Google Earth Engine

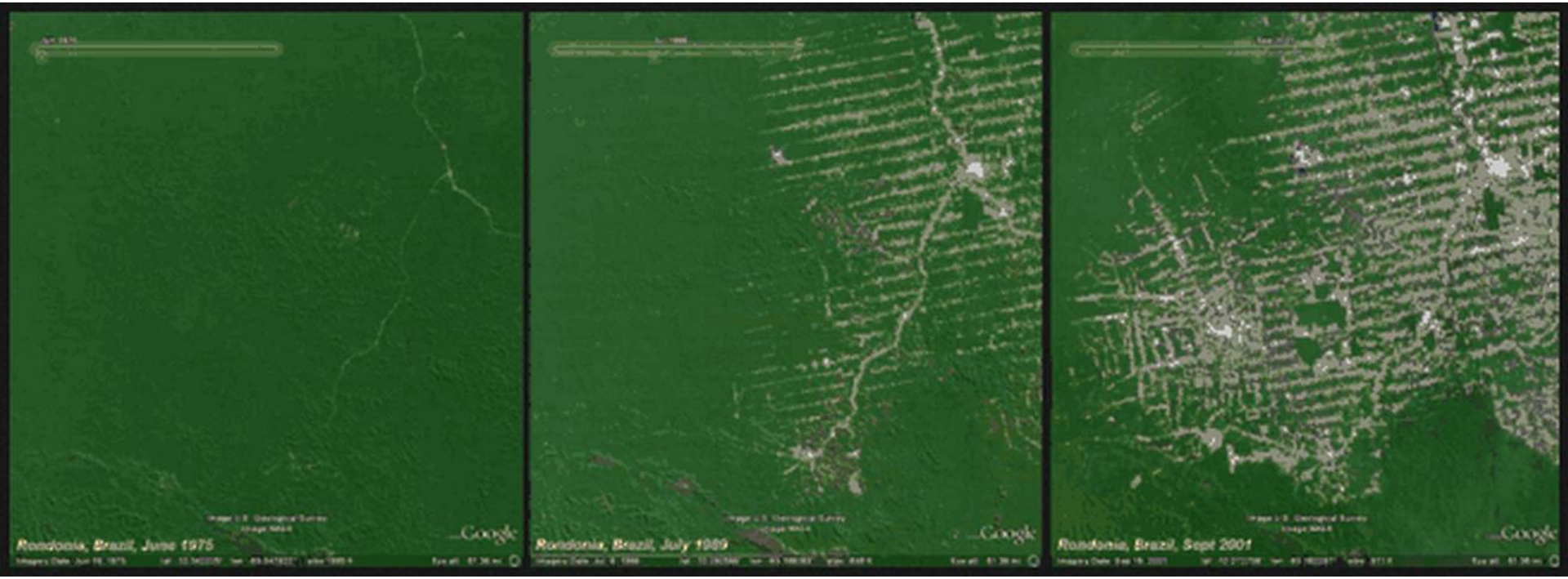
What is Google Earth Engine?

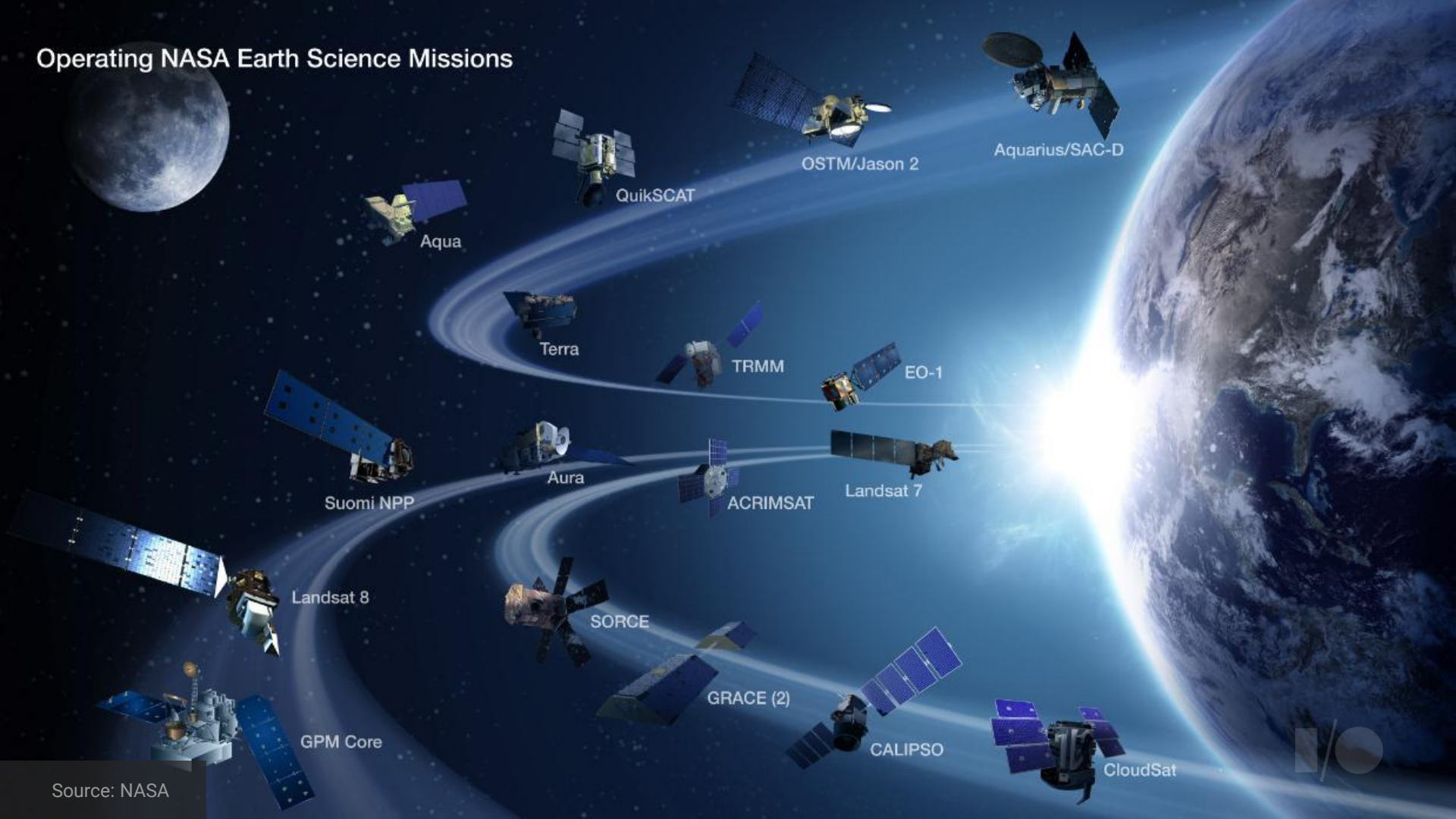
Google Earth Engine Team

https://goo.gl/F3uJzh

Background

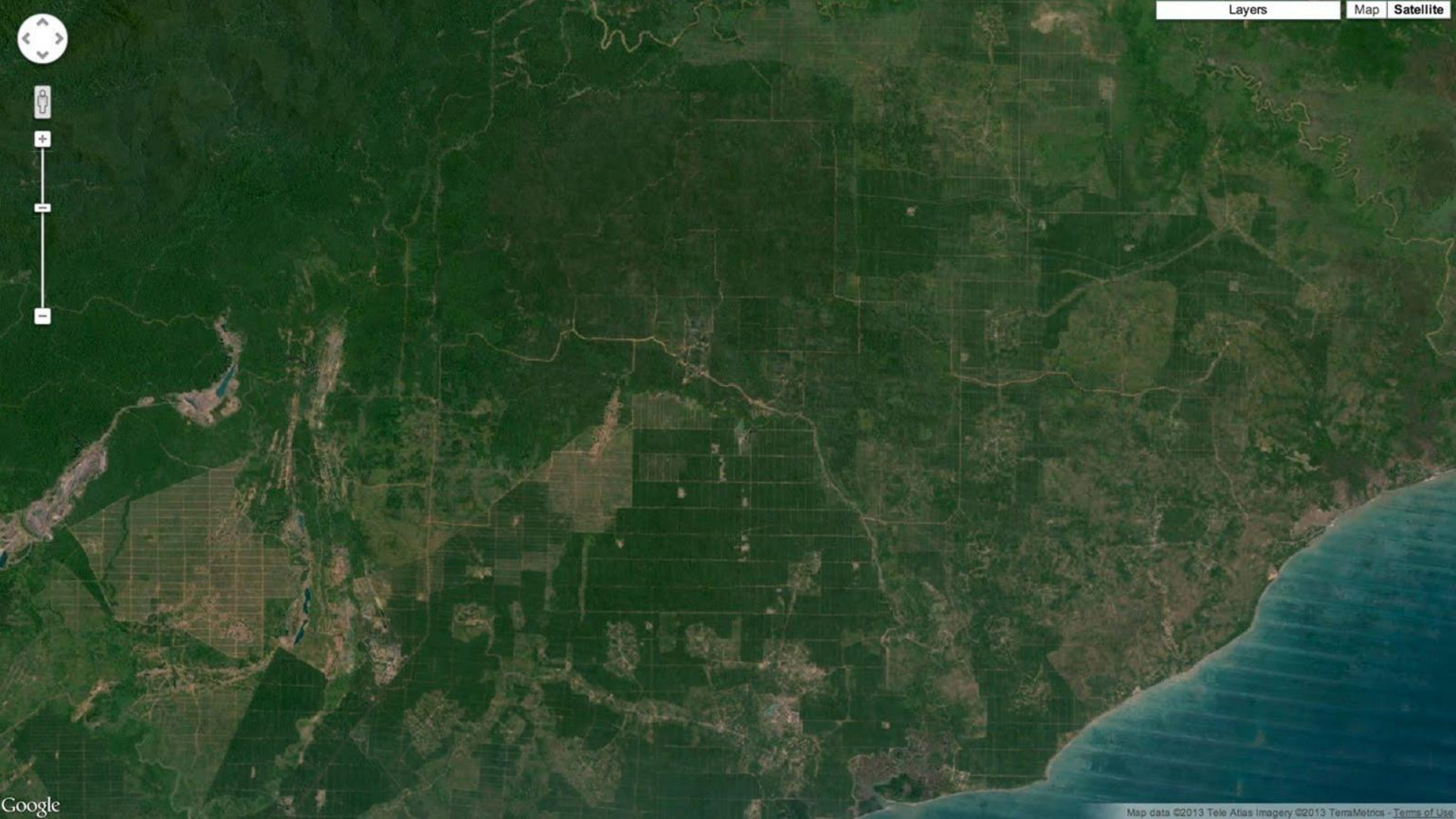
Google Earth Engine: Deriving Information from Earth Observation Data




