Google Earth Engine 应用

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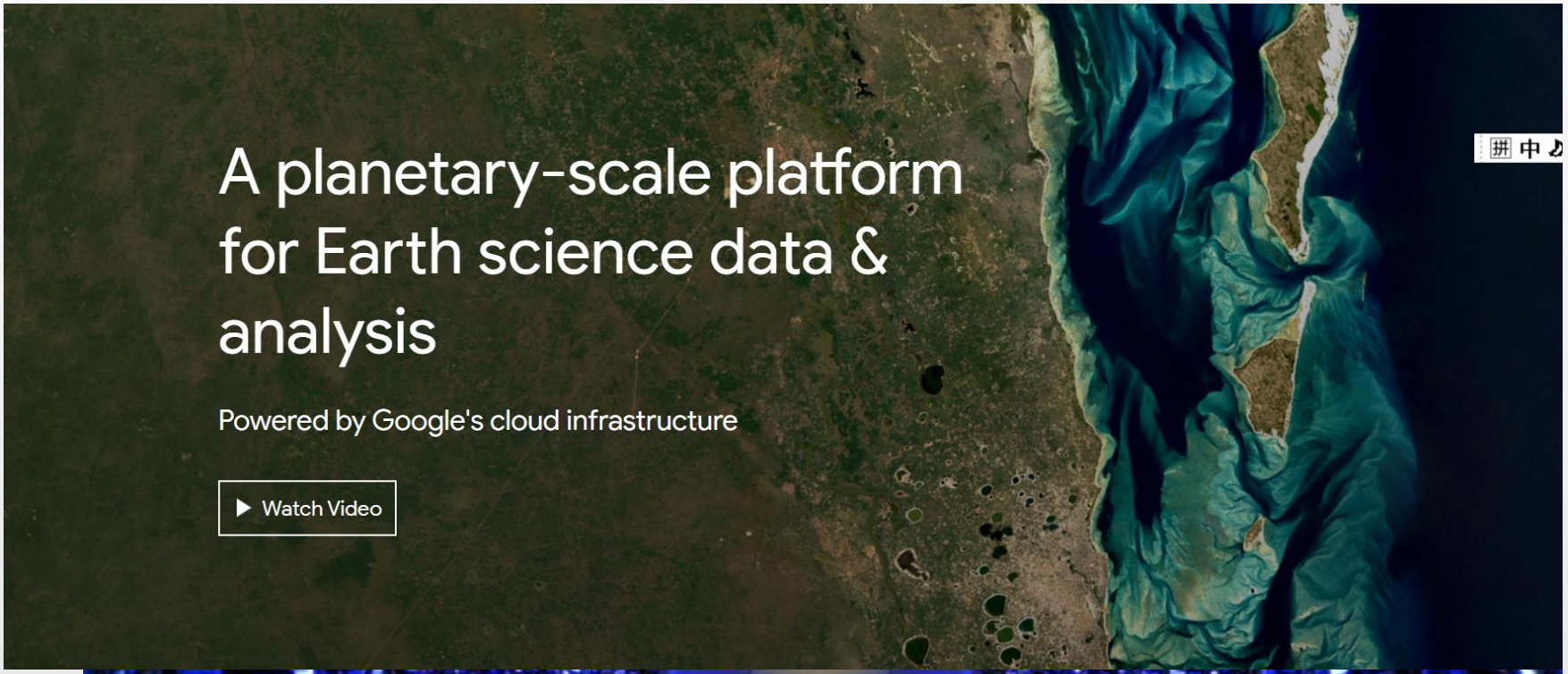
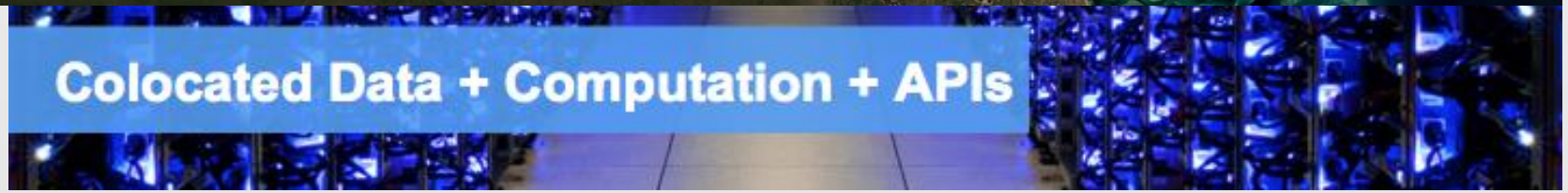
目录

