

RealEarth™

Real-time Visualization of Global Satellite Data and Derived Products

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Background

RealEarth is a data discovery and visualization platform developed at SSEC/CIMSS at the University of Wisconsin-Madison to support outreach and collaboration efforts of remote sensing scientists.

Started with a desire to...

- **Upgrade** a legacy app “PDA Automated Weather” (Russ Dengel’s “PAW”);
- **View** meteorological imagery in simple browser and mobile device interfaces;
- **Integrate** meteorological AOS data with GIS;
- **Animate** time-series imagery/data;
- **Scale** the infrastructure;
- **Distribute** the infrastructure.

Goal

Boiled down to:

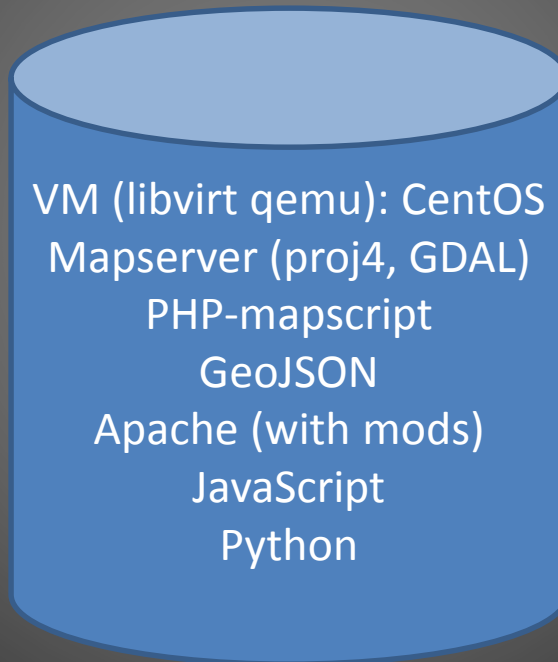
- Simple Visualization... of
- Complex Information... in
- Intuitive Interfaces

“RealEarth”