Operating NASA Earth Science Missions
OSTM/Jason 2
Aquarius/SAC-D
QuikSCAT
Aqua
Terra
TRMM
EO-1
Suomi NPP
Aura
ACRIMSAT
Landsat 7
Landsat 8
SORCE
GRACE (2)
GPM Core
CALIPSO
CloudSat

Source: NASA

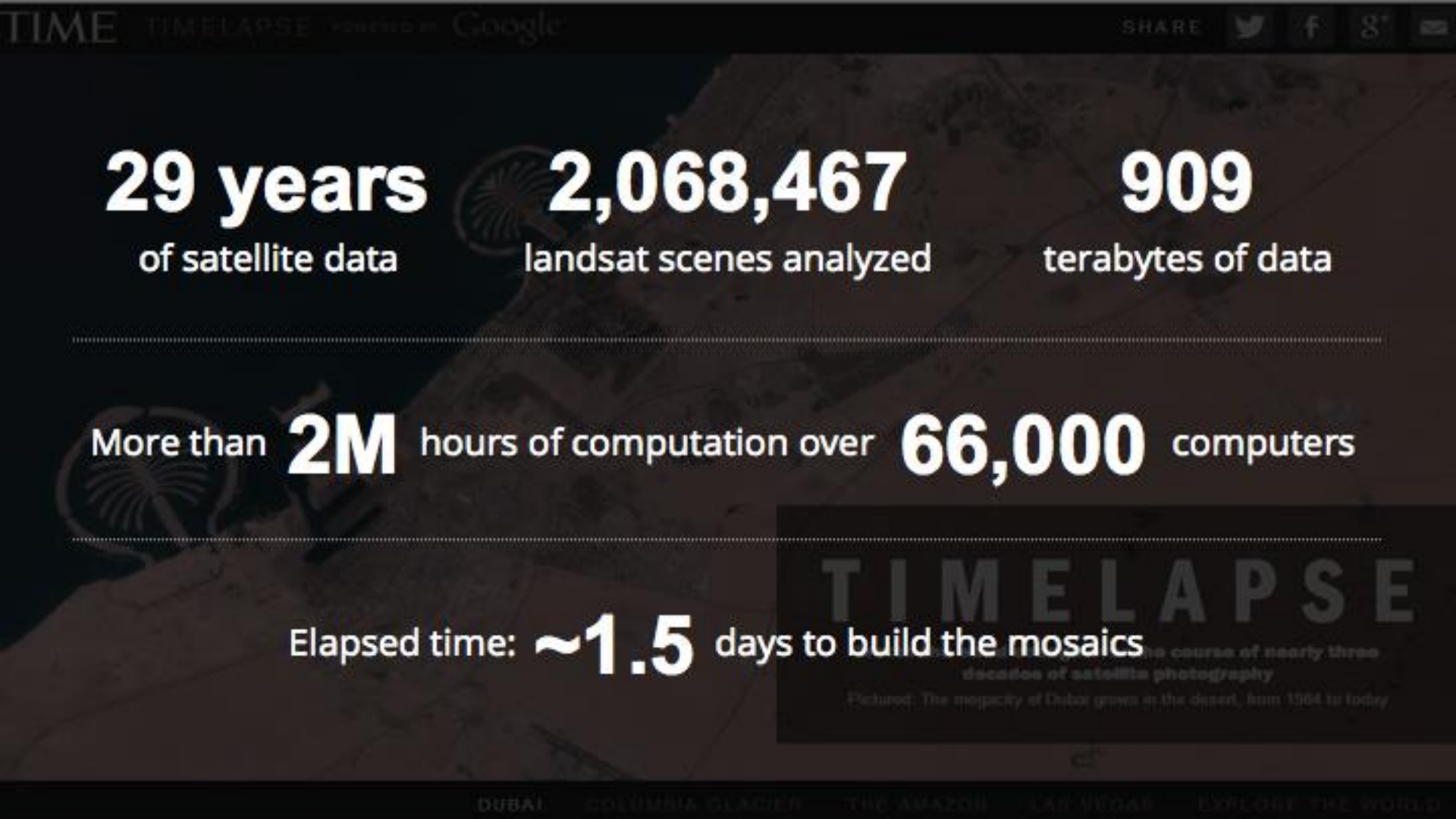

Colocated Data + Computation + APIs


Layers
Map
Satellite
Google
Map data ©2013 Tele Atlas Imagery ©2013 TerraMetrics - Terms of Use

TIMELAPSE

Watch the world change over the course of nearly three decades of satellite photography

Pictured: The megacity of Dubai grows in the desert, from 1984 to today


TIME TIMELAPSE
SHARE
29 years
of satellite data
2,068,467
landsat scenes analyzed
909
terabytes of data
More than 2M hours of computation over 66,000 computers
Elapsed time: ~1.5 days to build the mosaics
TIMELAPSE
DUBAI

Data Catalog

Google Earth Engine

The Earth Engine Public Data Catalog

Landsat 4, 5, 7, 8
Raw, TOA, SR, ...

MODIS
Daily, NBAR, LST, ...

Terrain
SRTM, GTOPO, NED, ...

Land Cover
GlobCover, NLCD, ...

Atmospheric
NOAA NCEP, OMI, ...

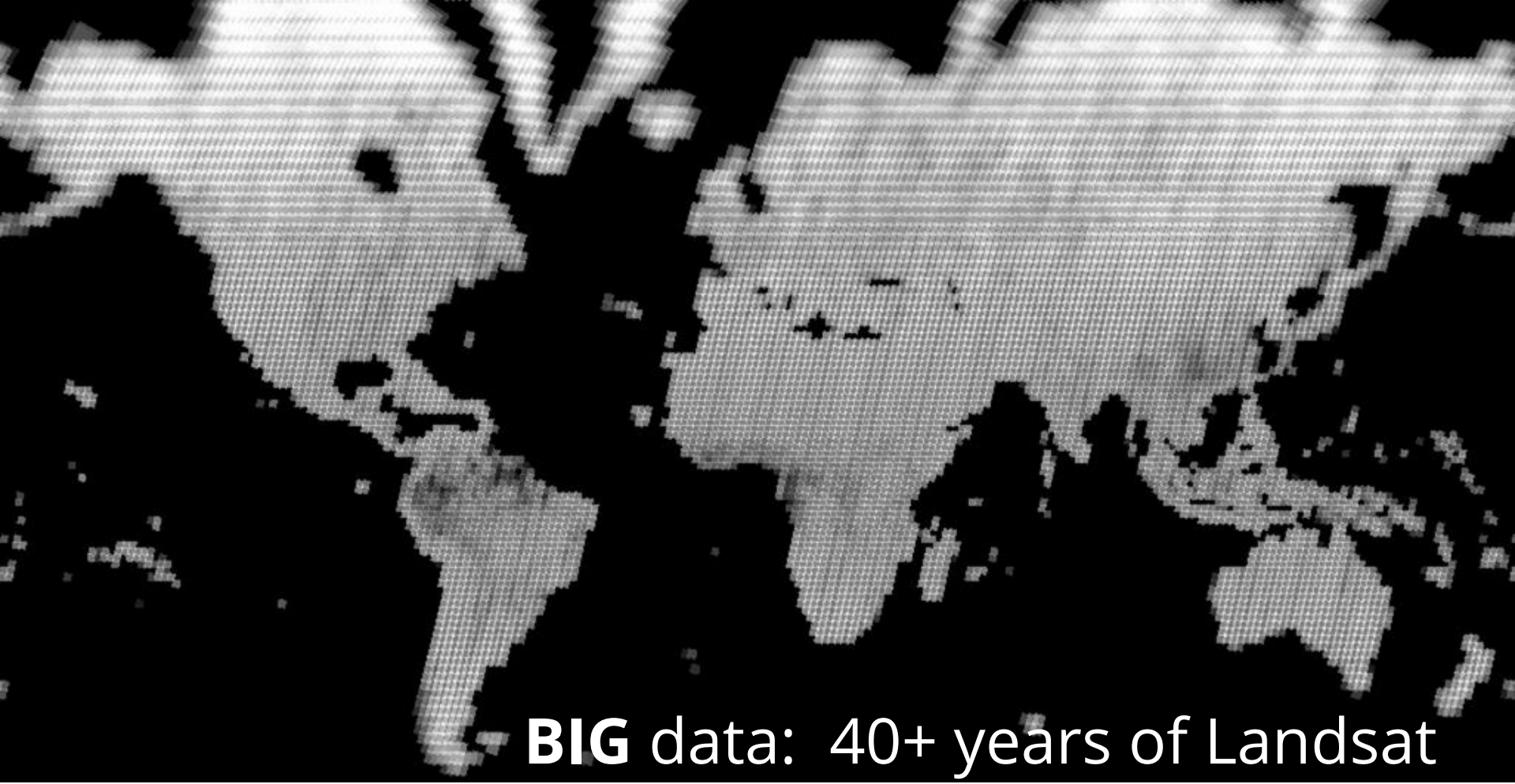
... and many more, updating daily!

