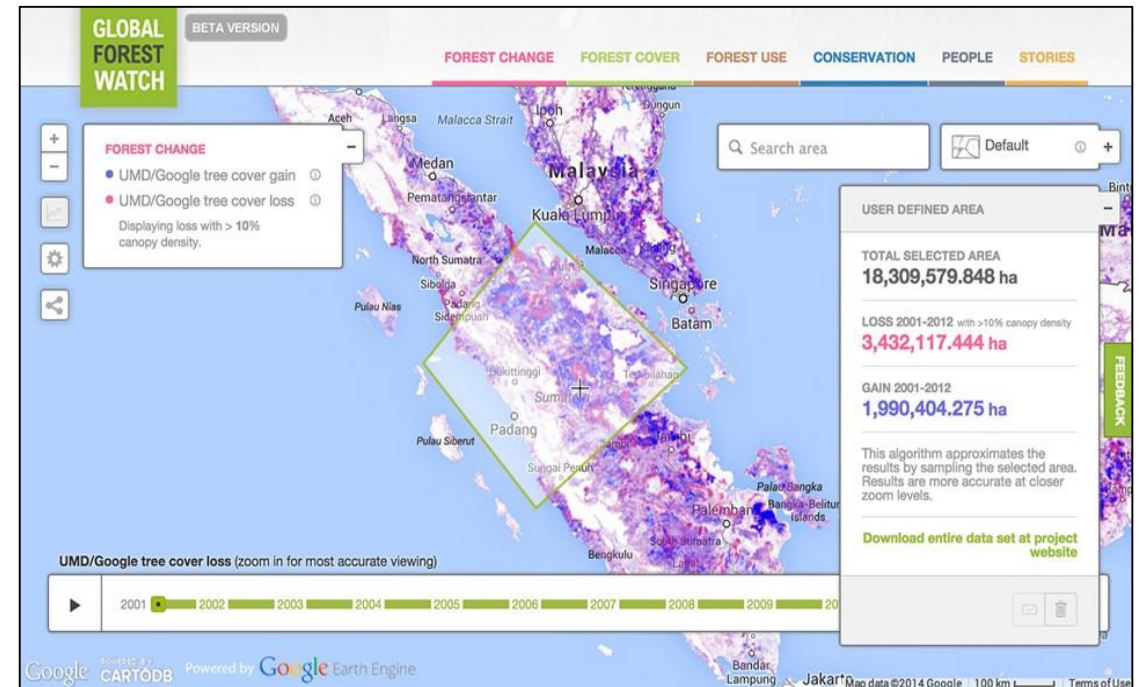


Source: *DMSP-OLS, Nighttime persistent lights*

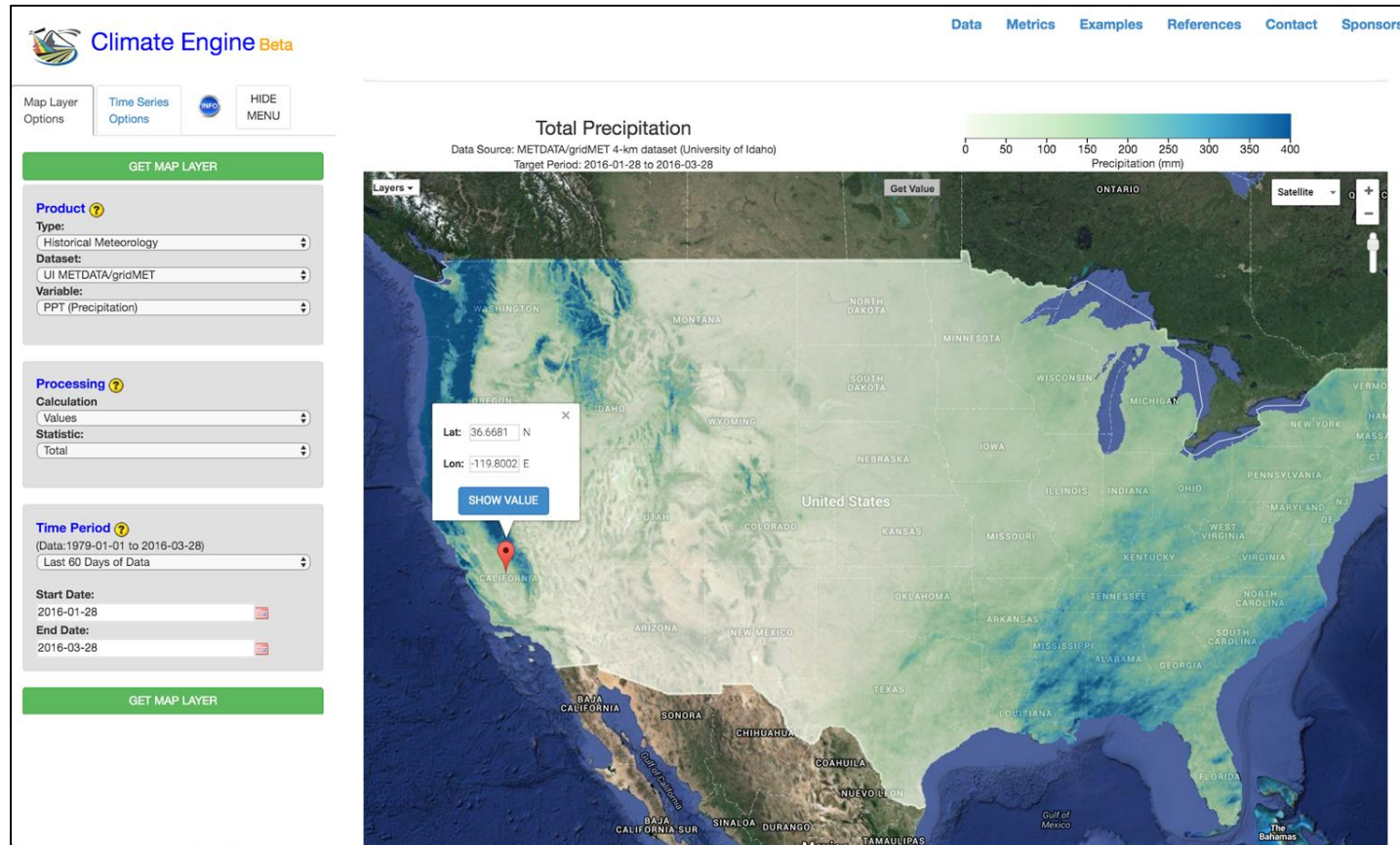
GLOBAL FOREST WATCH



www.globalforestwatch.org



CLIMATE ENGINE



EARTHENV

EarthEnv

Global, remote-sensing supported environmental layers for assessing status and trends in biodiversity, ecosystems, and climate