- (near) **Real** (time information)
- (full coverage of the) **Earth**

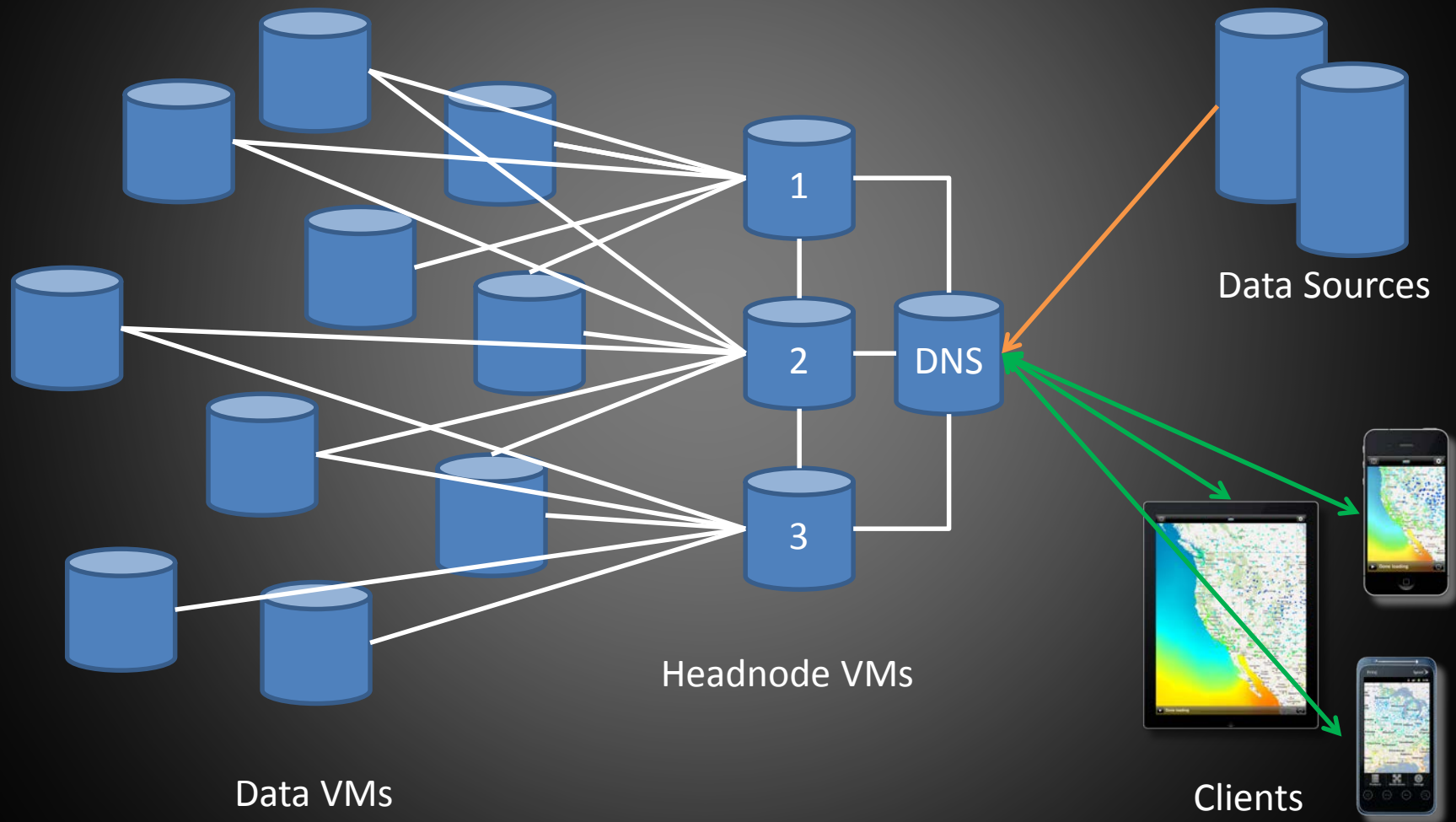
RealEarth™ VM

General Ingredients

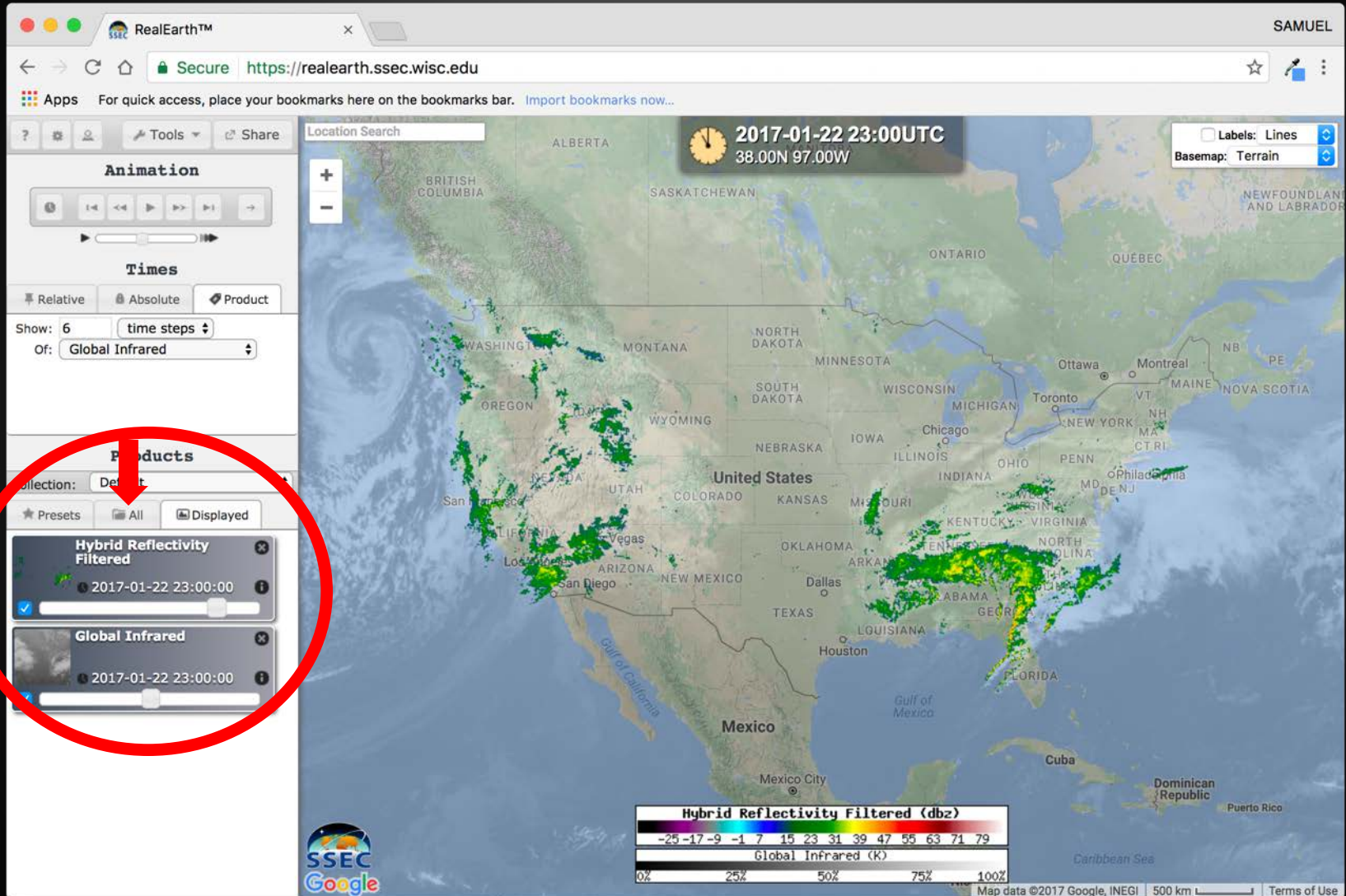


<https://www.ssec.wisc.edu/realearth/download/>

RealEarth™ General Architecture

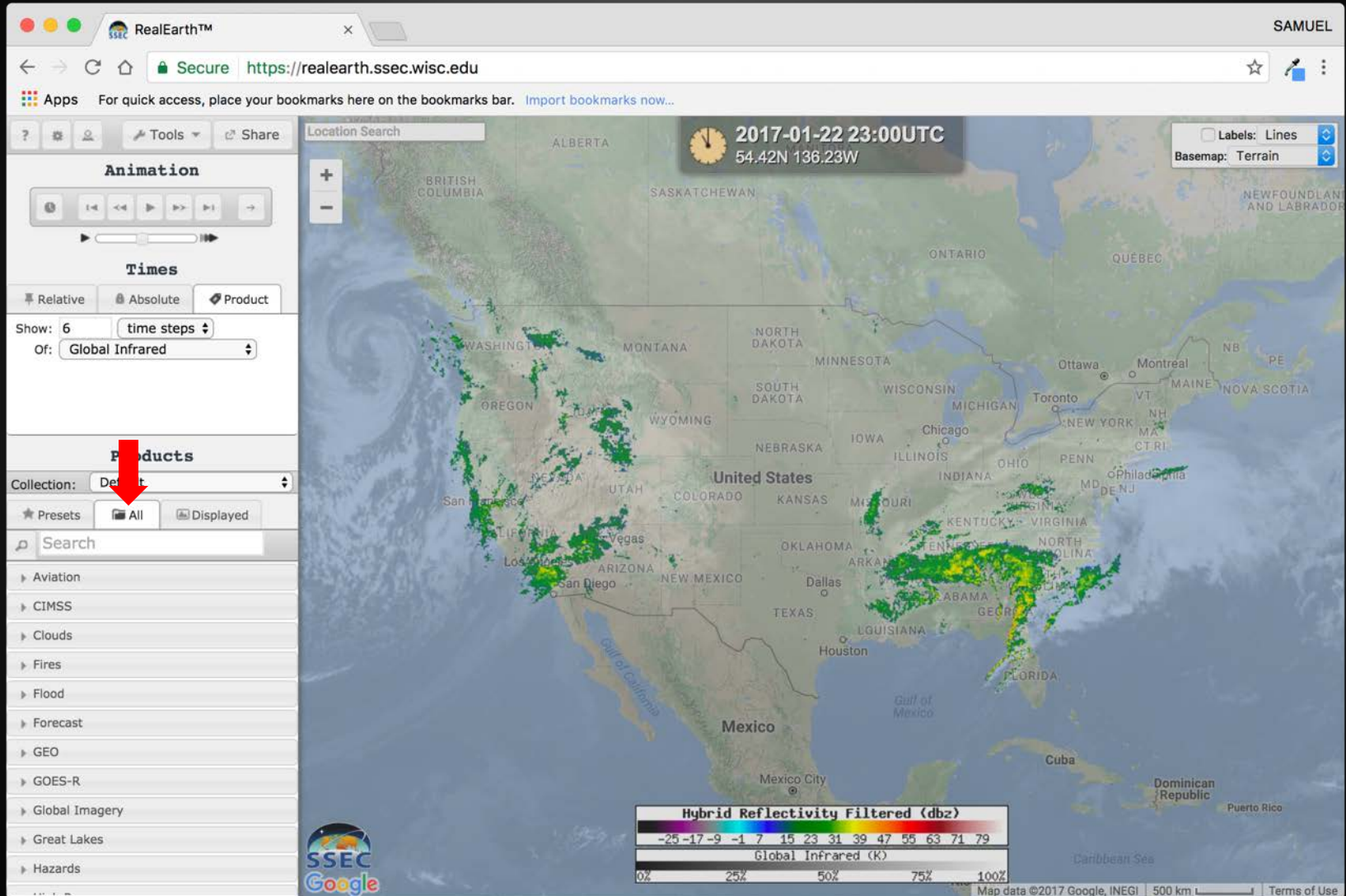


Basic Features



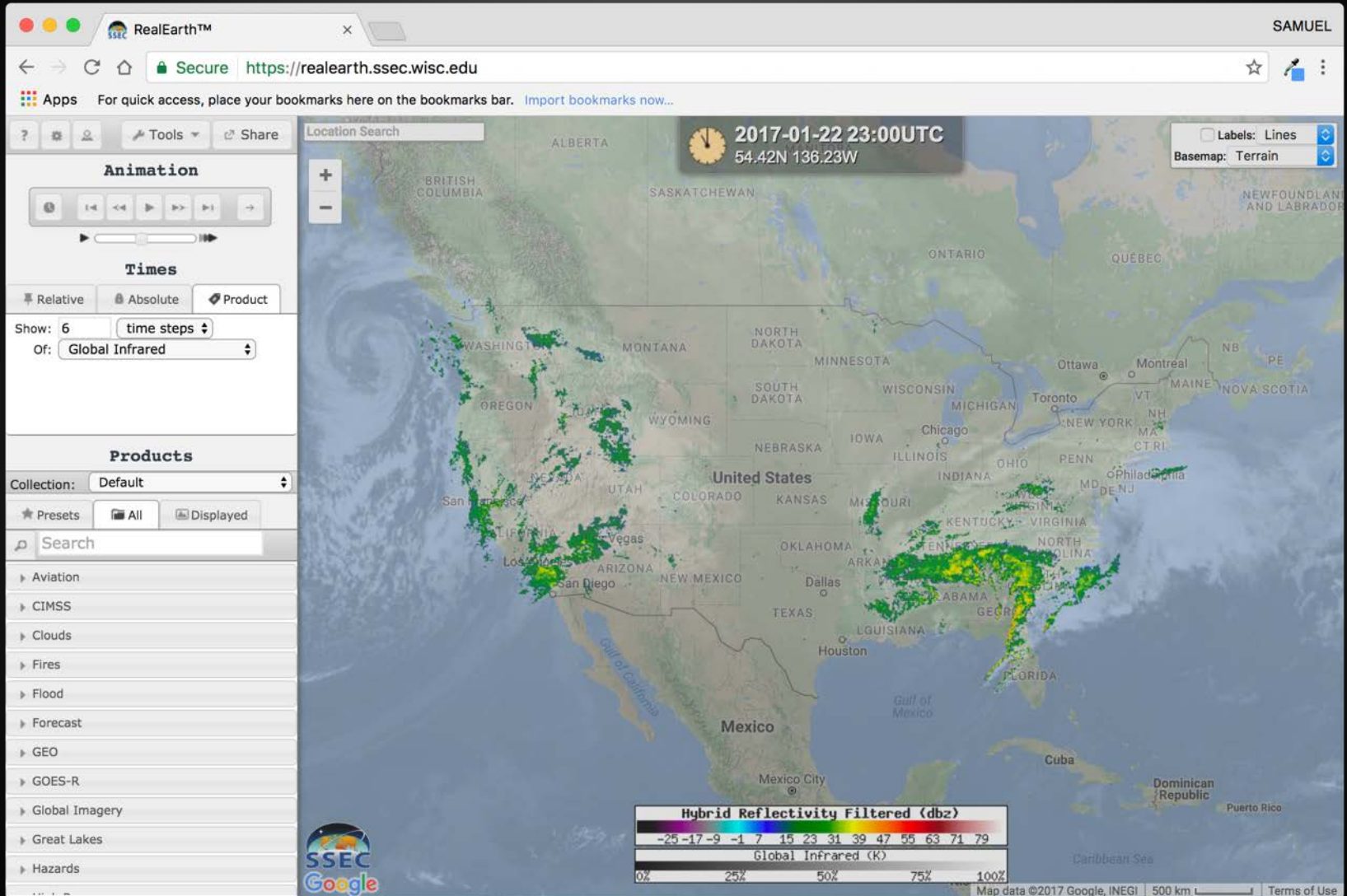