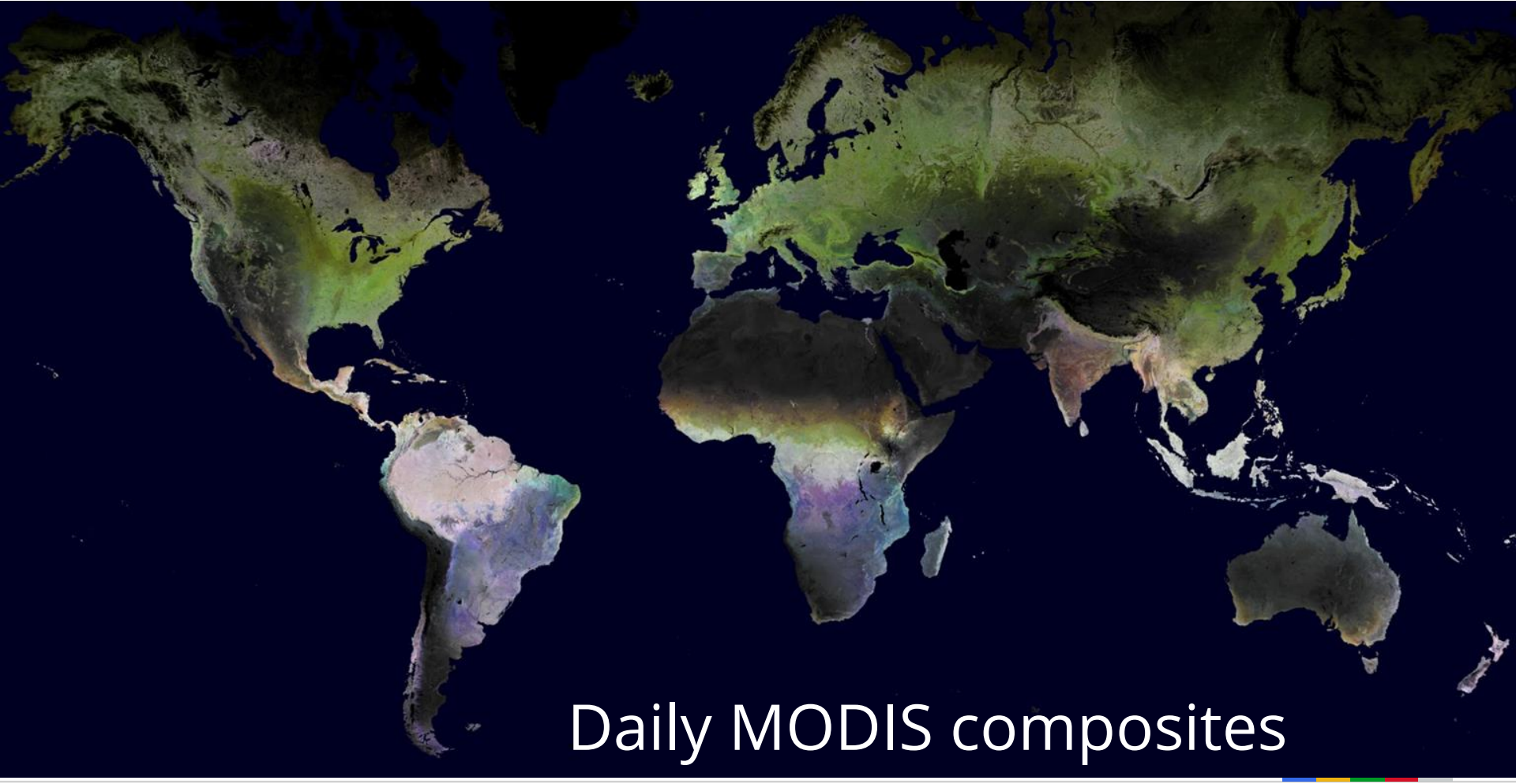
> 200 public datasets

> 5 million images

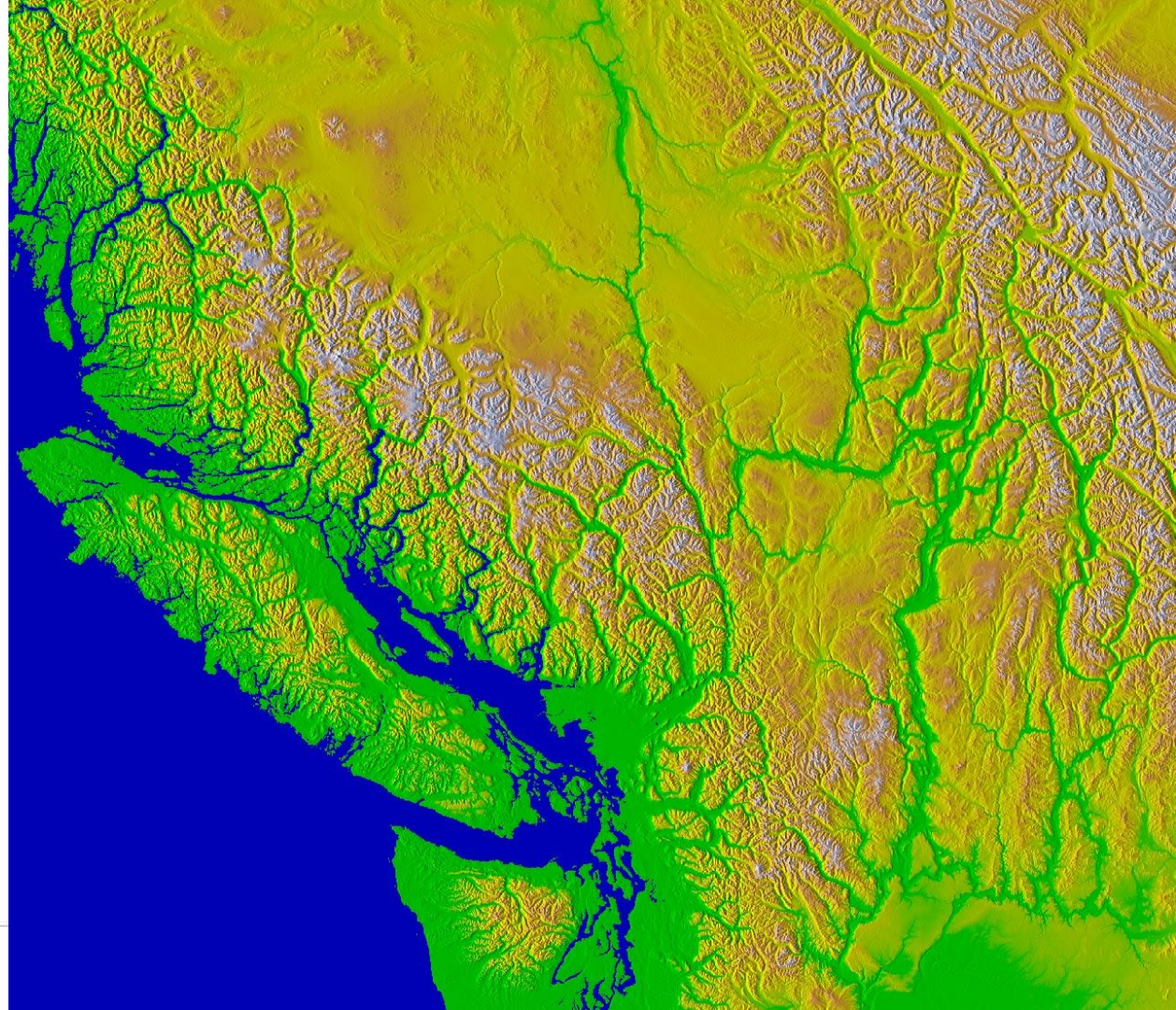
> 4000 new images every day

> 5 petabytes of data

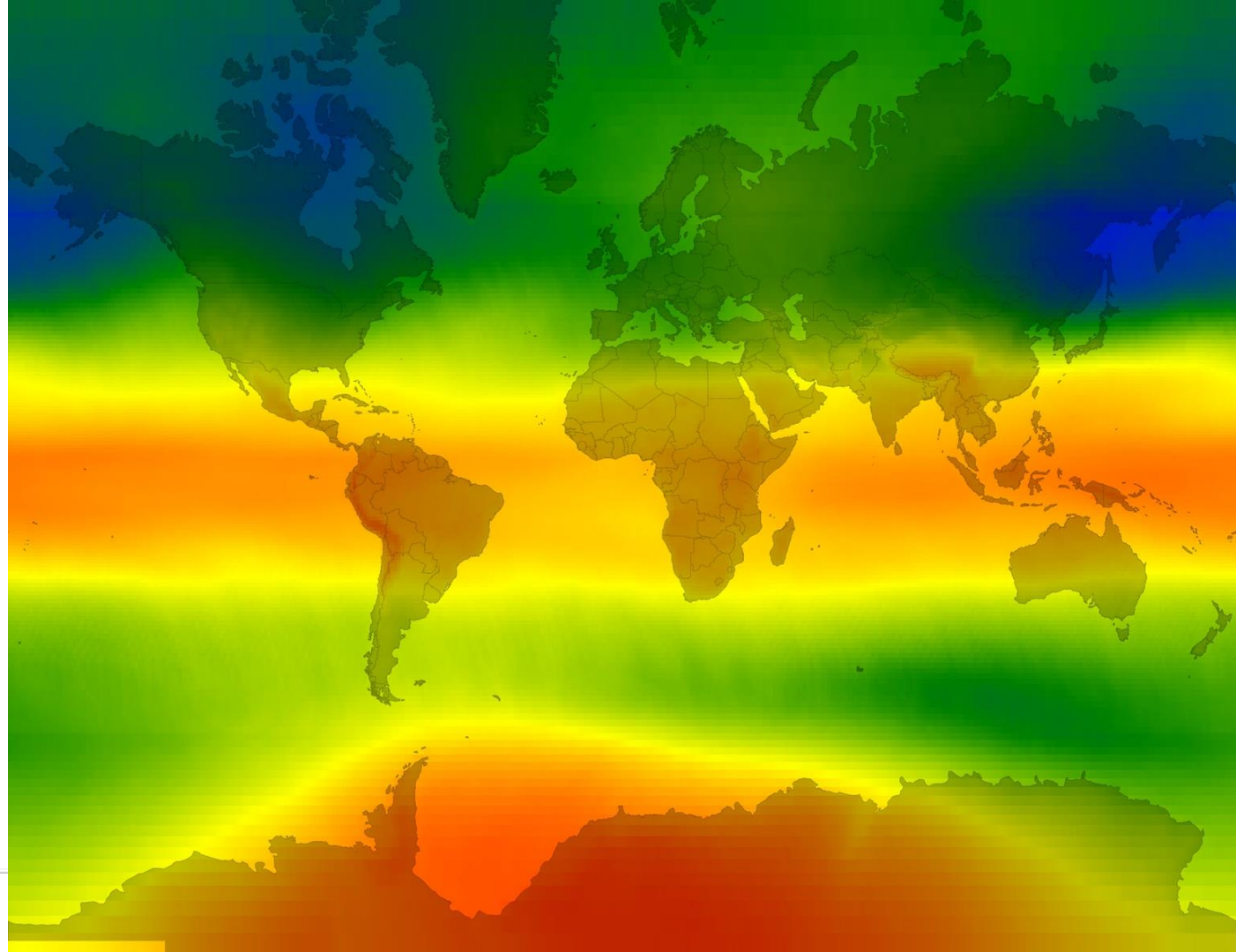

BIG data: 40+ years of Landsat


Daily MODIS composites

Terrain



Atmosphere



Google Earth Engine


Sentinel-1

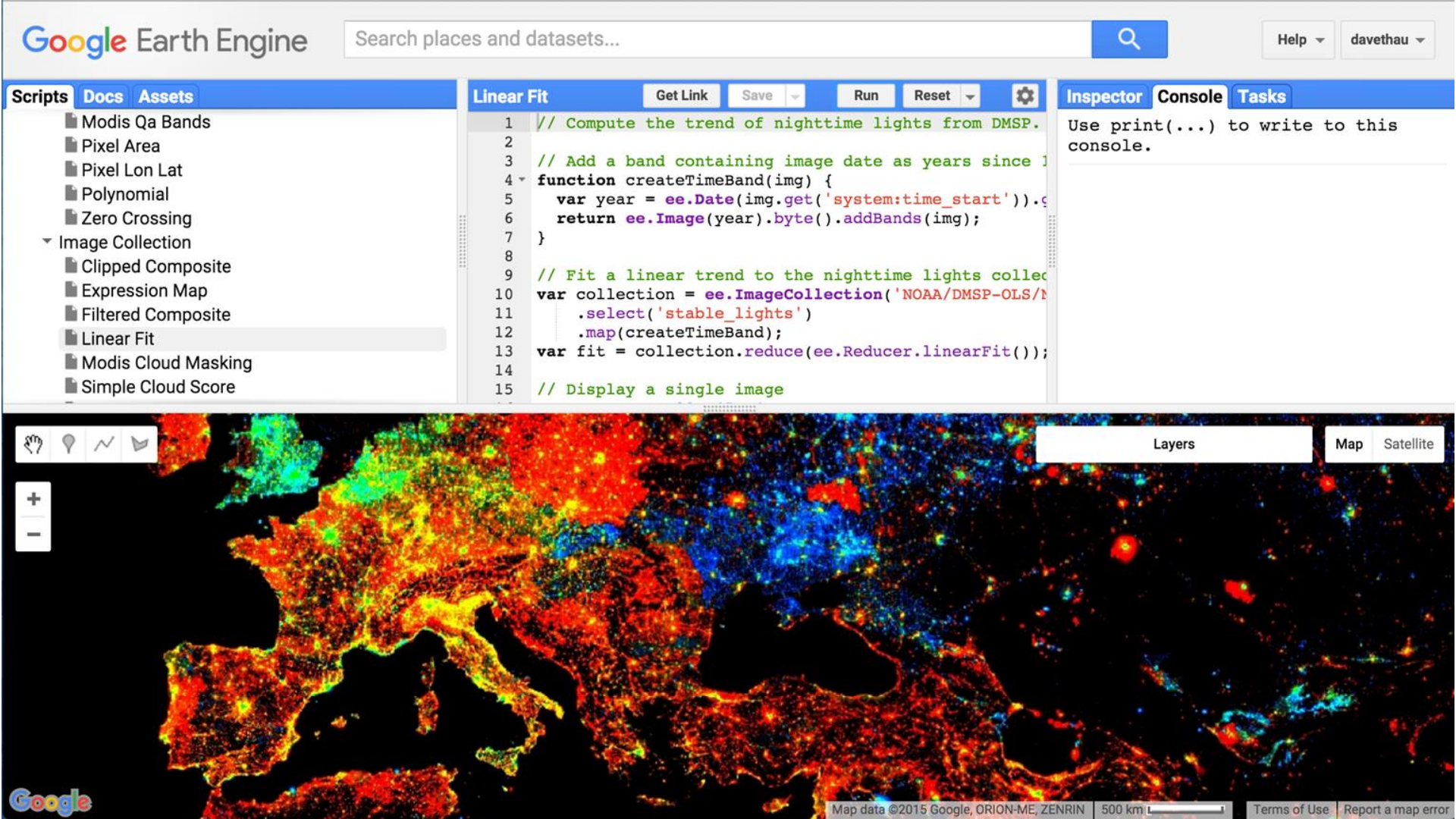
API

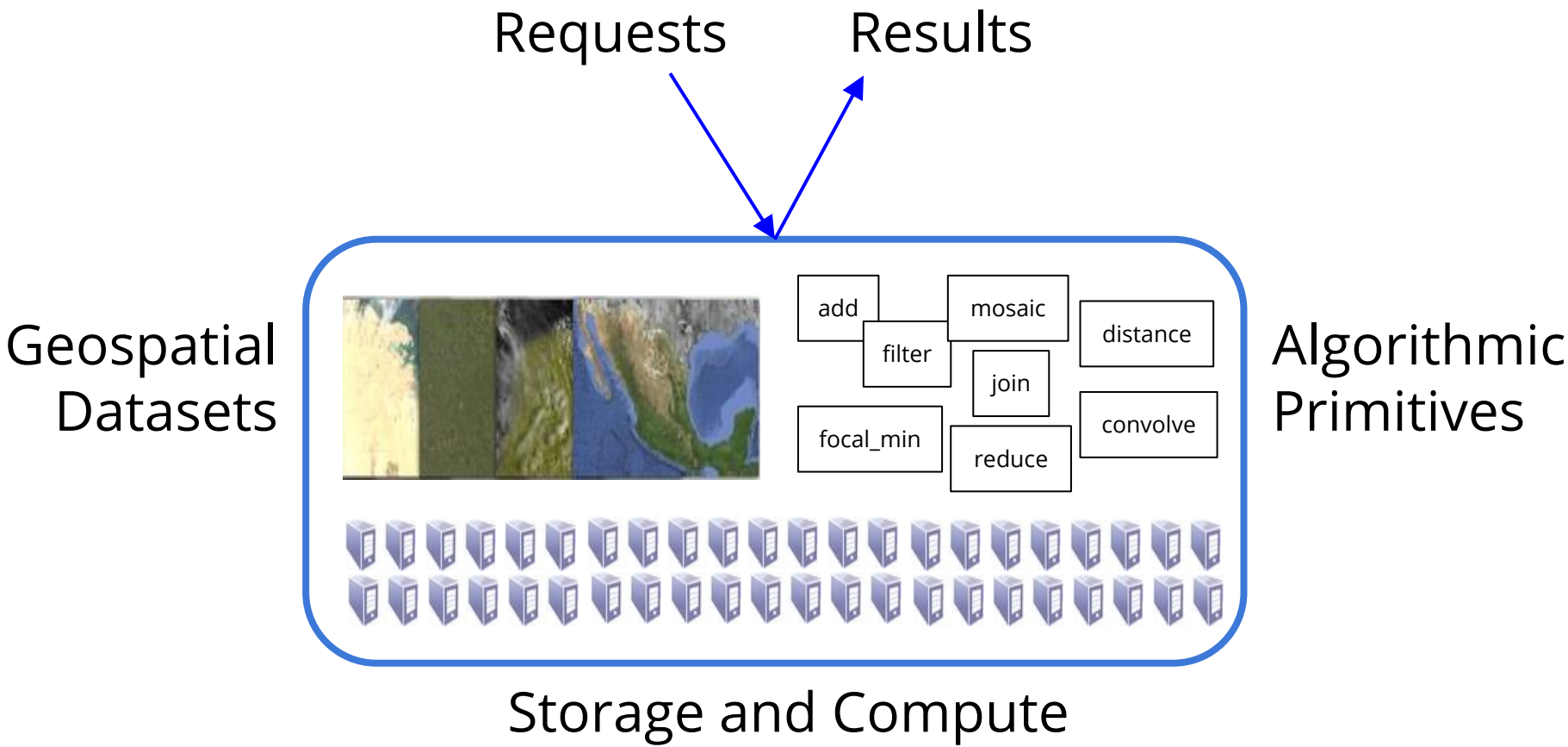
Google Earth Engine

Data Types and Geospatial Processing Functions

- **Image** - band math, clip, convolution, neighborhood, selection ...
- **Image Collection** - map, aggregate, filter, mosaic, sort ...
- **Feature** - buffer, centroid, intersection, union, transform ...
- **Feature Collection** - aggregate, filter, flatten, merge, sort ...