HOME PUBLICATIONS PARTNERS PRESS TEAM

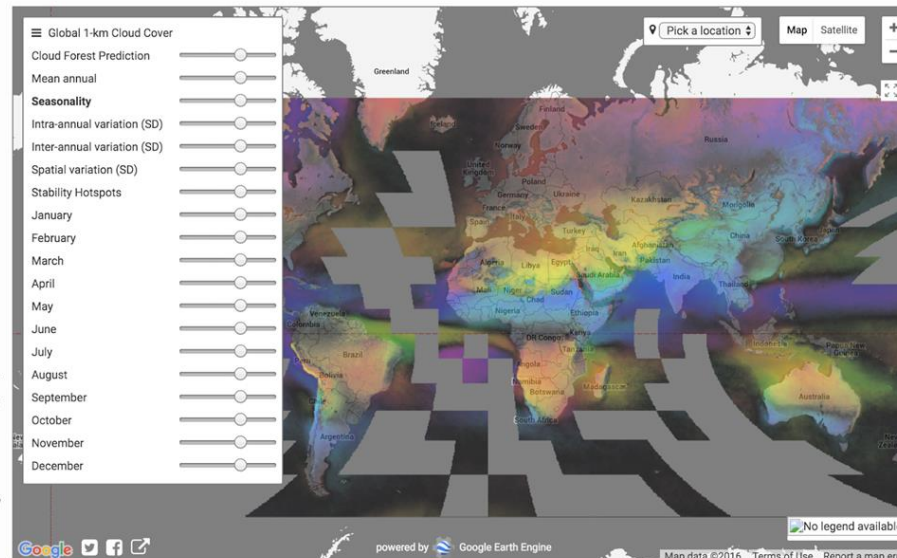
Global 1-km Cloud Cover

The datasets integrate 15 years of twice-daily remote sensing-derived cloud observations at 1-km resolution. For additional information about the integration approach and the evaluations of the datasets, please see the associated journal article:

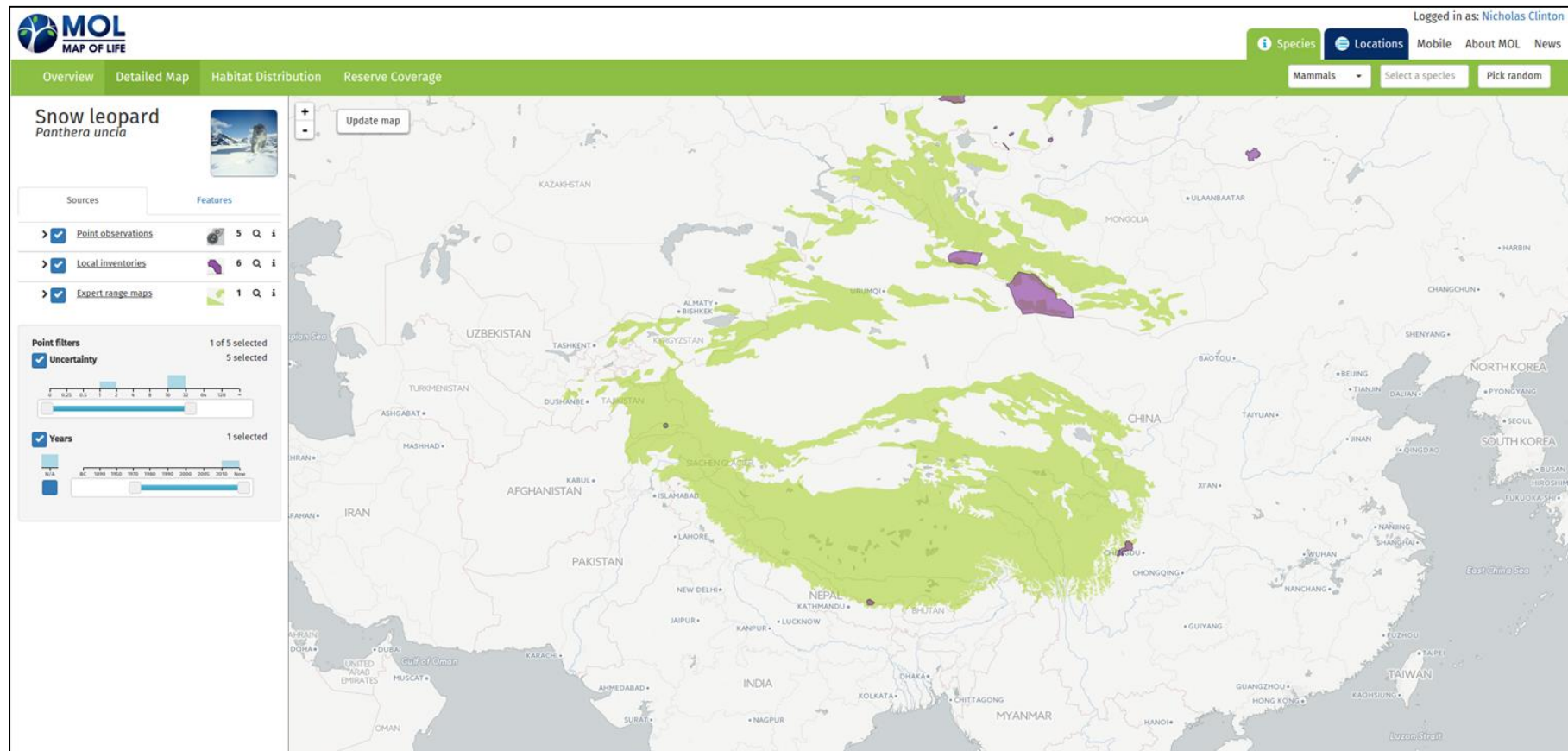
Wilson AM, Jetz W (2016) Remotely Sensed High-Resolution Global Cloud Dynamics for Predicting Ecosystem and Biodiversity Distributions. *PLoS Biol* 14(3): e1002415. doi:10.1371/journal.pbio.1002415

