

Investigando Series Temporales de Imágenes Satelitales

Cindy Schmidt, Amber McCullum

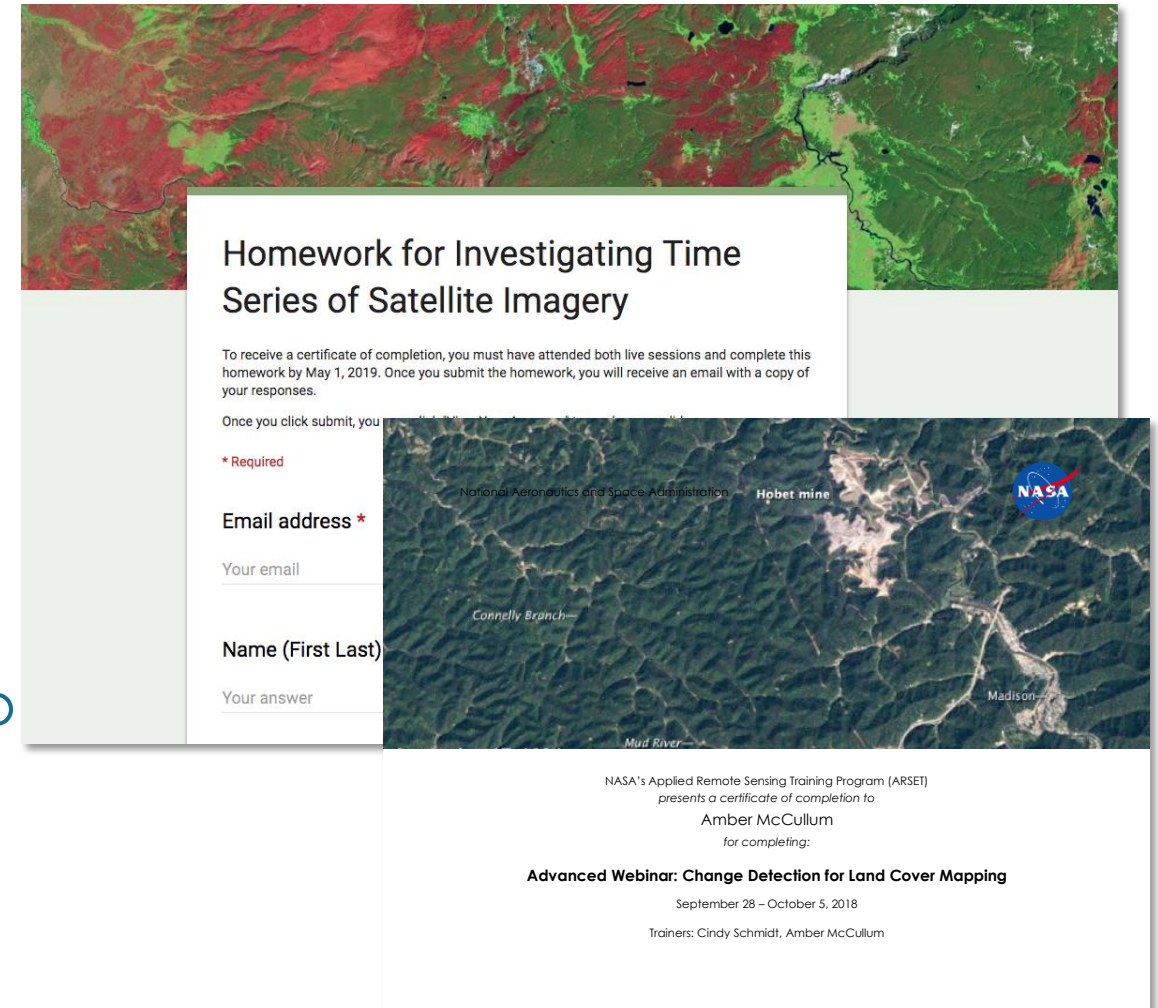
15 de abril de 2019

Estructura del Curso

- Dos sesiones, dos horas cada una el 15 y el 17 de abril de 2019
- Se presentará el mismo contenido en dos horarios diferentes cada día:
 - Sesión A: 10h-12h Horario Este de EE.UU. (UTC-4)
 - Sesión B: 18h- 20h Horario de EE.UU. (UTC-4)
 - **Por favor inscríbese y asista a solo una sesión por día**
- Las grabaciones de las presentaciones, los archivos PowerPoint y la tarea se podrán encontrar después de cada sesión aquí:
 - <https://arset.gsfc.nasa.gov/land/webinars/time-series-19>
- Preguntas y Respuestas después de cada sesión y/o por correo electrónico
 - cynthia.l.schmidt@nasa.gov, o
 - amberjean.mccullum@nasa.gov

Tarea y Certificados

- Tarea
 - Se asignará una tarea
 - Debe enviar sus respuestas vía Google Forms
- Certificado de Finalización:
 - Asista a ambas sesiones en vivo
 - Complete la tarea asignada antes del plazo (acceso mediante la página web de ARSET)
 - Plazo para la tarea: **miércoles 1^{ro} de mayo**
 - Recibirá su certificado aproximadamente dos meses después de la conclusión del curso de: marines.martins@ssaihq.com



Homework for Investigating Time Series of Satellite Imagery

To receive a certificate of completion, you must have attended both live sessions and complete this homework by May 1, 2019. Once you submit the homework, you will receive an email with a copy of your responses.

Once you click submit, you

*** Required**

Email address *

Your email

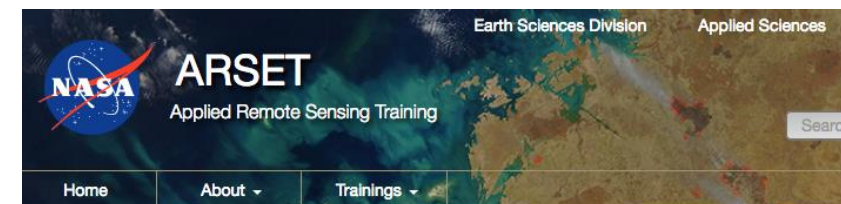
Name (First Last)

Your answer

NASA's Applied Remote Sensing Training Program (ARSET)
presents a certificate of completion to
Amber McCullum
for completing:
Advanced Webinar: Change Detection for Land Cover Mapping
September 28 – October 5, 2018
Trainers: Cindy Schmidt, Amber McCullum

Prerrequisitos

- Webinar ARSET *Introducción a la Percepción Remota (Teledetección)* o conocimiento equivalente
- Completar la [Capacitación Avanzada: Detección de Cambios para el Mapeo de la Cobertura Terrestre](#)
- Instalar Google Chrome:
<https://www.google.com/chrome/>
 - Para el ejercicio en Google Earth Engine, debe utilizar Chrome para asegurarse de que todas las funcionalidades sirvan
- Inscribirse al Google Earth Engine Code Editor:
<https://signup.earthengine.google.com/>



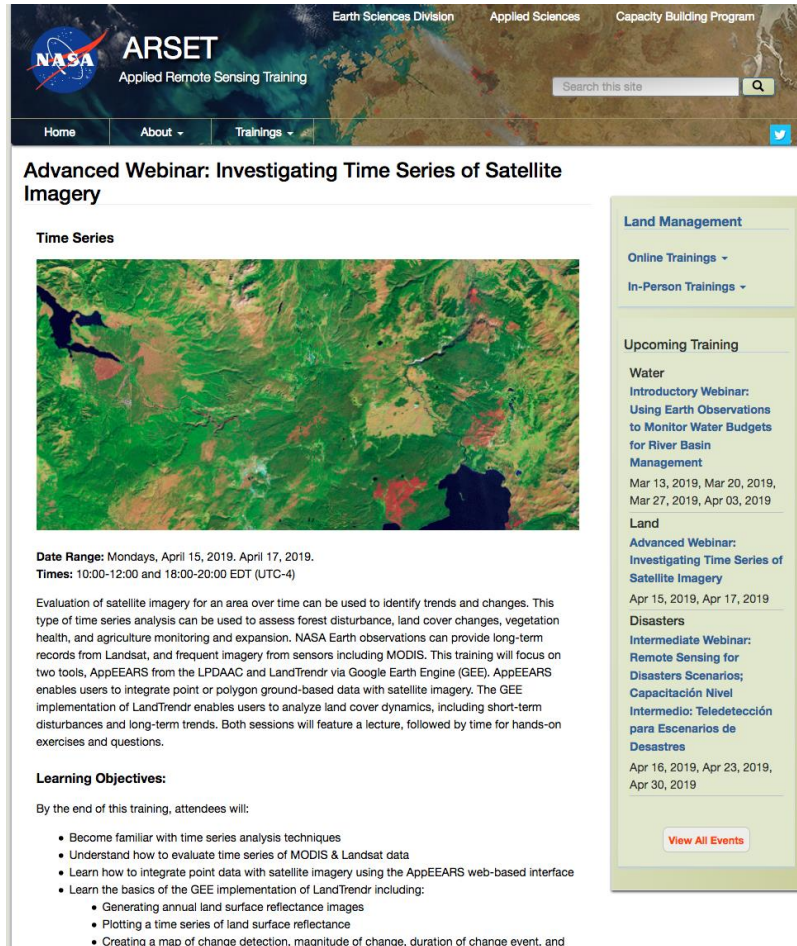
Advanced Webinar: Change Detection for Land Cover Mapping



Google Chrome

Cómo Acceder al Material del Curso

<https://arset.gsfc.nasa.gov/land/webinars/time-series-19>



ARSET
Applied Remote Sensing Training


Earth Sciences Division Applied Sciences Capacity Building Program

Search this site

Home About Trainings

Advanced Webinar: Investigating Time Series of Satellite Imagery

Time Series



Date Range: Mondays, April 15, 2019, April 17, 2019.
Times: 10:00-12:00 and 18:00-20:00 EDT (UTC-4)

Evaluation of satellite imagery for an area over time can be used to identify trends and changes. This type of time series analysis can be used to assess forest disturbance, land cover changes, vegetation health, and agriculture monitoring and expansion. NASA Earth observations can provide long-term records from Landsat, and frequent imagery from sensors including MODIS. This training will focus on two tools, AppEEARS from the LPDAAC and LandTrendr via Google Earth Engine (GEE). AppEEARS enables users to integrate point or polygon ground-based data with satellite imagery. The GEE implementation of LandTrendr enables users to analyze land cover dynamics, including short-term disturbances and long-term trends. Both sessions will feature a lecture, followed by time for hands-on exercises and questions.

Learning Objectives:

By the end of this training, attendees will:

- Become familiar with time series analysis techniques
- Understand how to evaluate time series of MODIS & Landsat data
- Learn how to integrate point data with satellite imagery using the AppEEARS web-based interface
- Learn the basics of the GEE implementation of LandTrendr including:
 - Generating annual land surface reflectance images
 - Plotting a time series of land surface reflectance
 - Creating a map of change detection, magnitude of change, duration of change event, and

Land Management

Online Trainings -

In-Person Trainings -

Upcoming Training

Water

Introductory Webinar:
Using Earth Observations
to Monitor Water Budgets
for River Basin
Management
Mar 13, 2019, Mar 20, 2019,
Mar 27, 2019, Apr 03, 2019

Land

Advanced Webinar:
Investigating Time Series of
Satellite Imagery
Apr 15, 2019, Apr 17, 2019

Disasters

Intermediate Webinar:
Remote Sensing for
Disasters Scenarios;
Capacitación Nivel
Intermedio: Teledetección
para Escenarios de
Desastres
Apr 16, 2019, Apr 23, 2019,
Apr 30, 2019

[View All Events](#)

Prerequisites:

Attendees that do not complete prerequisites may not be adequately prepared for the pace of the course.

- Complete **Sessions 1 & 2A of Fundamentals of Remote Sensing**, or equivalent experience
- Complete the **Advanced Webinar: Change Detection for Land Cover Mapping**
- Install Google Chrome: <https://www.google.com/chrome/>
 - For the Google Earth Engine exercise, Chrome should be used to make sure all features work
- Sign up for the Google Earth Engine Code Editor: <https://signup.earthengine.google.com/>

Audience:

Advanced users of remote sensing data within local, regional, state, federal, and non-governmental organizations involved in land management and conservation efforts. Professional organizations in the public and private sectors engaged in environmental management and monitoring will be given preference over organizations focused primarily on research.

Registration Information:

There is no cost for the webinar, but you must register to attend the sessions. Because we anticipate a high demand for this training, please only sign up for one session. Sessions will only be broadcast in English - Session A will cover the same content as Session B. Professional organizations in the public and private sectors engaged in water resources management and monitoring will be given preference over organizations focused primarily on research.

- [Register for Session A, 10:00-12:00 EDT \(UTC-4\) »](#)
- [Register for Session B, 18:00-20:00 EDT \(UTC-4\) »](#)

Course Agenda:

[Agenda_41.pdf](#)

April 15, 2019

This session will include a review of MODIS and Landsat, a review of change detection, an overview of time series analysis methods, and an AppEEARS hands-on exercise.

Application Area: Land

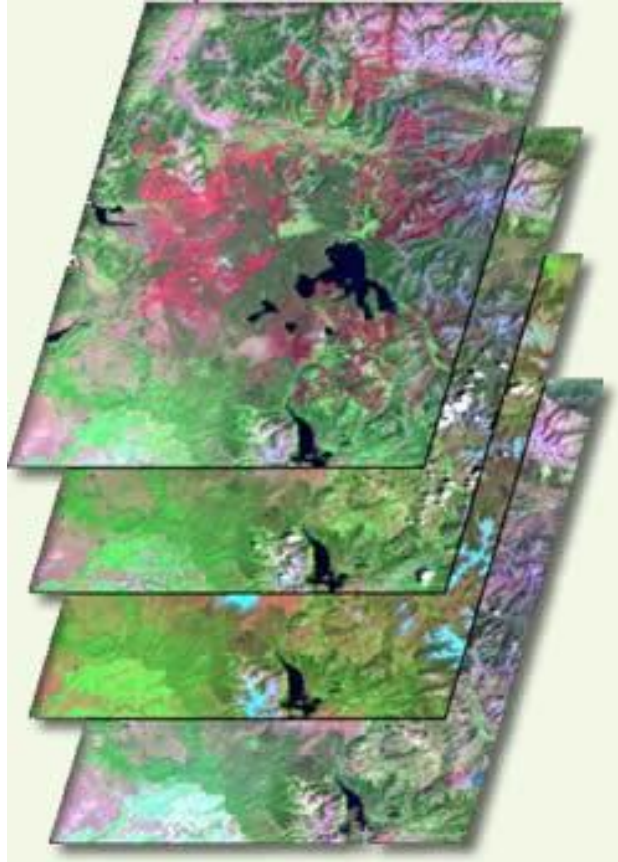
Available Languages: English

Instruments/Missions: Terra, Landsat, MODIS, Aqua

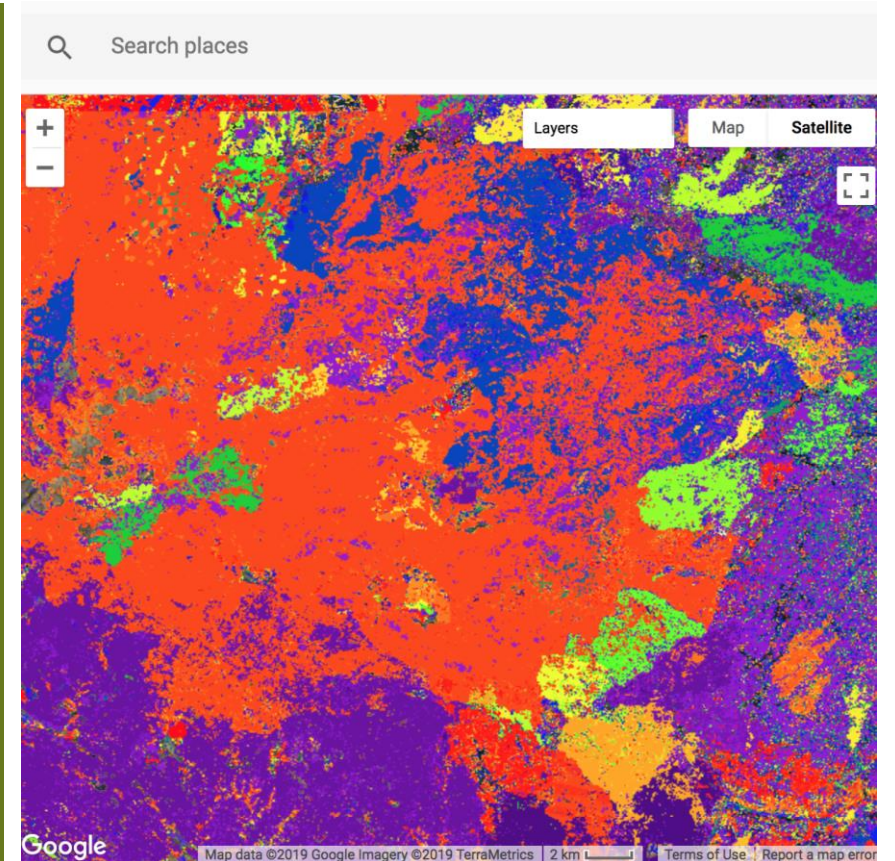
Keywords: Ecosystems, Land-Cover and Land-Use Change (LCLUC), Satellite Imagery, Tools

