

ARSET

Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

 @NASAARSET

How Can Health Professionals Use NASA Data: Acquiring and Using Environmental Data for Health Applications

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June 1, 2017

Outline

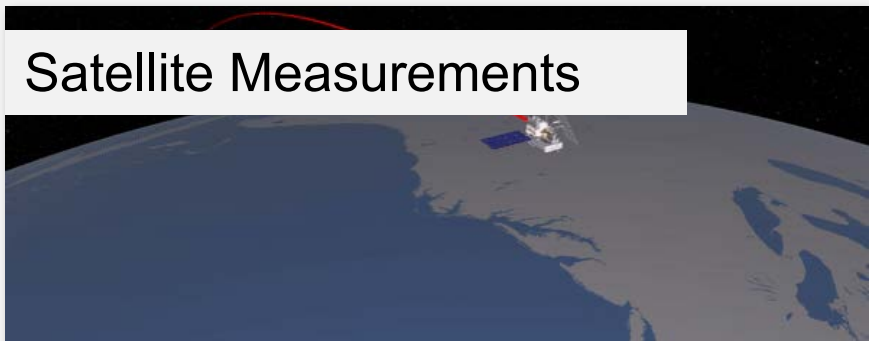
- Working with the Environmental Public Health Community
- Project Examples
- You have a health issue and want to determine if remote sensing data can be beneficial
- Acquiring remote sensing data
- Acquiring health data
- Linking remote sensing and health data
- Homework

| Challenges Working with the Environmental Public Health Community (International & Domestic)

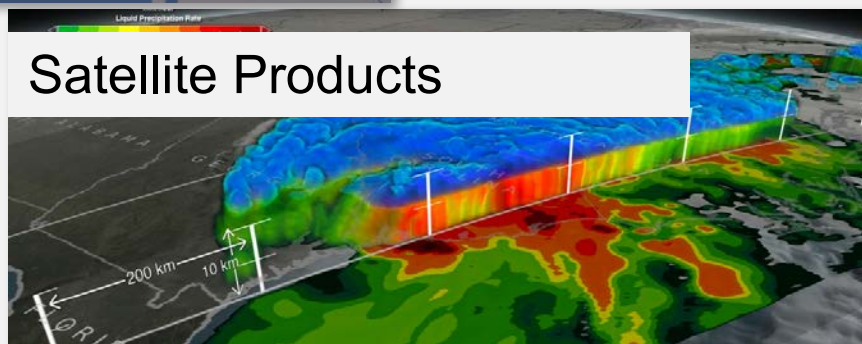
- Sharing data between agencies with different missions and mindsets
- Protecting confidentiality of information
- Ensuring high quality geocoded data
- Ensuring appropriate spatial and temporal resolution of environmental data
- Developing sound resources and methods for conducting data linkages and data analysis

Observations to Applications

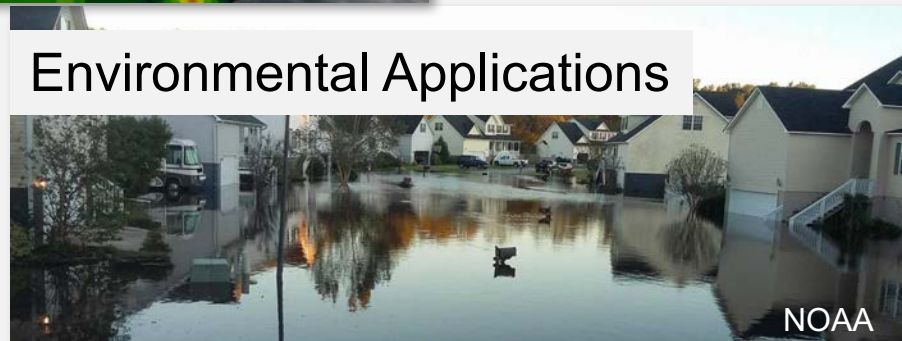
Satellite Measurements



Satellite Products



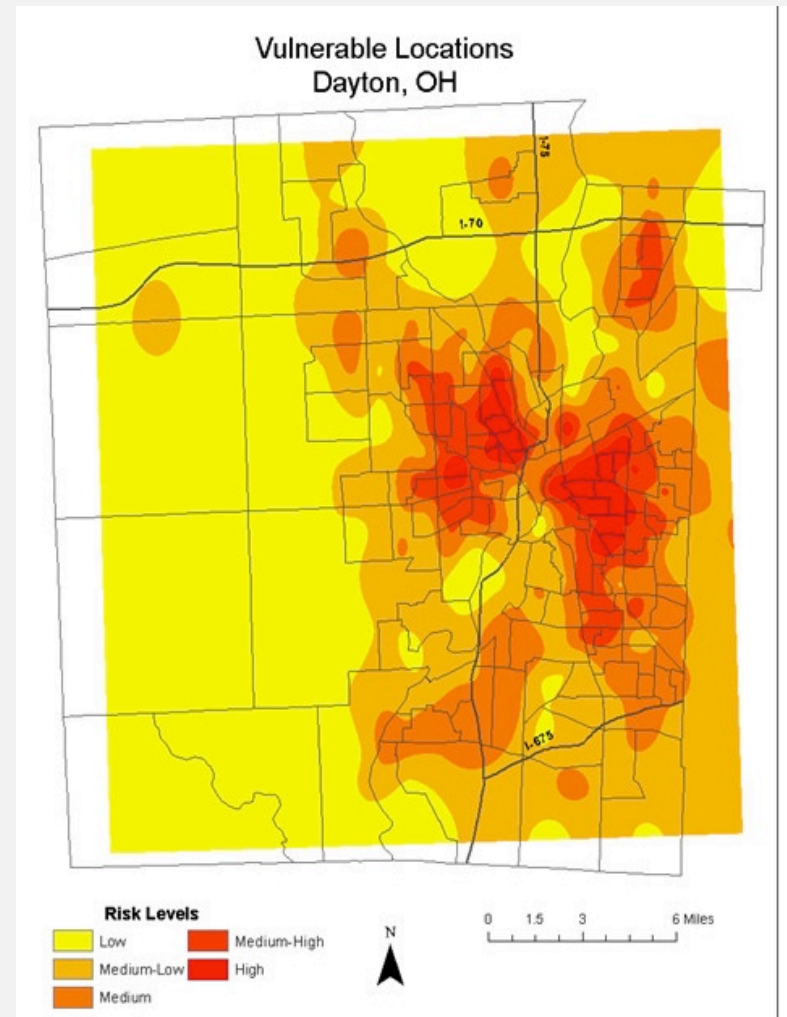
Environmental Applications



Examples of Data Applications

Environmental Public Health

- Remote sensing and modeling data, along with other sources of data, are used for a variety of applications, either:
 - directly
 - in statistical or physical modeling tools
- Remotely sensed data can be used:
 - to identify the hottest areas
 - improve identification of locations most vulnerable during extreme heat events

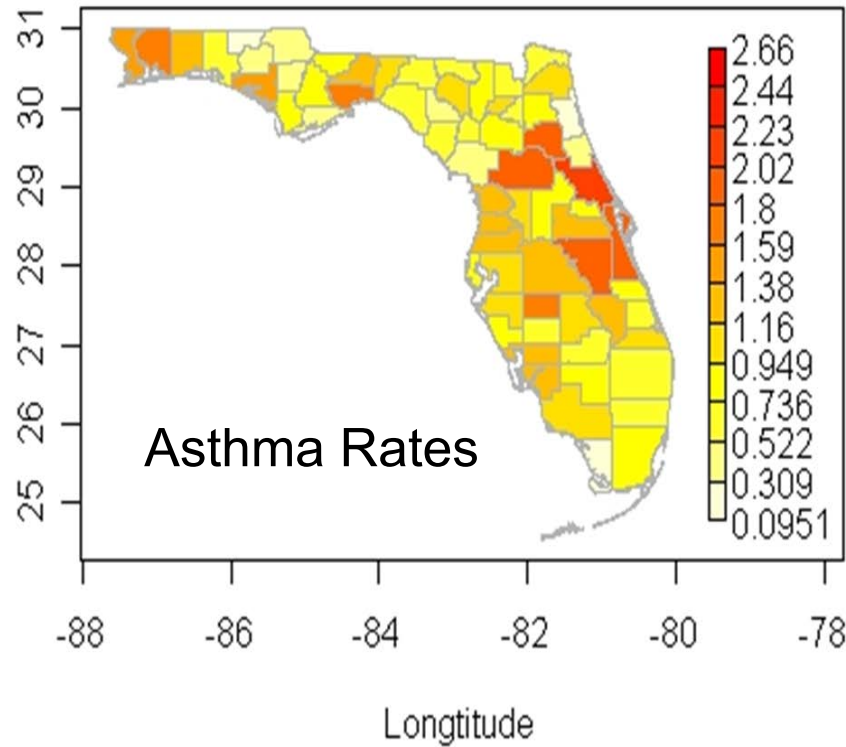


Examples of Data Applications

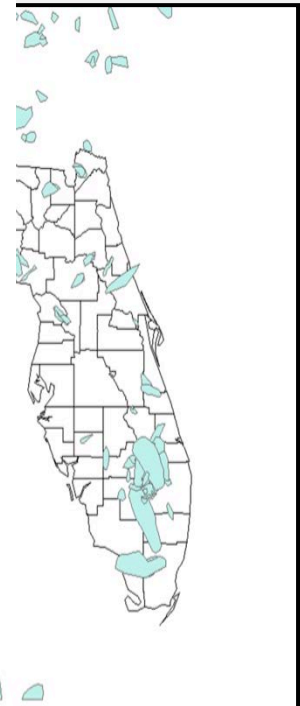
Fires, Smoke, and Public Health

- This environmental data can be combined with public health data to evaluate the effects of fires on air quality in Florida or other U.S. regions

2007 MODIS

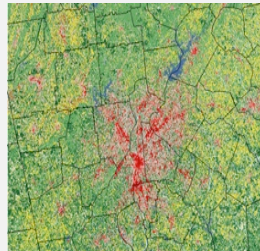


Smoke Plumes

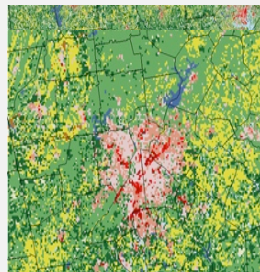


Examples of Data Applications

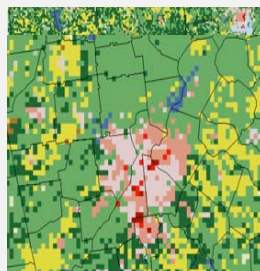
Relationship Between Living Environment and Blood Pressure



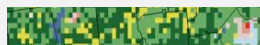
Landsat 30 m



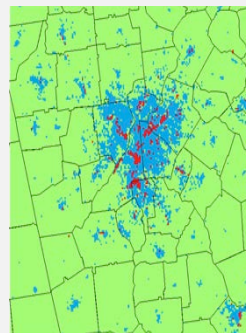
Landsat 1 km



Landsat 3 km



Landsat data was used at the native resolution of 30 m and resampled at other resolution to determine the optimal scale to distinguish urban, suburban, and rural living environments in the metropolitan Atlanta region



Living Environment	Mean SBP	Mean DBP
Urban	131±0.54	78±0.31
Suburban	127±0.42	77±0.24
Rural	127±0.76	76±0.44
<i>p-Value</i>	<i><0.0001</i>	<i>>0.0001</i>

Health Problem

- What question or questions are you trying to answer?
- What type environmental data products do you need that NASA could provide?
 - Land Cover/Land Use: blood pressure
 - Vegetation Extent: urban heating/heat stroke
 - Slope: natural disasters/landslides
 - Air Quality: respiratory illnesses
 - Water Quality (fresh or marine): red tides, respiratory, gastrointestinal illnesses
 - Precipitation: flooding and disasters
 - Soil Moisture: mosquito, vector borne diseases
 - Land Surface Temperature: extreme heat

Acquiring Remotely Sensed Data

- NASA
 - Reverb – ECHO NASA <https://reverb.echo.nasa.gov/reverb>
 - EARTHDATA (EOSDIS)
 - Browse and download processed data
- USGS
 - Global Visualization Viewer (GloVis)
 - Earth Explorer (USGS)

Reverb

<http://reverb.echo.nasa.gov/reverb/>

- Next generation metadata and service discovery tool
- Developed using modern web development technologies and presents you with an interface for discovering Earth Science data
- Updated on a monthly basis taking into account your user feedback and other, currently planned enhancements



Spatial & Temporal Search

The screenshot displays the EODIS (Earth Observing Data and Information System) interface, part of NASA's Earth Observing System. The header includes the NASA logo and the text "National Aeronautics and Space Administration". The main title is "EODIS NASA's Earth Observing System Data and Information System". The right side of the header features the "Reverb | ECHO" logo and the tagline "The Next Generation Earth Science Discovery Tool".