- **Filter** - by bounds, within distance, date, day-of-year, metadata ...
- **Reducer** - mean, linearRegression, percentile, histogram ....
- **Join** - simple, inner, outer, inverted ...
- **Kernel** - square, circle, gaussian, sobel, kirsch ...
- **Machine Learning -** CART, random forests, bayes, SVM, kmeans, cobweb ...
- **Projection** - transform, translate, scale ...

over 1000 data types and operators, and growing!


Google Earth Engine
Search places and datasets...
Help
davethau
Scripts
Docs
Assets
Modis Qa Bands
Pixel Area
Pixel Lon Lat
Polynomial
Zero Crossing
Image Collection
Clipped Composite
Expression Map
Filtered Composite
Linear Fit
Modis Cloud Masking
Simple Cloud Score
Linear Fit
Get Link
Save
Run
Reset
1 // Compute the trend of nighttime lights from DMSP.
2
3 // Add a band containing image date as years since 1
4 function createTimeBand(img) {
5 var year = ee.Date(img.get('system:time_start')).
6 return ee.Image(year).byte().addBands(img);
7 }
8
9 // Fit a linear trend to the nighttime lights collec
10 var collection = ee.ImageCollection('NOAA/DMSP-OLS/N
11 .select('stable_lights')
12 .map(createTimeBand);
13 var fit = collection.reduce(ee.Reducer.linearFit());
14
15 // Display a single image
Inspector
Console
Tasks
Use print(...) to write to this console.
Layers
Map
Satellite
Google
Map data ©2015 Google, ORION-ME, ZENRIN
500 km
Terms of Use
Report a map error

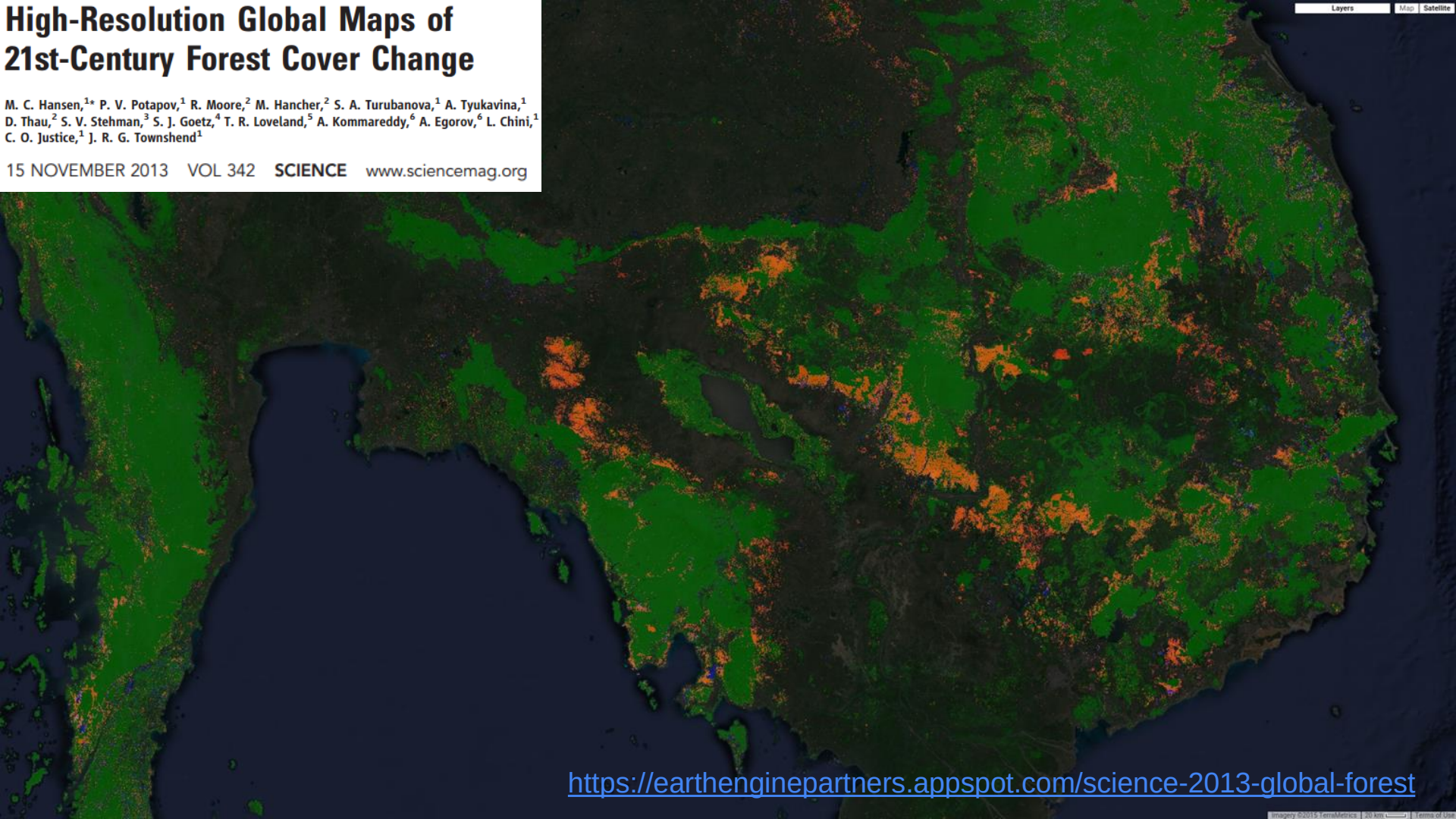

Requests
Results
Geospatial Datasets
add
mosaic
distance
filter
join
convolve
focal_min
reduce
Algorithmic Primitives
Storage and Compute