Esquema del Curso

Sesión 1:
Introducción
a Series
Temporales
y AppEEARS

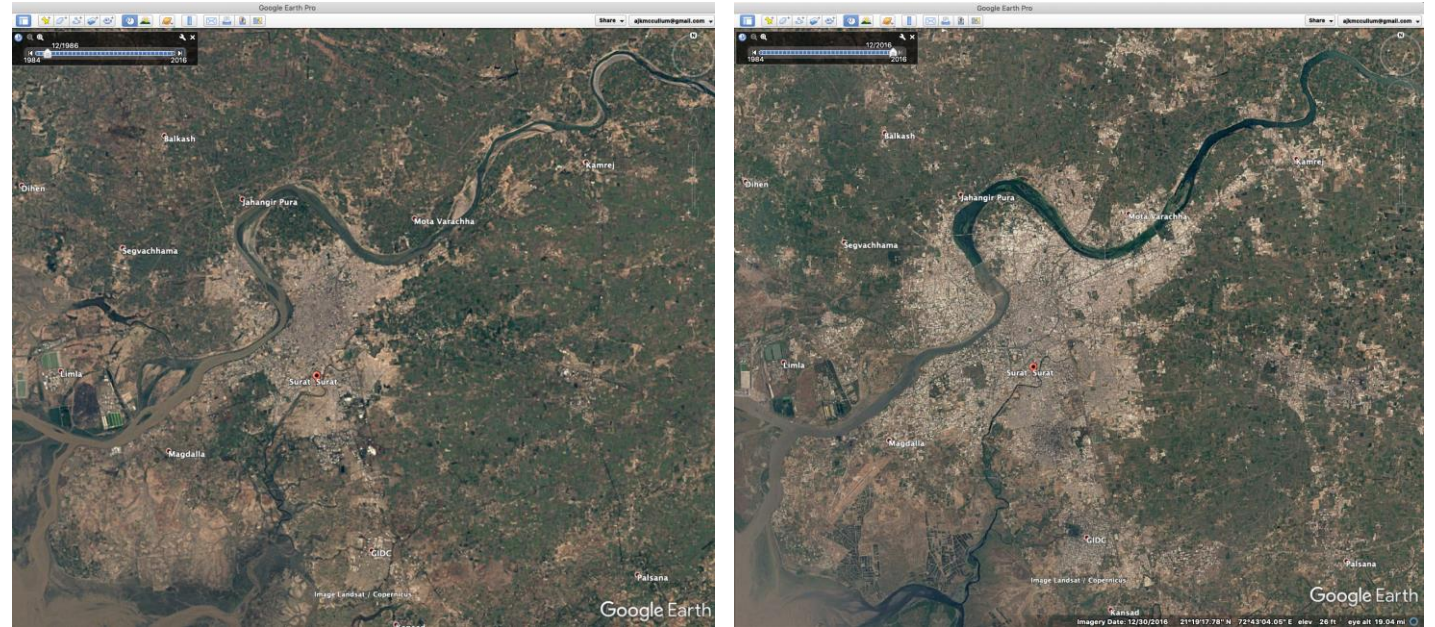


Sesión 2:
LandTrendr-
Resumen y
Aplicaciones

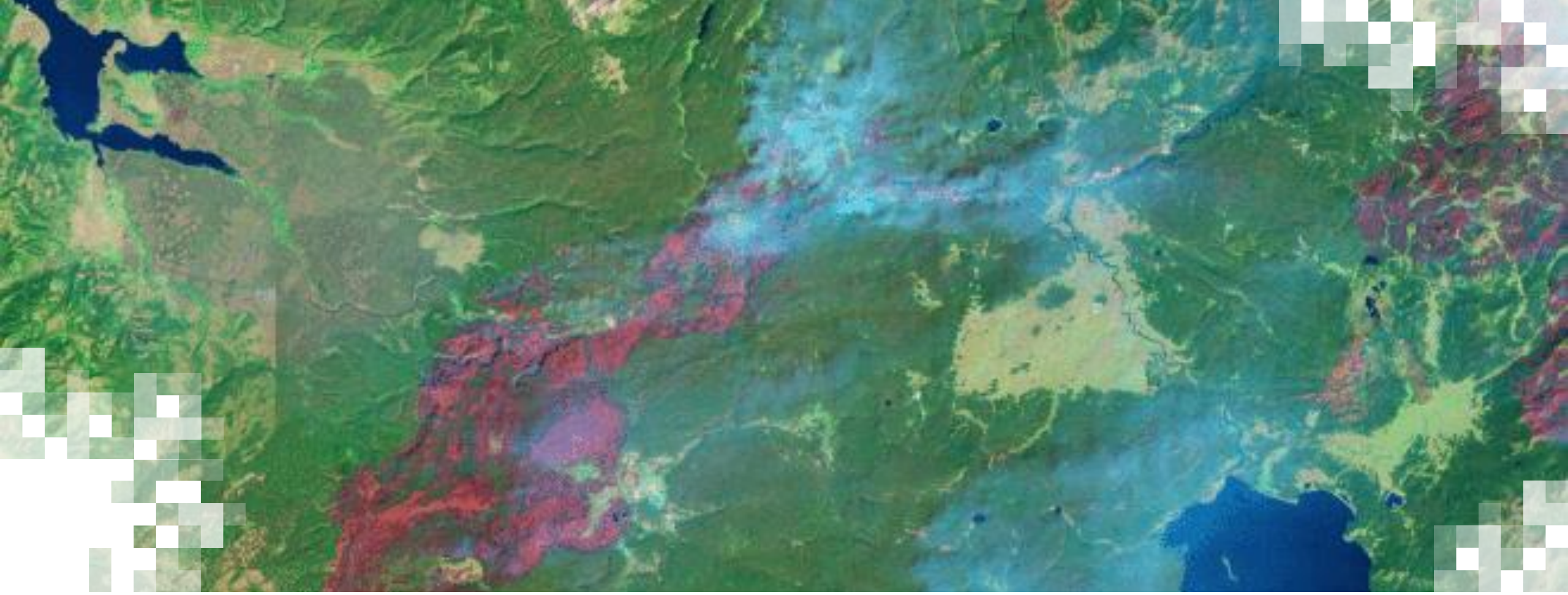


Sesión- 1 Agenda

- Resumen general de las series temporales de imágenes de satélite
- Tipos de análisis de series temporales:
 - Tendencias anuales y estacionales
 - Anomalías
 - Descriptores Ambientales
- Herramientas para Series Temporales
- Objetivos de Desarrollo Sostenible (ODSs)
 - Cubos de Datos Abiertos (Open Data Cubes u ODCs)
- Resumen de AppEEARS



Google Earth Pro (con deslizador temporal). Imágenes de Surat, India, una de las ciudades de mayor crecimiento del mundo entre 1986 (izq.) y 2016 (der.).

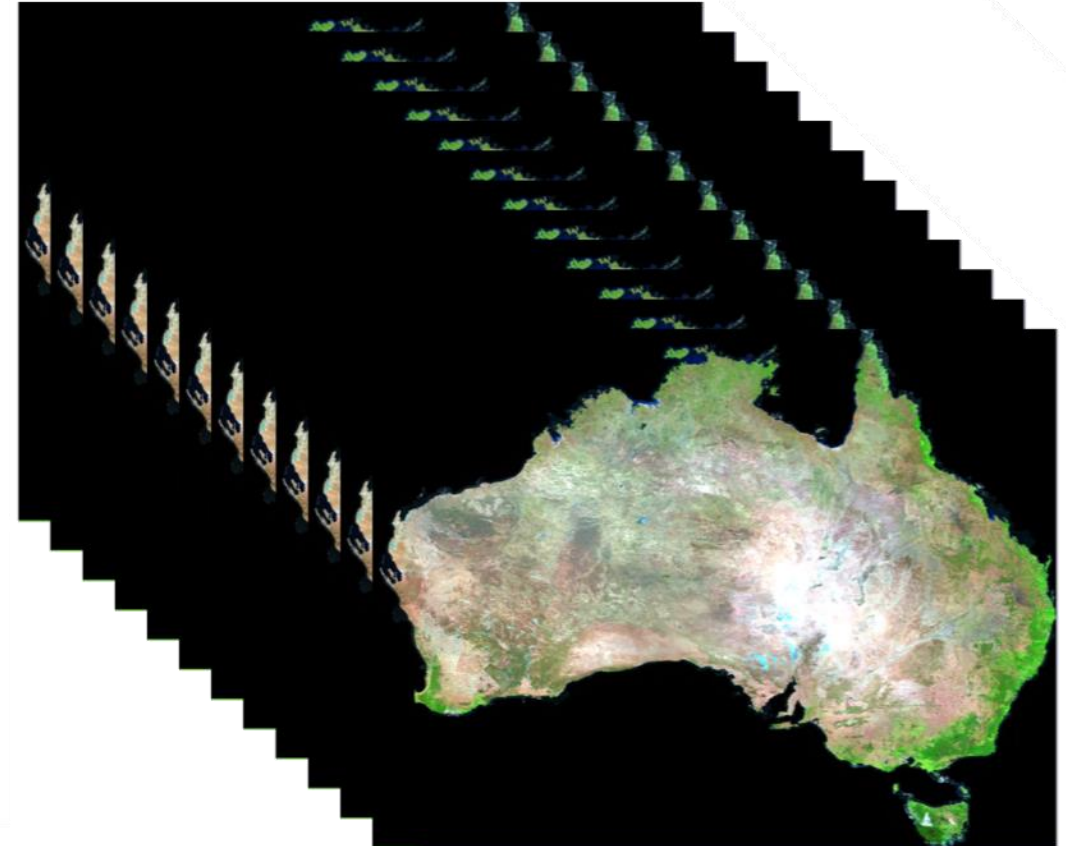


Resumen General de las Series Temporales de Imágenes de Satélite

Series Temporales Satelitales

Nuestra habilidad de identificar cambios a través del tiempo ha cambiado debido a:

- La disponibilidad de sets de datos satelitales a largo plazo
 - Landsat (+ de 30 años)
 - MODIS (18 años)
- El crecimiento de la potencia informática y computación la nube
- Mejores métodos de procesamiento

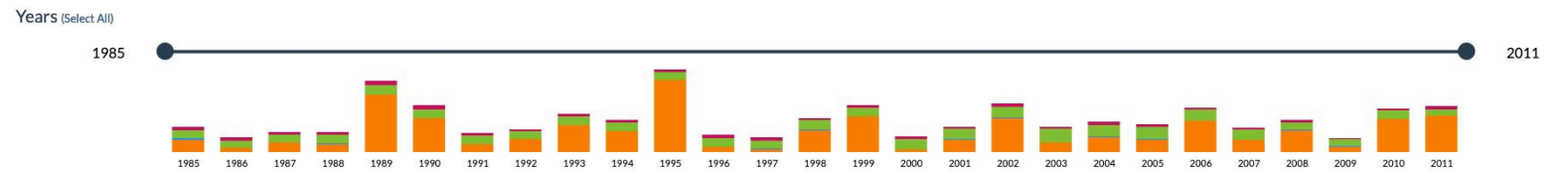
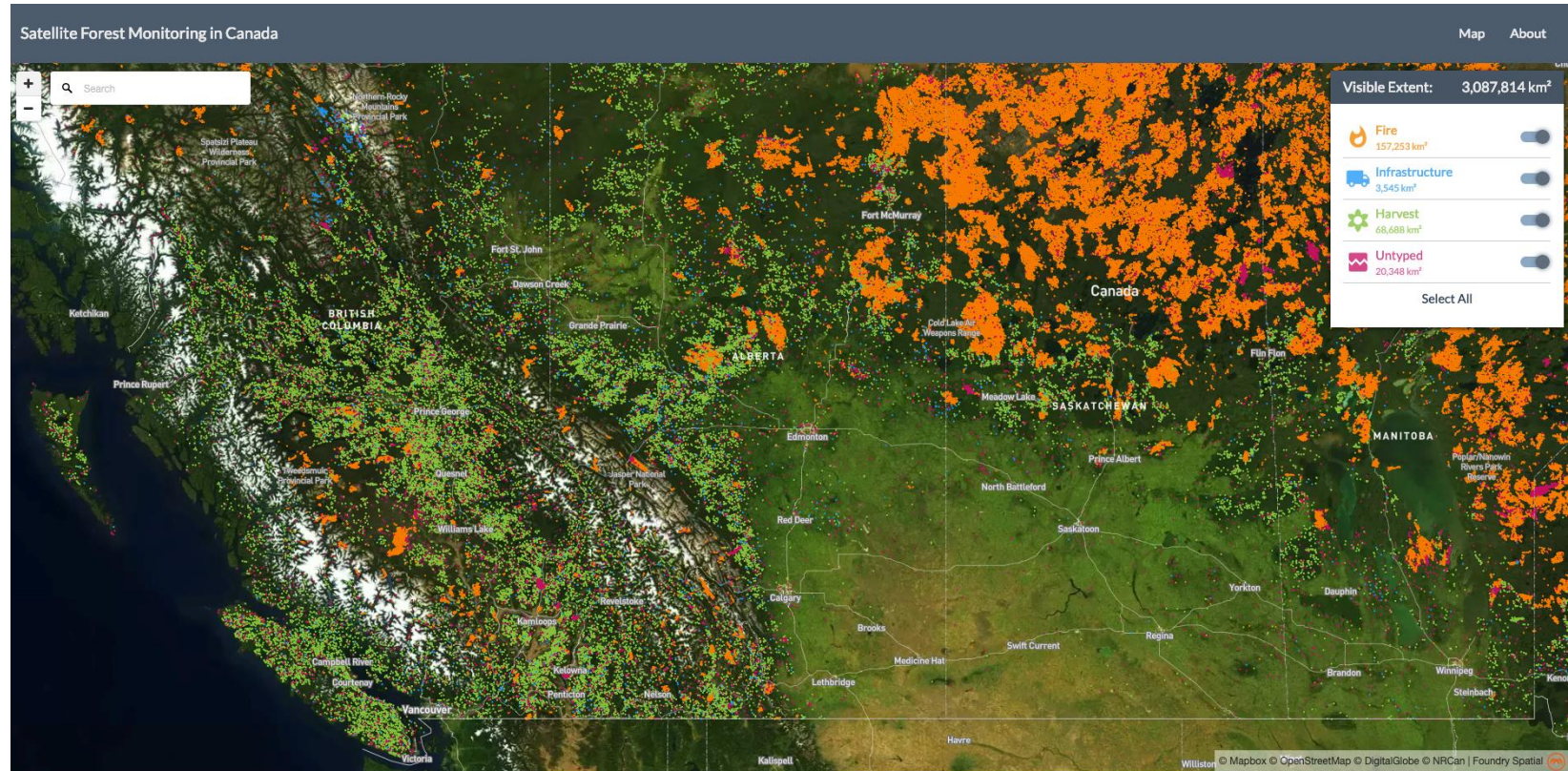


Imágenes Landsat apiladas de Australia

Fuente de la imagen: [Data Cube](#).