The interface is divided into several sections:

- Search Options:** A sidebar on the left containing links for "Spatial", "Search Terms", "Temporal", "Platforms & Instruments", "Campaigns", "Processing Levels", and "Science Keywords". It also includes a "Feedback?" button and a "Search by ESRI shape file" link.
- Step 1: Select Search Criteria:** The main search area, divided into "Spatial Search" and "Search Terms".
 - Spatial Search:** Includes a "Bounding Box" input field with the coordinates "23.886, -74.531, 40.286, -92.285". Below this is a map showing the search area over the Atlantic Ocean. A "Satellite" dropdown menu is visible. A "Reset" and "Clear" button are present.
 - Search Terms:** Includes a text input field with the example "e.g. MODIS Fire AST_LIA" and a "Clear" button. A link "Try out this query in Earthdata Search" is also present.
 - Temporal Search:** Includes "START" and "END" date range inputs. The "START" date is "2016-09-16 00:00:00" and the "END" date is "2017-04-16 23:59:59". Both have "Clear" buttons. A note states "* all times must be specified in GMT".
- Step 2: Select Datasets:** A list of datasets is displayed, including "1:100,000-scale Digital Line Graphs (DLG) from the U.S. Geological Survey", "2000 Pilot Environmental Sustainability Index (ESI)", "2001 Environmental Sustainability Index (ESI)", "2002 Environmental Sustainability Index (ESI)", "2005 Environmental Sustainability Index (ESI)", and "2008 Environmental Performance Index (EPI)". Each entry shows the "Archive Center", "Short Name", and "Version".
- Step 3: Discover Granules:** A section at the bottom indicating "No Datasets Selected".

Science Key Words

The screenshot shows the ECHO Reverb interface with the following details:

- Header:** NASA National Aeronautics and Space Administration, ECHOS: NASA's Earth Observing System Data and Information System, Reverb | ECHO The Next Generation Earth Science Discovery Tool.
- Navigation:** ECHOS Home | Reverb Home | About | Tutorial | Shopping Cart (0) | Order Status | Service Request Status | Sign In.
- Search Options:**
 - Spatial:** Bounding Box: 23.888, -74.831, 40.288, -82.285.
 - Temporal:** Start: 2016-09-16 00:00:00, End: 2017-04-16 23:59:59.
 - Platforms & Instruments:** [7]
 - Campaigns:** [7]
 - Processing Levels:** [7]
 - Science Keywords:** HUMAN DIMENSIONS >> HUMAN HEALTH, HUMAN DIMENSIONS >> HUMAN HEALTH >> ANATOMICAL PARAMETERS, HUMAN DIMENSIONS >> HUMAN HEALTH >> DISEASES/EPIDEMICS, HUMAN DIMENSIONS >> HUMAN HEALTH >> PUBLIC HEALTH.
- Search by Science Keywords:**
 - Selecting a parent means all children are included in the search.
 - Search Terms: [7]
 - Temporal Search: [7]
 - Science Keywords: HUMAN DIMENSIONS >> HUMAN HEALTH, HUMAN DIMENSIONS >> HUMAN HEALTH >> ANATOMICAL PARAMETERS, HUMAN DIMENSIONS >> HUMAN HEALTH >> DISEASES/EPIDEMICS, HUMAN DIMENSIONS >> HUMAN HEALTH >> PUBLIC HEALTH.
 - Checkboxes: ☐ HABITAT CONVERSIONS/FRAGMENTATION, ☐ HABITAT CONVERSION/FRAGMENTATION, ☐ HABITAT CONVERSION/FRAGMENTATION, ☒ HUMAN HEALTH, ☒ ANATOMICAL PARAMETERS, ☒ DISEASES/EPIDEMICS, ☒ PUBLIC HEALTH, ☒ VITAL STATISTICS, ☐ HUMAN SETTLEMENTS, ☐ INFRASTRUCTURE, ☐ LAND USE/LAND COVER, ☐ NATURAL HAZARDS, ☐ POPULATION.
- Results:** Found 26 datasets. Total Query Time: 2.85s. List of datasets: 2000 PL, 2001 Environmental Sustainability Index (ESI), 2002 Environmental Sustainability Index (ESI), 2005 Environmental Sustainability Index (ESI), 2008 Environmental Performance Index (EPI), 2010 Environmental Performance Index (EPI).
- Step 3: Discover Granules:** No Datasets Selected.

The screenshot shows the ECHO Reverb interface with the following details:

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- Navigation:** ECHOS Home | Reverb Home | About | Tutorial | Shopping Cart (0) | Order Status | Service Request Status | Sign In.
- Search Options:**
 - Spatial:** Bounding Box: 23.888, -74.831, 40.288, -82.285.
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 - Platforms & Instruments:** [7]
 - Campaigns:** [7]
 - Processing Levels:** [7]
 - Science Keywords:** HUMAN DIMENSIONS >> HUMAN HEALTH, HUMAN DIMENSIONS >> HUMAN HEALTH >> ANATOMICAL PARAMETERS, HUMAN DIMENSIONS >> HUMAN HEALTH >> DISEASES/EPIDEMICS, HUMAN DIMENSIONS >> HUMAN HEALTH >> PUBLIC HEALTH.
- Search by Science Keywords:**
 - Selecting a parent means all children are included in the search.
 - Search Terms: [7]
 - Temporal Search: [7]
 - Science Keywords: HUMAN DIMENSIONS >> HUMAN HEALTH, HUMAN DIMENSIONS >> HUMAN HEALTH >> ANATOMICAL PARAMETERS, HUMAN DIMENSIONS >> HUMAN HEALTH >> DISEASES/EPIDEMICS, HUMAN DIMENSIONS >> HUMAN HEALTH >> PUBLIC HEALTH.
 - Checkboxes: ☐ LAND USE/LAND COVER, ☐ NATURAL HAZARDS, ☐ POPULATION, ☒ PUBLIC HEALTH, ☒ DISEASES/EPIDEMICS, ☒ ENVIRONMENTAL HEALTH FACTORS, ☒ MALNUTRITION, ☒ MORBIDITY, ☒ RADIATION EXPOSURE, ☐ SOCIAL BEHAVIOR, ☐ SOCIOECONOMICS, ☐ SOCIOECONOMICS.
- Results:** Found 26 datasets. Total Query Time: 2.85s. List of datasets: 2000 PL, 2001 Environmental Sustainability Index (ESI), 2002 Environmental Sustainability Index (ESI), 2005 Environmental Sustainability Index (ESI), 2008 Environmental Performance Index (EPI), 2010 Environmental Performance Index (EPI).
- Step 3: Discover Granules:** No Datasets Selected.

Science Key Words

The screenshot shows the EOSDIS Reverb/ECHO interface. A 'Search by Science Keywords' dialog box is open, displaying a list of science keywords. The keywords are organized into a tree structure under the heading 'List of Selected Keywords'. The keywords include: FROZEN GROUND, GEOMORPHIC LANDFORMS/PROCESSES, GEOMORPHOLOGY, LAND TEMPERATURE, LAND HEAT CAPACITY, LAND SURFACE TEMPERATURE (checked), SKIN TEMPERATURE, LAND USE/LAND COVER, LAND USE/LANDCOVER, LANDSCAPE, SOILS, and SURFACE RADIATIVE PROPERTIES. The background shows the 'Step 1: Select Search Criteria' section with a map and search options.

The screenshot shows the EOSDIS Reverb/ECHO interface with search results. The 'Step 1: Select Search Criteria' section is visible, showing a map and search options. The 'Step 2: Select Datasets' section displays a list of datasets, including 'Millennium Ecosystem Assessment: MA Population', 'MODIS/Aqua Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V04', 'MODIS/Terra Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V04', 'Population Exposure Estimates in Proximity to Nuclear Power Plants: Country-Level Aggregates', 'Population Exposure Estimates in Proximity to Nuclear Power Plants: Locations', and 'Poverty Mapping Project: Global Subnational Prevalence of Child Malnutrition'. The 'Step 3: Discover Granules' section shows a list of granules, including 'MODIS/Aqua Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V04', 'MODIS/Terra Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V04', and 'MODIS/Terra Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V04'. The interface includes a feedback button and a search bar.

Granule Results

NASA National Aeronautics and Space Administration
EOSDIS NASA's Earth Observing System Data and Information System
Reverb | ECHO The Next Generation Earth Science Discovery Tool

EOSDIS Home | Reverb Home | About | Tutorial | Shopping Cart (0) | Order Status | Service Request Status | Sign In

Return to dataset results
Search Options

Spatial
 Bounding Box: 23.886, -74.531, 40.286, -92.285

Temporal
 Start: 2007-09-16 00:00:00
 End: 2017-04-16 23:59:59

Science Keywords
 HUMAN DIMENSIONS >> HUMAN HEALTH
 HUMAN DIMENSIONS >> HUMAN HEALTH
 ANATOMICAL PARAMETERS

Step 1: Select Granules [?]

List View | Map View | Image View | Timeline View

[+] MODIS/Aqua Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V004
 Archive Center: LPDAAC Short Name: MYD11A2 Version: 004 Collection ID: C28468912-LPDAAC_ECS

[+] MODIS/Terra Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V004
 Archive Center: LPDAAC Short Name: MOD11A2 Version: 004 Collection ID: C16893875-LPDAAC_ECS

Step 2: Go to Cart [?]

View Items in Cart

EOSDIS NASA's Earth Observing System Data and Information System
Reverb | ECHO The Next Generation Earth Science Discovery Tool

EOSDIS Home | Reverb Home | About | Tutorial | Shopping Cart (1) | Order Status | Service Request Status | Sign In

Return to dataset results
Search Options

Day/Night Flag
 Find granules captured during the day, night or anytime.
 Flag: Anytime

Data Access
 Find granules that have browse images.
☐ only granules with browse images
 Find granules that are available online.
☐ only granules with online access

Cloud Cover
 Find granules by cloud cover percentage.
 Percentage: (Example: 1-2)
 Click Here to Enter Range

Orbit Spatial Parameters
 Find granules with specific orbital spatial characteristics.
 Orbit Number: (Example: 153)
 Click Here to Enter Range
 Equatorial Crossing Longitude: (Example: -45.0)
 Click Here to Enter Range
 SIM/DO YYYY: (Example: 01/24/2001)
 Equatorial

Clear OK Cancel

Showing 1 to 9 of 1,389 granules Total Query Time: 0.30s

Granule ID	Start Time	End Time	Online Access	Browse	Alt
MOD11A2 A2000057 h24v15 004 2002357072	2000-02-26 00:00:05 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt
MOD11A2 A2000057 h17v13 004 2002357091	2000-02-26 00:00:05 UTC	2000-03-04 23:59:52 UTC	✓	B	Alt
MOD11A2 A2000057 h16v09 004 2002357092	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt
MOD11A2 A2000057 h17v04 004 2002357120	2000-02-26 00:00:06 UTC	2000-03-04 23:59:52 UTC	✓	B	Alt
MOD11A2 A2000057 h23v02 004 2002357173	2000-02-26 00:00:06 UTC	2000-03-04 23:48:10 UTC	✓	B	Alt
MOD11A2 A2000057 h18v00 004 2002357052	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt
MOD11A2 A2000057 h17v08 004 2002357052	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt
MOD11A2 A2000057 h24v02 004 2002357174	2000-02-26 00:00:06 UTC	2000-03-04 23:48:18 UTC	✓	B	Alt
MOD11A2 A2000057 h31v06 004 2002357093	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt

Step 2: Go to Cart [?]