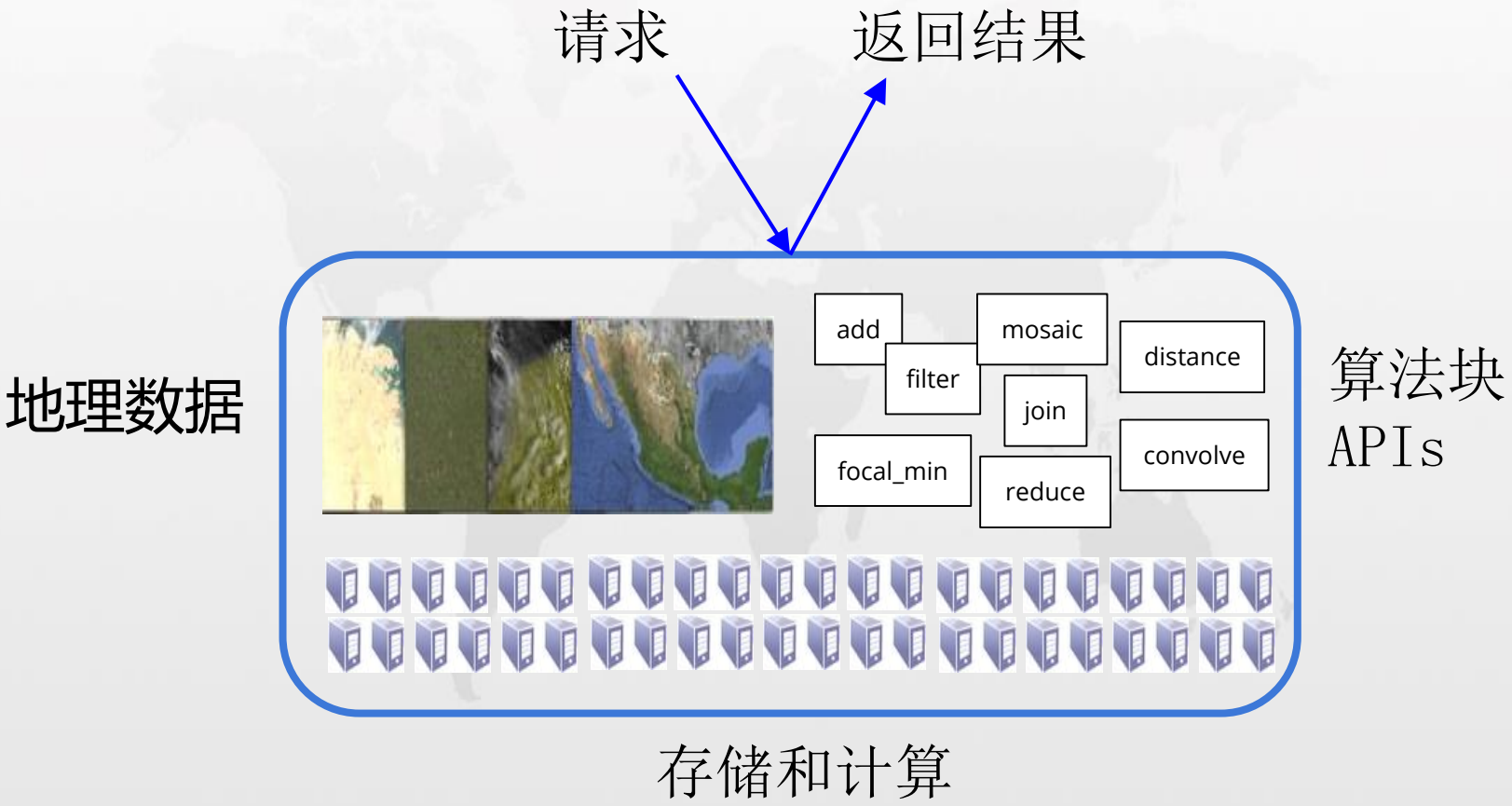
GEE 概况

Google Earth Engine





GEE 运行


请求
返回结果
地理数据
add
mosaic
distance
filter
join
focal_min
convolve
reduce
算法块
APIs
存储和计算

数据

1. 影像：Landsat MODIS……
2. 数据集产品：土地覆盖、LAI、NDVI……
3. 用户共享

https://developers.google.com/earth-engine/datasets/

MODIS
Daily, NBAR, LST, ...

Terrain
SRTM, GTOPO, NED, ...

Land Cover
GlobCover, NLCD, ...

... and many more, updating daily!