Tipos de Análisis de Series Temporales

- Tendencias anuales vs. estacionales
- Cambios graduales vs. abruptos
- Anomalías
- Descriptores ambientales



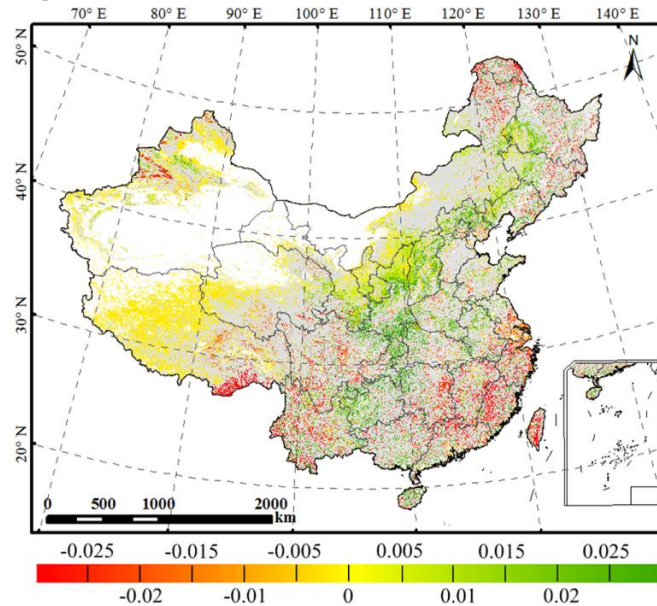
Monitoreo forestal por satélite en Canadá. Fuente de la imagen: [Foundry Spatial](https://www.foundryspatial.com/)

Tendencias Anuales vs. Estacionales

- Tendencias Anuales
 - Cambios anuales en la cobertura terrestre/uso del suelo durante períodos extendidos
 - Ej.: Tendencias en el verdor de la vegetación en China

Índice de Área Foliar (Leaf Area Index o LAI) anual de 2000 a 2014 según MODIS

Estos datos se utilizaron para analizar los cambios en la evapotranspiración y rendimiento hidrológico

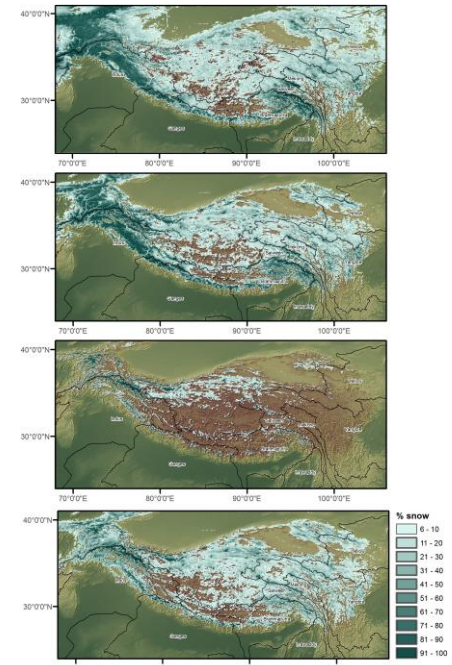


- Tendencias Estacionales
 - Impulsadas por la temperatura y/o precipitación anual
 - Ej.: Monitoreo del manto de nieve en el Himalaya

Manto de nieve estacional en base a la serie temporal MODIS del manto de nieve de mar. 2000 a feb. 2008.

(Invierno, (sup.), Primavera, Verano, Otoño (inferior))

Los valores muestran el porcentaje de tiempo que un pixel estuvo cubierto de nieve durante la estación dentro del período de tiempo específico

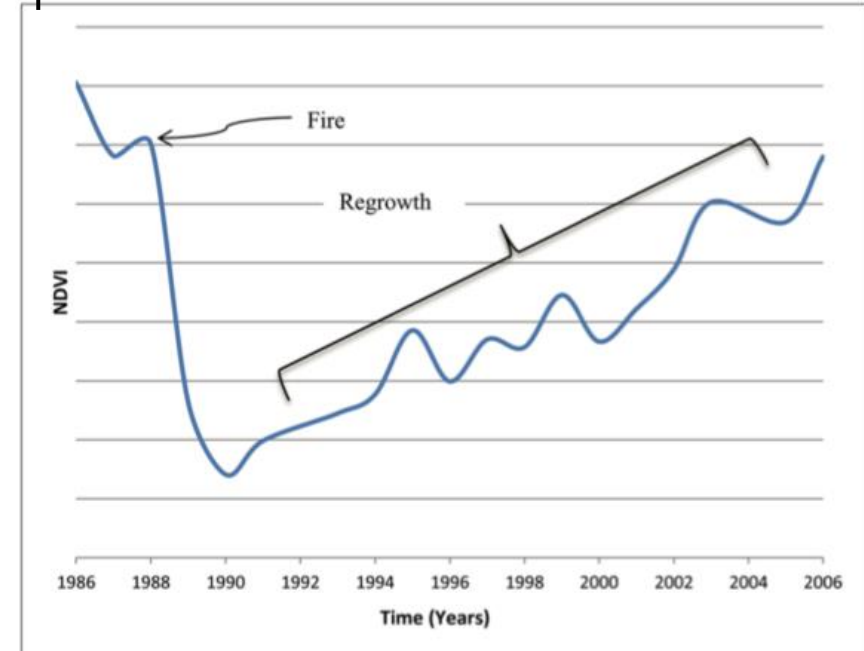


Fuentes de Imágenes: (izq.) Liu, Y. et al. (2016) Recent trends in vegetation greenness in China significantly altered annual evapotranspiration and water yield, Environmental Research Letters; (der.) Immerzeel, W.W. et al. (2009). Large-scale monitoring of snow cover and runoff simulation in Himalayan river basins using remote sensing, Remote Sensing of Environment

Cambios Graduales vs. Abruptos

- Cambios graduales:
 - Infestación de insectos en los bosques
 - Degradación del suelo
 - Recuperación del suelo
- Cambios abruptos:
 - Incendios forestales
 - Deforestación
 - Desarrollo urbano

- Ejemplo: Recuperación forestal después de un incendio forestal en el Parque Nacional Yellowstone

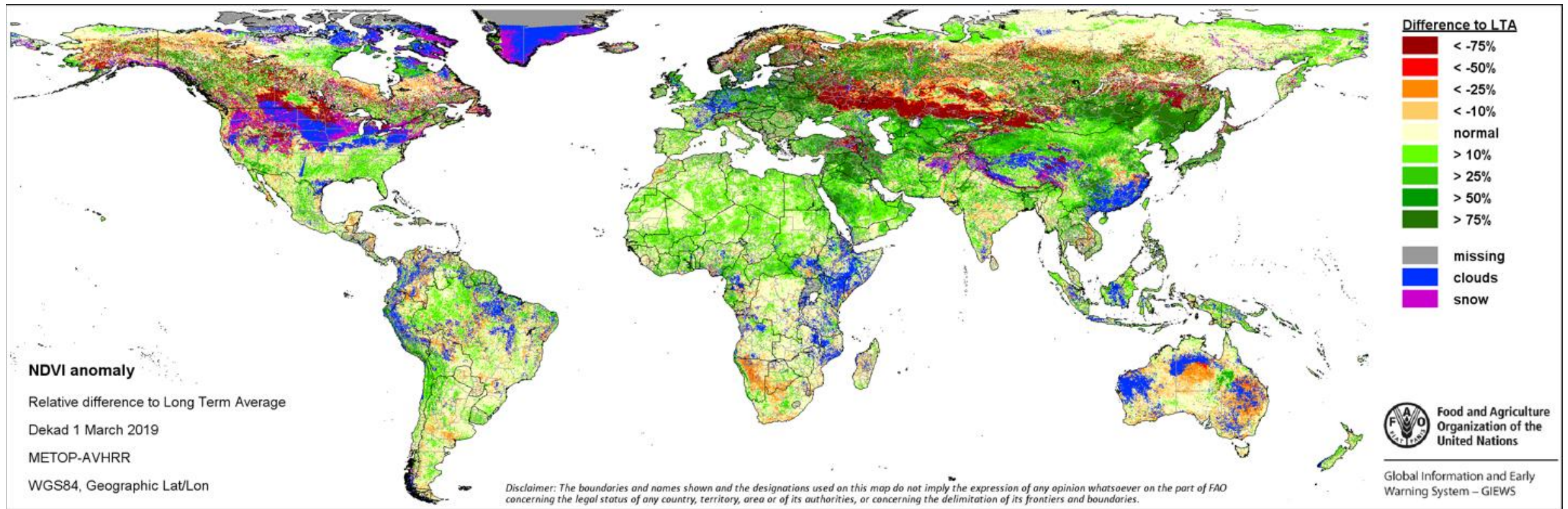


Cambios en valores NDVI entre 1986 y 2006 para un sitio en el Parque Nacional Yellowstone

Fuente de la Imagen: Franks, S. et al. (2013). Monitoring forest regrowth following large scale fire using satellite data- A case study of Yellowstone National Park, USA, European Journal of Remote Sensing

Anomalías

- Diferencia respecto a un promedio a largo plazo
- Ejemplo: Anomalías del NDVI Globales de la FAO

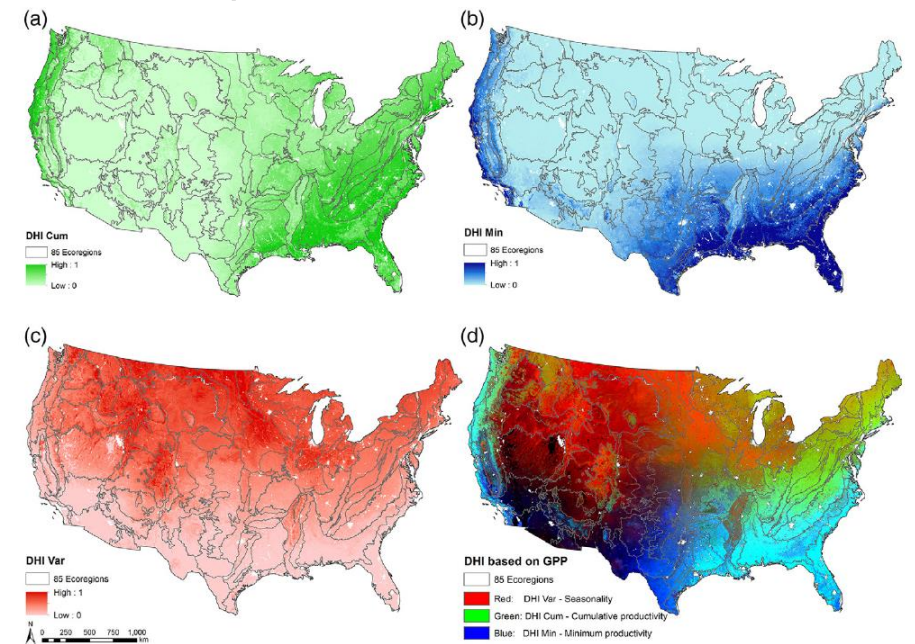


<http://www.fao.org/giews/earthobservation/>

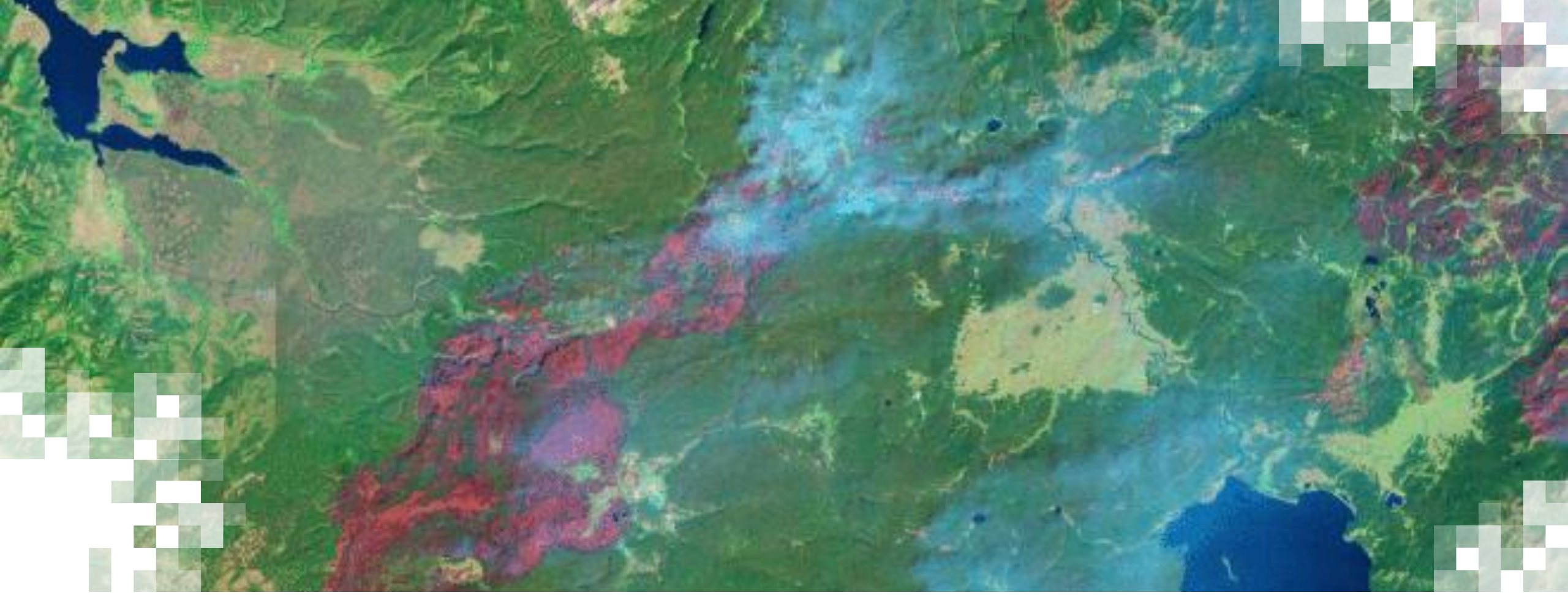
Descriptores Ambientales

- Se utilizan series temporales de observaciones satelitales para derivar descriptores ambientales
- Ejemplo: Los Índices de Hábitat Dinámicos (Dynamic Habitat Indices o DHIs) usan series temporales de observaciones satelitales del verdor para describir la dinámica de la vegetación para entender la riqueza de especies de aves
 - Los DHIs capturan variaciones estacionales en la energía que las especies pueden utilizar como alimentación
 - La dinámica de la vegetación incluye: productividad, nivel mínimo de cobertura perenne, grado de estacionalidad de la vegetación

Índices de Hábitat Dinámicos derivados de datos MODIS GPP 2003-2014 (a) DHI acumulativo; (b) DHI mínimo; (c) DHI de variación; (d) DHI combinado



Hobi, M.L. et al. (2017). A comparison of Dynamic Habitat Indices derived from different MODIS products as predictors of avian species richness, Remote Sensing of Environment.