View Items in Cart

EOSDIS NASA's Earth Observing System Data and Information System
Reverb | ECHO The Next Generation Earth Science Discovery Tool

EOSDIS Home | Reverb Home | About | Tutorial | Shopping Cart (1999) | Order Status | Service Request Status | Account | Sign Out (logout)

Return to dataset results
Search Options

List View | Map View | Image View | Timeline View

[+] MODIS/Aqua Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V004
 Archive Center: LPDAAC Short Name: MYD11A2 Version: 004 Collection ID: C28468912-LPDAAC_ECS

[+] MODIS/Terra Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid V004
 Archive Center: LPDAAC Short Name: MOD11A2 Version: 004 Collection ID: C16893875-LPDAAC_ECS

Save Granule Results as csv Save Granule Results as xml Add Selected to Cart

Showing 1 to 9 of 92,659 granules Total Query Time: 9.39s

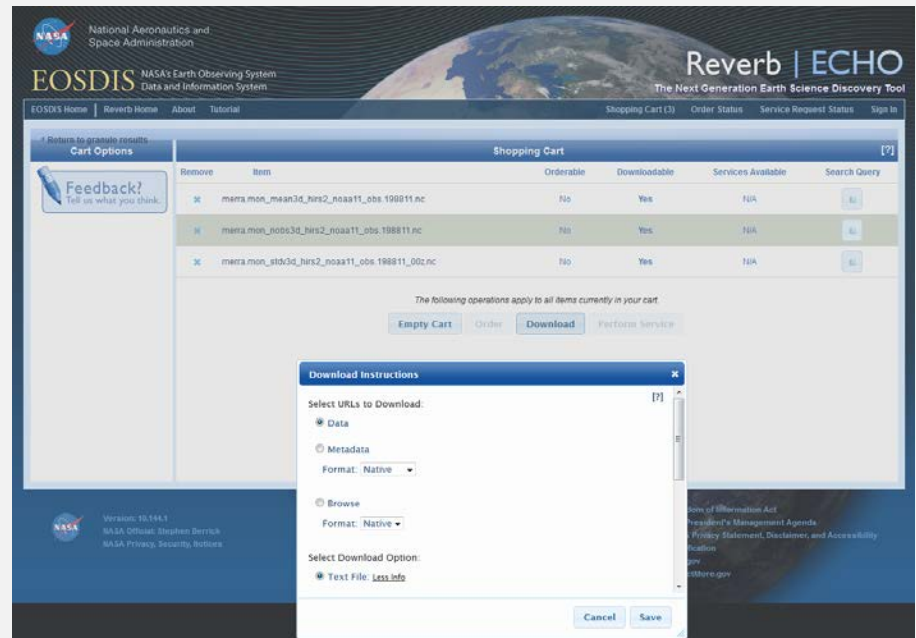
Granule ID	Start Time	End Time	Online Access	Browse	Alt
MOD11A2 A2000057 h24v15 004 2002357072	2000-02-26 00:00:05 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt
MOD11A2 A2000057 h17v13 004 2002357091	2000-02-26 00:00:05 UTC	2000-03-04 23:59:52 UTC	✓	B	Alt
MOD11A2 A2000057 h16v09 004 2002357092	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt
MOD11A2 A2000057 h17v04 004 2002357120	2000-02-26 00:00:06 UTC	2000-03-04 23:59:52 UTC	✓	B	Alt
MOD11A2 A2000057 h23v02 004 2002357173	2000-02-26 00:00:06 UTC	2000-03-04 23:48:10 UTC	✓	B	Alt
MOD11A2 A2000057 h18v00 004 2002357052	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt
MOD11A2 A2000057 h17v08 004 2002357052	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt
MOD11A2 A2000057 h24v02 004 2002357174	2000-02-26 00:00:06 UTC	2000-03-04 23:48:18 UTC	✓	B	Alt
MOD11A2 A2000057 h31v06 004 2002357093	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	B	Alt

Step 2: Go to Cart [?]

View Items in Cart

Ordering Granules

- Click on shopping cart icon to retrieve files of interest
 - Order, download or request services
- Using as a guest requires completion of a form each time. If you have an account this will not be needed
- Submit order to begin processing
- Will get order tracking number by email
- ftp links will follow for data download



- HDF format is ingestible into ArcMap/QGIS without data conversion to a geotiff

REVERB Data Retrieval and Ordering Overview

- Search for data using temporal and spatial constraints, specific data attributes, and processing levels
- Use map to drag a bounding box over the region of interest
- Platform and instrument search options menu
- Use calendar widget to set temporal range
- Can add keyword using text field
- When finished, click “search for granules” radio button
- Select granules for shopping cart and order



Earthdata

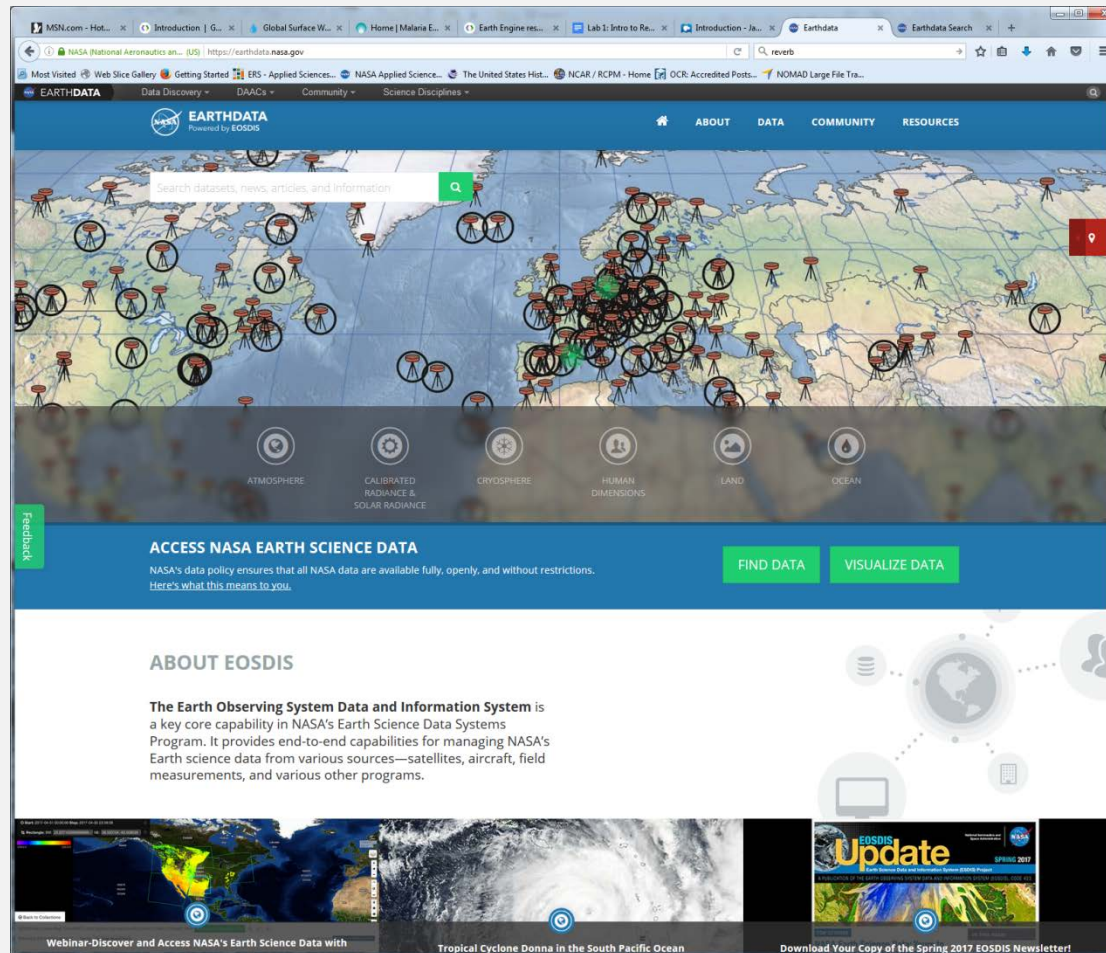
<http://earthdata.nasa.gov/>

- The Earth Observing System Data and Information System (EOSDIS) is a key core capability in NASA's Earth Science Data Systems Program
- It provides end-to-end capabilities for managing NASA's Earth science data from various sources
 - satellites
 - aircraft
 - field measurements
 - various other programs

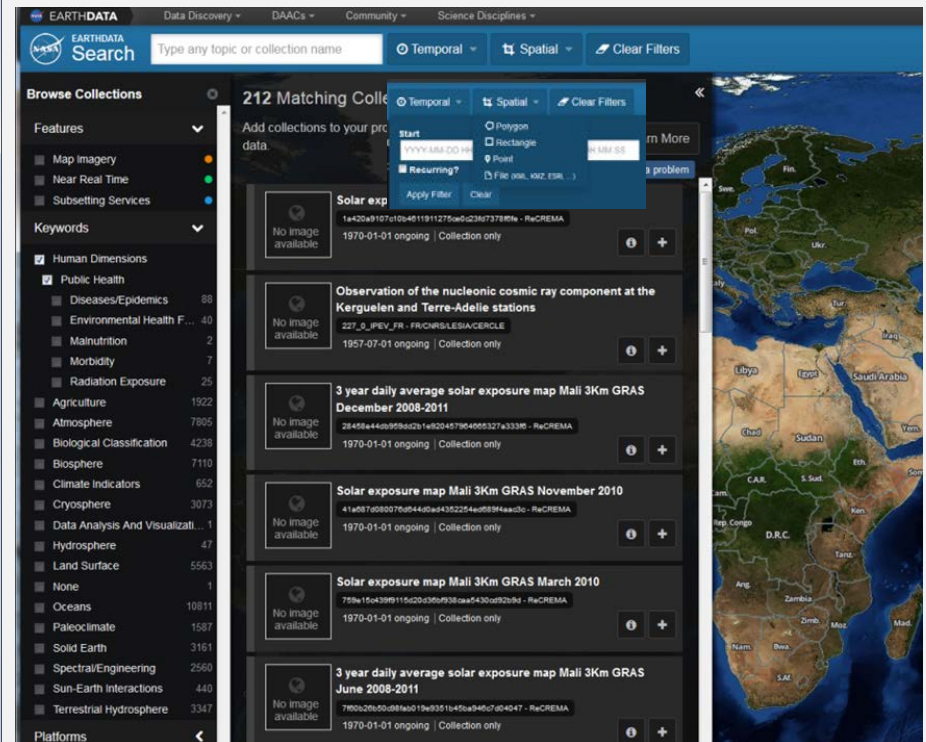
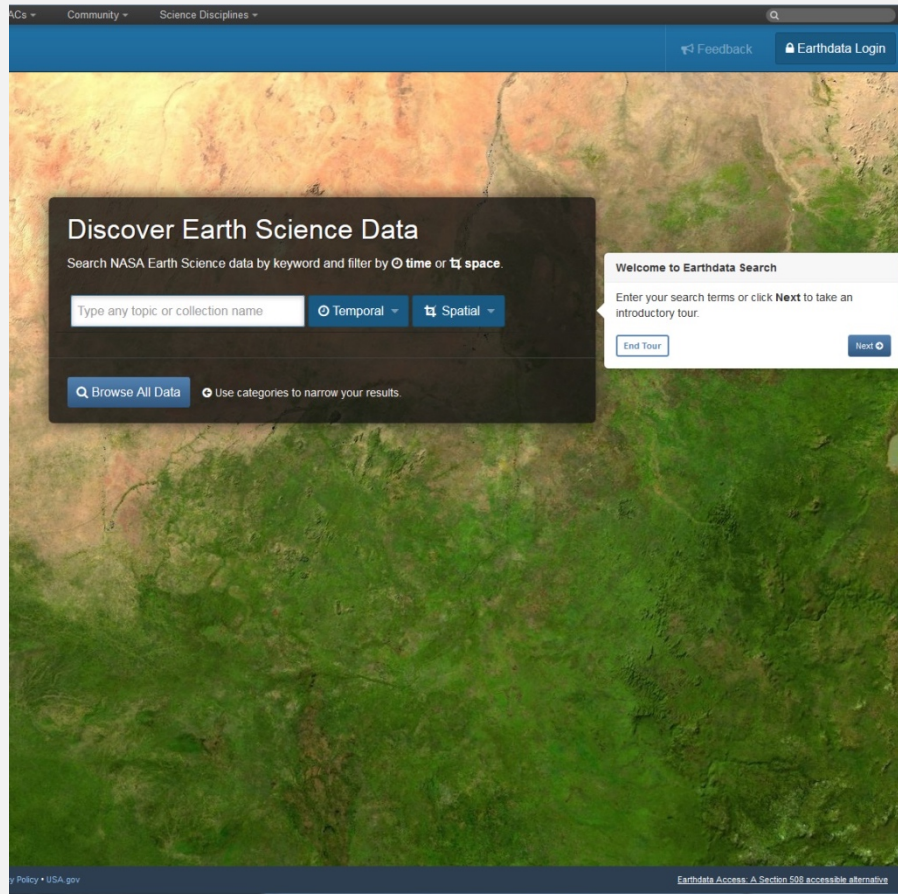
The screenshot shows the Earthdata website interface. At the top, there's a navigation bar with links like 'EARTHDATA', 'Data Discovery', 'DAACs', 'Community', and 'Science Disciplines'. Below this, a banner for 'EOSDIS' (NASA's Earth Observing System Data and Information System) is visible, along with a 'Reverb' search bar and 'ECHO' logo. A red double-headed arrow points to the 'EOSDIS' logo and the 'Reverb' search bar. The main content area shows a 'Step 1: Select Granules' section with a table of data granules. The table has columns for Granule ID, Start Time, End Time, and Online Access. Two granules are listed: MYD11C2 A2016177 041.2016194125252 hdf and MYD11C2 A2016185 041.2016194125338 hdf. Below the table is a 'Step 2: Go to Cart' section with a 'View Items in Cart' button. The footer contains the NASA logo, version information (10.142.1), and links to the President's Management Agenda, NASA Privacy Statement, and Accessibility.