> 200 public datasets

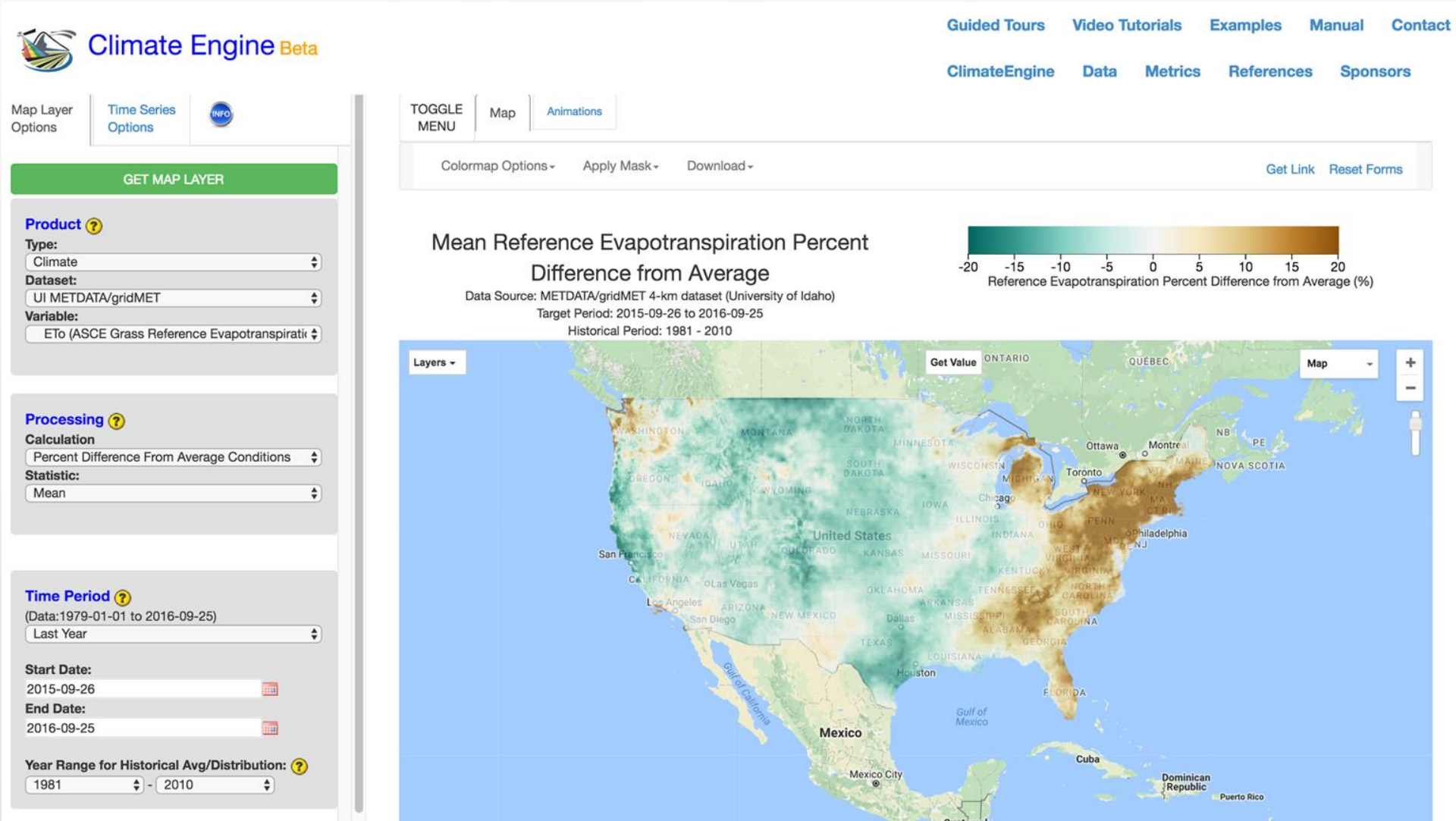
> 5 million images

> 4000 new images every day

> 5 petabytes of data

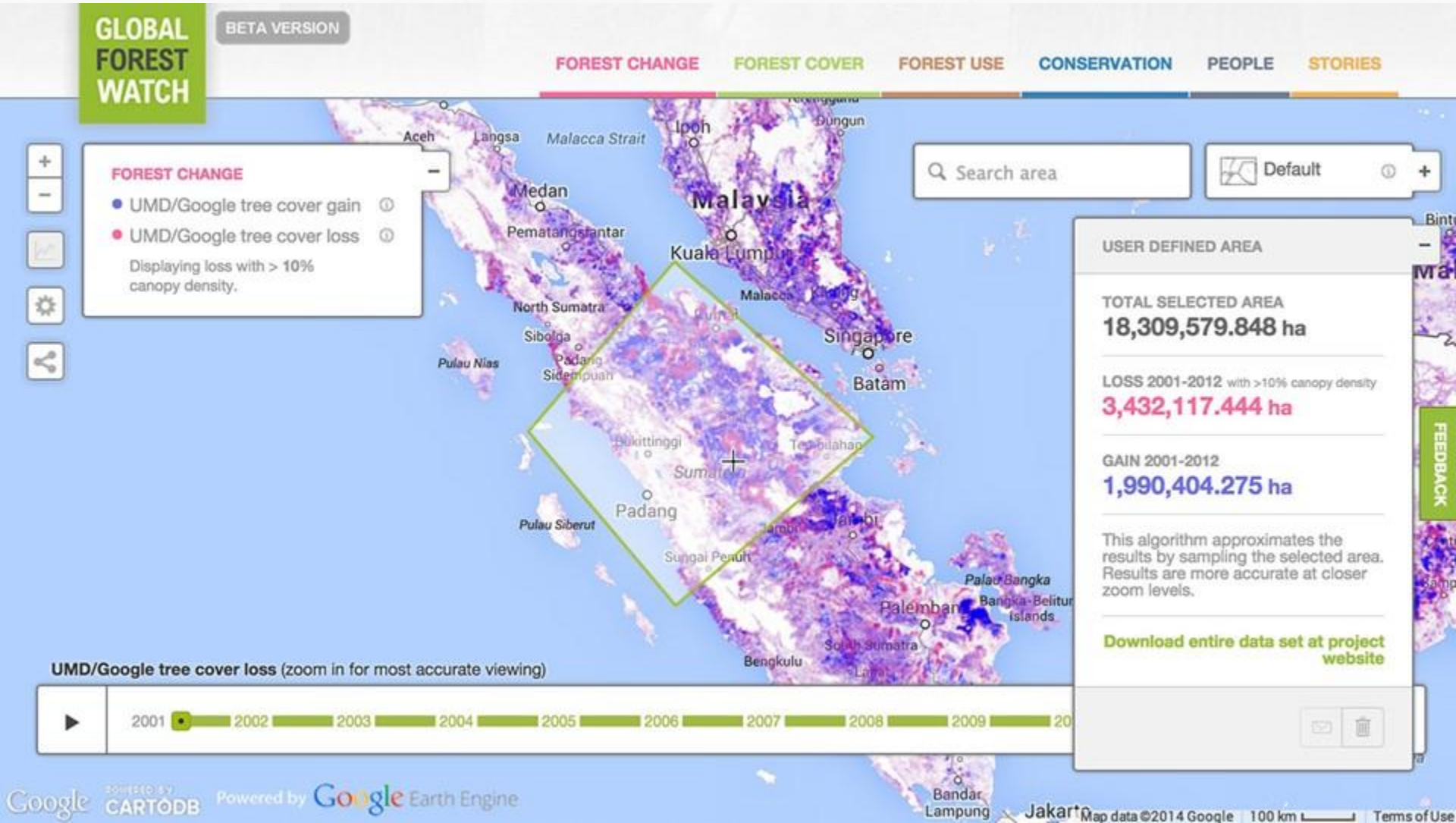
应用

➢Apps：二次开发


Climate Engine Beta
Guided Tours
Video Tutorials
Examples
Manual
Contact
ClimateEngine
Data
Metrics
References
Sponsors
Map Layer Options
Time Series Options
INFO
GET MAP LAYER
Product
Type:
Climate
Dataset:
UI METDATA/gridMET
Variable:
ETo (ASCE Grass Reference Evapotranspirati
Processing
Calculation
Percent Difference From Average Conditions
Statistic:
Mean
Time Period
(Data:1979-01-01 to 2016-09-25)
Last Year
Start Date:
2015-09-26
End Date:
2016-09-25
Year Range for Historical Avg/Distribution:
1981
2010
TOGGLE MENU
Map
Animations
Colormap Options
Apply Mask
Download
Get Link
Reset Forms
Mean Reference Evapotranspiration Percent Difference from Average
Data Source: METDATA/gridMET 4-km dataset (University of Idaho)
Target Period: 2015-09-26 to 2016-09-25
Historical Period: 1981 - 2010
-20 -15 -10 -5 0 5 10 15 20
Reference Evapotranspiration Percent Difference from Average (%)
Layers
Get Value
Map
United States
Mexico
Ottawa
Montreal
Toronto
Chicago
Philadelphia
San Francisco
Los Angeles
San Diego
Las Vegas
Dallas
Houston
Mexico City
Cuba
Dominican Republic
Puerto Rico

应用

- Apps：二次开发


GLOBAL FOREST WATCH
BETA VERSION
FOREST CHANGE
FOREST COVER
FOREST USE
CONSERVATION
PEOPLE
STORIES
FOREST CHANGE
UMD/Google tree cover gain
UMD/Google tree cover loss
Displaying loss with > 10% canopy density.
Search area
Default
USER DEFINED AREA
TOTAL SELECTED AREA
18,309,579.848 ha
LOSS 2001-2012 with >10% canopy density
3,432,117.444 ha
GAIN 2001-2012
1,990,404.275 ha
This algorithm approximates the results by sampling the selected area. Results are more accurate at closer zoom levels.
Download entire data set at project website
FEEDBACK
UMD/Google tree cover loss (zoom in for most accurate viewing)
2001 2002 2003 2004 2005 2006 2007 2008 2009
Aceh
Langsa
Malacca Strait
Ipoh
Medan
Malaysia
Pematangsiantar
Kuala Lumpur
North Sumatra
Sibolga
Pulau Nias
Singapore
Batam
Padang
Pulau Siberut
Palembang
Bengkulu
Bandar Lampung
Jakarta
Google
CARTODB
Powered by Google Earth Engine
Map data ©2014 Google
100 km
Terms of Use

应用

- Apps:二次开发


USAID
FROM THE AMERICAN PEOPLE
NASA
Google
adpc
SERVIR MEKONG
Home
About
Application
Eco Dash
Spatio-temporal
EVI Mapping
Explore historic vegetation change.
Eco Dash is a collaborative effort between its developers and its community of users. We welcome suggestions for improvements on our Github issues page.