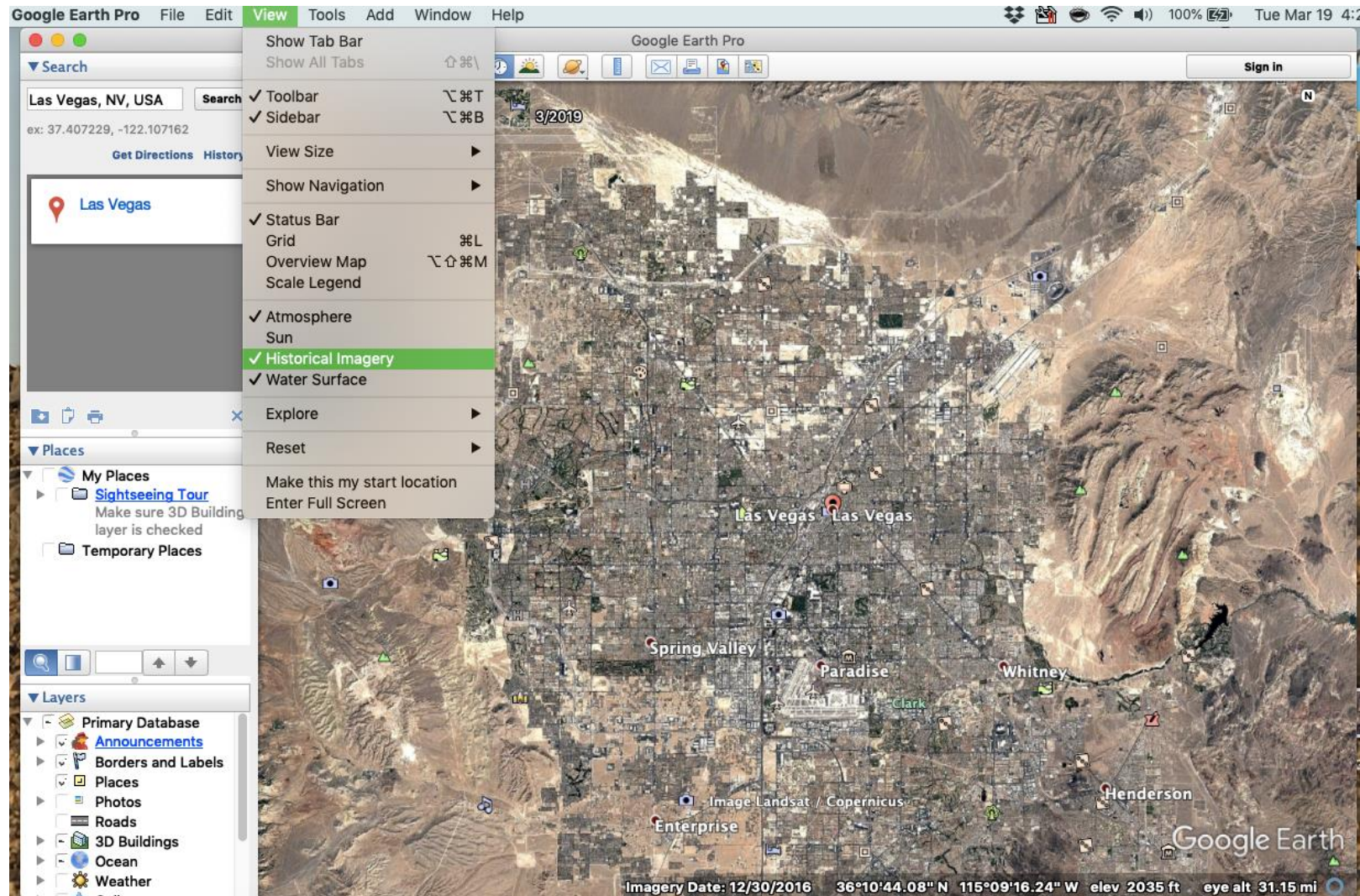


Herramientas para la Investigación de Series Temporales

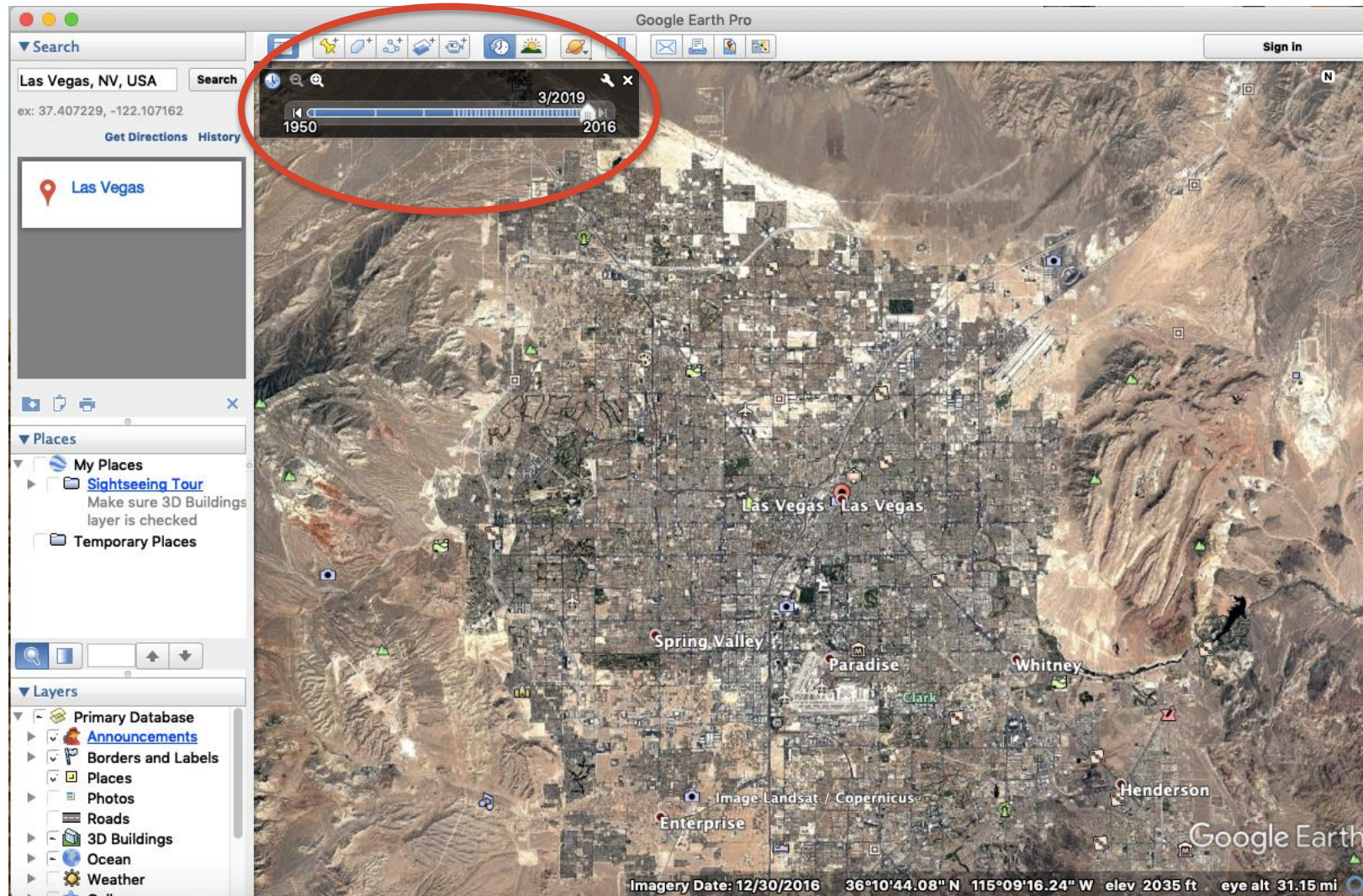
Herramientas para la Investigación de Series Temporales

- Visualización de series temporales
 - Google Earth Engine Timelapse
 - Google Earth
 - Sentinel Hub EO Browser (Agencia Espacial Europea)
- Análisis de series temporales
 - Open Data Cube
 - BFAST
 - AppEEARS (Land Processes DAAC)
 - Landtrendr (la próxima semana)