Granule ID	Start Time	End Time	Online Access
MYD11C2 A2016177 041.2016194125252 hdf	2016-06-25 00:00:00 UTC	2016-07-02 23:59:59 UTC	✓
MYD11C2 A2016185 041.2016194125338 hdf	2016-07-03 00:00:00 UTC	2016-07-10 23:59:59 UTC	✓

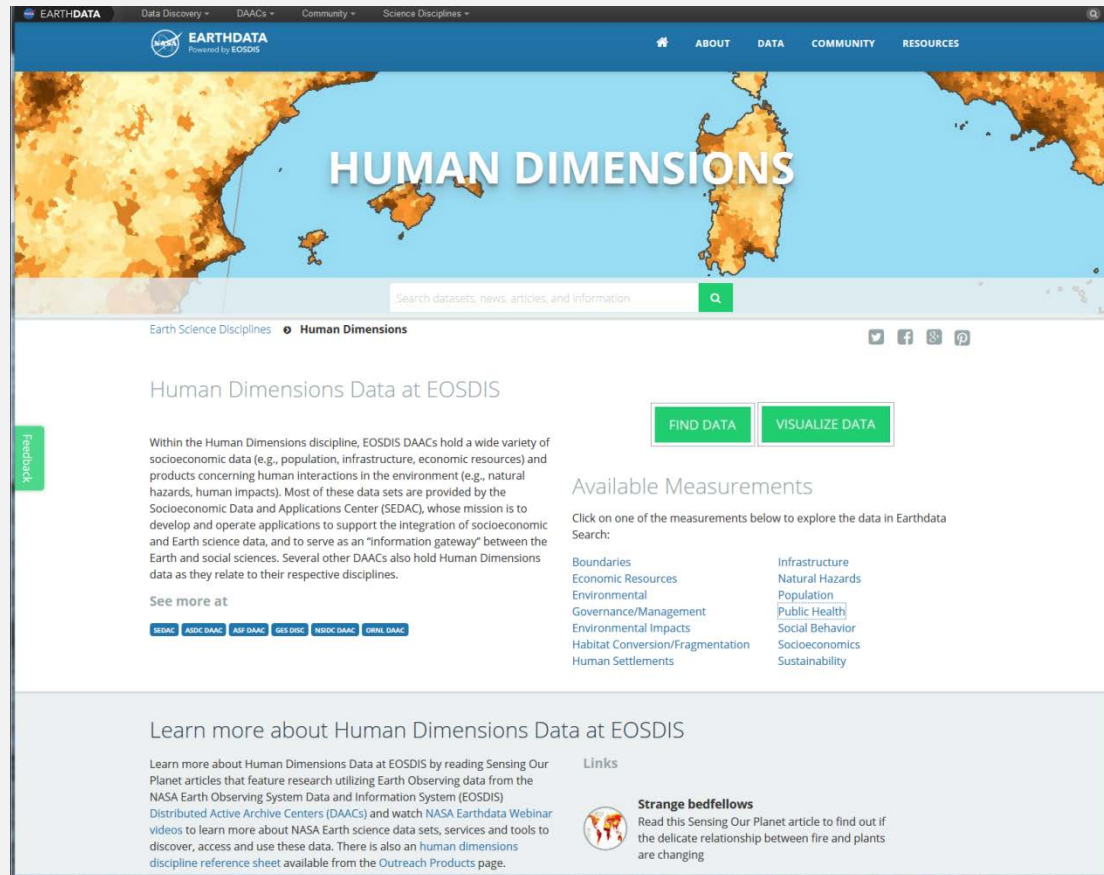
Earthdata



Earthdata: Public Health



Earthdata: Human Dimensions



The screenshot shows the Earthdata website's 'Human Dimensions' section. The header includes the Earthdata logo and navigation links for Data Discovery, DAACs, Community, and Science Disciplines. The main banner features a world map with the title 'HUMAN DIMENSIONS' and a search bar. Below the banner, the 'Human Dimensions Data at EOSDIS' section provides a description of the data and links to 'Find Data' and 'Visualize Data'. The 'Available Measurements' section lists various data categories such as Boundaries, Economic Resources, and Infrastructure. The bottom section, 'Learn more about Human Dimensions Data at EOSDIS', includes a paragraph about Sensing Our Planet articles and a link to a 'Strange bedfellows' article.

EARTHDATA Data Discovery - DAACs - Community - Science Disciplines -

EARTHDATA
Powered by EOSDIS

ABOUT DATA COMMUNITY RESOURCES

HUMAN DIMENSIONS

Search datasets, news, articles, and information

Earth Science Disciplines • Human Dimensions

Human Dimensions Data at EOSDIS

Within the Human Dimensions discipline, EOSDIS DAACs hold a wide variety of socioeconomic data (e.g., population, infrastructure, economic resources) and products concerning human interactions in the environment (e.g., natural hazards, human impacts). Most of these data sets are provided by the Socioeconomic Data and Applications Center (SEDAC), whose mission is to develop and operate applications to support the integration of socioeconomic and Earth science data, and to serve as an "information gateway" between the Earth and social sciences. Several other DAACs also hold Human Dimensions data as they relate to their respective disciplines.

See more at

SEDAC ASDC DAAC ASF DAAC SES DMC NESDC DAAC DRIHL DAAC

FIND DATA **VISUALIZE DATA**

Available Measurements

Click on one of the measurements below to explore the data in Earthdata Search:

Boundaries	Infrastructure
Economic Resources	Natural Hazards
Environmental	Population
Governance/Management	Public Health
Environmental Impacts	Social Behavior
Habitat Conversion/Fragmentation	Socioeconomics
Human Settlements	Sustainability

Learn more about Human Dimensions Data at EOSDIS

Learn more about Human Dimensions Data at EOSDIS by reading Sensing Our Planet articles that feature research utilizing Earth Observing data from the NASA Earth Observing System Data and Information System (EOSDIS) Distributed Active Archive Centers (DAACs) and watch NASA Earthdata Webinar videos to learn more about NASA Earth science data sets, services and tools to discover, access and use these data. There is also an [human dimensions discipline reference sheet](#) available from the Outreach Products page.

Links

Strange bedfellows
Read this Sensing Our Planet article to find out if the delicate relationship between fire and plants are changing

Earthdata: Environmental Sustainability Example

The screenshot displays the Earthdata Search web application. The search bar at the top contains the text 'human dimensions'. Below the search bar, a sidebar on the left lists various categories and keywords, including 'Human Dimensions', 'Sustainability', and 'Environmental Sustainability'. The main content area shows a list of 95 matching collections. The first collection is 'Environmental Treaty Status Data Set, 2012 Release', followed by several 'Environmental Performance Index (EPI)' datasets for different years (2006, 2008, 2010, 2012, 2014). Each collection entry includes a thumbnail image (labeled 'No image available'), the collection name, the data source (CIESIN/SEDAC), and the time period. A map of the world is visible on the right side of the interface, showing the spatial distribution of the data.

This screenshot shows a detailed view of a specific project collection within the Earthdata Search interface. The collection is titled '2014 Environmental Performance Index (EPI)'. It includes a 'Download Project Data' button and a 'Back to Collection Search' link. The collection details show the data source as CIESIN/SEDAC and the time period as 2002-01-01 to 2014-00-00. A map of the world is visible on the right side of the interface, showing the spatial distribution of the data.

URL Direct Download

The screenshot displays the Earthdata Search web application. The browser's address bar shows the URL: <https://search.earthdata.nasa.gov/search/project/collection/details?ps=C10000000541-SEDAC/C10000000541-SEDAC&qt=Z>. The search results page for the '2014 Environmental Performance Index (EPI)' is shown. The left sidebar contains a world map and metadata for the dataset, including spatial coordinates, temporal extent, and metadata formats. The main content area displays a map of Africa and a 'Related URLs' pop-up window with links to 'Get Related Visualization' and 'General Documentation'. The bottom of the page features a list of science keywords and a processing center section.

2014 Environmental Performance Index (EPI) VERSION 2014.20

Spatial Coordinates:
Bounding Rectangle: (80.0°, -180.0°, -55.0°, 180.0°)

Temporal Extent:
2002-01-01 ongoing

GIS Imagery Projection Availability:
None

Metadata Formats: [HTML](#) | [Native](#) | [ATOM](#) | [ECHO10](#) | [ISO19115](#) | [DIF](#)

API Endpoints: [OSDD](#)

Related URLs:
[View All Related URLs](#)

The 2014 Environmental Performance Index (EPI) ranks 178 countries on 20 performance indicators in the following 9 policy categories: health impacts, air quality, water and sanitation, water resources, agriculture, forests, fisheries, biodiversity and habitat, and climate and energy. These categories track performance and progress on two broad policy objectives, environmental health and ecosystem vitality. The EPI's proximity-to-target methodology facilitates cross-country comparisons among economic and regional peer groups. The data set includes the 2014 EPI and component scores, backcast EPI scores for 2002-2012, and time-series source data. The 2014 EPI was formally released in Davos, Switzerland, at the

Processing Center:
Archive Center:
SEDAC
Short Name:
CIESIN_SEDAC_EPI_2014

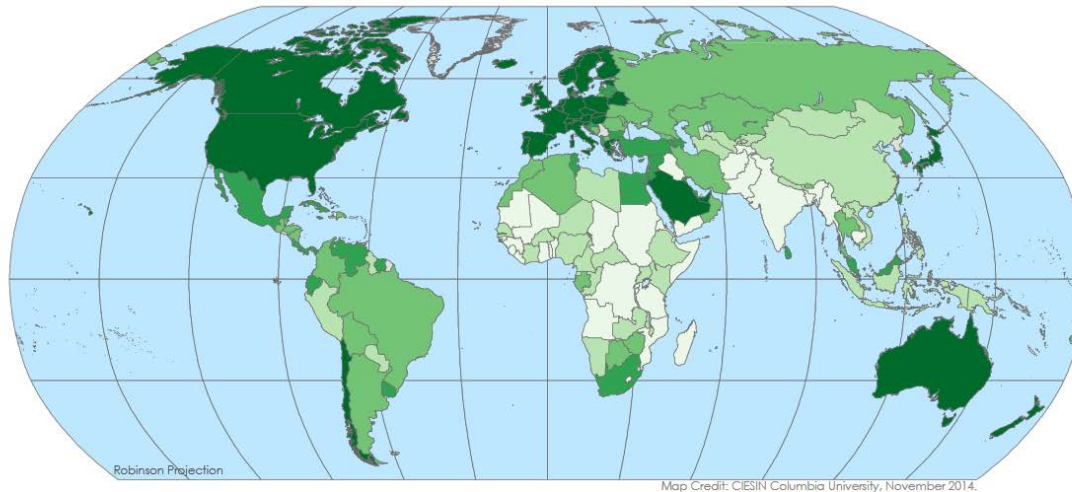
Contacts:
SEDAC Services
ciesin.info@ciesin.columbia.edu
+1 845-365-8920 (Telephone)
+1 845-365-8922 (Fax)

Science Keywords:
[Earth Science](#) | [Agriculture](#) | [Agricultural Aquatic Sciences](#)
[Earth Science](#) | [Atmosphere](#) | [Air Quality](#)
[Earth Science](#) | [Biosphere](#) | [Ecological Dynamics](#)
[Earth Science](#) | [Human Dimensions](#) | [Environmental Governance/Management](#)

Sustainability Indicator Example

2014 EPI

Environmental Performance Index (EPI)



The 2014 EPI ranks 178 countries on 20 performance indicators in the following 9 policy categories: health impacts, air quality, water and sanitation, water resources, agriculture, forests, fisheries, biodiversity and habitat, and climate and energy. These categories track performance and progress on two broad policy objectives, environmental health and ecosystem vitality. Each indicator has an associated environmental public health or ecosystem sustainability target. The full report including a complete description of the EPI, underlying data sets, and methodology is available online at the NASA Socioeconomic Data and Applications Center (SEDAC).