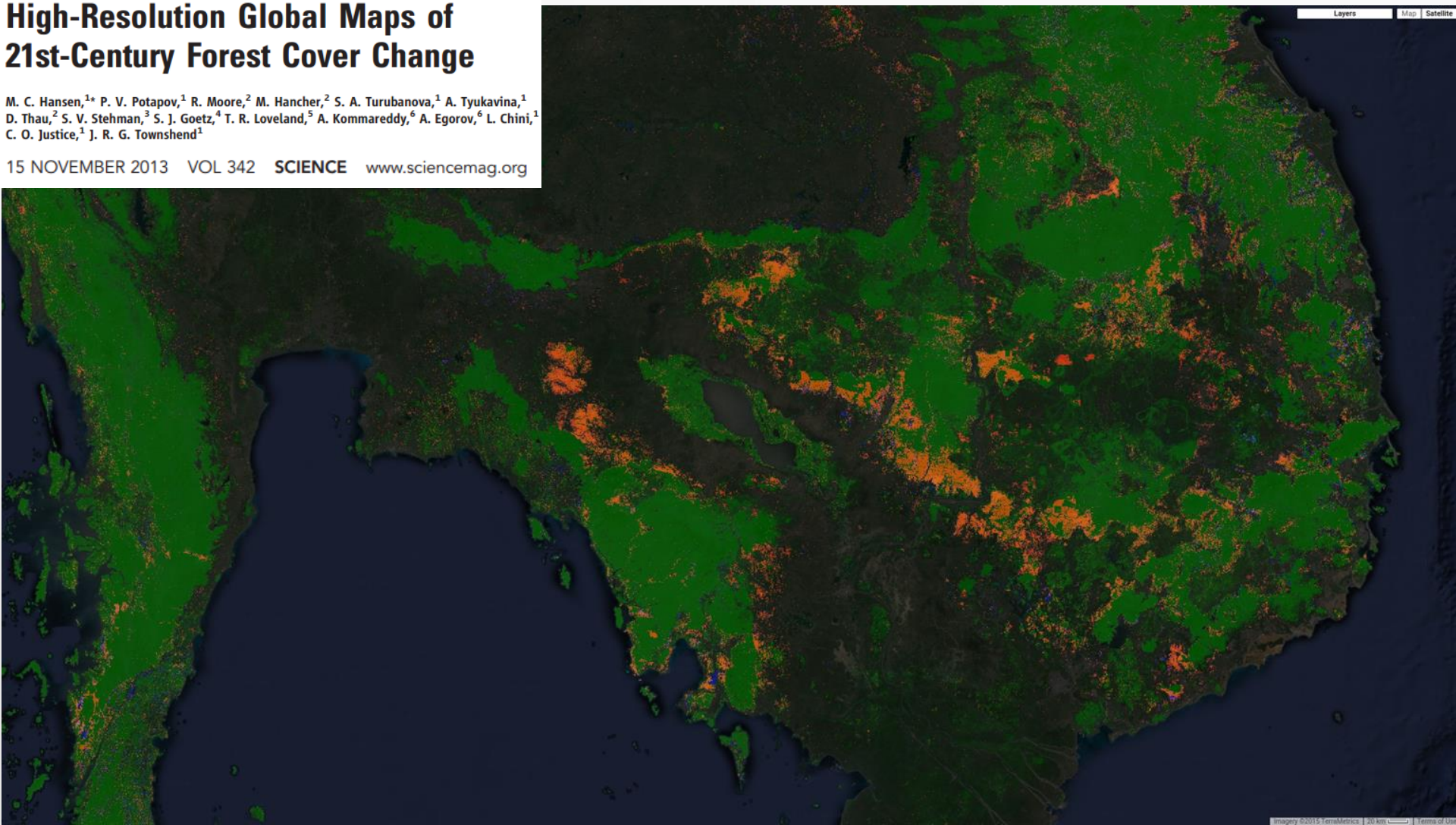
应用

- 地理数据分析

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



应用

- 地理数据分析

RESEARCH ARTICLE

CONSERVATION BIOLOGY

Tracking changes and preventing loss in critical tiger habitat

10.1126/sciadv.1501675

Anup R. Joshi,[1]* Eric Dinerstein,[2] Eric Wikramanayake,[2] Michael L. Anderson,[2] David Olson,[2] Benjamin S. Jones,[3] John Seidensticker,[2,4] Susan Lumpkin,[2] Matthew C. Hansen,[5] Nigel C. Sizer,[6] Crystal L. Davis,[6] Suzanne Palminteri,[2] Nathan R. Hahn[2]

Sci. Adv. 2016;2:e1501675 1 April 2016

"This study was made possible by free availability of satellite imagery, cloud computing services, and interactive web tools. We were able to analyze 14 years of high-resolution global forest loss data across 76 landscapes that span 13 countries."

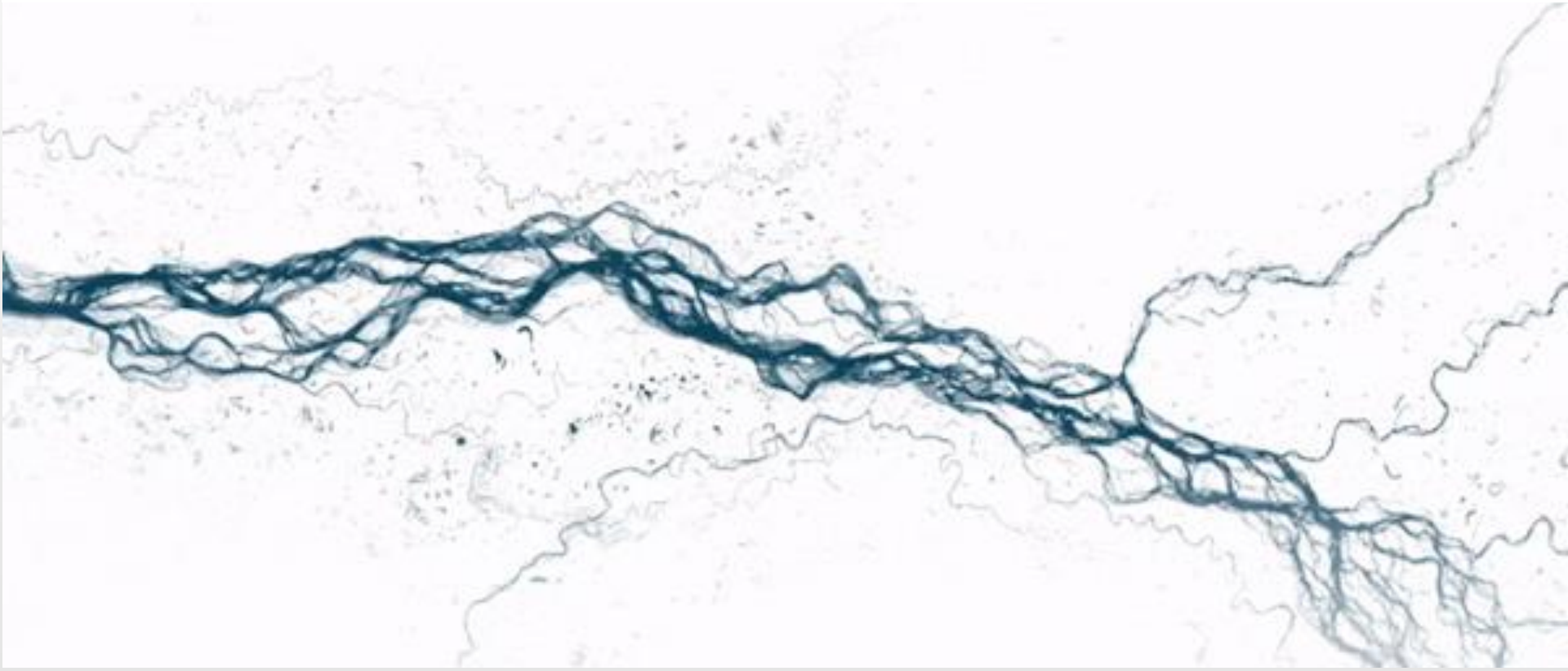
Photo: Dibyendu Ash, www.goingwild.com

应用

➢地理数据分析

High-resolution mapping of global surface water and its long-term changes

Jean-François Pekel[1], Andrew Cottam[1], Noel Gorelick[2] & Alan S. Belward[1]