Applications

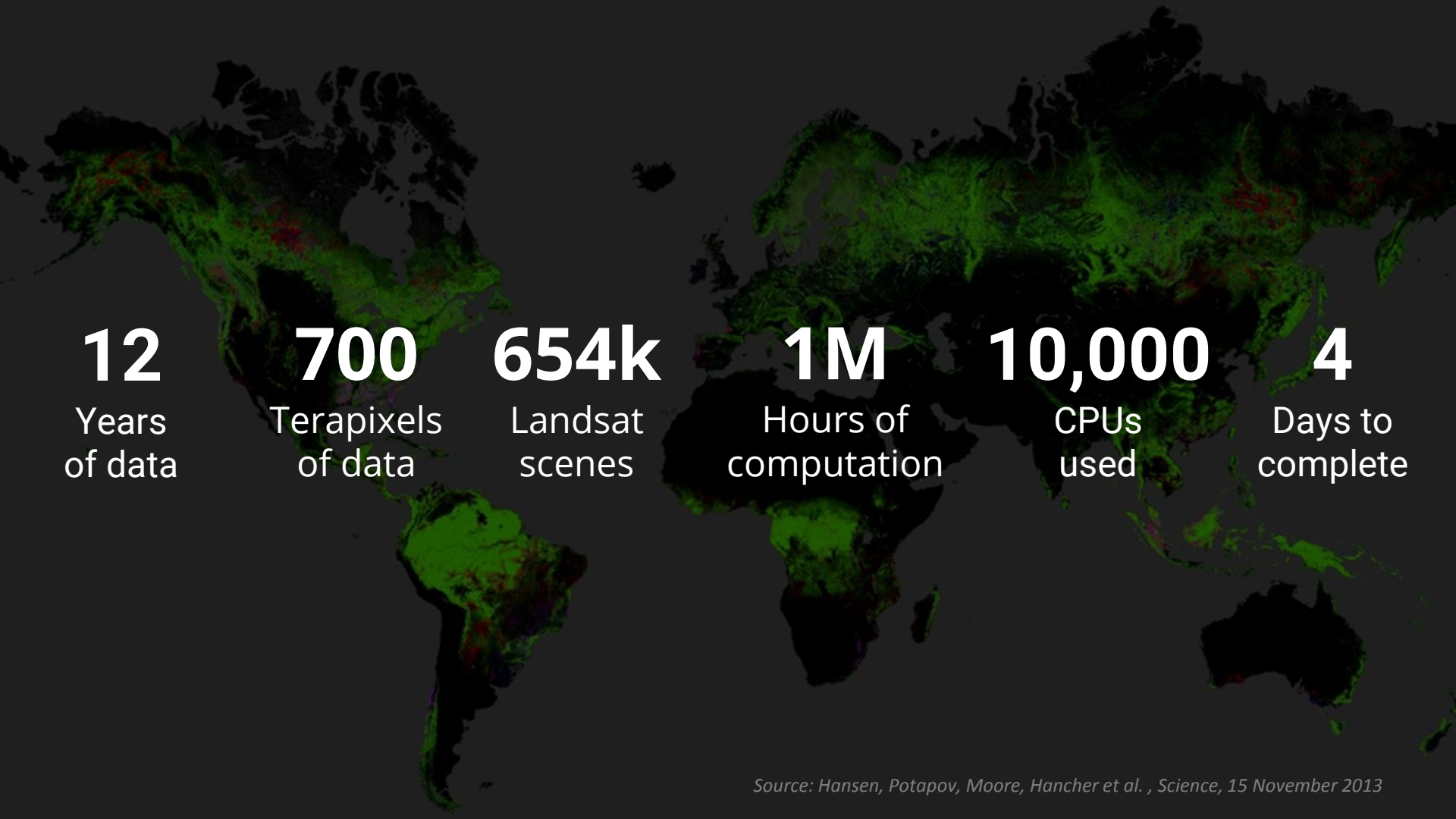
High-Resolution Global Maps of 21st-Century Forest Cover Change

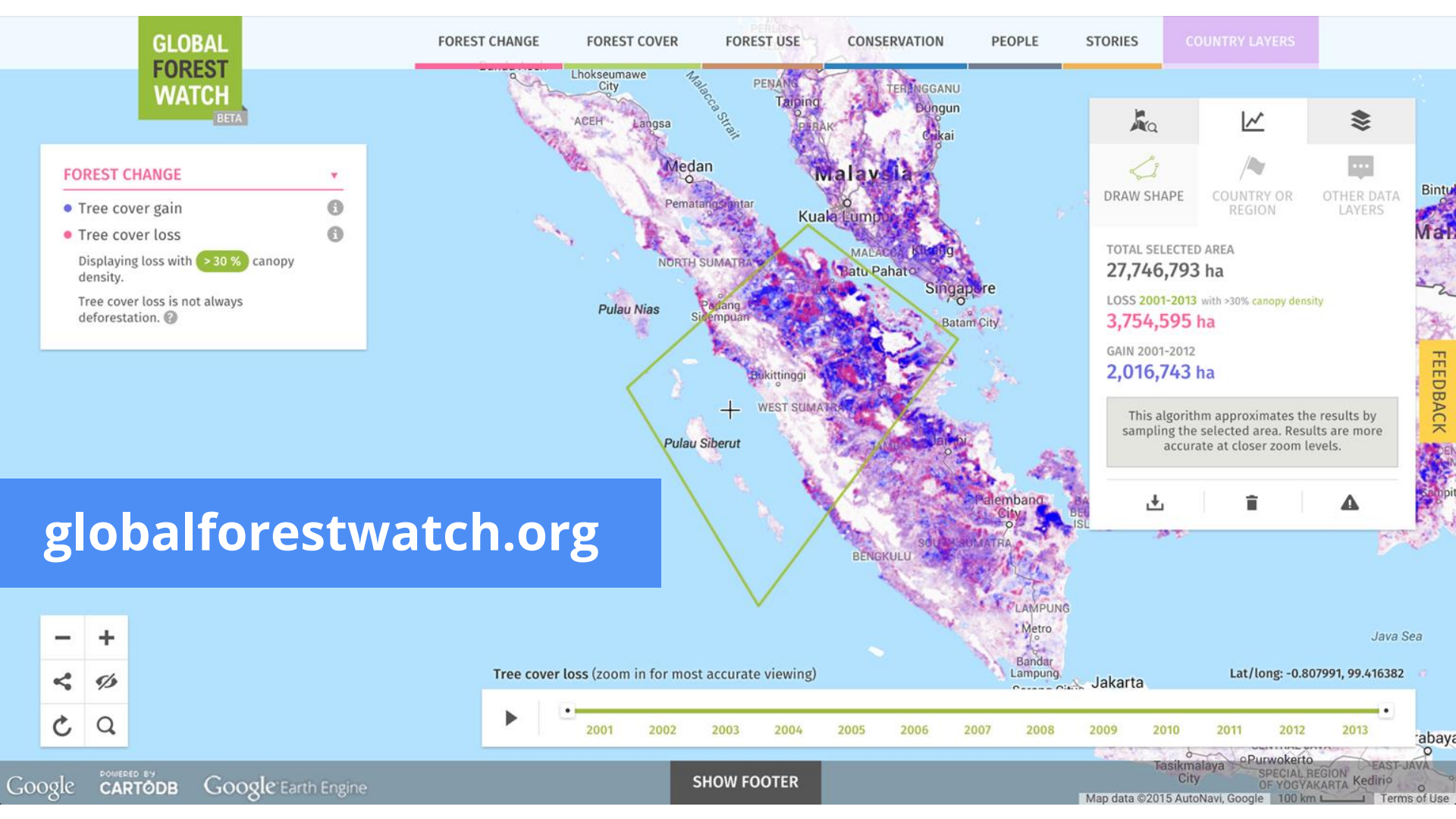
M. C. Hansen,[1]* P. V. Potapov,[1] R. Moore,[2] M. Hancher,[2] S. A. Turubanova,[1] A. Tyukavina,[1] D. Thau,[2] S. V. Stehman,[3] S. J. Goetz,[4] T. R. Loveland,[5] A. Kommareddy,[6] A. Egorov,[6] L. Chini,[1] C. O. Justice,[1] J. R. G. Townshend[1]