2014 EPI Scores

15.47–36.19
36.20–45.50
45.51–53.45
53.46–66.49
66.50–87.67
no EPI score

Center for International Earth
Science Information Network
EARTH INSTITUTE · COLUMBIA UNIVERSITY

Data Source: Yale Center for Environmental Law and Policy - YCELP - Yale University, Center for International Earth Science Information Network - CIESIN - Columbia University, and World Economic Forum - WEF. 2014. 2014 Environmental Performance Index (EPI). Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC).
<http://dx.doi.org/10.7927/H4416V05>.

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Socioeconomic Data and Applications Center (SEDAC)

The screenshot displays the SEDAC website interface. At the top, the NASA logo is followed by the text "SOCIOECONOMIC DATA AND APPLICATIONS CENTER (SEDAC)" and a subtitle "A Data Center in NASA's Earth Observing System Data and Information System (EOSDIS) — Hosted by CIESIN at Columbia University". Below this is a navigation bar with links: DATA, MAPS, THEMES, RESOURCES, SOCIAL MEDIA, ABOUT, and HELP. A search bar is also present. The main content area is titled "Environmental Performance Index (EPI)" and "Environmental Performance Index, 2014 Release (2002–2014)". It features a sidebar with "Data Sets (5)" and "Map Gallery (49)". The main content area includes a "Downloads" section with links for "Full Report and Analysis (19.6 MB pdf file)" and "Indicator Metadata (353 KB pdf file)". Below this, there is a list of "EPI 2014 Data" and "EPI 2014 Indicator Time Series Data" with various categories and file sizes.

Environmental Performance Index (EPI)

Environmental Performance Index, 2014 Release (2002–2014)

Collection Overview

Data Sets (5)

- Environmental Performance Index, 2014 Release (2002–2014)

Map Gallery (49)

Map Services (24)

Citations

FAQs

Project Website

Downloads

Data:

View Recommended Citation(s)

The full report in PDF format is available for download below, together with the data in Excel format.

EPI 2014 Report:

- Full Report and Analysis (19.6 MB pdf file)
- Indicator Metadata (353 KB pdf file)

EPI 2014 Data:

- 2014 EPI (765 KB zipped xls file)

EPI 2014 Indicator Time Series Data:

The indicator time series data are provided in Excel workbooks by policy category. Note that the availability of time series data varies by indicator.

- Health Impacts (133 KB)
- Air Quality (242 KB)
- Water and Sanitation (212 KB)
- Water Resources (48 KB)
- Agriculture (345 KB)
- Forests (48 KB)
- Fisheries (484 KB)
- Biodiversity and Habitat (328 KB)
- Climate and Energy (265 KB)

Center for International Earth Science Information Network

HOME | DATA | DATA USES | DATA CITATIONS | MAPS | MAP SERVICES

NEWS | TOOLS | GUIDES | PUBLICATIONS | BLOG POSTS

ABOUT | HELP | PRIVACY | USER REGISTRATION

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Example of EPI data for one air pollutant category


Air Pollution (PM2.5) - Population weighted exposure to PM2.5 (micro-grams per cubic meter)

Source: Aaron van Donkelaar (in prep), 2014 (embargoed)

Notes: NA = Not Applicable

Country	2000	2001	2002	2003
Afghanistan	8.6	8.42	10.64	10.81
Albania	14.73	14.6	13.79	13.77
Algeria	8.28	8.16	8.74	9.12
American Samoa	3.09	3.08	3.13	3.13
Andorra	9.3	3.59	6.66	6.41
Angola	7.85	7.74	7.59	7.86
Anguilla	0.97	0.7	0.97	0.97
Antigua and Barbuda	2.57	2.56	2.7	3.05
Argentina	5.45	5.33	5.34	5.25
Armenia	12.24	9.17	13.36	14
Aruba	4.74	4.74	3.69	3.69
Australia	3.01	2.48	3.32	3.55
Austria	16.41	15.57	15.19	16.93
Azerbaijan	12.93	12.62	11.57	10.49
Bahamas	7.2	7.12	6.31	5.93
Bahrain	8.97	8.97	10.37	10.37
Bangladesh	17	16.97	19.32	20.78
Barbados	2.89	2.88	2.99	3.2

Earthdata Menu

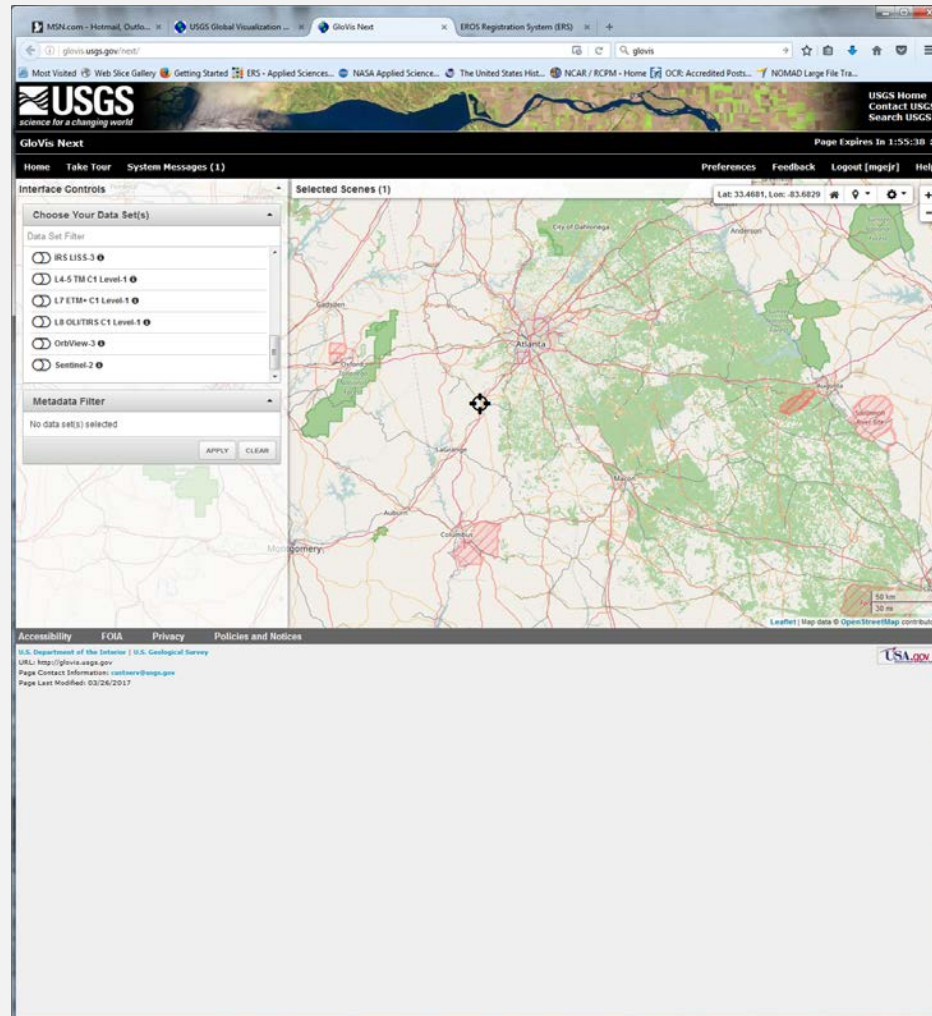
<div>  EARTHDATA </div> <div> Data Discovery ▾ DAACs ▾ Community ▾ Science Disciplines ▾ </div>					
Calibrated Radiance and Solar Radiance					
Atmosphere	Calibrated Radiance and Solar Radiance	Cryosphere	Human Dimensions	Land	Ocean
Aerosols	Infrared Wavelengths	Frozen Ground	Boundaries	Erosion/Sedimentation	Bathymetry/Seafloor Topography
Air Quality	Lidar	Glaciers/Ice Sheets	Economic Resources	Frozen Ground	Coastal Process
Altitude	Microwave	Sea Ice	Environmental Governance/Management	Geomorphology	Marine Geophysics
Atmospheric Chemistry (Mesospheric and Thermospheric/Ionospheric)	Platform Characteristics	Snow/Ice	Environmental Impacts	Land Temperature	Ocean Acoustics
Atmospheric Electricity (Lightning)	Radar		Habitat Conversion/Fragmentation	Land Use/Land Cover	Ocean Chemistry
Atmospheric Phenomena	Radio Wave		Human Settlements	Landscape	Ocean Circulation
Atmospheric Pressure	Sensor Characteristics		Infrastructure	Soils	Ocean Heat Budget
Atmospheric Radiation (Radiative Energy Fluxes)	Ultraviolet Wavelengths		Natural Hazards	Surface Radiative Properties	Ocean Optics
Atmospheric Temperature	Visible Wavelengths		Population	Topography	Ocean Pressure
Atmospheric Water Vapor (Humidity)	X-Ray		Public Health	Earth Gases/Liquids	Ocean Temperature
Atmospheric Winds	Ionosphere/Magnetosphere Dynamics		Social Behavior	Geochemistry	Ocean Waves
Clouds	Solar Activity		Socioeconomics	Geodetics	Ocean Winds
Precipitation	Solar Energetic Particle Flux		Sustainability	Geomagnetism	Salinity/Density
	Solar Energetic Particle Process			Geomorphic Landforms/Processes	Sea Ice
				Gravity/Gravitational Field	Sea Surface Topography
				Rocks/Minerals/Crystals	
				Tectonics	
<div> <div>NASA Global Climate Change</div> <div>NITRD</div> <div>NOAA</div> <div>USGEO</div> <div>USGS</div> </div>					

USGS Data Retrieval Tools

- Global Visualization Viewer (GloVis)
- Earth Explorer

USGS Global Visualization Viewer (GloVis Next)

<http://glovis.usgs.gov/next/>



GloVis Next

The screenshot displays the USGS GloVis Next web application. The header features the USGS logo and navigation links. The main interface is divided into a left sidebar with controls and a central map area. The sidebar includes a 'Choose Your Data Set(s)' section with radio buttons for L4-5 TM C1 Level-1, L7 ETM+ C1 Level-1, L8 OLI/TIRS C1 Level-1 (selected), OrbView-3, and Sentinel-2. Below this is a 'Metadata Filter' section with date range, cloud cover, and month filters. The map area shows a yellow-tinted satellite view of the Southeastern United States, with a black crosshair centered over Montgomery, Alabama. The map includes a scale bar and a 'Selected Scenes (1)' header. The footer contains accessibility links, contact information, and the USA.gov logo.

USGS
science for a changing world

GloVis Next

USGS Home
Contact USGS
Search USGS

Page Expires In 1:58:11

Home Take Tour System Messages (1) Preferences Feedback Logout [mgejr] Help

Interface Controls

Choose Your Data Set(s)

Data Set Filter

☐ L4-5 TM C1 Level-1

☐ L7 ETM+ C1 Level-1

☒ L8 OLI/TIRS C1 Level-1

87,955 scenes are represented by the coverage layer. Zoom in on the map to display imagery for this data set.