<https://realearth.ssec.wisc.edu>

Basic Features



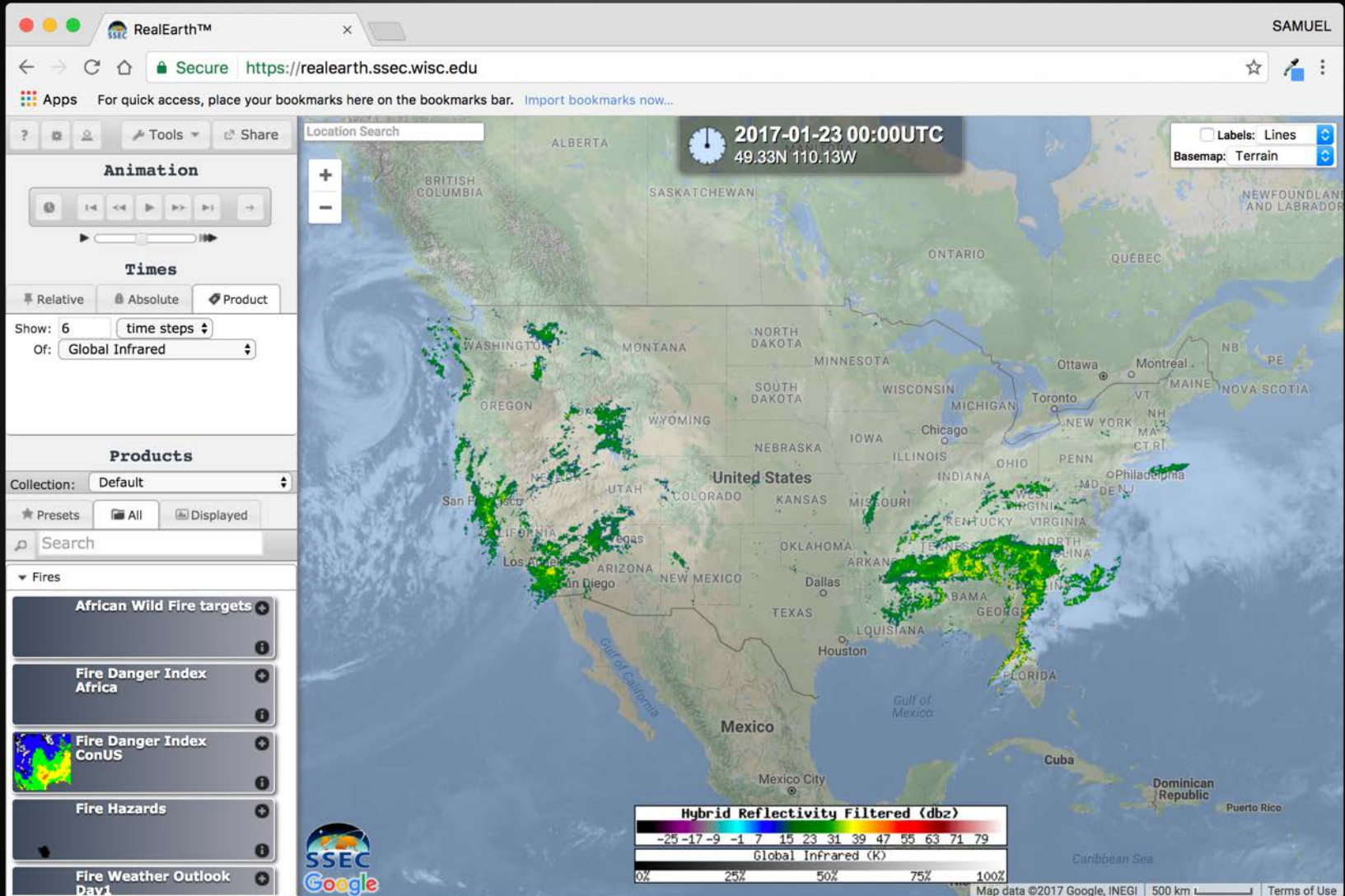
<https://realearth.ssec.wisc.edu>

Basic Features



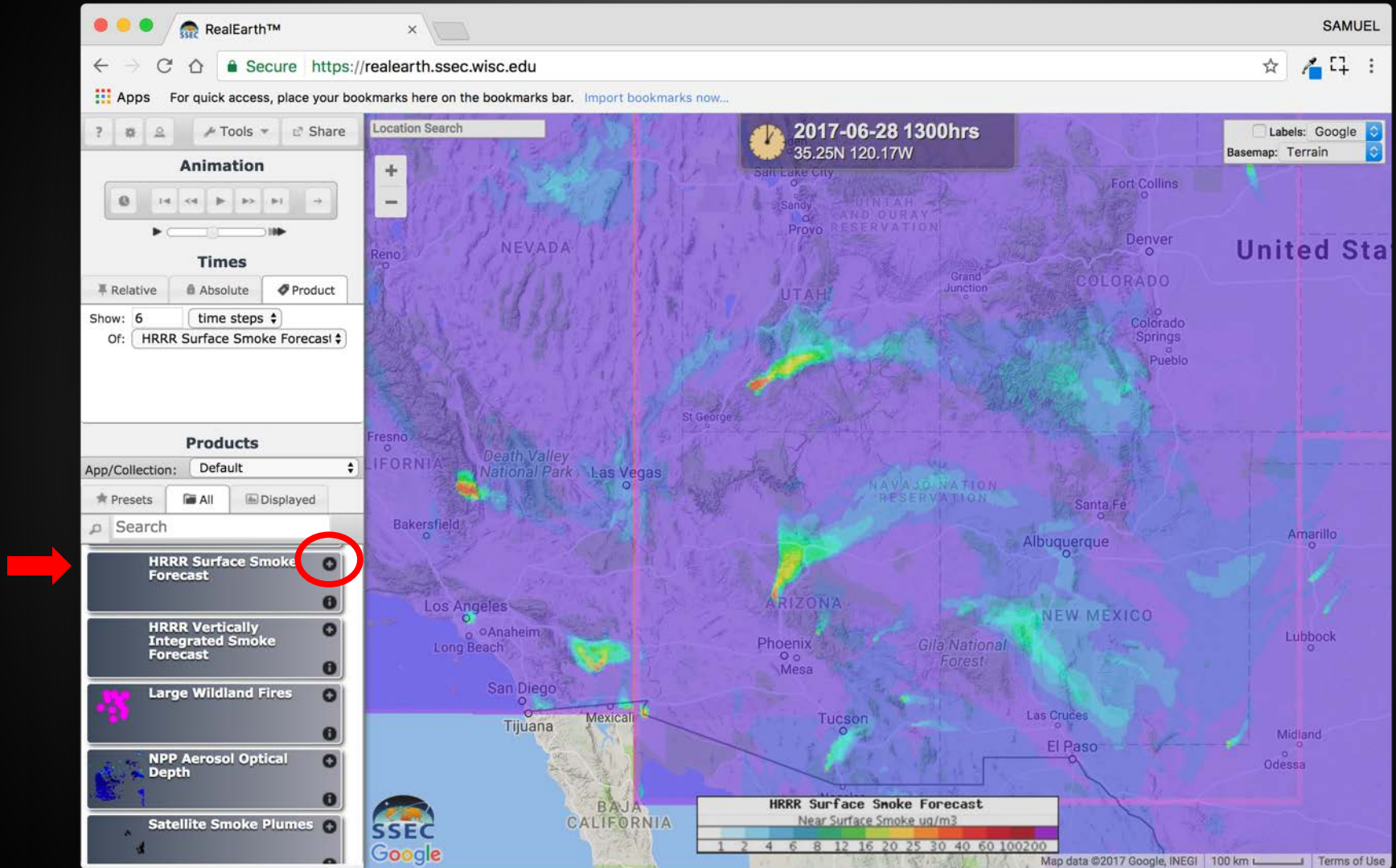
<https://realearth.ssec.wisc.edu>

Basic Features



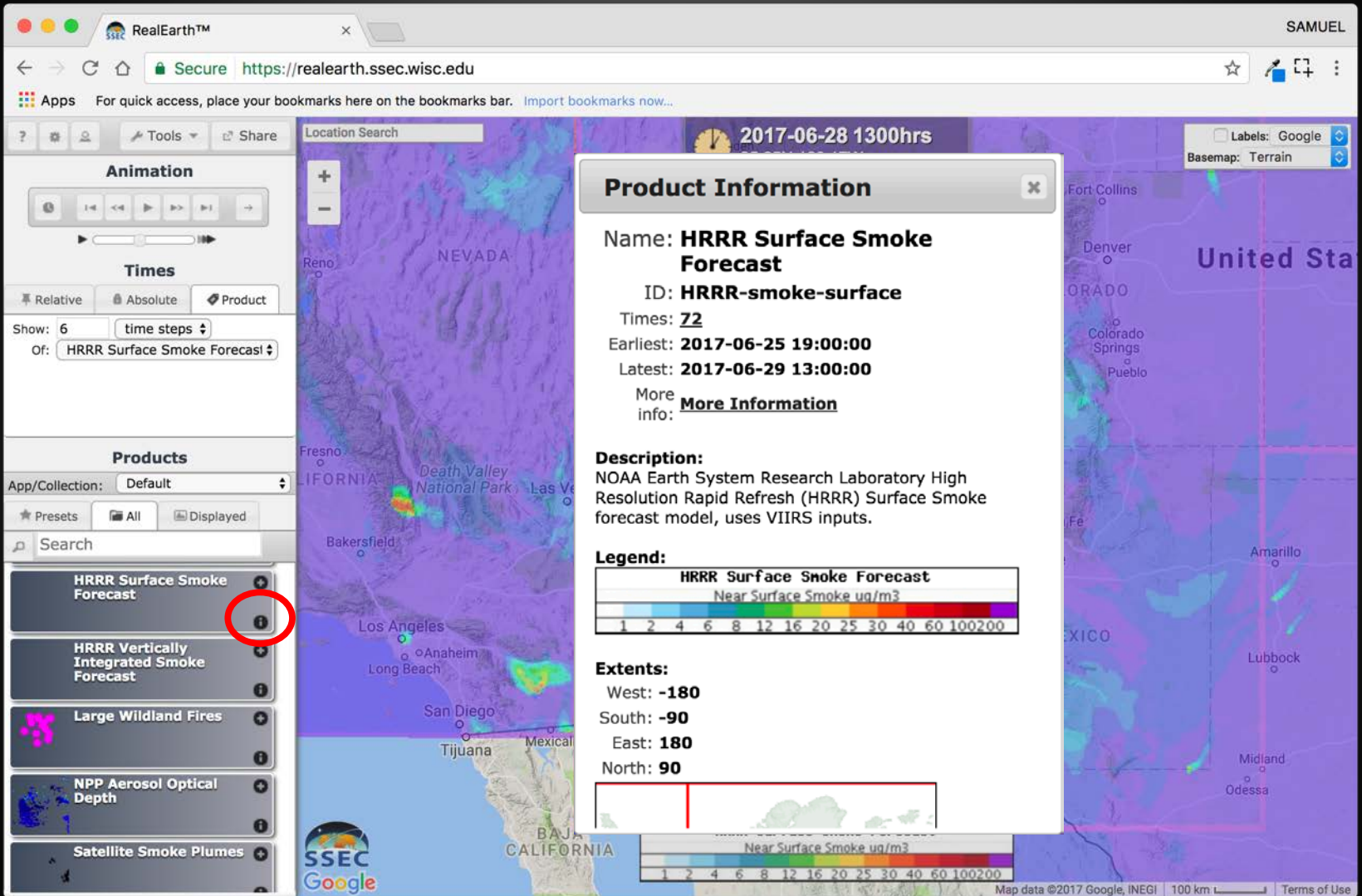
<https://realearth.ssec.wisc.edu>

Basic Features



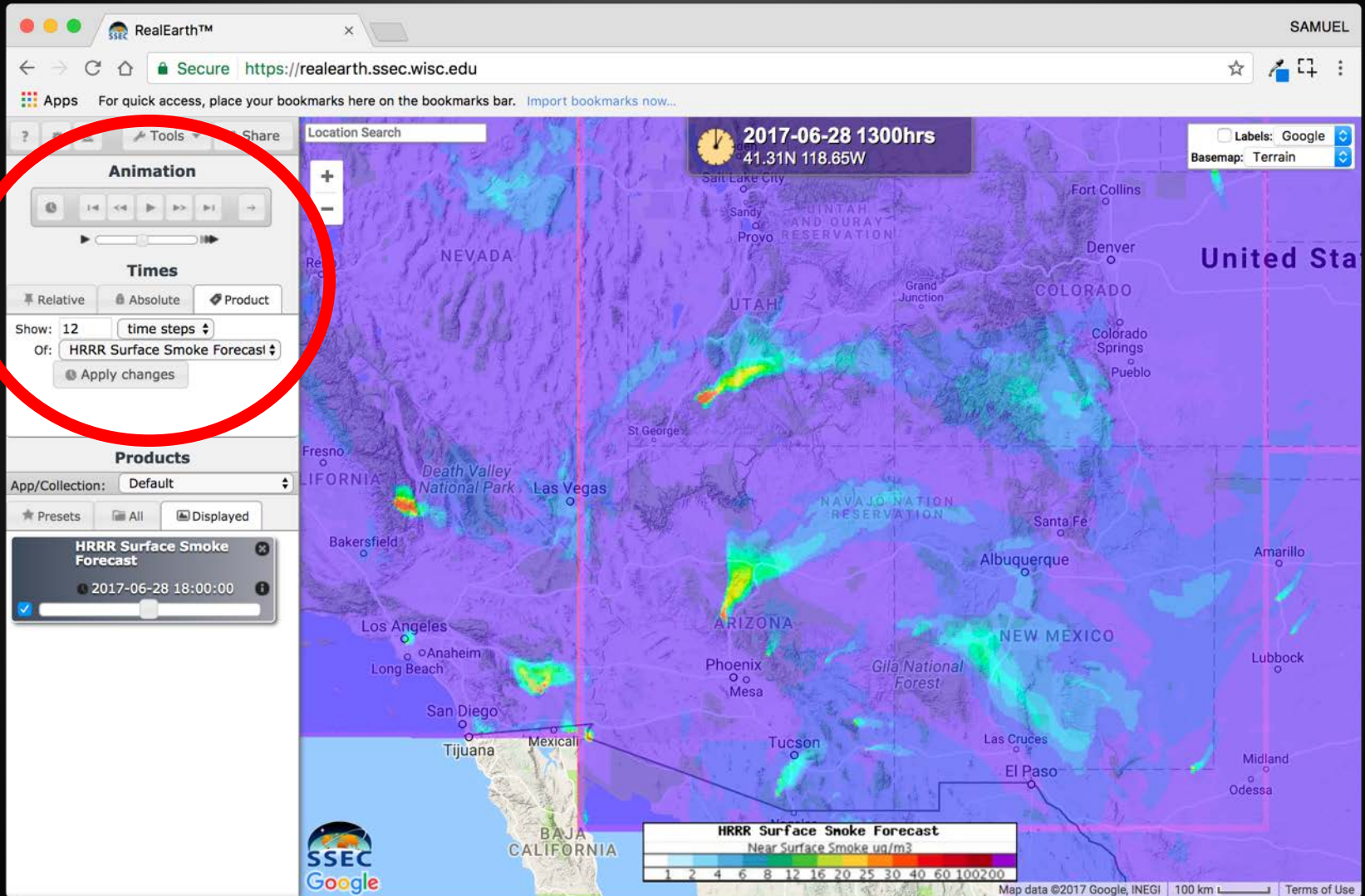