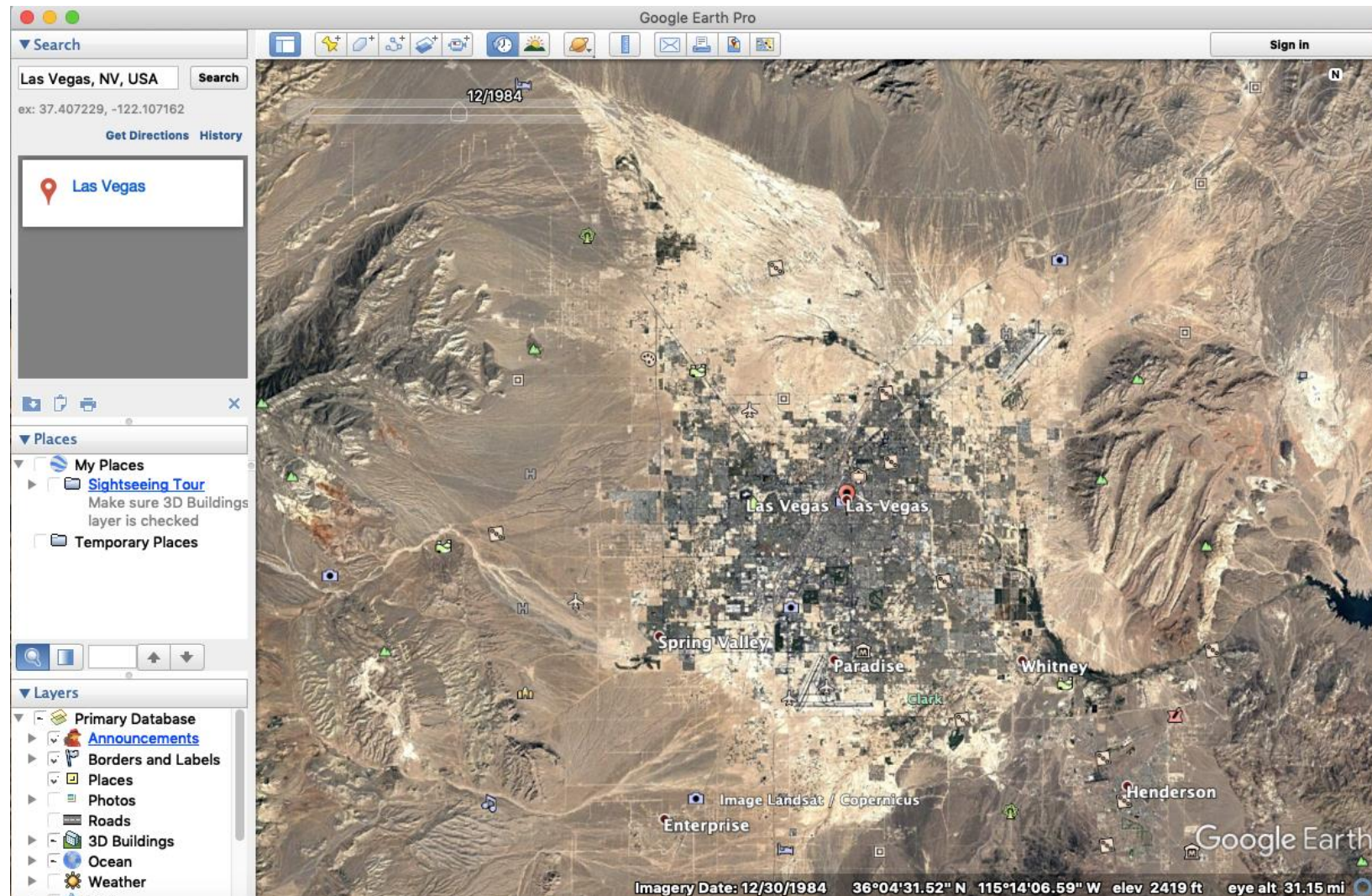
Google Earth: Las Vegas



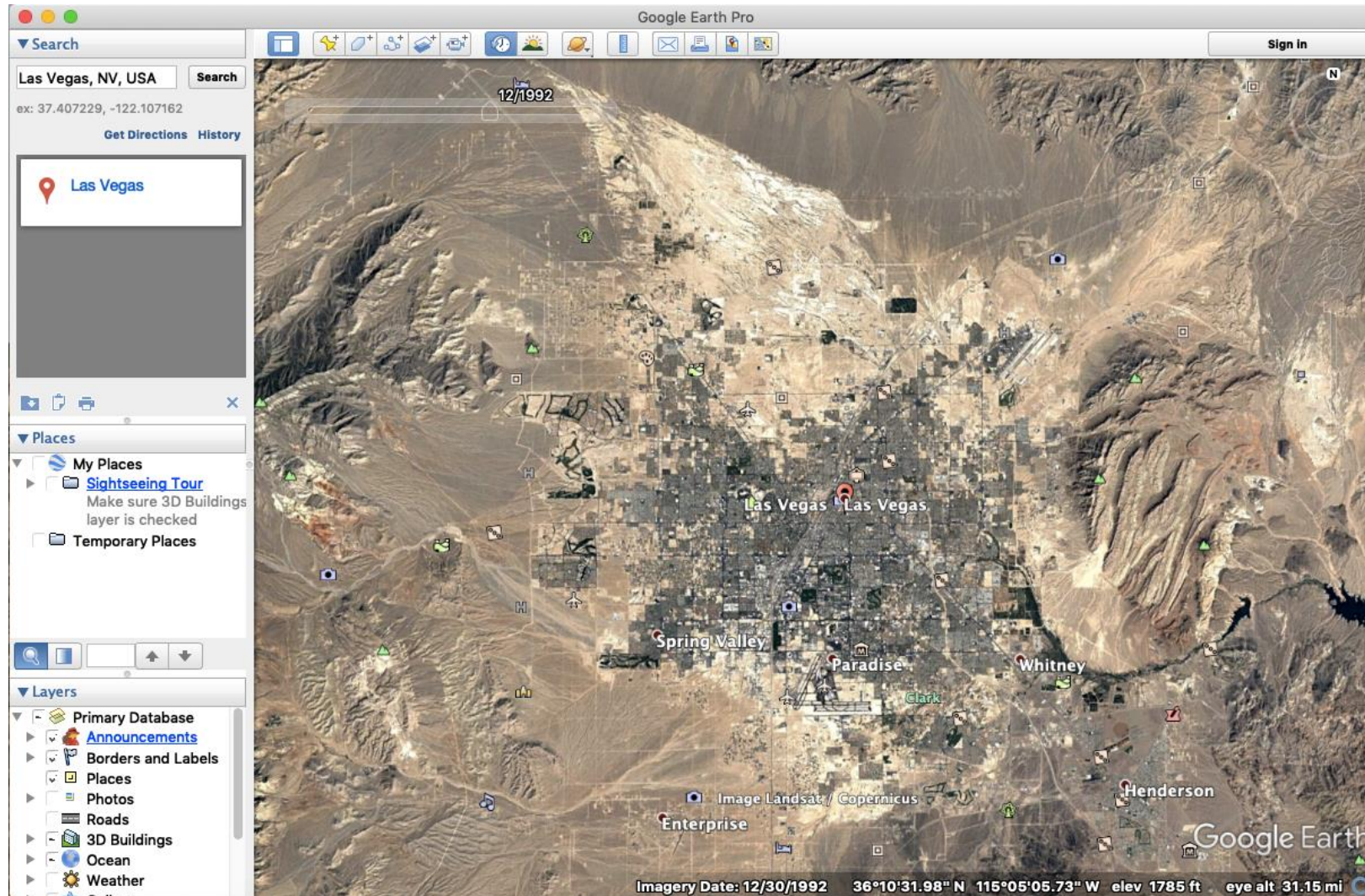
Las Vegas 2016



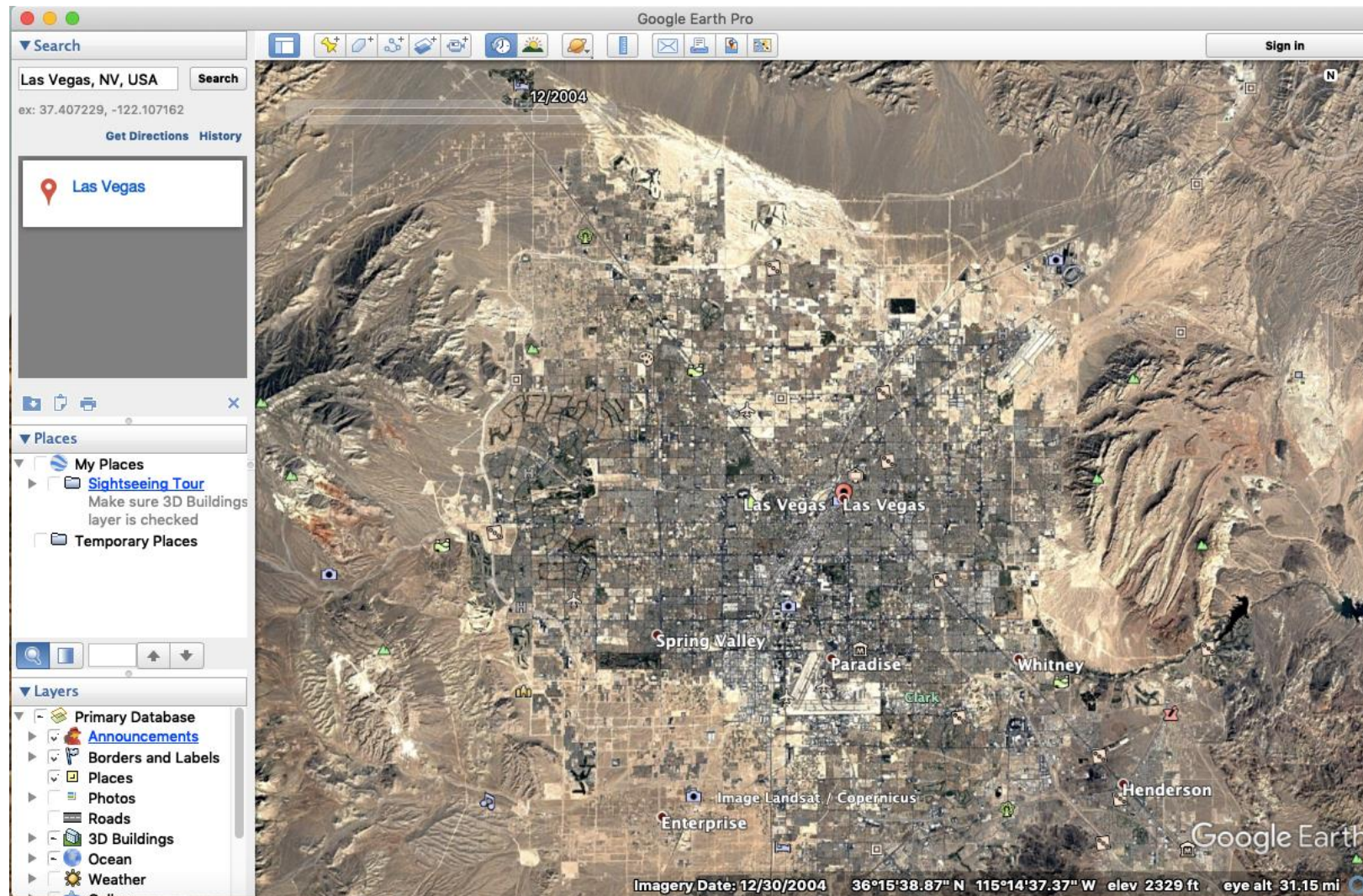
Las Vegas 1984



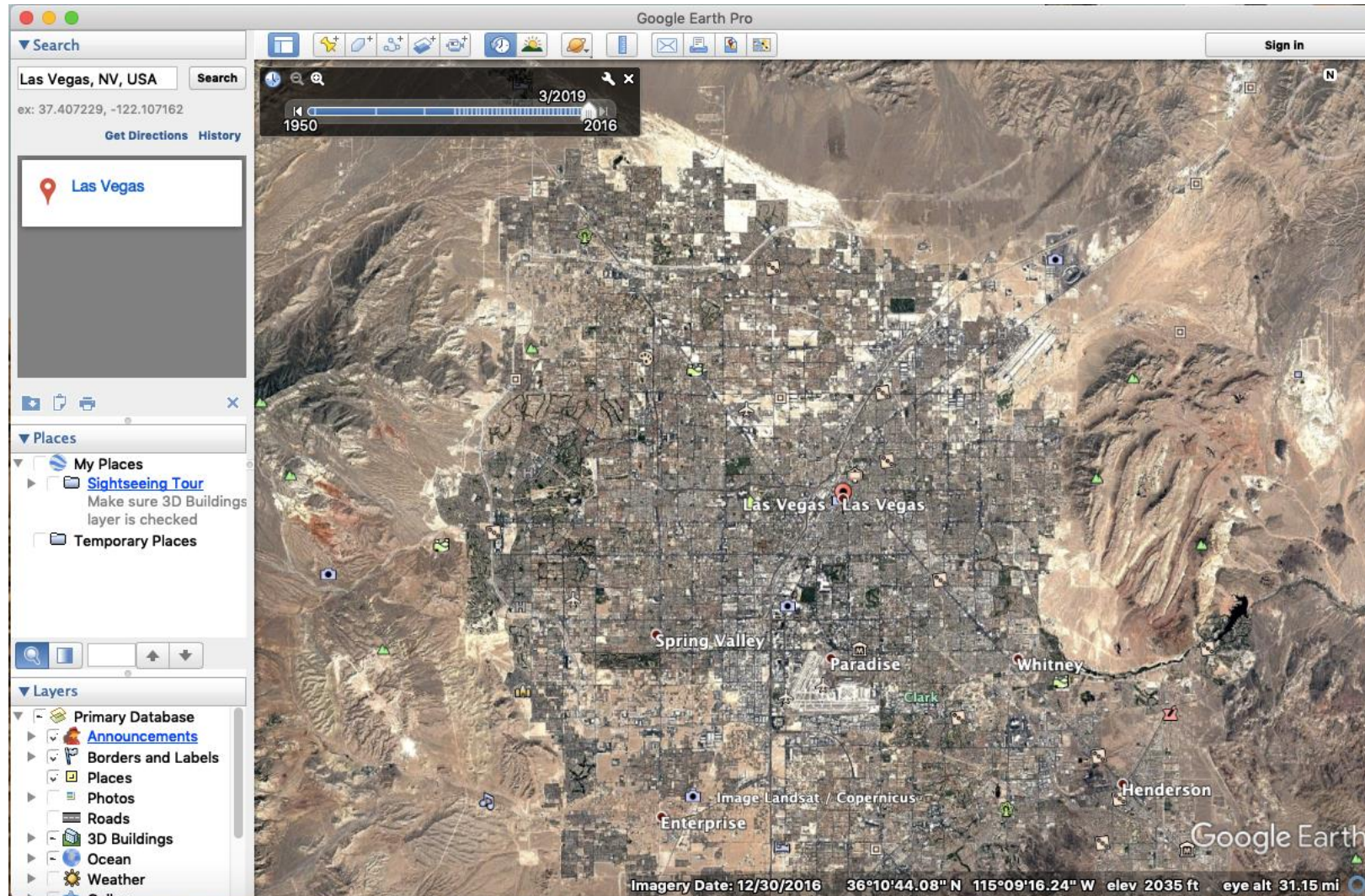
Las Vegas 1992



Las Vegas 2004



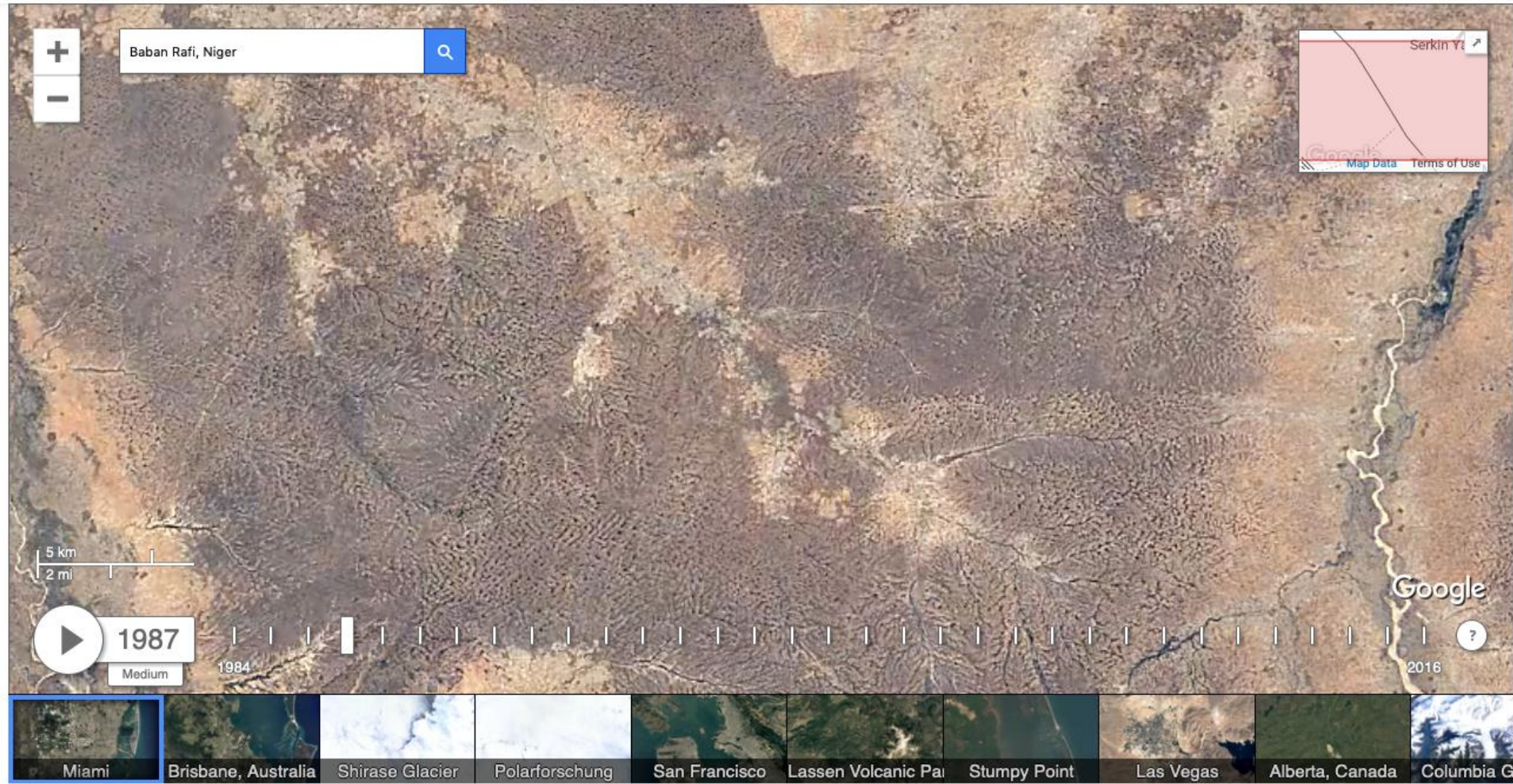
Las Vegas 2016



Google Earth Engine Timelapse: Bosque Baban Rafi, Níger

Google Earth Engine

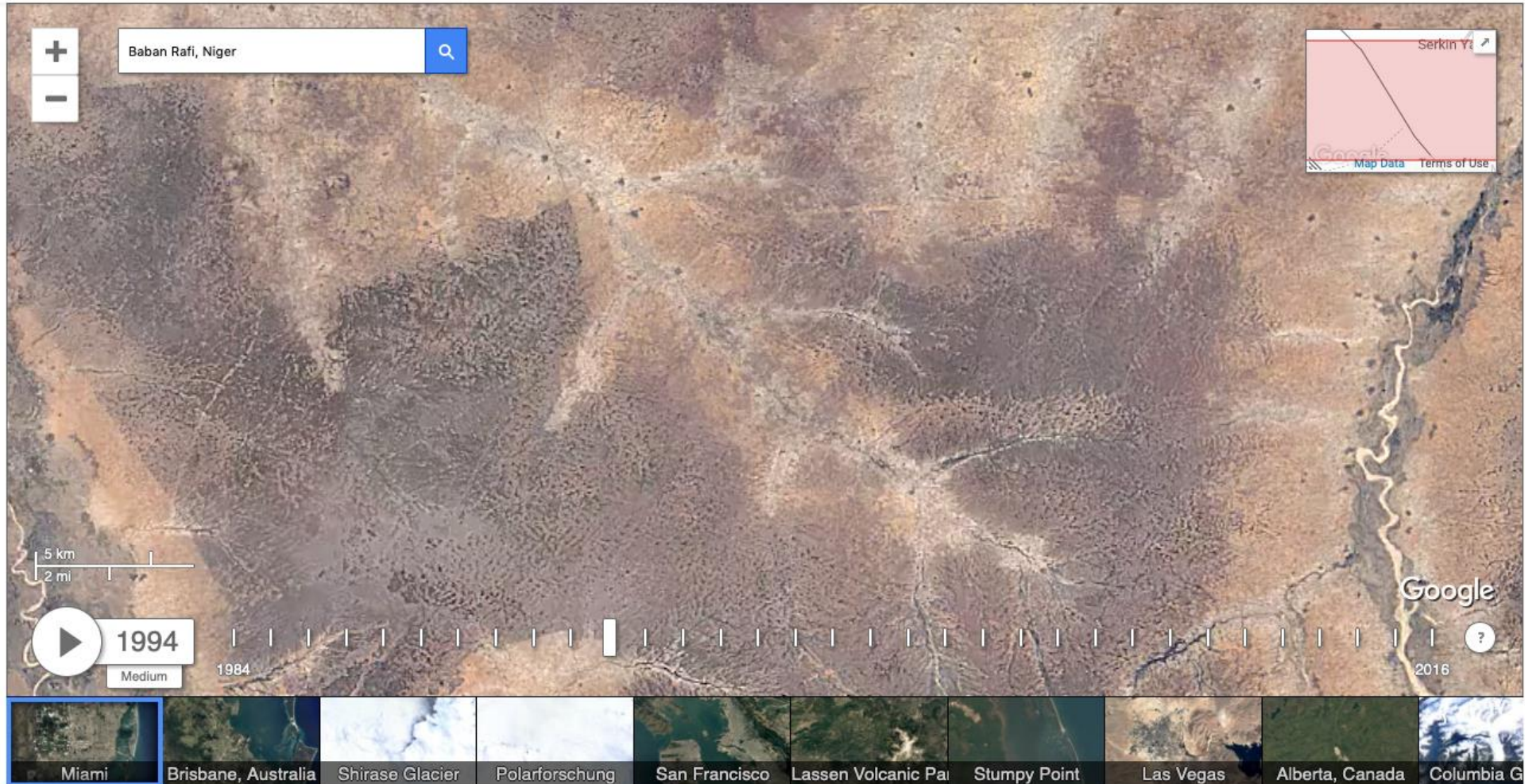
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Google Earth Engine Timelapse: Bosque Baban Rafi, Níger