Dataset Details

Cloud cover can influence numerous important ecological processes including reproduction, growth, survival, and behavior, yet our assessment of its importance at the appropriate spatial scales has remained remarkably limited. If captured over large extent yet at sufficiently fine spatial grain cloud cover dynamics may provide key information for delineating a variety of habitat types and predicting species distributions. Here we develop new near-global, fine-grain (=1km) monthly cloud frequencies from 15 years of twice-daily MODIS satellite images that expose spatio-temporal cloud cover dynamics of previously undocumented global complexity. We demonstrate that cloud cover varies strongly in its geographic heterogeneity and that the direct, observation-based nature of cloud-derived metrics can improve predictions of habitats, ecosystem, and species distributions with reduced spatial autocorrelation compared to commonly used interpolated climate data. These findings support the fundamental role of remote sensing as an effective lens through which to understand and globally monitor the fine-grain spatial variability of key biodiversity and ecosystem properties.



MAP OF LIFE





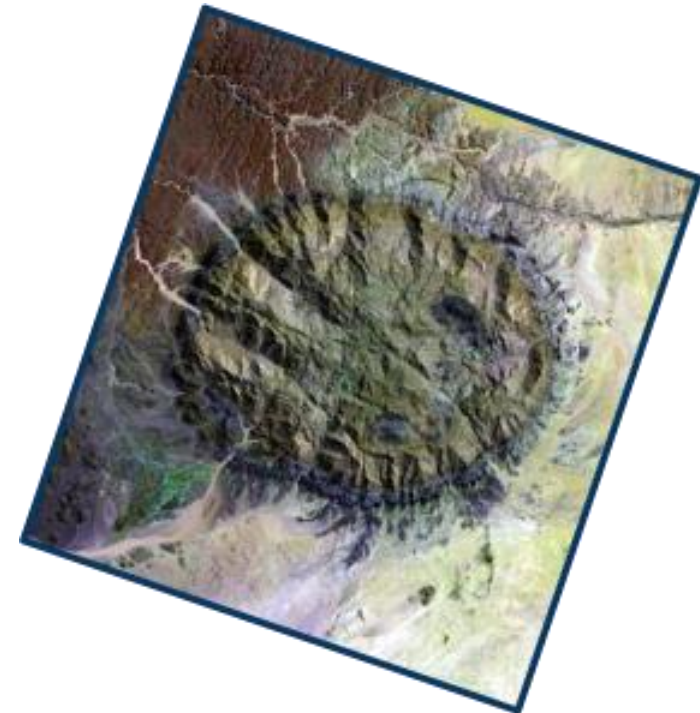
HOW DOES IT WORK?

Global algorithm processing
Map-Reduce paradigm

GLOBAL-SCALE ALGORITHM PROCESSING

Get an image

- Pick projection, resolution, bands, bounding-box, visualization



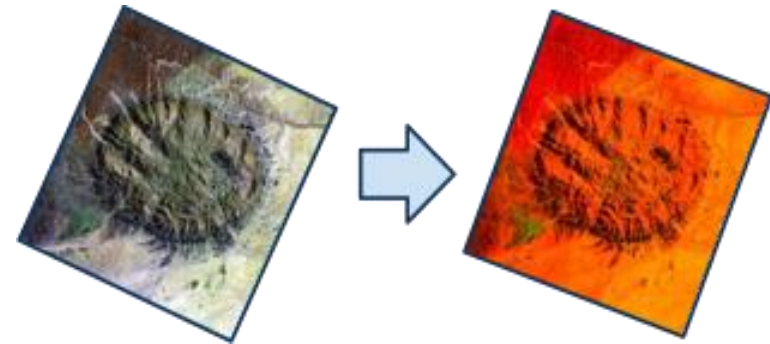
GLOBAL-SCALE ALGORITHM PROCESSING

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Apply an algorithm to an image