应用

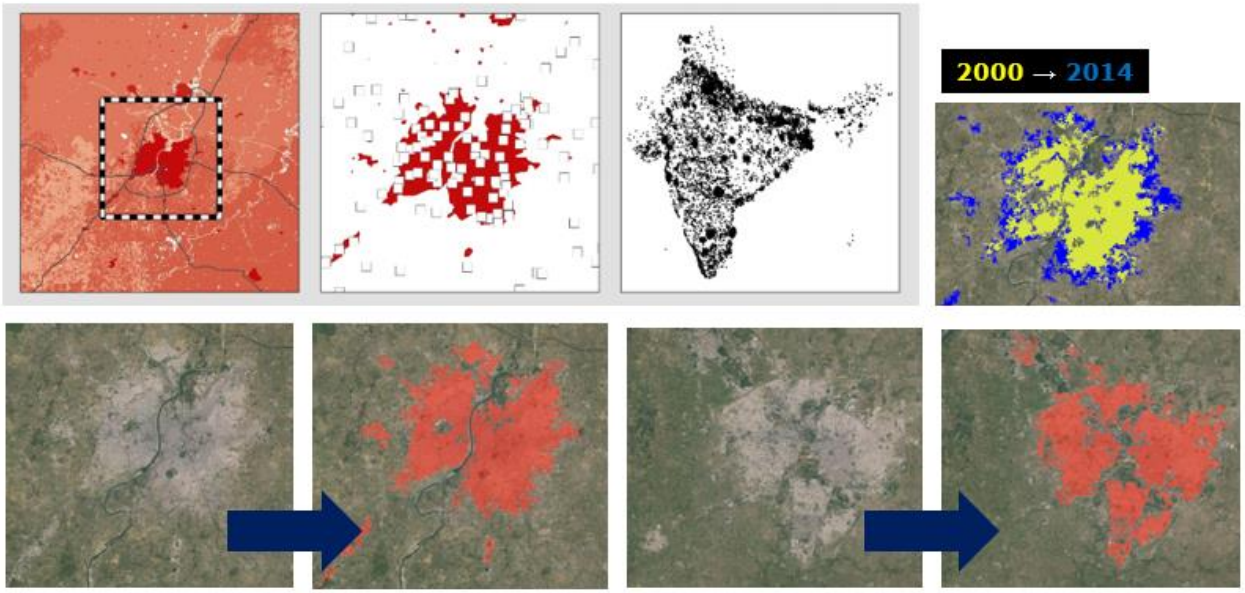
➢地理数据分析

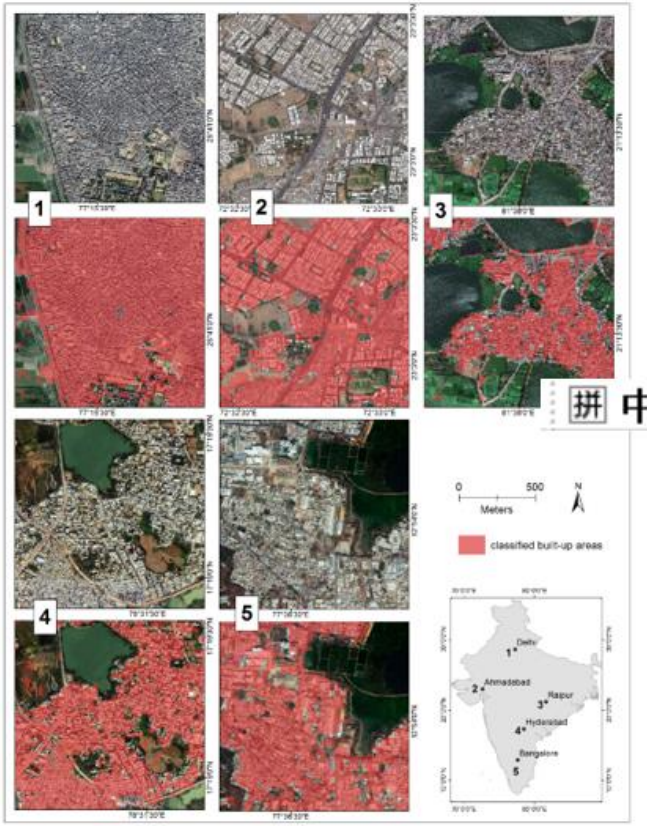
Detecting the Boundaries of Urban Areas in India: A Dataset for Pixel-Based Image Classification in Google Earth Engine

Ran Goldblatt [1,*], Wei You [2], Gordon Hanson [1] and Amit K. Khandelwal [3]

remote sensing

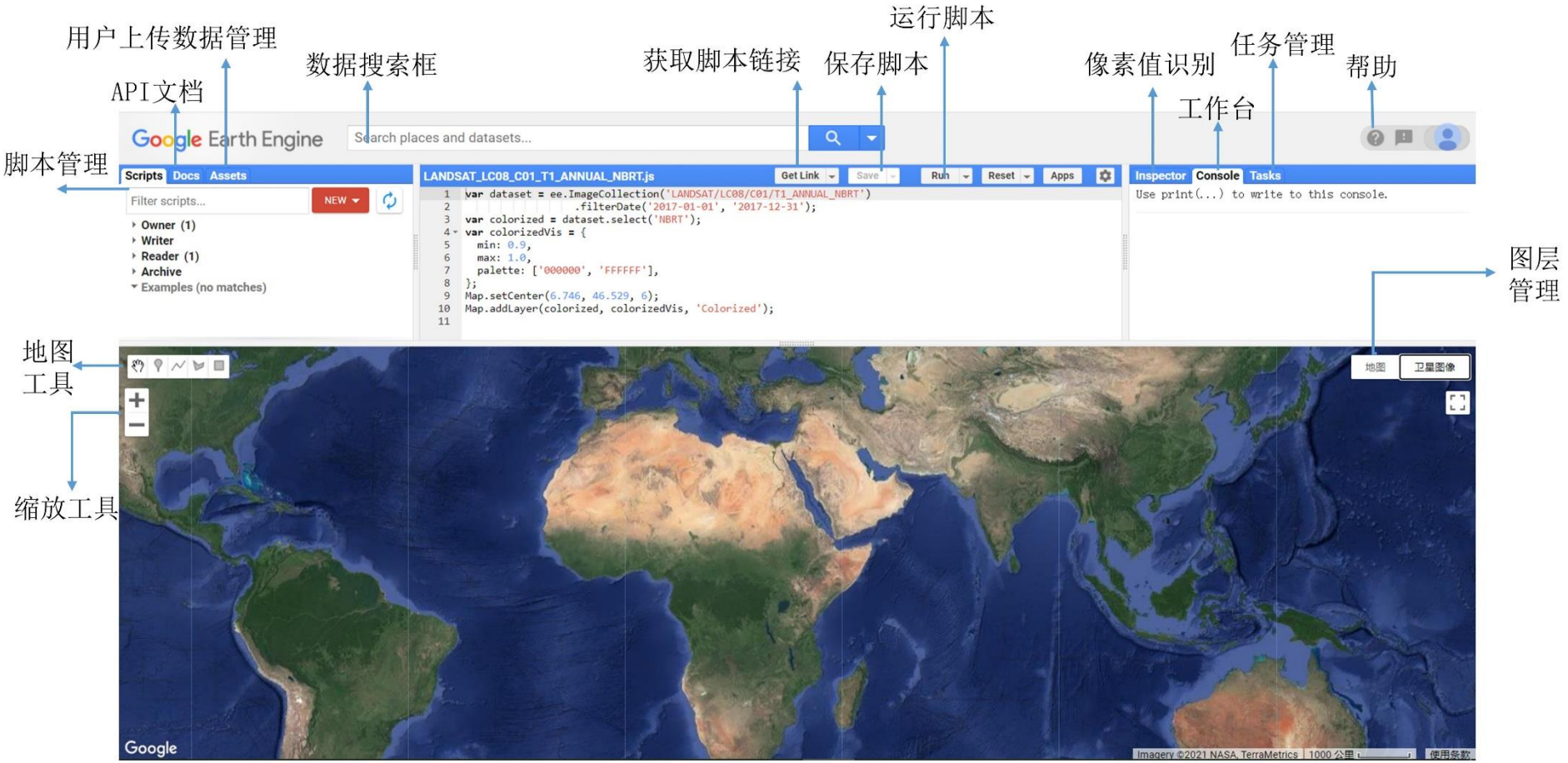
Remote Sens. 2016, 8, 634; doi:10.3390/rs8080634