Google Earth Engine

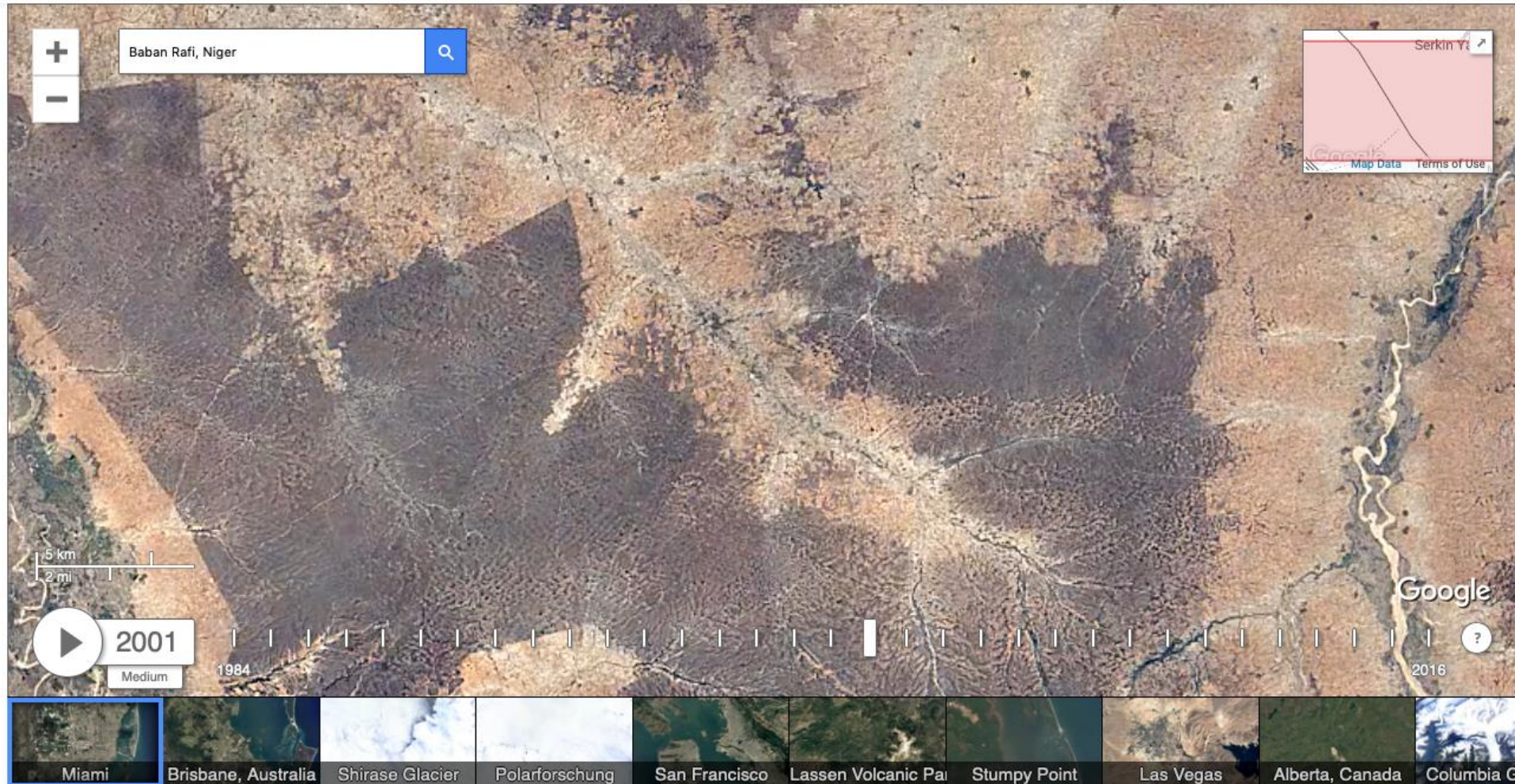
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Google Earth Engine Timelapse: Bosque Baban Rafi, Níger

Google Earth Engine

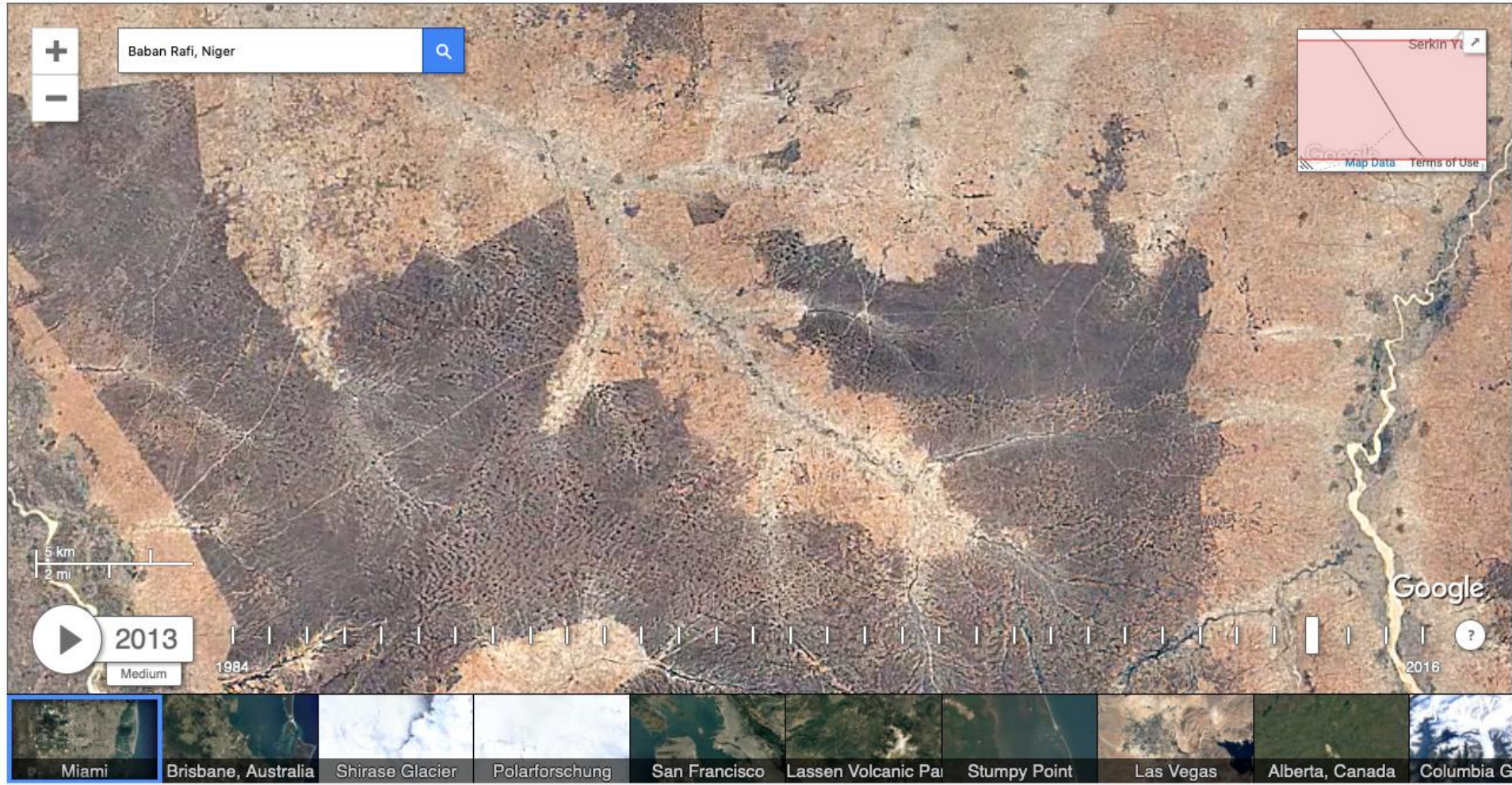
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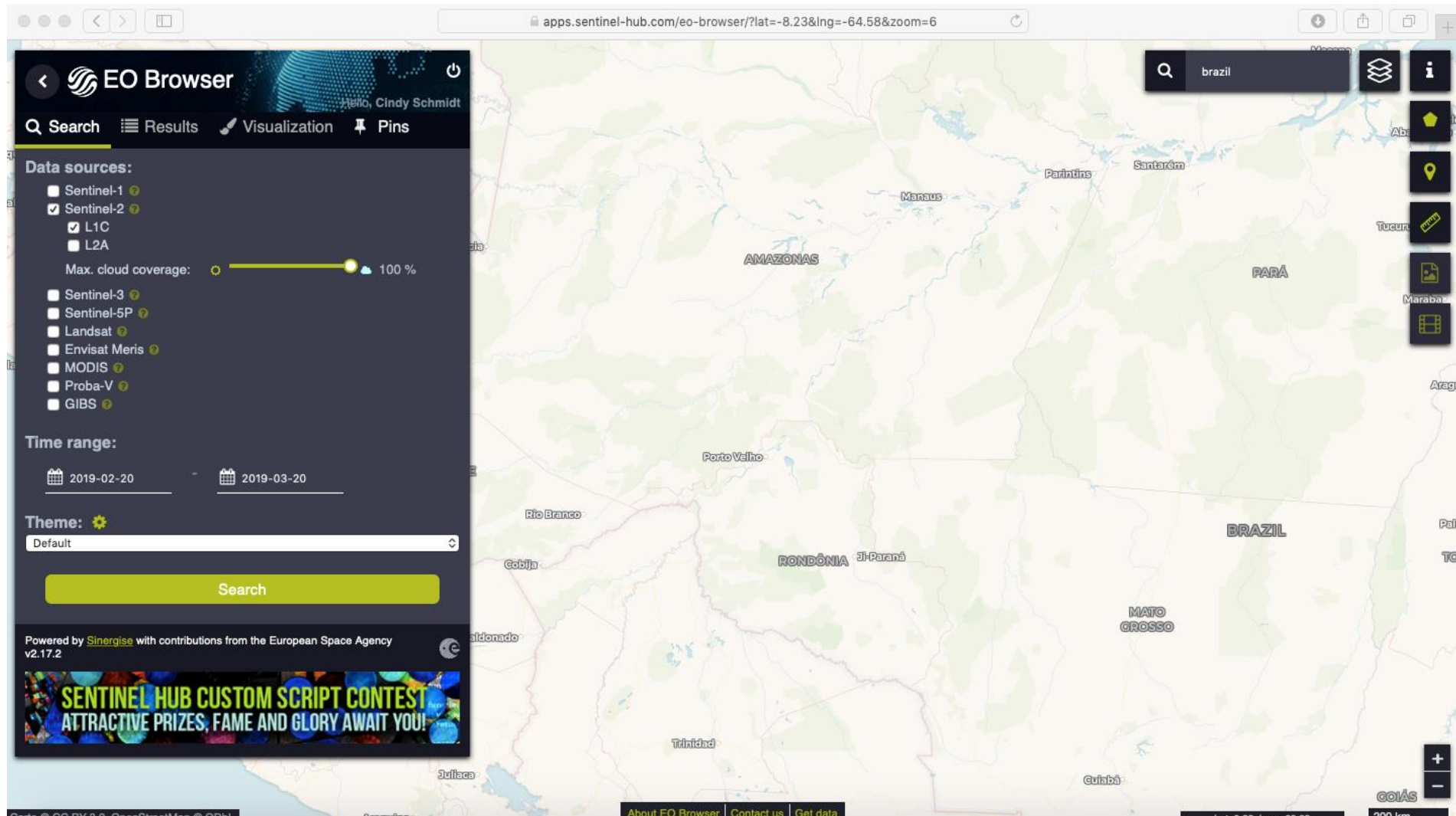
Google Earth Engine Timelapse: Bosque Baban Rafi, Níger

Google Earth Engine

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Sentinel Hub EO Browser: Brasil



Sentinel Hub EO Browser: Brasil

The screenshot displays the Sentinel Hub EO Browser interface. The browser address bar shows the URL: `apps.sentinel-hub.com/eo-browser/?lat=-8.23&lng=-64.58&zoom=6`. The interface includes a search bar with the text "brazil" and a "Results" panel on the left. The "Results" panel shows 50 results, with three visible entries:

- Result 1:** 2019-03-19, 15:24:02 UTC, 1.71 % cloud cover, EPSG:4326, 18LVK. Includes a "Visualize" button.
- Result 2:** 2019-03-19, 14:43:03 UTC, 2.54 % cloud cover, EPSG:4326, 20LNL. Includes a "Visualize" button.
- Result 3:** 2019-03-19, 14:41:27 UTC, 0.63 % cloud cover, EPSG:4326, 20LQH. Includes a "Visualize" button.

The main map area shows a satellite view of Brazil with several blue rectangular overlays indicating search areas. Labels on the map include "AMAZONAS", "PARÁ", "RONDÔNIA", "MATO GROSSO", "Manaus", "Parintins", "Santarém", "Porto Velho", "Rio Branco", "Gobjira", "Trindade", "Guinabá", and "Goiás". The interface also features a navigation toolbar on the right and a footer with the text "Powered by Sinergise with contributions from the European Space Agency v2.17.2" and a banner for the "SENTINEL HUB CUSTOM SCRIPT CONTEST".