☐ OrbView-3

☐ Sentinel-2

Metadata Filter

Date Range All Data Sets

01/01/2016 to 05/01/2016

Cloud Cover All Data Sets

0-100 or empty to 0-100 or empty

Months All Data Sets

Jan Feb

APPLY CLEAR

Selected Scenes (1)

Lat: 28.3237, Lon: -86.1328

200 km
100 mi

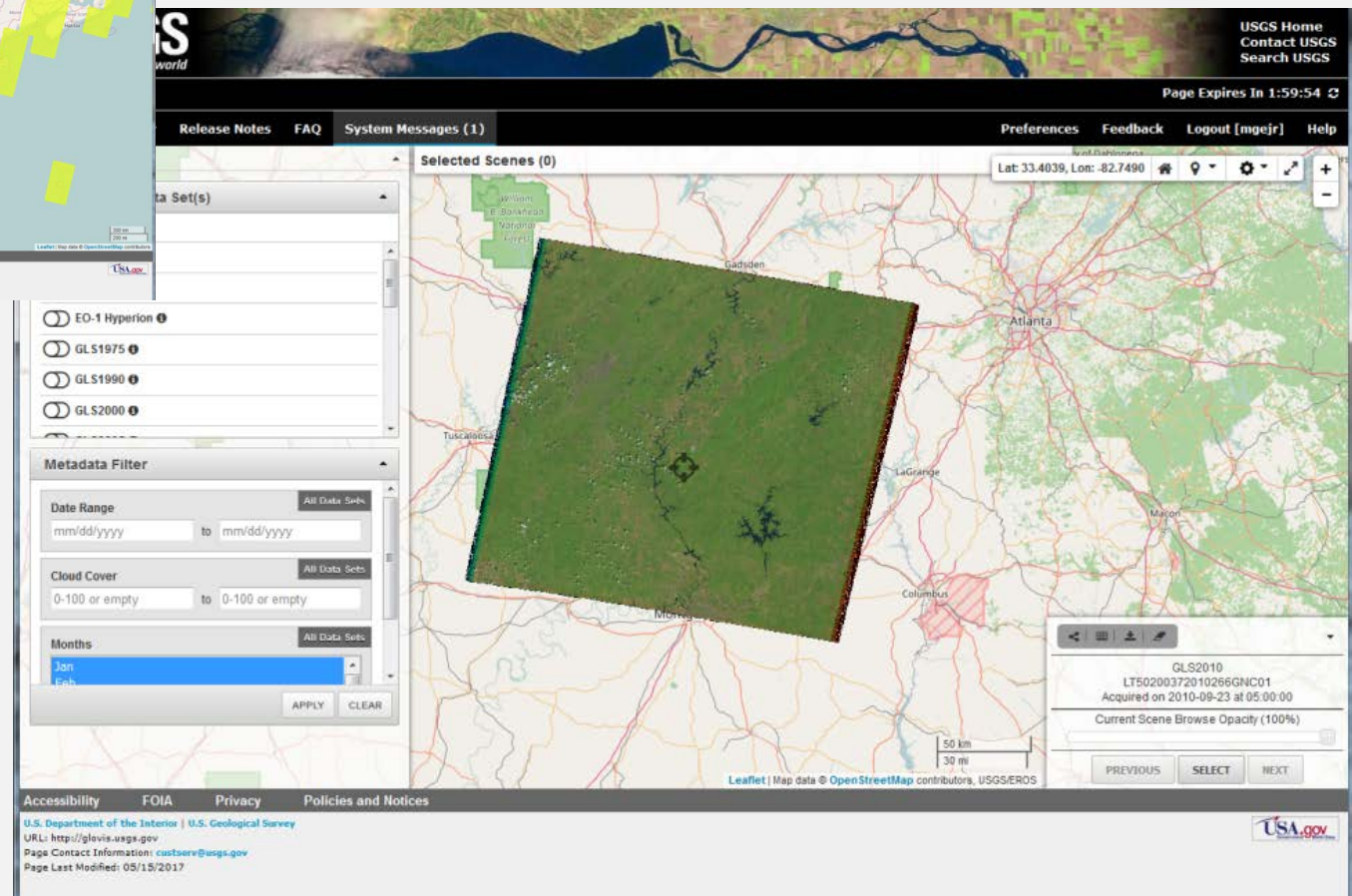
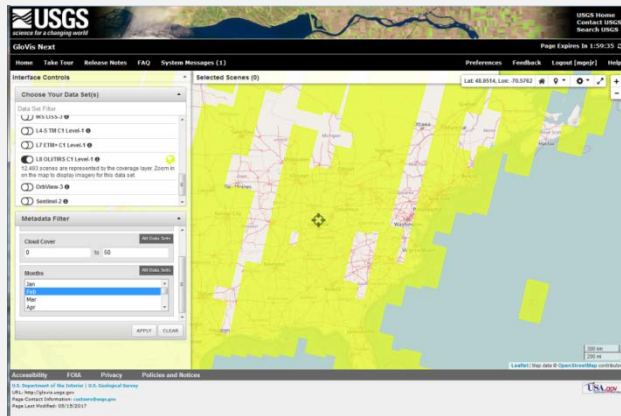
Leaflet | Map data © OpenStreetMap contributors

Accessibility FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey
URL: <http://glovis.usgs.gov>
Page Contact Information: custserv@usgs.gov
Page Last Modified: 03/26/2017

USA.gov

Coverage Area and Scene Selection



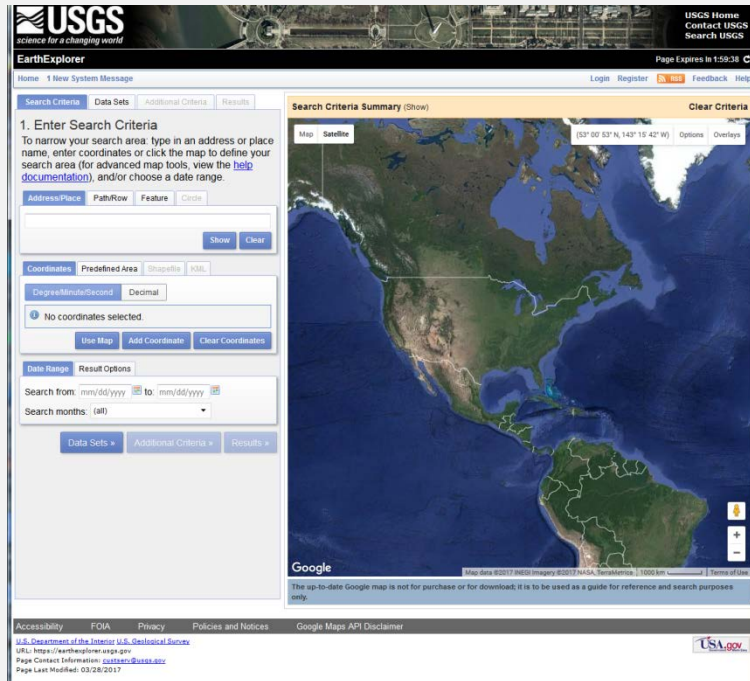
Review Metadata and Download

The screenshot displays the USGS GloVis Next web application. The interface includes a top navigation bar with links like Home, Take Tour, Release Notes, FAQ, System Messages (1), Preferences, Feedback, Logout [mgejr], and Help. A sidebar on the left contains 'Interface Controls' with 'Choose Your Data Set(s)' and 'Metadata Filter' sections. The main area shows a map with a selected scene. A 'Download Options' dialog box is open, listing four download options for the selected scene: LandsatLook Natural Color Image (8.04 MB), LandsatLook Thermal Image (2.32 MB), LandsatLook Quality Image (906.02 KB), and LandsatLook Images with Geographic Reference (11.24 MB). A 'Metadata' table is also visible, providing detailed information about the selected scene.

Parameter	Value
Acquisition Date	2016/01/23
Collection Category	T1
Collection Number	1
WRS Path	024
WRS Row	038
Target WRS Path	024
Target WRS Row	038
Nadir/Off Nadir	NADIR
Roll Angle	-001
Date L-1 Generated	2017/02/24
Start Time	2016.023.16.43.52.8846790
Stop Time	2016.023.16.44.24.7546760
Station Identifier	LGN
Day/Night Indicator	DAY
Land Cloud Cover	33.95
Forest Cloud Cover	33.05

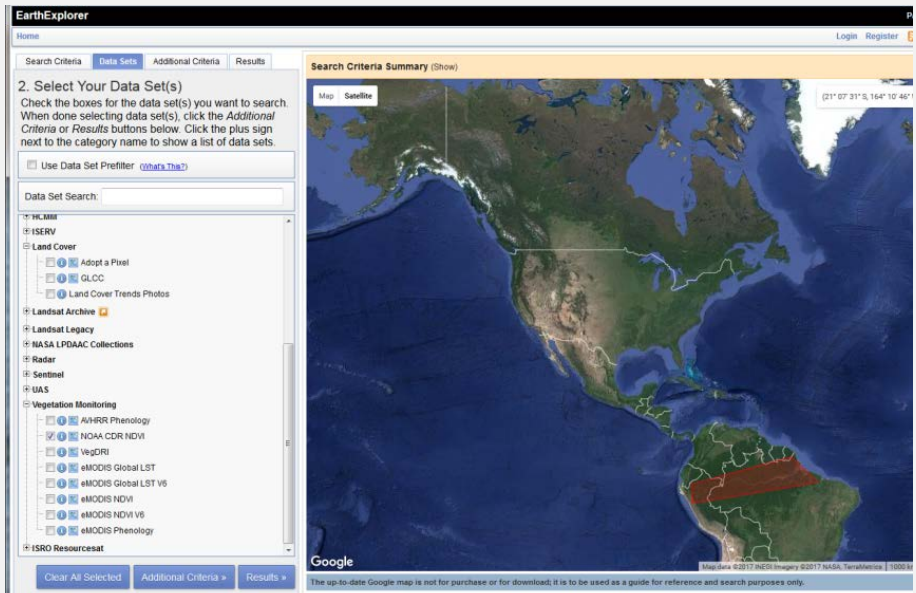
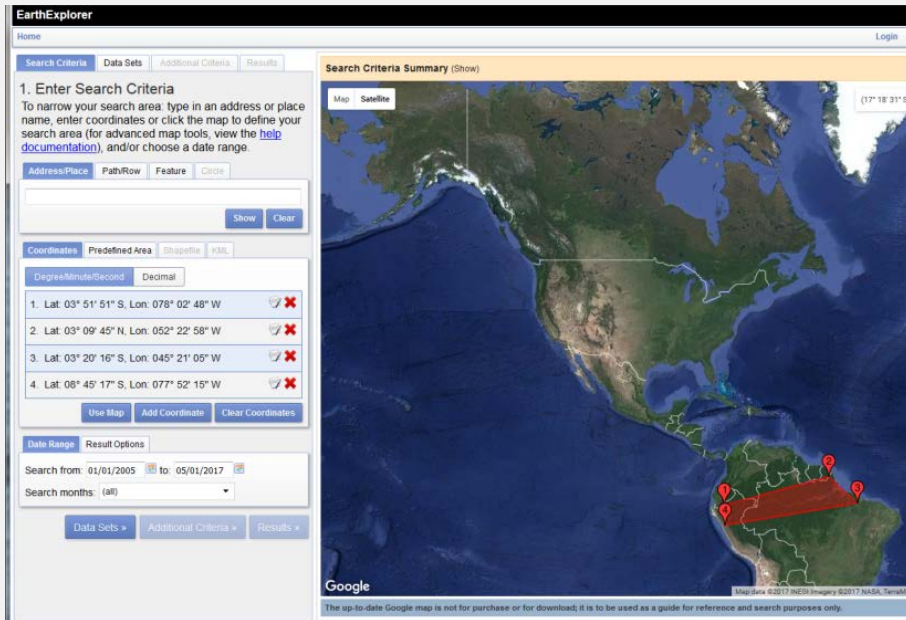
EarthExplorer (EE)

<http://earthexplorer.usgs.gov/>

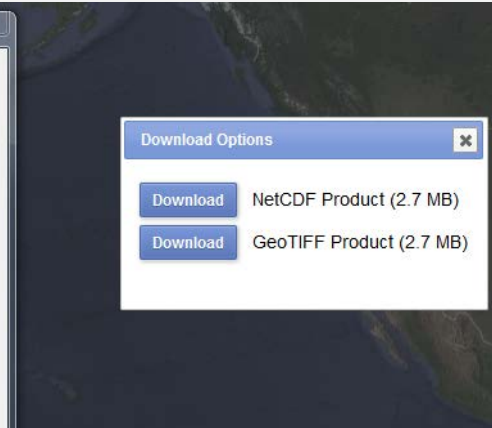
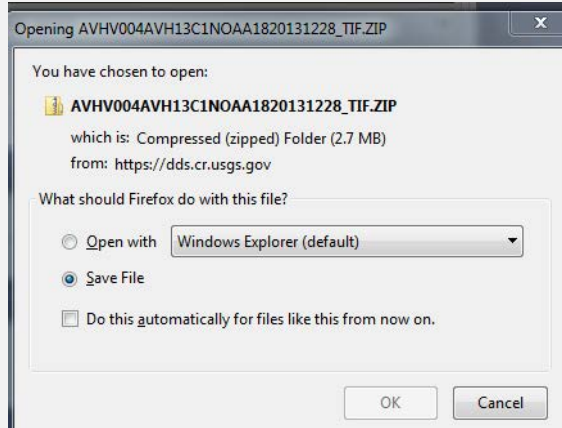
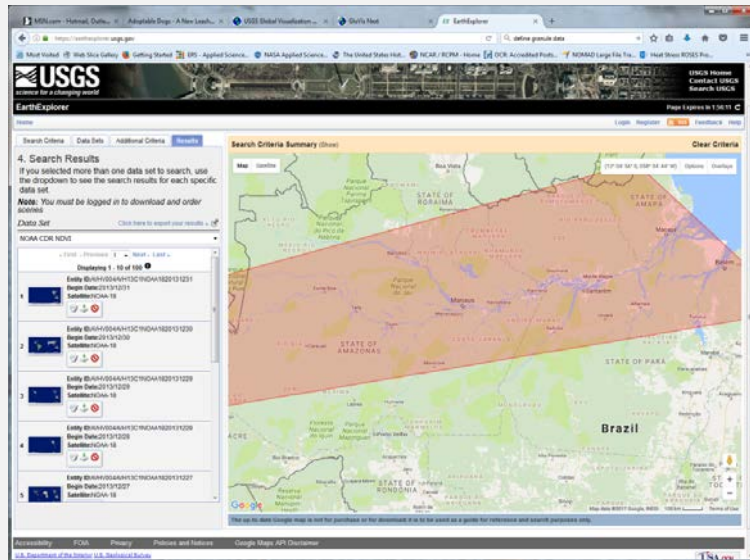