The dataset can be accessed online as a Google Fusion Table at:
https://www.google.com/fusiontables/DataSource?docid=1fWY4IyYiV-BA5HsAKi2V9LdoQgsbFtKK2BoQiHb0#rows:id=1

基本功能和方法


用户上传数据管理
API文档
数据搜索框
获取脚本链接
保存脚本
运行脚本
像素值识别
任务管理
帮助
工作台
脚本管理
图层管理
地图工具
缩放工具
Google Earth Engine
Search places and datasets...
Scripts
Docs
Assets
Filter scripts...
NEW
Owner (1)
Writer
Reader (1)
Archive
Examples (no matches)
LANDSAT_LC08_C01_T1_ANNUAL_NBRT.js
Get Link
Save
Run
Reset
Apps
var dataset = ee.ImageCollection('LANDSAT/LC08/C01/T1_ANNUAL_NBRT')
.filterDate('2017-01-01', '2017-12-31');
var colorized = dataset.select('NBRT');
var colorizedVis = {
min: 0.9,
max: 1.0,
palette: ['000000', 'FFFFFF'],
};
Map.setCenter(6.746, 46.529, 6);
Map.addLayer(colorized, colorizedVis, 'Colorized');
Inspector
Console
Tasks
Use print(...) to write to this console.
地图
卫星图像
Google
Imagery ©2021 NASA, TerraMetrics

基本功能和方法

- JavaScript
- 基本的数据类型：

Feature

Image

ImageCollection

FeatureCollection

Geometry

Reduce

Filter

List

Dictionary

Array

Date

String

Number

基本功能和方法

1. Filter:

最常使用的是对时间的删选

```
var data = ee.ImageCollection("MODIS/006/MOD13A1")
        .select("NDVI")
       .filterBounds(roi)
       .filterDate("2017-1-1", "2019-1-1")
       .filter(ee.Filter.calendarRange(6,9,"month"))
        .filter(ee.Filter.dayOfYear(120,330))
         .map(function(img){
              img = img.clip(roi);
              return img; });
```

ee.Filter

- ee.Filter(*filter*)
- ee.Filter.and(var_args)
- ee.Filter.bounds(geometry, *errorM…*
- ee.Filter.calendarRange(start, *end*, …
- ee.Filter.contains(*leftField*, *rightVal…*
- ee.Filter.date(start, *end*)
- ee.Filter.dateRangeContains(*leftFi…*
- ee.Filter.dayOfYear(start, end)
- ee.Filter.disjoint(*leftField*, *rightValu…*
- ee.Filter.eq(name, value)
- ee.Filter.equals(*leftField*, *rightValu…*
- ee.Filter.expression(expression)
- ee.Filter.greaterThan(*leftField*, *righ…*
- ee.Filter.greaterThanOrEquals(*left…*
- ee.Filter.gt(name, value)

https://code.earthengine.google.com/58ee35ec331974b68e3f7176ac85fa1a

基本功能和方法

2. 循环：

- Evaluate：异步
- Map：单个元素
- Iterate：可处理上下数据关系，如计算累积量
- For

举例：以2000-2010年的平均值为基准，计算2011-2014年NDVI和EVI的偏移累积。参数List存储了每一次循环的中间变量

https://code.earthengine.google.com/d53fc7c0fea49b6b29829ce5dc7a7f4e

基本功能和方法

3. 裁剪

- Clip, Mask ,filterBounds, region
- 对于数据本身来说，只有Clip是真正的裁剪，
- mask可用于掩膜计算
- 函数中的region和bounds只对函数本身起作用。
- filterBounds 相交筛选时相！

举例比较：

https://code.earthengine.google.com/0480e8d7500a97edc94f7cbbebe3d8a5

基本功能和方法

4. Reduce

- Image.reduce
- Image.reduceNeighborhood
- Image.reduceRegion
- Image.reduceRegions
- Image.reduceToVectors
- ImageCollection.reduce
- FeatureCollection.reduceColumns
- FeatureCollection.ReduceToImage

40+ reducers

- Reducer.count
- Reducer.histogram
- Reducer.linearFit
- Reducer.linearRegression
- Reducer.max
- Reducer.mean
- Reducer.median
- Reducer.min
- Reducer.stdDev
- Reducer.sum
- Reducer.toCollection
- Reducer.toList
- Reducer.variance

基本功能和方法

比较四种reduce

(1)ImageCollection.min()

(2)ImageCollection.reduce(ee.Reducer.min());

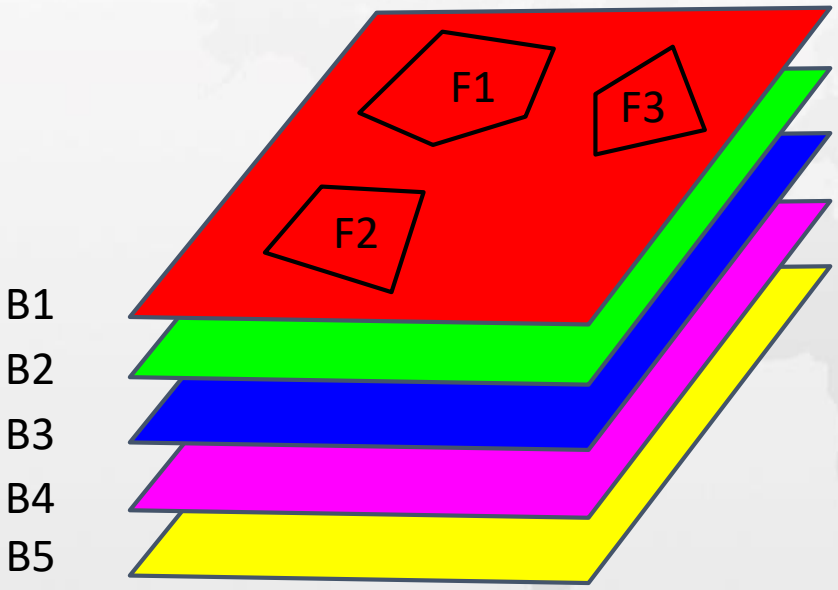
(3)ReduceRegion(reducer为min)

(4)Image.min()

https://code.earthengine.google.com/2cc0a866b7ef54c4f39a6deb2d00772d

基本功能和方法

Reduce Regions



FeatureCollection

	B1	B2	B3	B4	B5
F1					
F2					
F3					

基本功能和方法

5. Join:关联两个图层

举例：筛选公交站2公里内的公园：

```
var joinFilter = ee.Filter.withinDistance({
  distance: 2000,
  leftField: '.geo',
  rightField: '.geo'});
var closeParks = ee.Join.simple().apply({
  primary: parks,
  secondary: bart,
  condition: joinFilter});
```

https://code.earthengine.google.com/979cbce9c9e37ea3a47fc91a2a55dd47

基本功能和方法

6. 结果的导出与展示

- Google 为每一位用户免费提供云端硬盘
- GEE平台支持以多种格式（TIFF、PNG、JPEG图片格式、CSV文件格式以及MP3视频格式等）
- 相关方法