<https://realearth.ssec.wisc.edu>

Basic Features



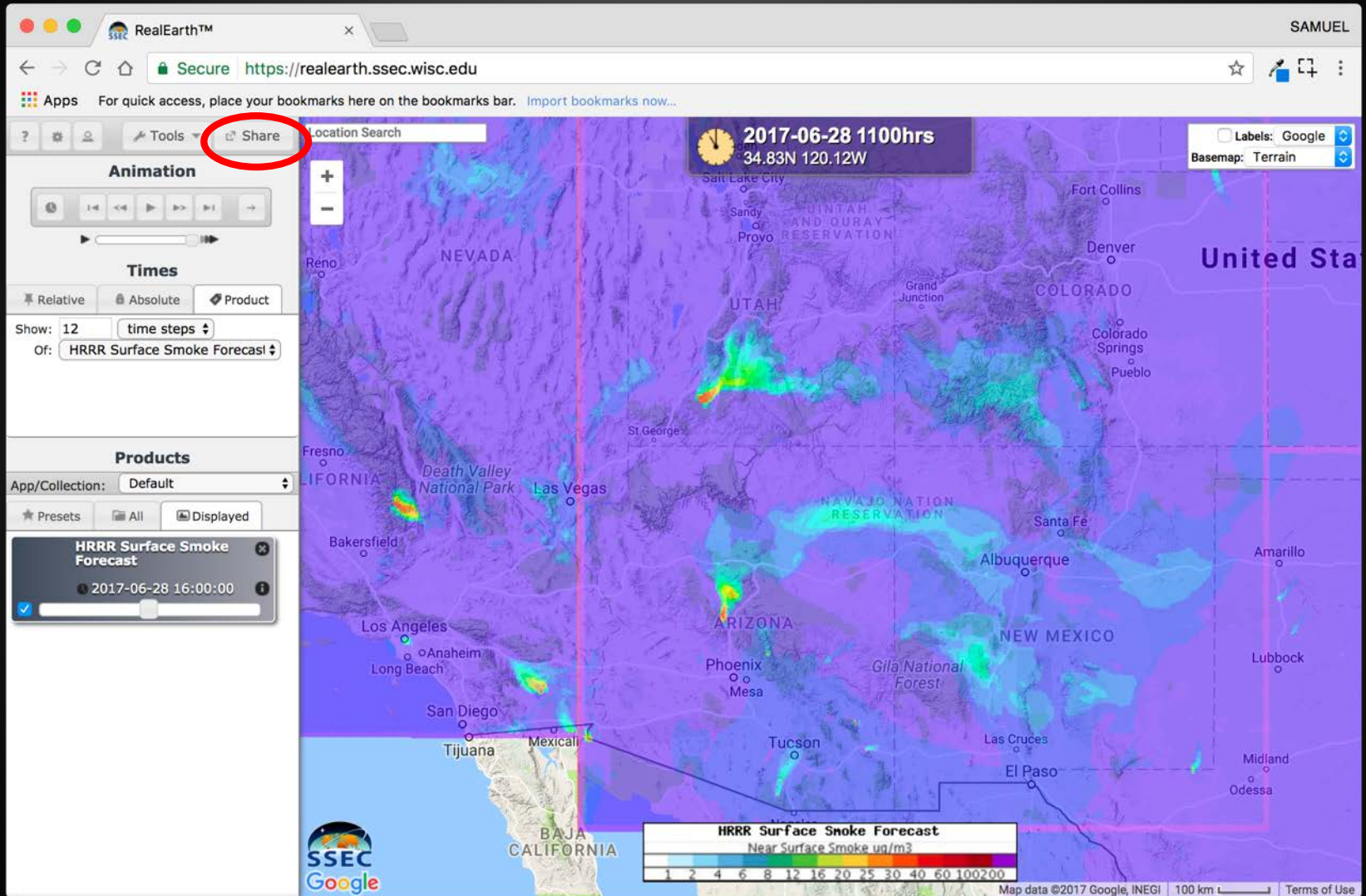
<https://realearth.ssec.wisc.edu>

Basic Features



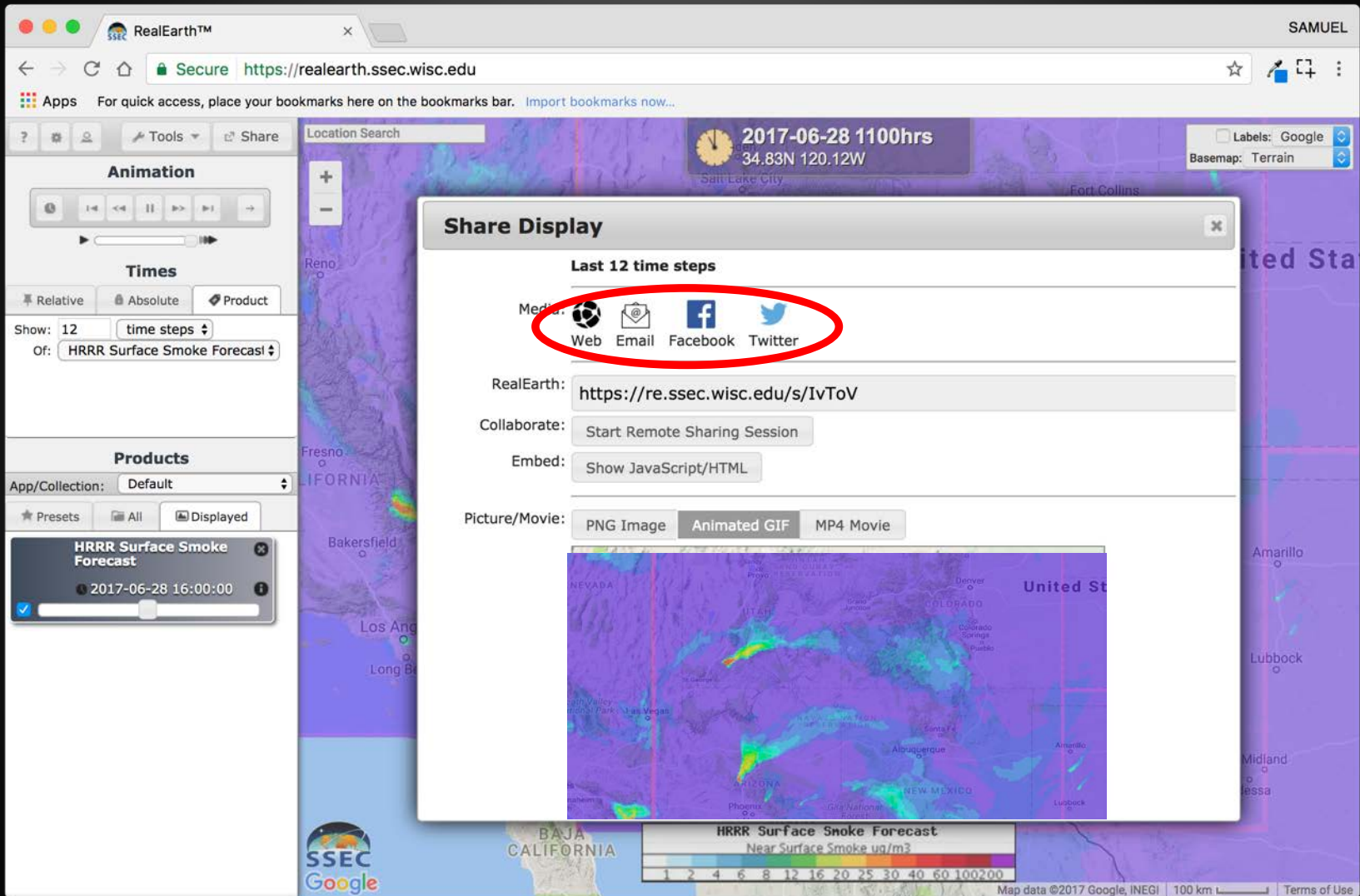
<https://realearth.ssec.wisc.edu>

Basic Features



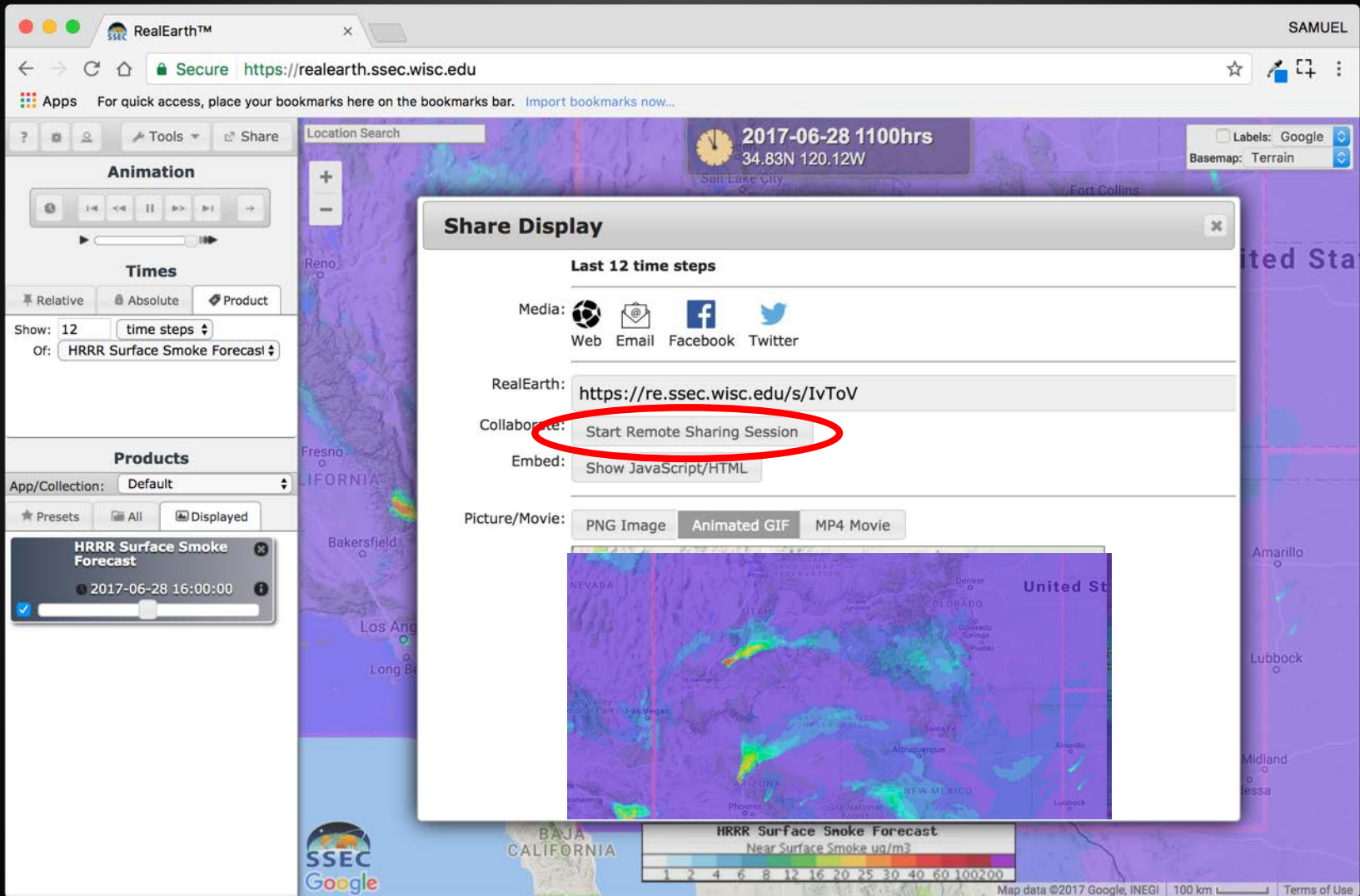
<https://realearth.ssec.wisc.edu>

Basic Features



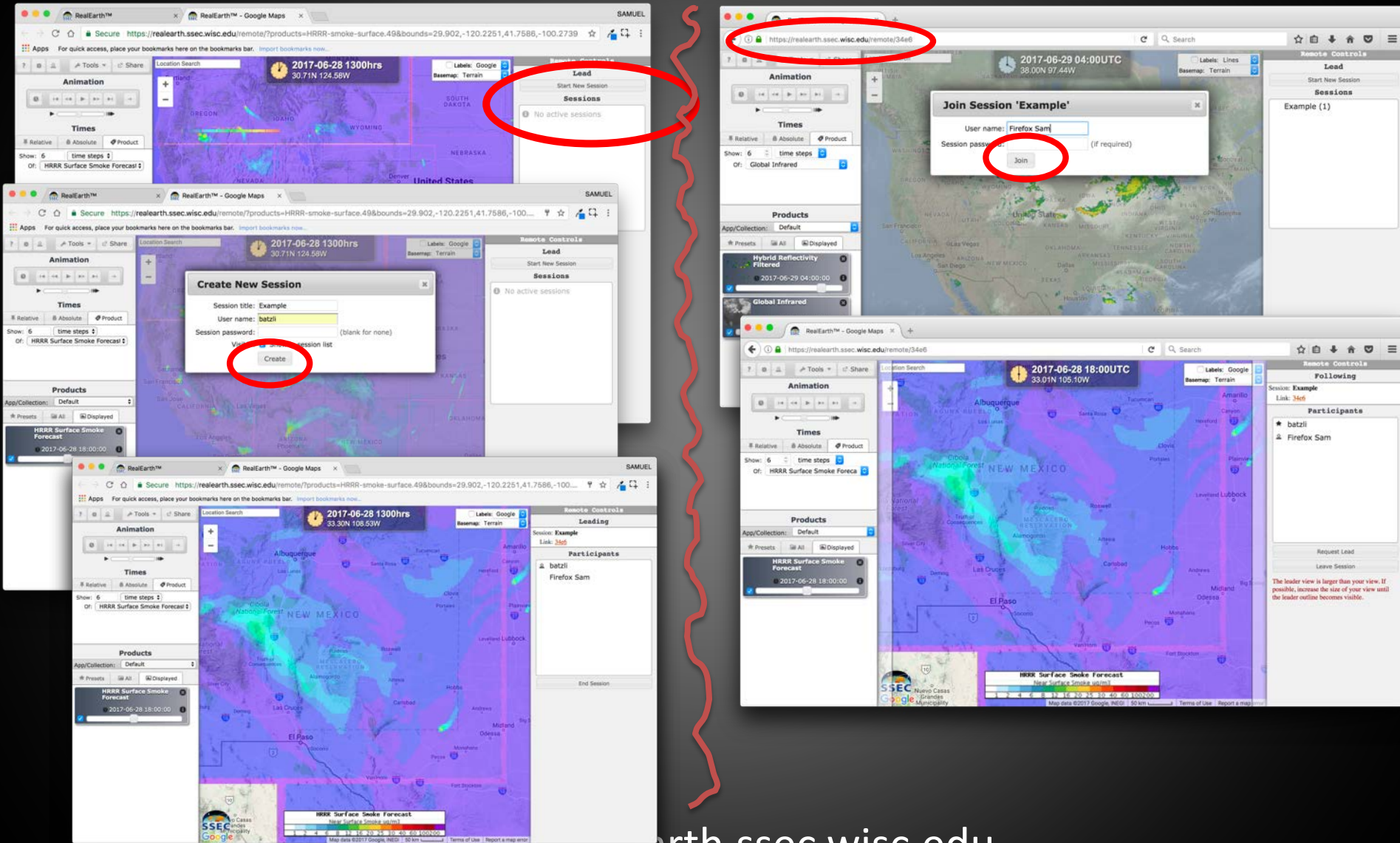