15 NOVEMBER 2013 VOL 342 **SCIENCE** www.sciencemag.org

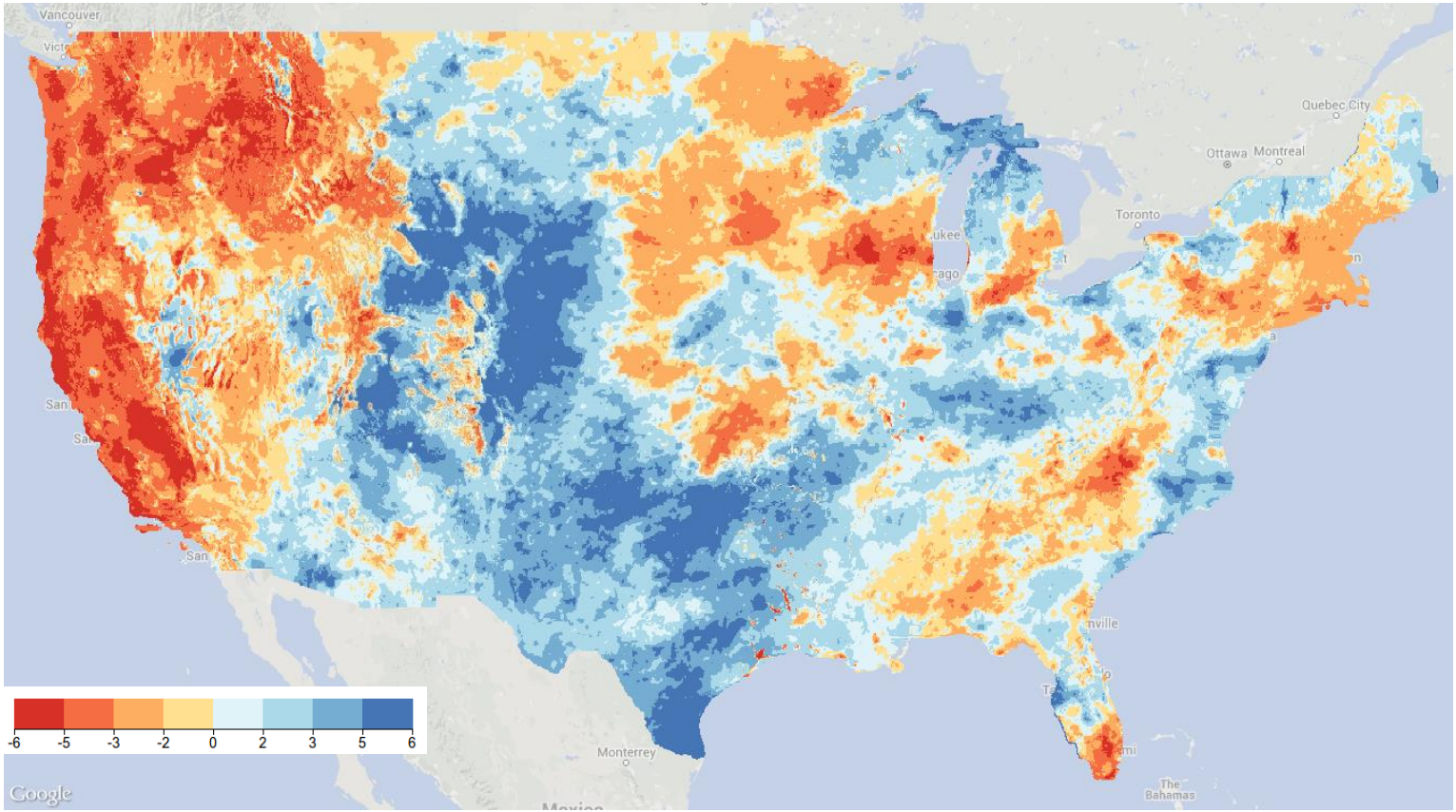


https://earthenginepartners.appspot.com/science-2013-global-forest

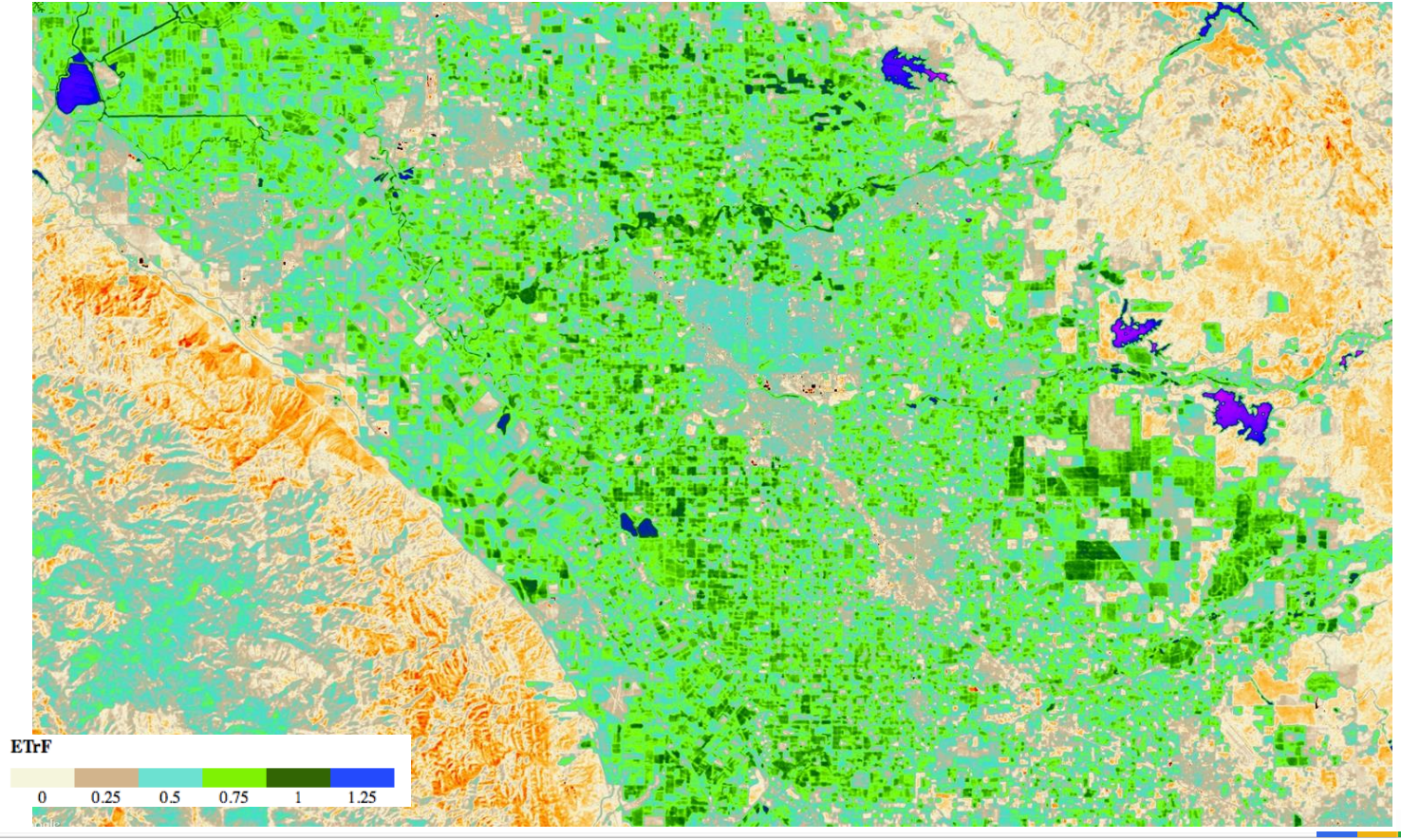

12
Years of data
700
Terapixels of data
654k
Landsat scenes
1M
Hours of computation
10,000
CPUs used
4
Days to complete
Source: Hansen, Potapov, Moore, Hancher et al. , Science, 15 November 2013


GLOBAL FOREST WATCH
BETA
FOREST CHANGE
FOREST COVER
FOREST USE
CONSERVATION
PEOPLE
STORIES
COUNTRY LAYERS
FOREST CHANGE
Tree cover gain
Tree cover loss
Displaying loss with > 30 % canopy density.
Tree cover loss is not always deforestation.
DRAW SHAPE
COUNTRY OR REGION
OTHER DATA LAYERS
TOTAL SELECTED AREA
27,746,793 ha
LOSS 2001-2013 with >30% canopy density
3,754,595 ha
GAIN 2001-2012
2,016,743 ha
This algorithm approximates the results by sampling the selected area. Results are more accurate at closer zoom levels.
FEEDBACK
globalforestwatch.org
Tree cover loss (zoom in for most accurate viewing)
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Lat/long: -0.807991, 99.416382
SHOW FOOTER
Google
POWERED BY CARTODB
Google Earth Engine
Map data ©2015 AutoNavi, Google
100 km
Terms of Use
Lhokseumawe City
ACEH
Langsa
Malacca Strait
PENANG
Taiping
PERAK
TERENGGANU
Dungun
Cukai
Medan
Malaysia
Pematangsiantar
Kuala Lumpur
NORTH SUMATRA
MALACCA
Klang
Batu Pahat
Singapore
Pulau Nias
Padang Sidempuan
Batam City
Bukittinggi
WEST SUMATRA
Pulau Siberut
Palembang City
SOUTH SUMATRA
BENGKULU
LAMPUNG
Metro
Bandar Lampung
Java Sea
Jakarta
Tasikmalaya City
Purwokerto
SPECIAL REGION OF YOGYAKARTA
Kediri
EAST JAVA