基本功能和方法

- 使用GEE下载影像（不推荐）：

1. 把所有时相的影像作为波段以一个image导出
2. 循环导出imageCollection种的每一张影像

- Table数据的导出：

1. 通过导出函数
2. 通过展示图表之后交互导出

举例：CJ_Drive_image

https://code.earthengine.google.com/ee0c74cd3980aaf9d9ceccddf37032e7

应用实例

MOD13A1.006 Terra Vegetation Indices 16-Day Global 500m

Dataset Availability

2000-02-18T00:00:00 - 2021-06-26T00:00:00

Dataset Provider

NASA LP DAAC at the USGS EROS Center

Collection Snippet

```
ee.ImageCollection("MODIS/006/MOD13A1")
```

See example

Tags

vegetation ndvi evi modis

DESCRIPTION | BANDS | TERMS OF USE | CITATIONS | DOIS

Resolution

500 meters

Bands Table

Name	Description	Min	Max	Units	Wavelength	Sca
NDVI	Normalized Difference Vegetation Index	-2000	10000			0.00
EVI	Enhanced Vegetation Index	-2000	10000			0.00
DetailedQA	VI quality indicators					
DetailedQA Bitmask	• Bits 0-1: VI quality (MODLAND QA Bits) ◦ 0: VI produced with good quality ◦ 1: VI produced, but check other QA ◦ 2: Pixel produced, but most probably cloudy					

CLOSE IMPORT

应用实例

1. 使用数据产品的情况

例1：基于站点的长时间序列NDVI提取与分析

Steps:

① 查找数据产品

② 限定时间和范围

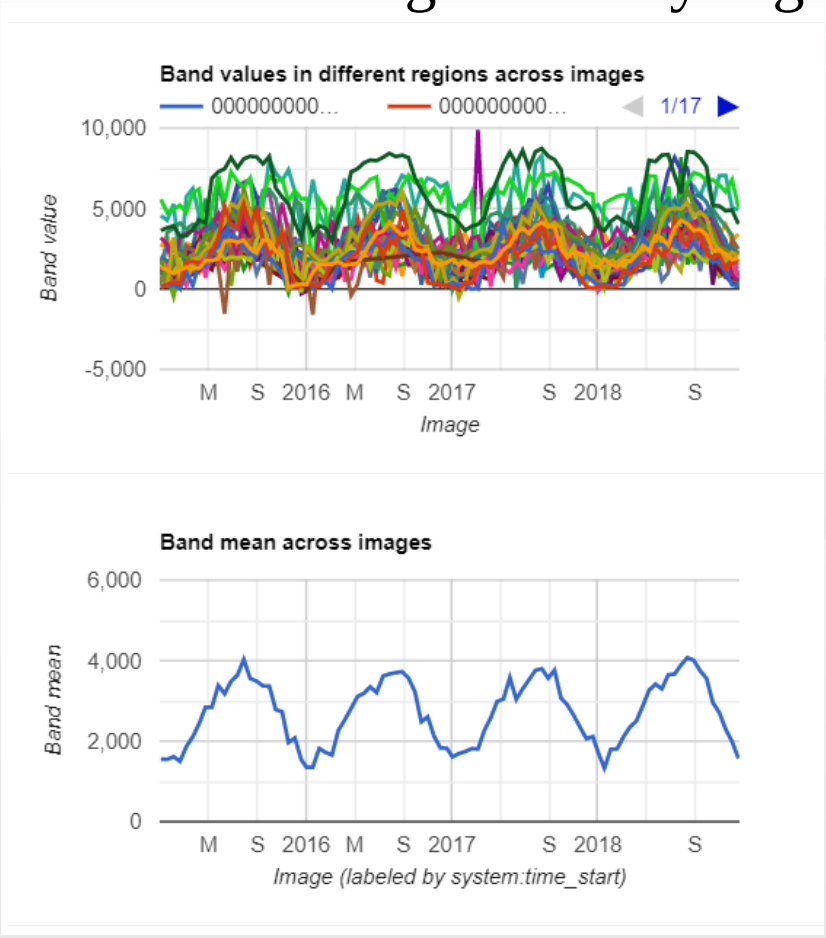
③ 提取时间序列

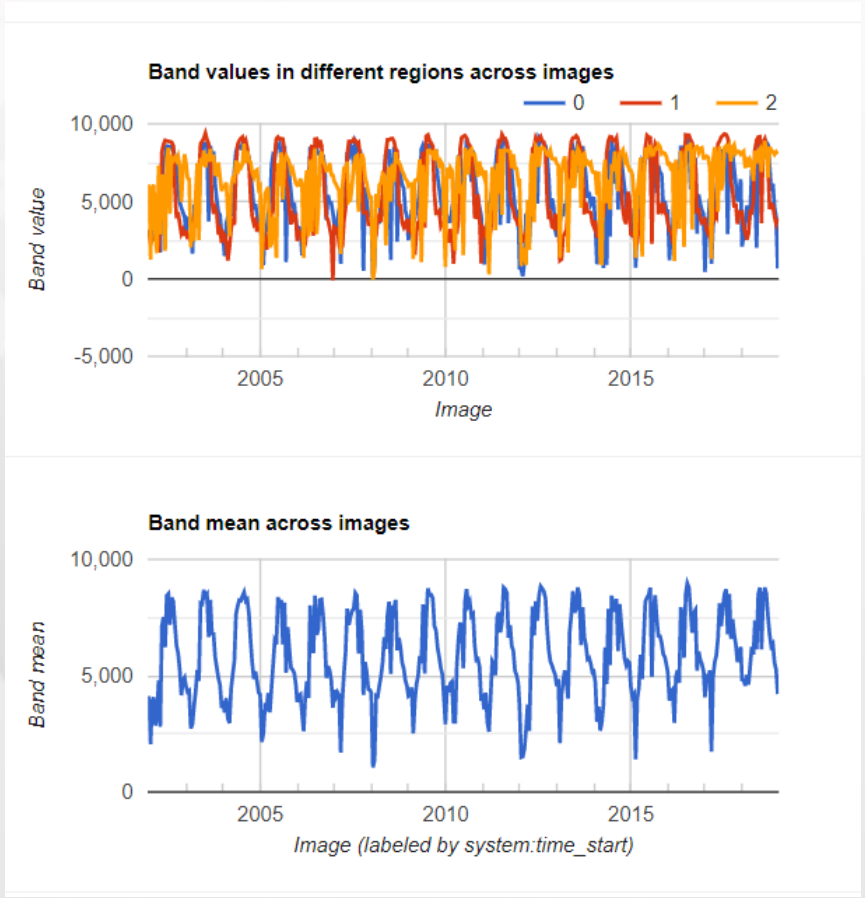
④ 展示时间序列

https://code.earthengine.google.com/82c905a82e70e26e788aefc9ae7165b4

应用实例

ui.Chart.image.seriesByRegion和ui.Chart.image.series的区别





https://code.earthengine.google.com/82c905a82e70e26e788aefc9ae7165b4

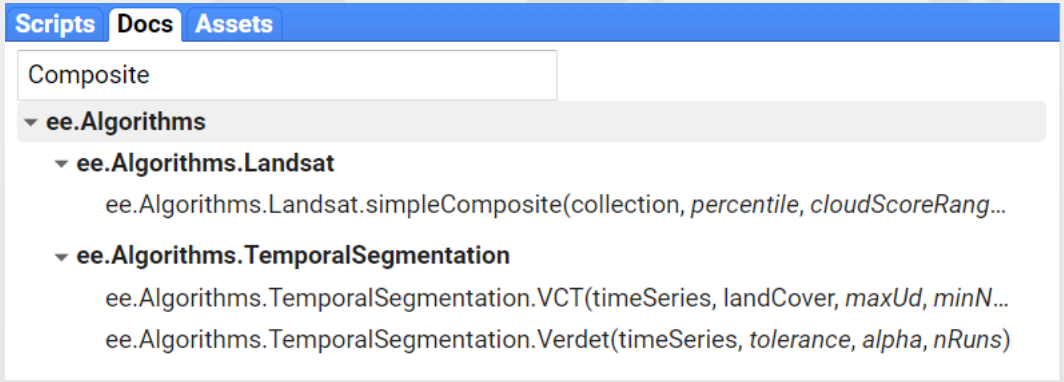
应用实例

例2：时间维度上的数据合成

① 通过collection的

mean(),min(),max(),median()等方法结合针对时间的循环实现。

② 内置函数，只对Landsat,云最少



https://code.earthengine.google.com/f82cdff807de4297a809820773efec1f
https://code.earthengine.google.com/a327b18d2c30aad9c456906bbcaa2d14

应用实例

2. 有数据产品满足要求的情况(一个综合例子)

Steps:

① 选择影像

② 影像预处理

③ 计算指数

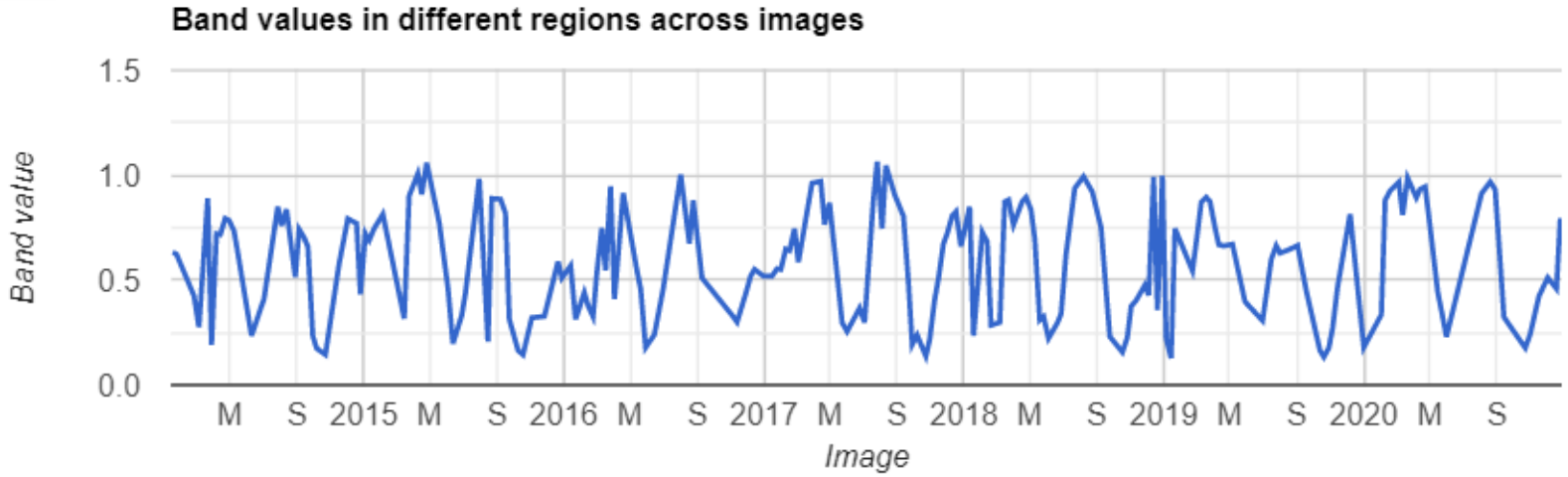
④ 时间序列展示

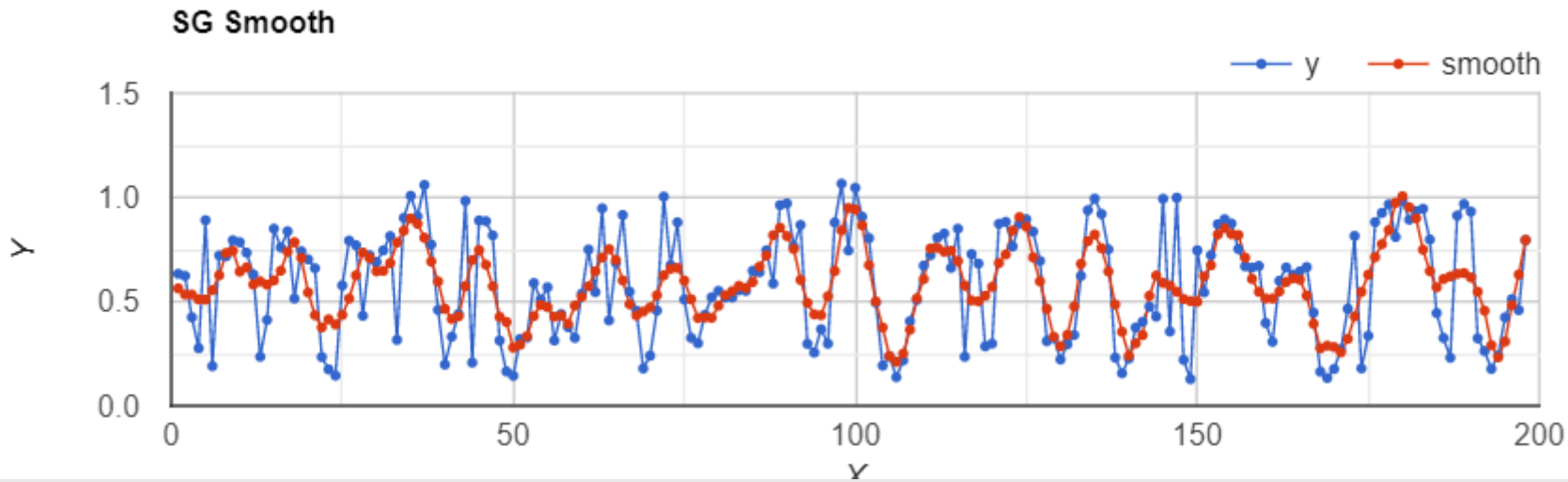
⑤ 时间序列平滑/拟合（SG滤波）

⑥ 线性回归/自相关/协方差

https://code.earthengine.google.com/4a05308f2efe548feae68c61da052992

应用实例





https://code.earthengine.google.com/4a05308f2efe548feae68c61da052992

GEE 学习资料

1. 官方网址https://earthengine.google.com/
2. 官方说明文档（推荐！！！！！ ）
   https://developers.google.com/earth-engine/
3. B站视频（基础）
   https://www.bilibili.com/video/BV1Sb411p7TQ?p=4&share_source=copy_web
4. GEE官方案例

谢谢！