Sentinel Hub EO Browser: Brasil

The screenshot displays the Sentinel Hub EO Browser interface. The left sidebar shows search results for 'brazil', listing three satellite images from 2019-03-19. The main map area shows a satellite view of Brazil with several blue rectangular overlays indicating search areas. A red circle highlights the 'Time Lapse' icon in the right-hand toolbar. The URL in the browser address bar is `apps.sentinel-hub.com/eo-browser/?lat=-8.23&lng=-64.58&zoom=6`.

Results

Showing 50 results. [Clear data](#)

- 2019-03-19
15:24:02 UTC
1.71 %
EPSG:4326
18LVK
[Visualize](#)
- 2019-03-19
14:43:03 UTC
2.54 %
EPSG:4326
20LNL
[Visualize](#)
- 2019-03-19
14:41:27 UTC
0.63 %
EPSG:4326
20LQH
[Visualize](#)

Powered by [Sinergise](#) with contributions from the European Space Agency v2.17.2

SENTINEL HUB CUSTOM SCRIPT CONTEST
ADAPTIVE DDT7C FAME AND GLORY AWAIT YOU!

Crear animación del intervalo de tiempo (time lapse)

Sentinel Hub EO Browser: Brasil

Timelapse

2014-02-01 - 2019-03-19

20 % Select All

- 2015-09-16
- 2015-10-06
- 2016-01-04
- 2016-02-03
- 2016-02-16
- 2016-03-04
- 2016-03-17
- 2016-04-03
- 2016-04-13

2016-04-03

20 km

OpenGIS SENTINEL Hub

Speed: 1 frames / s 1 / 122: 2016-04-03 Download

Sentinel Hub EO Browser: Brasil

The screenshot displays the Sentinel Hub EO Browser interface for a timelapse of a satellite image of Brazil. The interface is divided into several sections:

- Top Left:** A date range selector showing "2014-02-01" and "2019-03-19" with calendar icons. This area is circled in red. Below it is a "Seleccionar intervalo" label.
- Left Panel:** A vertical list of image dates with corresponding thumbnails. The dates include 2015-09-16, 2015-10-06, 2016-01-04, 2016-02-03, 2016-02-16, 2016-03-04, 2016-03-17, 2016-04-03 (highlighted with a green checkmark), and 2016-04-13 (also with a green checkmark).
- Main Image:** A large satellite image of a forested area, dated "2016-04-03". A scale bar indicates "20 km". Logos for "Copernicus" and "SENTINEL Hub" are visible in the bottom right corner of the image.
- Bottom Panel:** Playback controls including a play button, "Speed: 1 frames / s", a progress bar, "1 / 122: 2016-04-03", and a "Download" button.

Sentinel Hub EO Browser: Brasil

Timelapse

2014-02-01 - 2019-03-19

Seleccionar cobertura nubosa

Select All

20%

2015-09-16

2015-10-06

2016-01-04

2016-02-03

2016-02-16

2016-03-04

2016-03-17

2016-04-03

2016-04-13

20 km

OpenGIS SENTINEL Hub

Speed: 1 frames / s

1 / 122: 2016-04-03

Download

Sentinel Hub EO Browser: Brasil

Timelapse

2014-02-01 - 2019-03-19

20 % Select All

- 2015-09-16
- 2015-10-06
- 2016-01-04
- 2016-02-03
- 2016-02-16
- 2016-03-04
- 2016-03-17
- 2016-04-03
- 2016-04-13

Seleccionar imágenes

20 km

Openeo SENTINEL Hub

Speed: 1 frames / s 1 / 122: 2016-04-03 Download

Sentinel Hub EO Browser: Brazil

Timelapse

2014-02-01 - 2019-03-19

20 % Select All

- 2015-09-16
- 2015-10-06
- 2016-01-04
- 2016-02-03
- 2016-02-16
- 2016-03-04
- 2016-03-17
- 2016-04-03
- 2016-04-13

2016-04-03

20 km

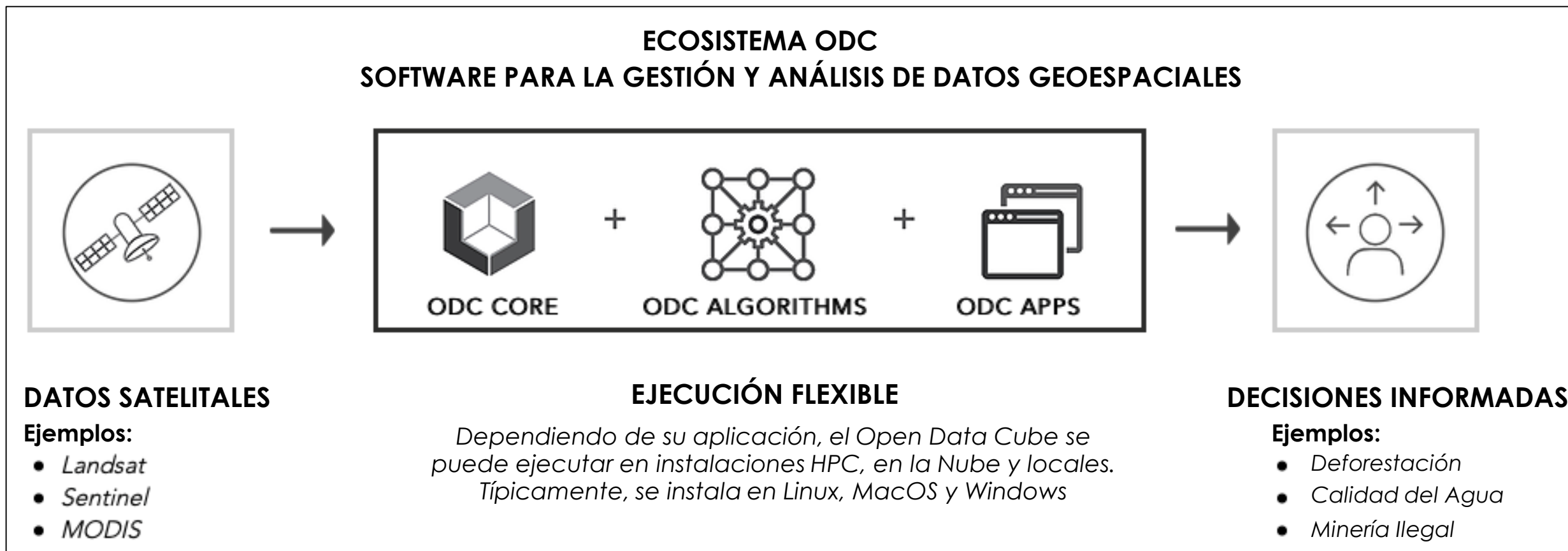
OpenGIS SENTINEL Hub

Reproducir animación

Speed: 1 frames / s 1 / 122: 2016-04-03 Download

Open Data Cube

- Proyecto de Software de fuente abierta para la gestión y análisis de datos geoespaciales



<https://www.opendatacube.org>

Africa Regional Data Cube

- Fue desarrollado para abordar los Objetivos de Desarrollo Sostenibles (ODSs)
- Fue desarrollado por el Comité sobre Observaciones de la Tierra (CEOS por sus siglas en inglés) en colaboración con el Grupo de Observaciones de la Tierra (GEO por sus siglas en inglés), Amazon Web Services y la Universidad de Strathmore en Kenia



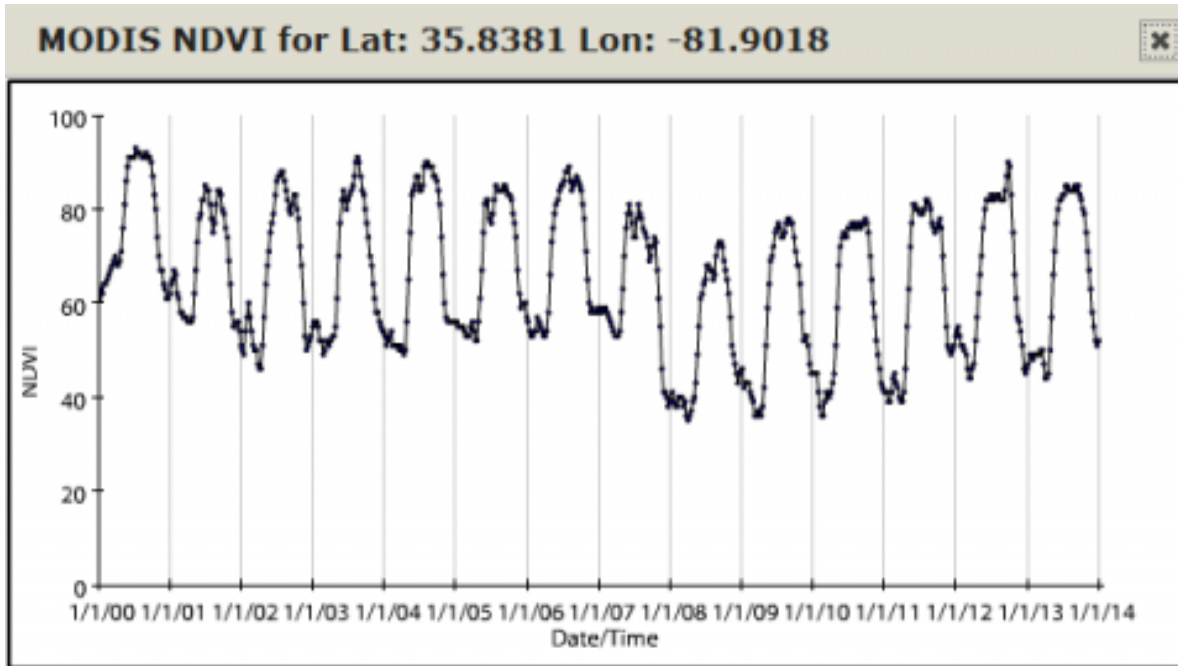
Africa Regional Data Cube

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Representación Gráfica de Series Temporales

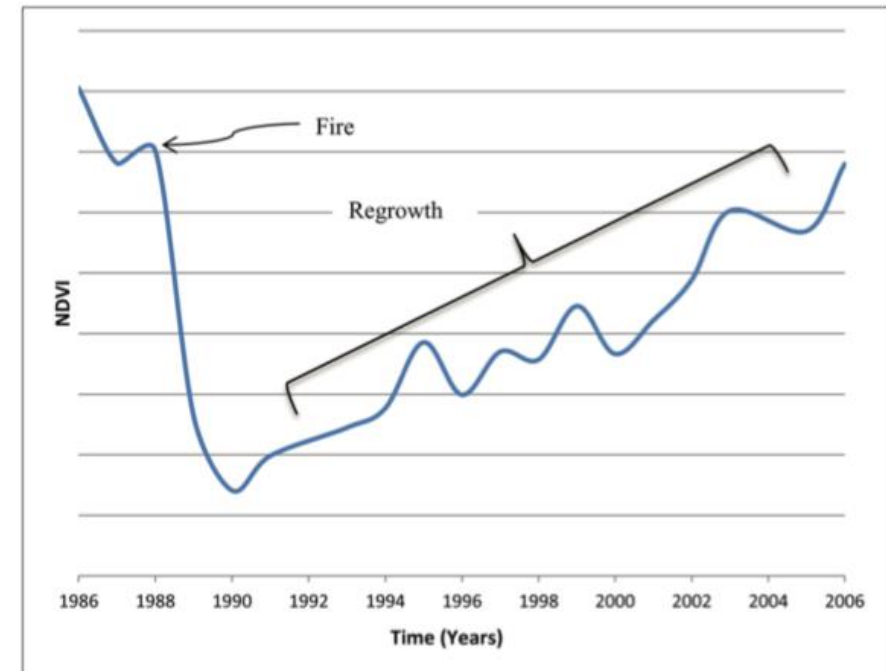
- Fenología: NDVI Mensual



¿Cuáles son las tendencias?

- Máx., mín., o medio anual

- Disturbios: Tendencias Anuales

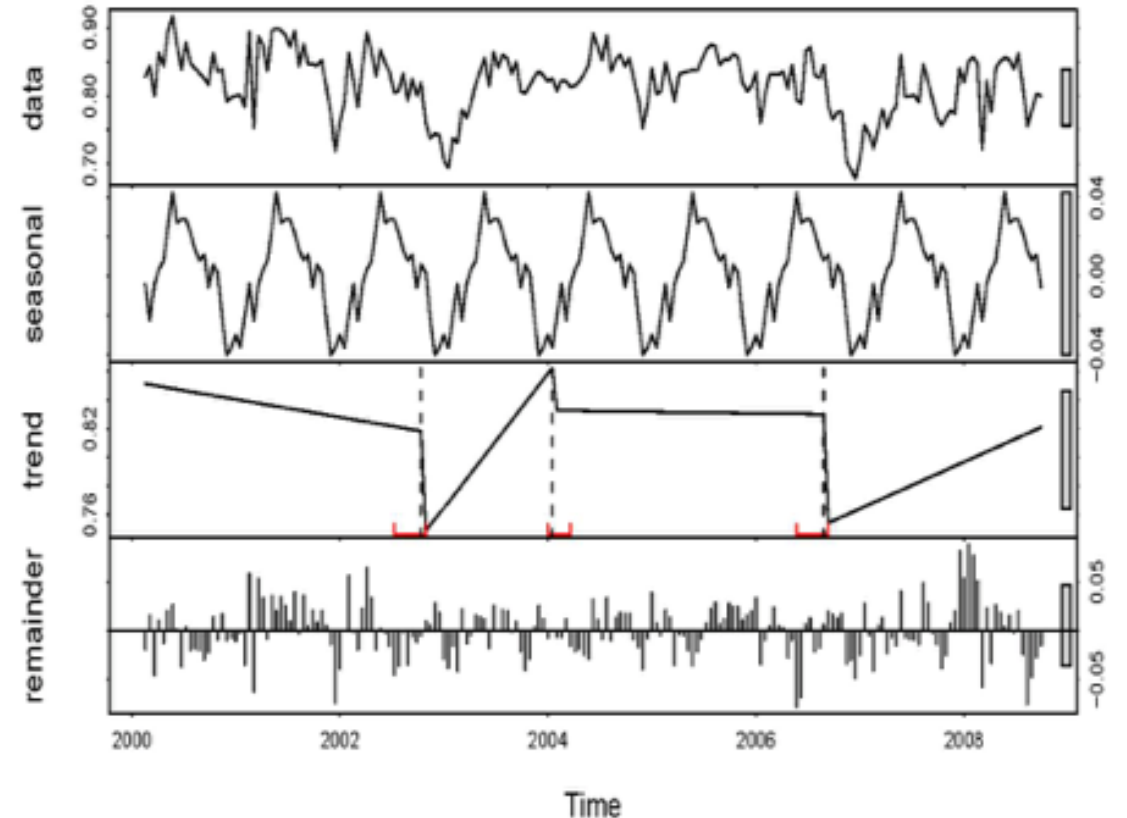


Cambios en los valores NDVI entre 1986 y 2006 para un sitio en el Parque Nacional Yellowstone

Método “Breaks for Additive Seasonal and Trend* (BFAST)

- Descompone datos satelitales de series temporales en componentes de tendencias, estacionales y restantes
- Permite identificar la ubicación y el momento de los cambios
- Disponible como paquete R:
<http://bfast.r-forge.r-project.org>