Palmer drought severity index, difference from median



Simplified surface energy balance, reference evapotranspiration



Map-of-Life, habitat suitability modeling

MOL MAP OF LIFE

Overview | Detailed Map | Habitat Distribution | Reserve Coverage

Snow leopard
Panthera uncia

Sources | Features

Point observations 5
Local inventories 6
Expert range maps 1

Point filters 1 of 5 selected
Uncertainty 5 selected
Years 1 selected

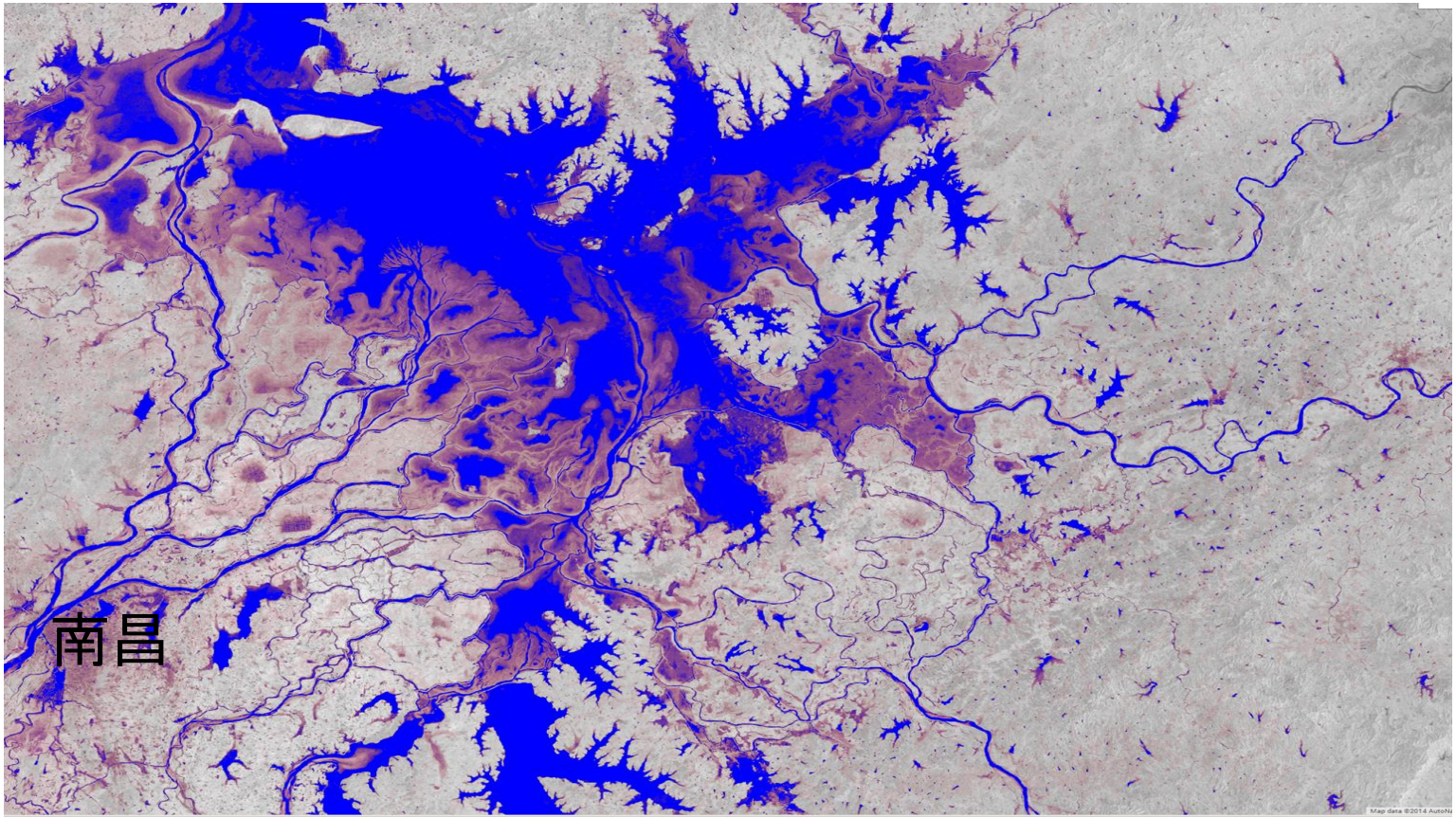
Update map

KAZAKHSTAN
MONGOLIA
ULAANBAATAR
ALMATY
BISHKEK
URUMQI
UZBEKISTAN
TASHKENT
KYRGYZSTAN
TURKMENISTAN
ASHGABAT
DUSHANBE
TAJIKISTAN
MASHHAD
IRAN
AFGHANISTAN
KABUL
ISLAMABAD
LAHORE
PAKISTAN
NEW DELHI
JAIPUR
KANPUR
LUCKNOW
NEPAL
KATHMANDU
BHUTAN
CHINA
BAOTOU
BEIJING
TIANJIN
DALIAN
SHENYANG
CHANGCHUN
NORTH KOREA
PYONGYANG
SEOUL
SOUTH KOREA
BUSAN
HIROSHIMA
FUKUOKA
TAIYUAN
JINAN
QINGDAO
XI'AN
NANJING
SHANGHAI
WUHAN
CHONGQING
NANCHANG
GUIYANG
FUZHOU
TAIPEI
TAIWAN
KAOHSIUNG
GUANGZHOU
HONG KONG
DHAKA
KOLKATA
CHITTAGONG
MYANMAR
HANOI
INDIA
AHMEDABAD
SURAT
NAGPUR
KARACHI
DUBAI
MUSCAT
OMAN
UNITED ARAB EMIRATES
Gulf of Oman
East China Sea
Luzon Strait

Google Earth Engine

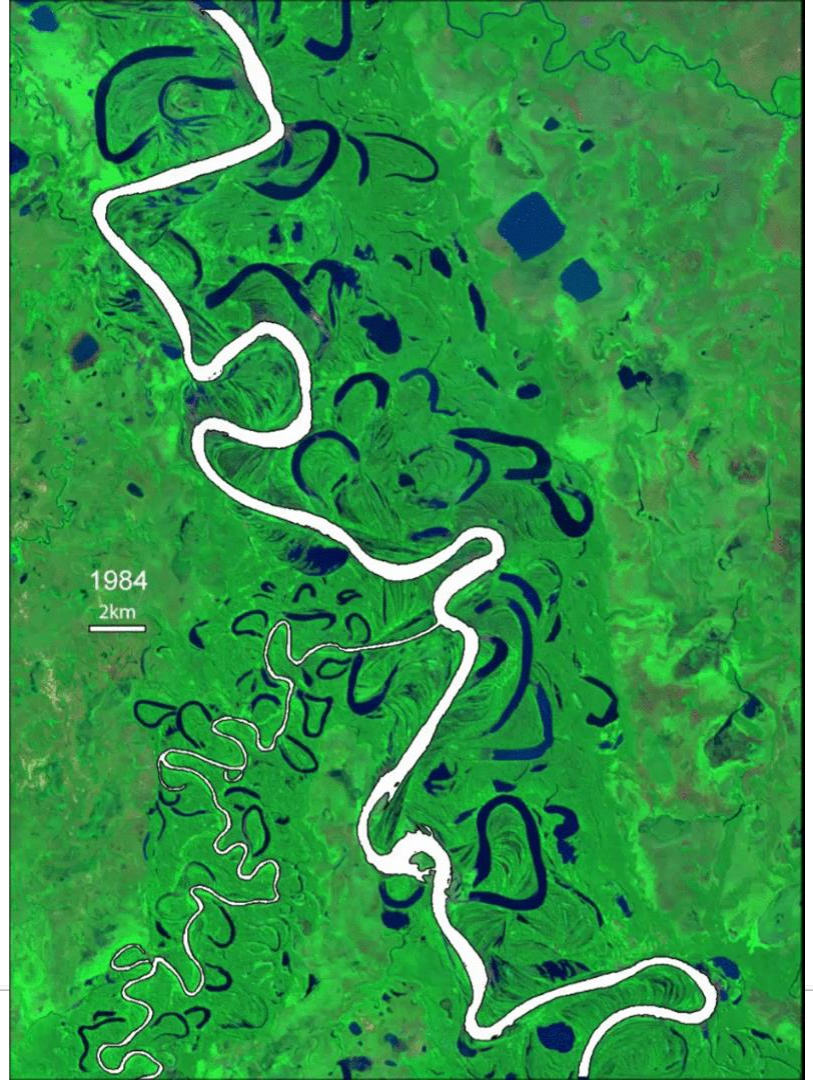
http://mol.org/

Surface water occurrence - Pekel et al., JRC



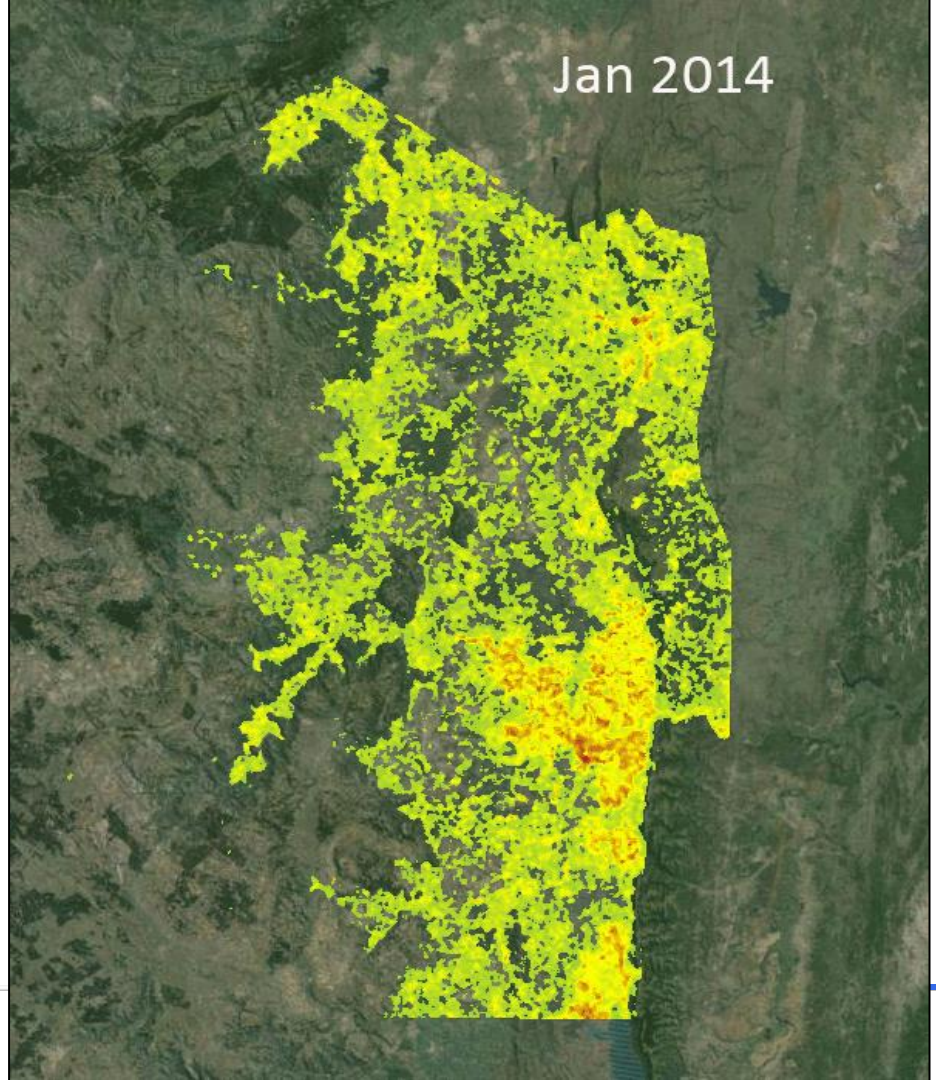
River morphology

Bryk et al. UC Berkeley



Malaria risk mapping

Sturrock et al. UCSF



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earthengine.google.com/signup