- Spatial search with map
- Select dataset
- Select results
 - Footprint
 - Browse
 - Metadata
 - Download
- Additional Criteria (cloud cover, etc.)
- Must login to download data

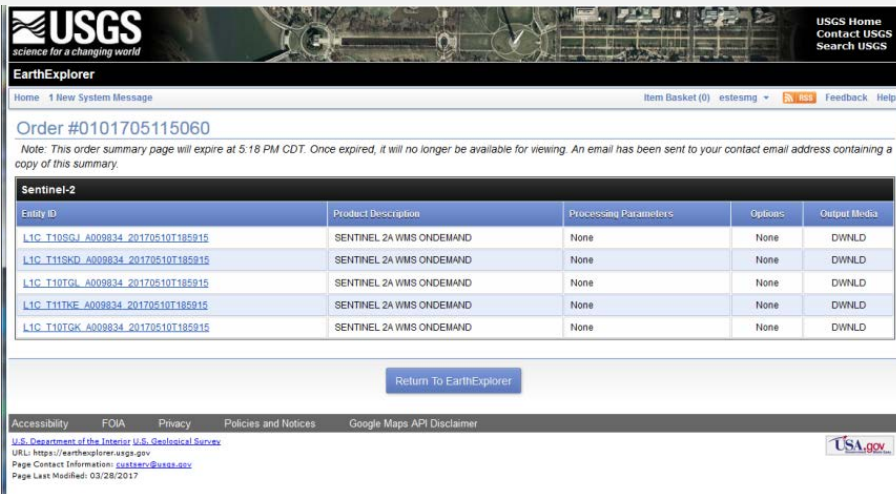
Using Earth Explorer



Direct Download of Files



Data Order



USGS
science for a changing world

EarthExplorer

Home 1 New System Message Item Basket (0) estersmg Feedback Help

Order #0101705115060

Note: This order summary page will expire at 5:18 PM CDT. Once expired, it will no longer be available for viewing. An email has been sent to your contact email address containing a copy of this summary.

Entity ID	Product Description	Processing Parameters	Options	Output Media
L1C_T10SGJ_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD
L1C_T10SD_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD
L1C_T10TGL_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD
L1C_T11TKE_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD
L1C_T10TGL_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD

[Return To EarthExplorer](#)

Accessibility FOIA Privacy Policies and Notices Google Maps API Disclaimer

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URL: <https://earthexplorer.usgs.gov>
Page Contact Information: custserv@usgs.gov
Page Last Modified: 03/28/2017



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EarthExplorer

Home 1 New System Message Save Criteria Load Favorite Manage Criteria Item Basket (0) estersmg Feedback Help

Search Criteria Data Sets Additional Criteria Results

Search Criteria Summary (Show) Clear Criteria

4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Show Result Controls

Data Set Click here to export your results

Sentinel-2

Displaying 1 - 10 of 100

1	Entity ID: L1C_T15TWH_A009833_20170510T172112 Coordinates: 42.8565145, -92.3282569 Acquisition Date: 20170510
2	Entity ID: L1C_T18TYK_A009832_20170510T153559 Coordinates: 40.1176199, -72.0993769 Acquisition Date: 20170510
3	Entity ID: L1C_T18TYL_A009832_20170510T153559 Coordinates: 41.0174452, -71.9690143 Acquisition Date: 20170510
4	Entity ID: L1C_T19TBF_A009832_20170510T153559 Coordinates: 41.020432, -71.9152964 Acquisition Date: 20170510
	Entity ID: L1C_T19TBE_A009832_20170510T153559 Coordinates: 40.1205139, -71.876469

[View Item Basket](#) [Submit Standing Request](#)

Map Satellite (67° 20' 23" N, 116° 53' 40" W) Options Overlays

Google

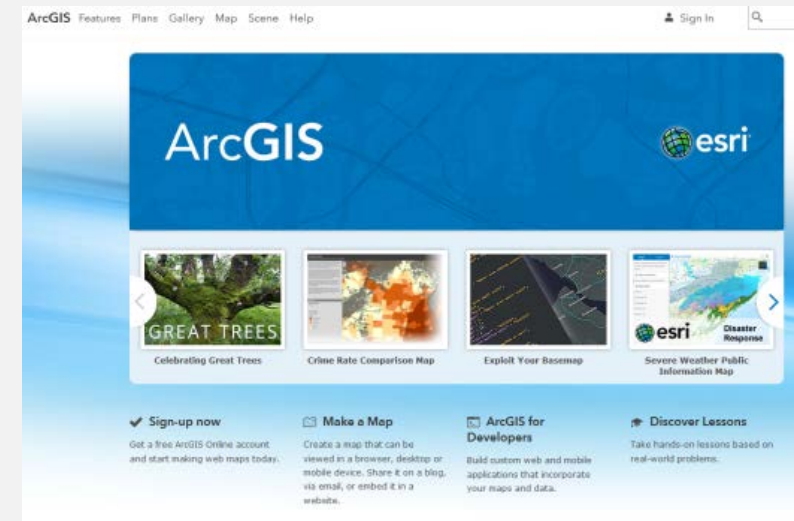
The up-to-date Google map is not for purchase or for download; it is to be used as a guide for reference and search purposes only.

Accessibility FOIA Privacy Policies and Notices Google Maps API Disclaimer

U.S. Department of the Interior U.S. Geological Survey
URL: <https://earthexplorer.usgs.gov>
Page Contact Information: custserv@usgs.gov
Page Last Modified: 03/28/2017

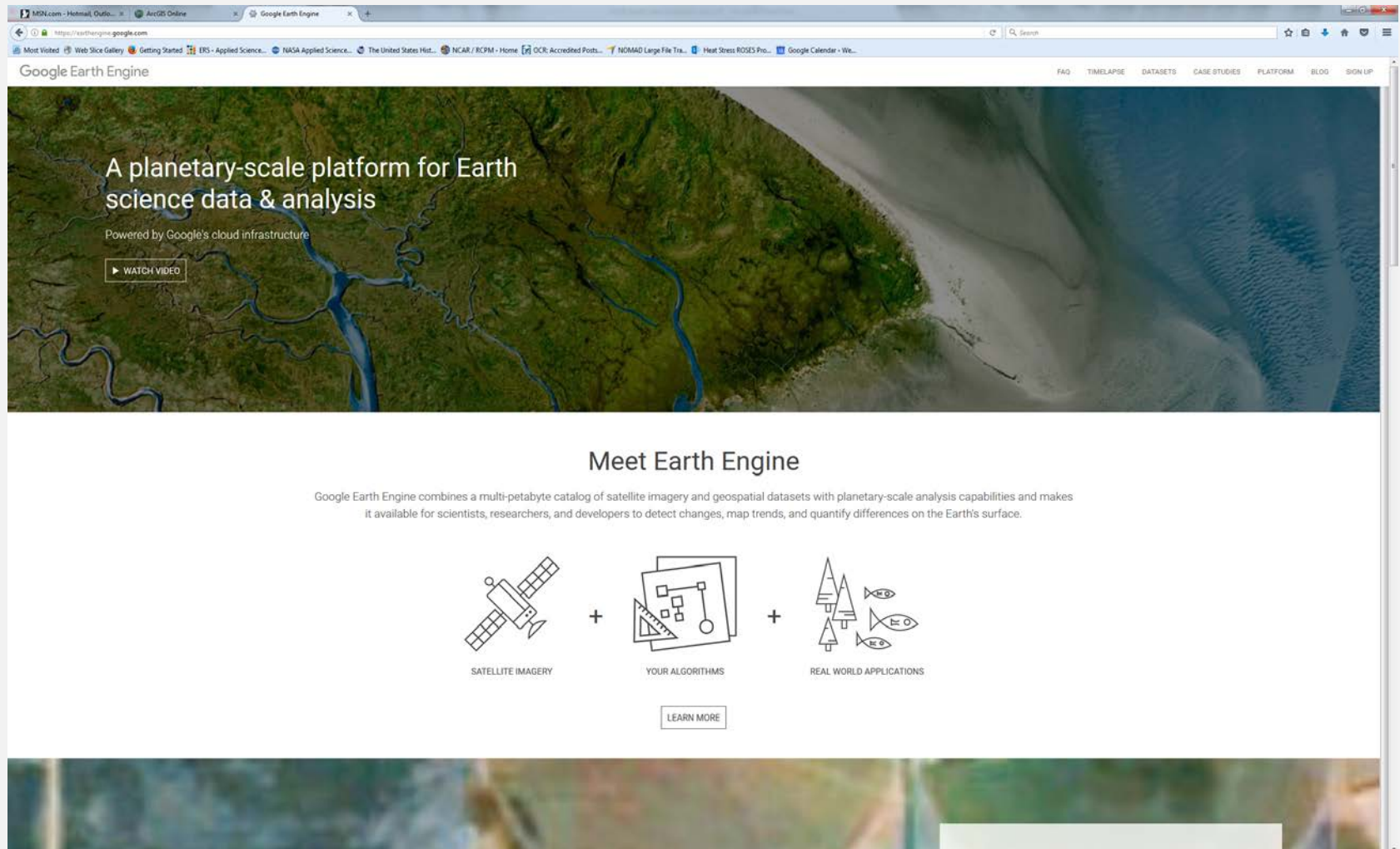
Linking Environmental and Health Data

- Problem: how do I get environmental and health data in the same geographic space for analyses?
 - Open Source Geospatial Tools (R, python, etc.)
 - ArcGIS
 - ArcGIS online (<https://www.arcgis.com/home/index.html>)
 - Erdas/ENVI
 - **Google Earth Engine (GEE)**



GEE

<http://earthengine.google.com/>



Tabs for Timelapse and Datasets

The screenshot displays the Google Earth Engine web interface. At the top, the navigation bar includes links for FAQ, TIMELAPSE, DATASETS, CASE STUDIES, PLATFORM, BLOG, and SIGN UP. The main map area shows a satellite view of the Americas with a search bar at the top left. Below the map, a timeline slider is set to 1990, with a 'Past' button and a '1990' label. A row of thumbnail images shows various locations: Miami, Brisbane, Australia, Los Angeles, Washington, San Francisco, Lassen Volcano, Par, Slumby Point, Las Vegas, Alberta, Canada, and Columbia. Below the map, the 'Timelapse' section is active, featuring three dataset cards: Landsat, Sentinel, and MODIS. Each card includes a thumbnail image, the dataset name, a brief description, and a link to search for data in Earth Engine.

Google Earth Engine

FAQ TIMELAPSE DATASETS CASE STUDIES PLATFORM BLOG SIGN UP

Search for places...