Serie temporal NDVI de una plantación de pinos



*Descomposiciones para Estacional Aditivo y Tendencias en inglés

Reference: Verbesselt, J. et al. (2010). Detecting trend and seasonal changes in satellite image time series. Remote Sensing of Environment 114 (1): 106-115

Application for Extracting and Exploring Analysis Ready Samples (AppEEARS)

(Aplicación para Extraer y Explorar Muestras Listas Para el Análisis)

Land Processes Distributed Active Archive Center (LP DAAC) (Centro de Archivos Activos Distribuidos de Procesos del Suelo)

Interfaz en línea para acceder, procesar y visualizar productos de datos geoespaciales

The screenshot displays the AppEEARS web application interface. At the top, there is a navigation bar with 'Extract', 'Explore', and 'Help' options, along with a 'Sign In' button. The main content area is divided into several sections:

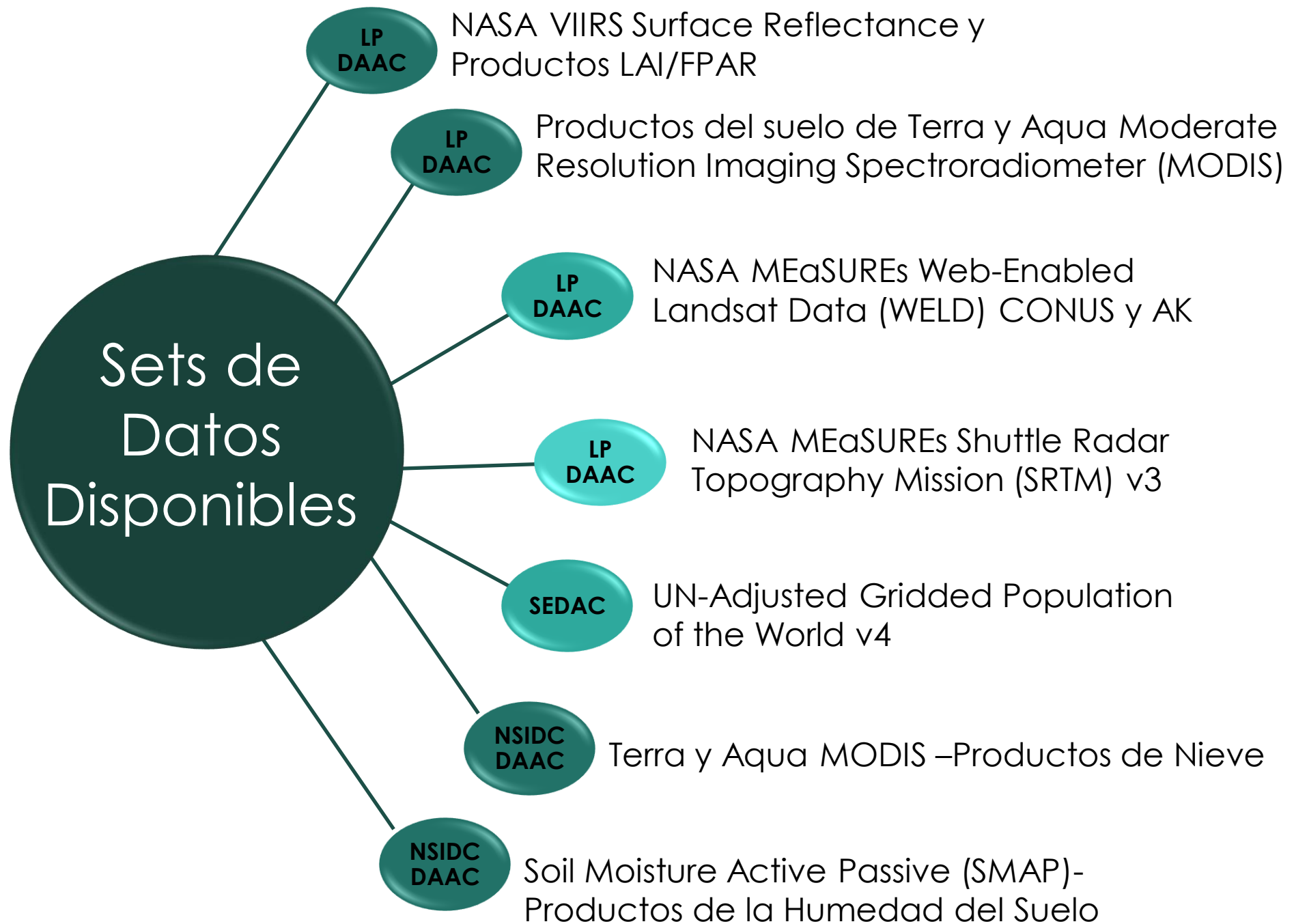
- Welcome to AppEEARS!**: A central banner with the application's name and a brief description: "Application for Extracting and Exploring Analysis Ready Samples (AppEEARS)".
- Extract Area Sample**: A panel on the left with input fields for 'Enter a name to identify your sample', 'Start Date', and 'End Date'. It includes a map showing a geographic area with red markers.
- Extract Point Sample**: A panel on the right with input fields for 'Enter a name to identify your sample', 'Start Date', and 'End Date'. It includes a map showing a specific point location with a blue dot.
- View Area Sample**: A panel at the bottom left showing a map and a 'View Area Sample' button.
- View Point Sample**: A panel at the bottom right showing a 'View Point Sample' button and a 'View Time Series' button.

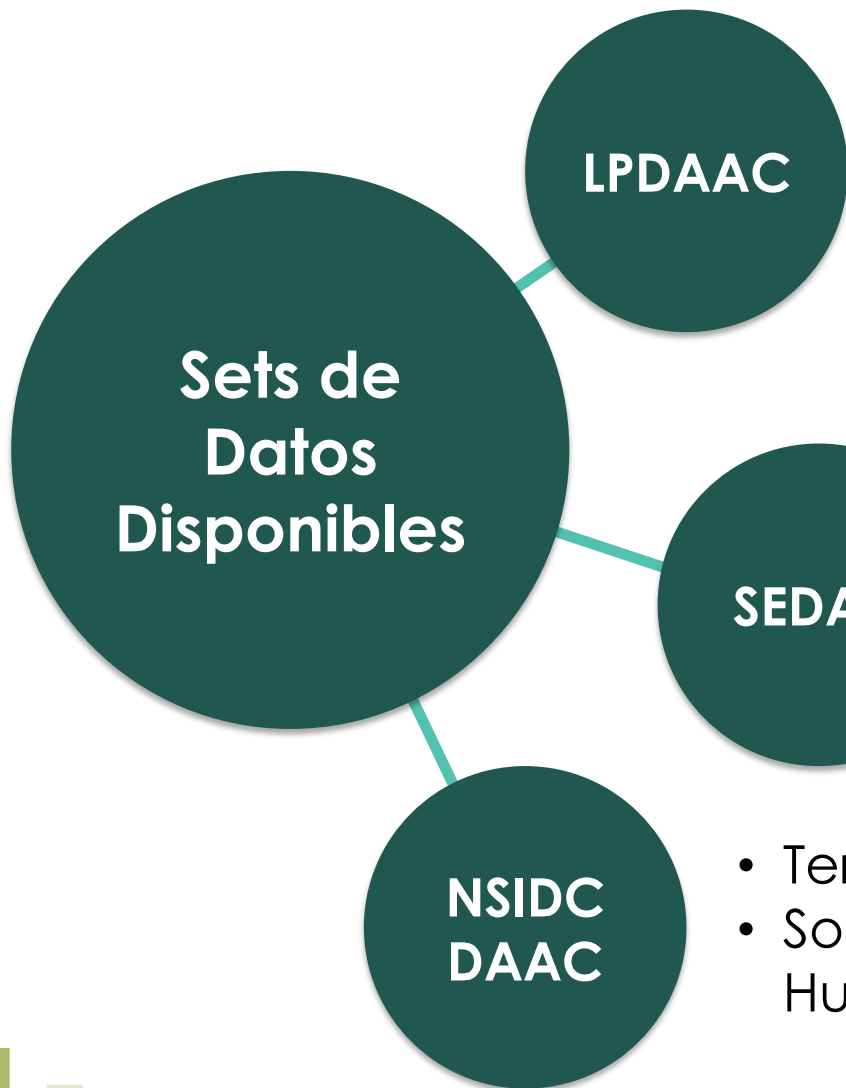
Below the main interface, there are several smaller screenshots showing data visualizations:

- A 'Time Series' plot showing data points over time.
- A 'Scatter Plot' showing data points in a 2D space.
- A 'Box Plot' showing the distribution of data across categories.
- A 'Stacked Area Chart' showing multiple data series over time.

A central text box contains the AppEEARS logo and the URL: <https://lpdaacsvc.cr.usgs.gov/appeears/>

<https://lpdaacsvc.cr.usgs.gov/appeears/>





- NASA VIIRS Surface Reflectance y Productos LAI/FPAR
- Productos del Suelo de Terra y Aqua Moderate Resolution Imaging Spectroradiometer (MODIS)
- NASA MEaSUREs Web-Enabled Landsat Data (WELD) CONUS y AK
- NASA MEaSUREs Shuttle Radar Topography Mission (SRTM) v3

- UN-Adjusted Gridded Population of the World v4

- Terra y Aqua MODIS – Productos de Nieve
- Soil Moisture Active Passive (SMAP) – Productos de la Humedad del Suelo

Sets de Datos Disponibles

LPDAAC

NASA VIIRS Surface Reflectance y Productos LAI/FPAR

LPDAAC

Productos del Suelo de Terra y Aqua Moderate Resolution Imaging Spectroradiometer (MODIS)

LPDAAC

NASA MEaSUREs Web-Enabled Landsat Data (WELD) CONUS y AK

LPDAAC

NASA MEaSUREs Shuttle Radar Topography Mission (SRTM) v3

SEDAC

UN-Adjusted Gridded Population of the World v4

NSIDC DAAC

Terra y Aqua MODIS – Productos de Nieve

NSIDC DAAC

Soil Moisture Active Passive (SMAP) Soil Moisture Products



Area Sample
Point Sample

Welcome to AppEEARS!

Application for **E**xtracting and **E**xploring **A**nalysis **R**eady **S**amples (**AppEEARS**)

The Application for Extracting and Exploring Analysis Ready Samples (**AppEEARS**) offers a simple and efficient way to access and transform geospatial data from a variety of federal data archives. AppEEARS enables users to subset **geospatial datasets** using spatial, temporal, and band/layer parameters. Two types of sample requests are available: **point samples** for geographic coordinates and **area samples** for spatial areas via vector polygons. Sample requests submitted to AppEEARS provide users not only with data values, but also associated quality data values. Interactive visualizations with summary statistics are provided for each sample within the application, which allow users to preview and interact with their samples before downloading their data. Get started with a sample request using the Extract option above, or visit the [Help page](#) to learn more.



Extract Point Sample



Start a new request



Copy a previous request

- [Beetle 3](#) i
- [Beetle 2](#) i
- [Beetle1](#) i
- [point sample july](#) i
- [Point Example](#) i



Upload a request file

Drop a JSON file containing the request to copy or [click here](#) to select the file.

JSON request files (*.request.json) are included in the download bundle available from any AppEEARS requests.

Extract Point Sample

Enter a name to identify your sample

Upload coordinates from a file

Drop a CSV file containing the coordinates or [click here](#) to select the file. Coordinates can also be entered manually in the uploaded coordinates box.

The CSV file can contain up to 4 columns separated by commas with each coordinate on a separate line.

1. ID (*optional*) - uniquely identifies the coordinate
2. Category (*optional*) - label to group common coordinates
3. Latitude - latitude in decimal degrees (-90 to 90)
4. Longitude - longitude in decimal degrees (-180 to 180)

Uploaded coordinates (ID, Category, Lat, Long): 0

Upload or enter the coordinates to include in the sample (e.g. US-Ha1, DBF, 42.5378, -72.1715)

Start Date



End Date ⓘ



Is Date Recurring?

Selected coordinates





Add coordinates using the 📍 tool. View coordinate details by clicking the markers on the map.

Select the layers to include in the sample ⓘ

Selected layers

Select the layers to include in the sample

▶ Submit

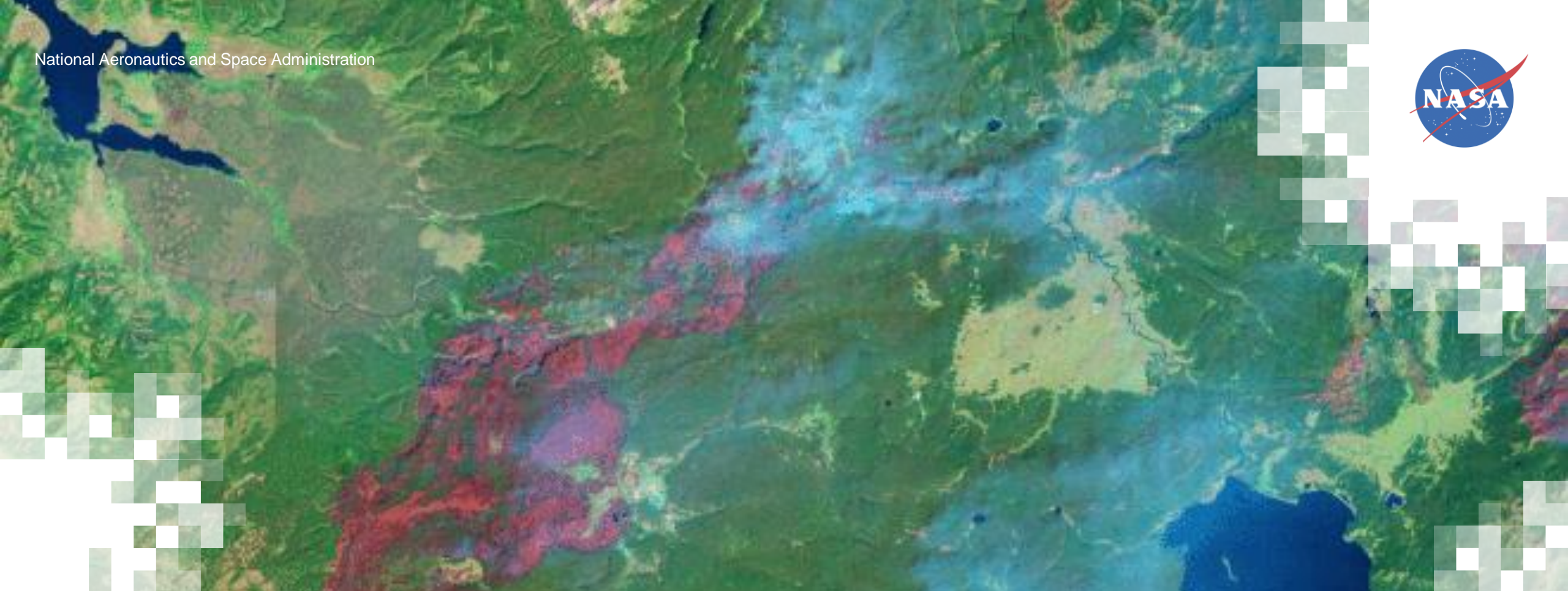
✕ Cancel

¡¡¡Comencemos!!!



Contactos

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Gracias

Sesión 2: jueves 17 de abril, Algoritmos de Series Temporales y LandTrendr

15/04/2019