- Library functions or script your own



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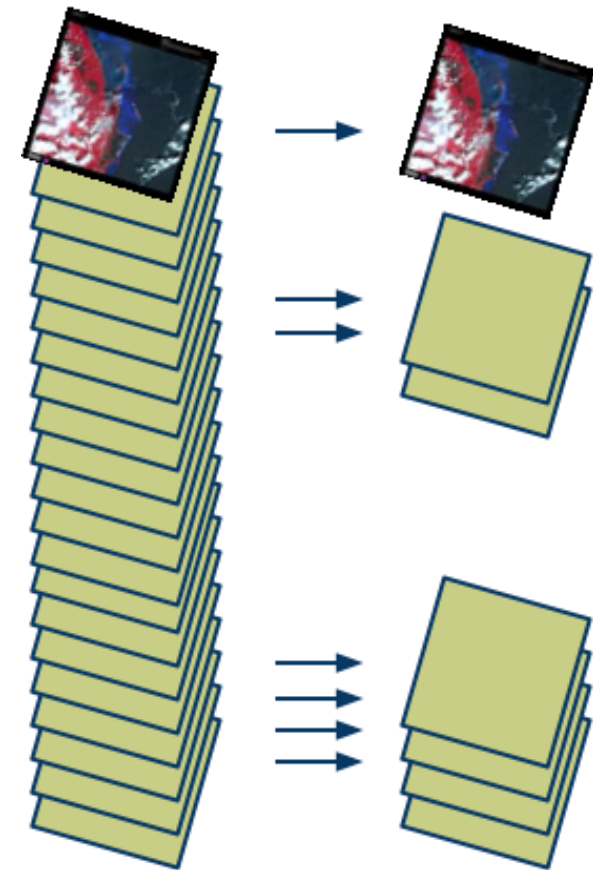
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Apply an algorithm to an image

- Library functions or script your own

Filter an image collection

- Time, Space & Metadata search



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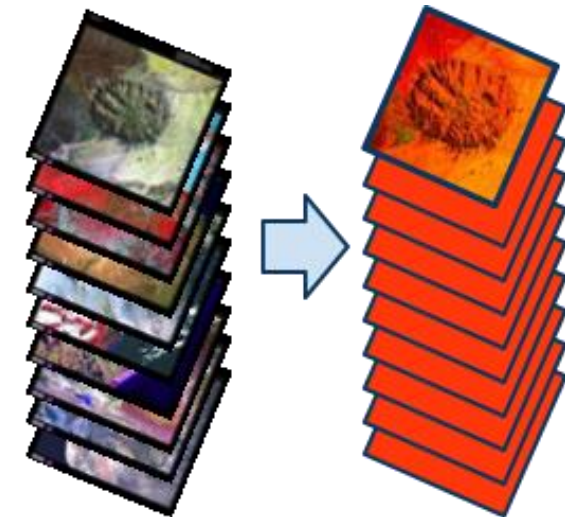
- Library functions or script your own

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Map an algorithm over an image collection

- $N \rightarrow N$



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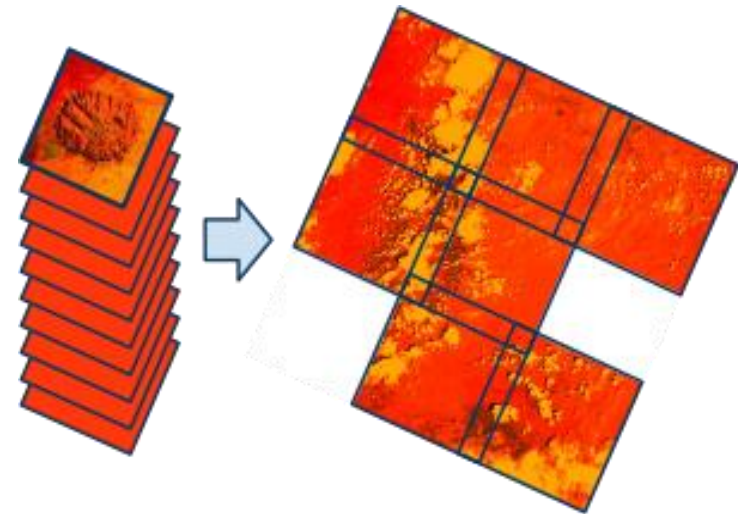
- Time, Space & Metadata search

Map an algorithm over an image collection

- $N \rightarrow N$

Reduce a collection

- $N \rightarrow 1$ or $N \rightarrow M$





QUESTIONS?

Credits:

Noel Gorelick, Google

Gennadii Donchyts, Deltares