1000 km
500 mi

1990
Past

1994 2016

Miami Brisbane, Australia Los Angeles Washington San Francisco Lassen Volcano, Par Slumby Point Las Vegas Alberta, Canada Columbia

Timelapse

Landsat
Landsat, a joint program of the USGS and NASA, has been observing the Earth continuously from 1972 through the present day. Today the Landsat satellites image the entire Earth's surface at a 30-meter resolution about once every two weeks, including multispectral and thermal data. Earth Engine makes this data available in its raw form, as TOA-corrected reflectance, and in various ready-to-use computed products such as NDVI and EVI vegetation indices.
[Search Landsat data in Earth Engine](#)

Sentinel
ESA's Sentinel-1 mission uses radar to image the Earth in all weather conditions, even at night. The satellites capture C-band synthetic aperture radar (SAR) image data at 30- to 120-meter resolution in several polarization modes. Earth Engine includes a growing collection of Sentinel-1 data preprocessed using the Sentinel 1 Toolbox.
[View Sentinel data in Earth Engine](#)

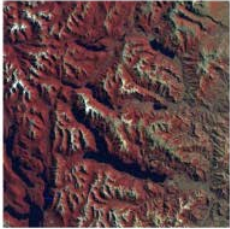
MODIS
The Moderate Resolution Imaging Spectroradiometer (MODIS) sensors on NASA's Terra and Aqua satellites have been acquiring images of the Earth daily since 1999. The Earth Engine catalog includes a variety of data products that NASA produces from MODIS data, including daily imagery, 16-day BRDF-adjusted surface reflectance, and derived products such as vegetation indices and snow cover.
[Search MODIS data in Earth Engine](#)

Share or Embed

Data Catalogue

Open Sensor of Interest

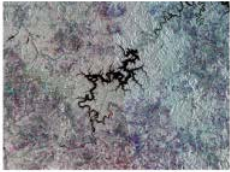
[IMAGERY](#) [GEOPHYSICAL](#) [CLIMATE & WEATHER](#) [DEMOGRAPHIC](#)



Landsat

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[View Sentinel data in Earth Engine.](#)

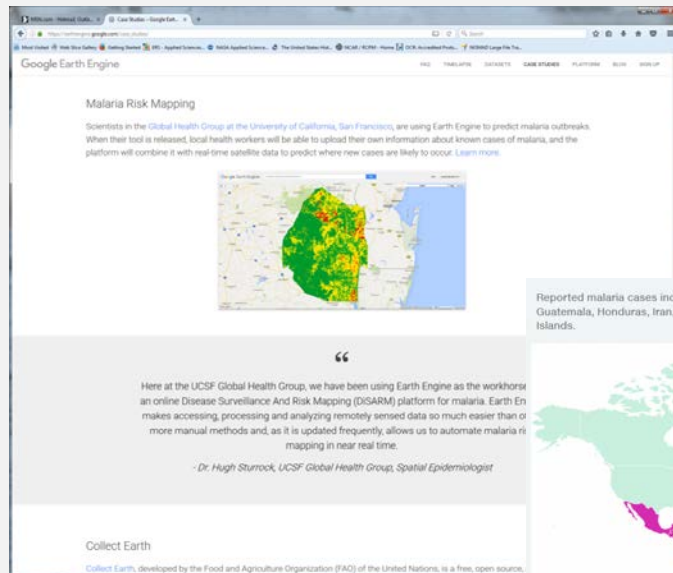


MODIS

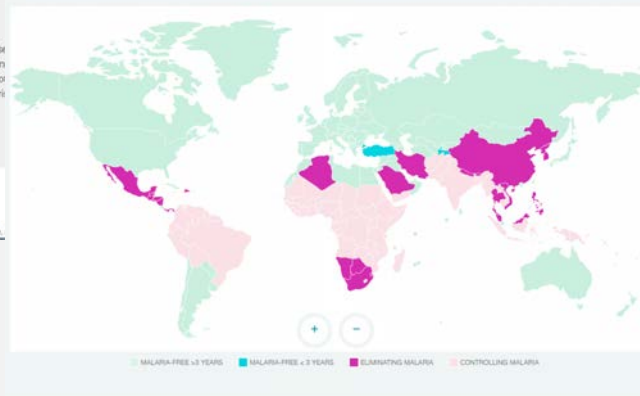
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[Search MODIS data in Earth Engine.](#)

Case Studies

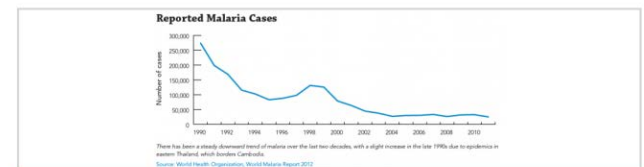


Reported malaria cases increased from 2014 to 2015 in the following 12 countries: Algeria, China, Dominican Republic, Guatemala, Honduras, Iran, Nicaragua, Philippines, Republic of Korea, Sao Tome & Principe, Saudi Arabia, and the Solomon Islands.

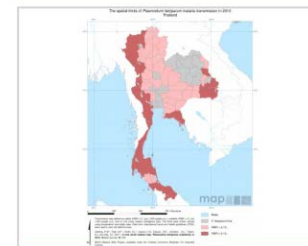


Regional Progress

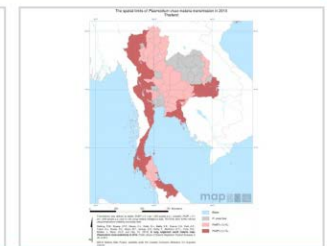
Global malaria eradication will be achieved region by region, requiring greater collaboration among bordering countries. One of the biggest challenges to eliminating malaria is cross-border transmission and importation. Mosquitoes carrying the malar parasite know no borders. Regional initiatives formalize collaboration among countries and create an enabling environment will help achieve elimination targets. Regional collaborations catalyze political commitment, build consensus and engagem



Reported cases



P falciparum transmission limit (2010)

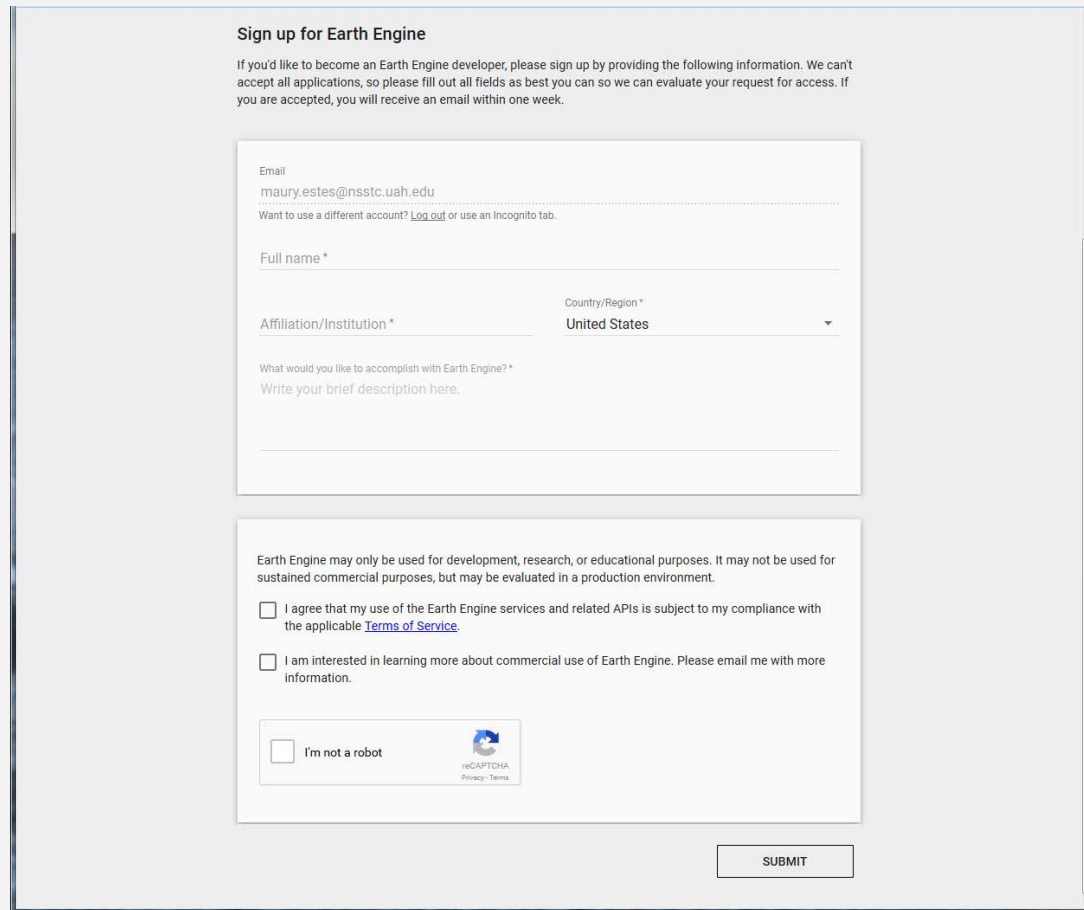


P vivax transmission limit (2010)

Reported Malaria cases by country in the Indonesia region

Sign up for Earth Engine

<https://earthengine.google.com/signup>

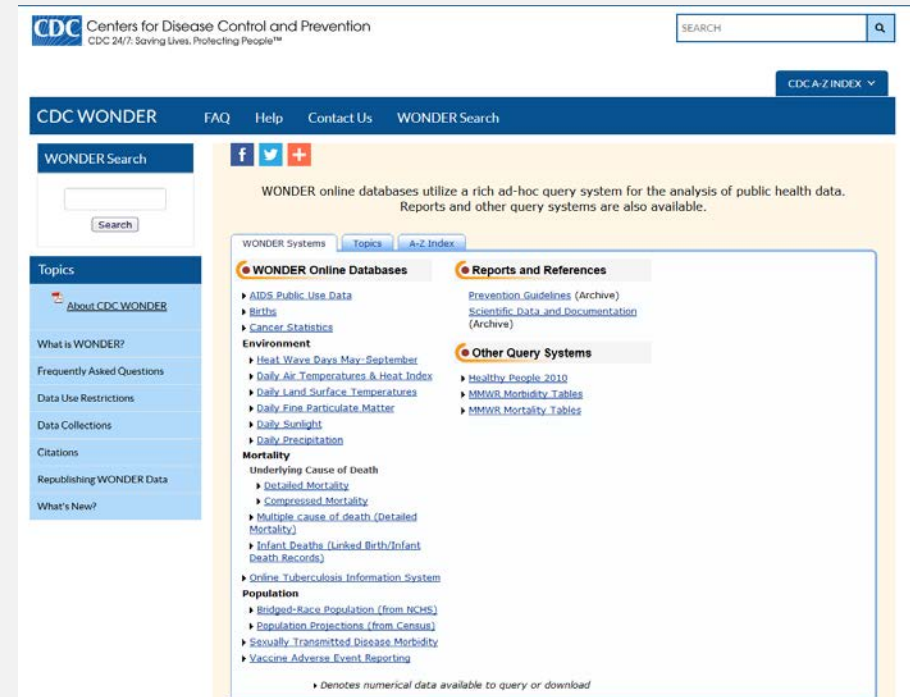


The screenshot shows the Earth Engine sign-up page. At the top, it says "Sign up for Earth Engine" followed by a paragraph explaining that users must provide information to be accepted, with a one-week email response time. The form fields include: "Email" (pre-filled with maury.estes@nsstc.uah.edu), "Full name" (required), "Country/Region" (dropdown menu showing "United States"), "Affiliation/Institution" (required), and "What would you like to accomplish with Earth Engine?" (text area). Below the form, there are two checkboxes: "I agree that my use of the Earth Engine services and related APIs is subject to my compliance with the applicable Terms of Service" and "I am interested in learning more about commercial use of Earth Engine. Please email me with more information." At the bottom left is a reCAPTCHA "I'm not a robot" checkbox, and at the bottom right is a "SUBMIT" button.

Earth Engine is free for research, education and non profit use

Acquiring Health Data

- **NASA doesn't collect health data**
- CDC, hospital admissions and emergency department records are good sources
- Mortality and morbidity plus location of death or illness are essential data to evaluate linkages between health outcomes and the physical environment
- **The Centers for Disease Control WONDER website** provides health data on a county wide scale for the U.S. <http://wonder.cdc.gov/>



Wrap-up

- Two NASA and two USGS based search and retrieval tools presented
 - All tools have features for spatial, temporal and thematic searches for data and information.
 - Which tool is best for you maybe a combination of personal preference and the type data you need.
- Google Earth Engine is a powerful resource for both data retrieval and geoprocessing analysis
 - Also a portal to various type of health related information

Homework: Reverb

1. Do a global data search, so no need for a bounding box
 - Set the temporal criteria for July 1-5, 2016
 - Set key science words as land surface temperature
 - Select this dataset from the list: MODIS/Aqua Land Surface Temperature/Emissivity 8-Day L3 Global 0.05Deg CMG V041
 - Search for granules
 - Compare side by side the two browse images one from June 25 to July 2 (1st image) and the other from July 3 (2nd image) to July 10 to answer these questions:
 - Q: Is the regional temperature for the Southeast United States warming, cooling or about the same between the 2 8-day composite images?
 - Q: Is the regional temperature for north Africa warming, cooling or about the same between the 2 8-day composite images?

Homework: Search, Acquiring, and Using Earthdata

Use the EARTH DATA tool to locate the dataset for Environmental Performance Index 2014 and access the health impacts file to answer the questions below

- Q: Is child mortality higher or lower in the year 1990 in the United States of America or Guadeloupe?
- Q: Same question in 2014?

Homework: GloVis

3. Use GloVis to find a L8 OLI/TIRS scene from 2016 that has less than 10% cloud cover for Metropolitan Atlanta (all areas inside I-285, the loop road)

- Write down the Landsat Scene Identifier
- Note the Cloud Cover Percent

Homework - GEE

- 4. Use Google Earth Engine to determine the following:
 - 4a. Since 1990 when did Malaria cases peak in Paraguay, South America?
 - 4b. What was the cause of this outbreak?