<http://realearth.ssec.wisc.edu>

Basic Features



<http://realearth.ssec.wisc.edu>

Basic Features



<http://realearth.ssec.wisc.edu>

Basic Features

The screenshot displays the RealEarth™ web application interface. The main map shows a smoke forecast over the Western United States. A 'Share Display' dialog box is open, providing options to share the current view. The dialog includes a 'Last 12 time steps' section with media sharing icons (Web, Email, Facebook, Twitter). It also shows the RealEarth URL (<https://re.ssec.wisc.edu/s/IvToV>) and a 'Collaborate' button. The 'Embed' section has a red circle around the 'Show JavaScript/HTML' button. Below this, there are options for 'Picture/Movie' (PNG Image, Animated GIF, MP4 Movie). A small thumbnail of the smoke forecast map is shown at the bottom of the dialog. The background interface includes a left sidebar with 'Animation', 'Times', and 'Products' sections, and a top navigation bar with a location search and a timestamp of 2017-06-28 11:00hrs.

RealEarth™

Secure <https://realearth.ssec.wisc.edu>

Apps For quick access, place your bookmarks here on the bookmarks bar. [Import bookmarks now...](#)

Tools Share

Location Search

2017-06-28 1100hrs
34.83N 120.12W

Labels: Google
Basemap: Terrain

Share Display

Last 12 time steps

Media:
Web Email Facebook Twitter

RealEarth: <https://re.ssec.wisc.edu/s/IvToV>

Collaborate: [Start Remote Sharing Session](#)

Embed: [Show JavaScript/HTML](#)

Picture/Movie: [PNG Image](#) [Animated GIF](#) [MP4 Movie](#)

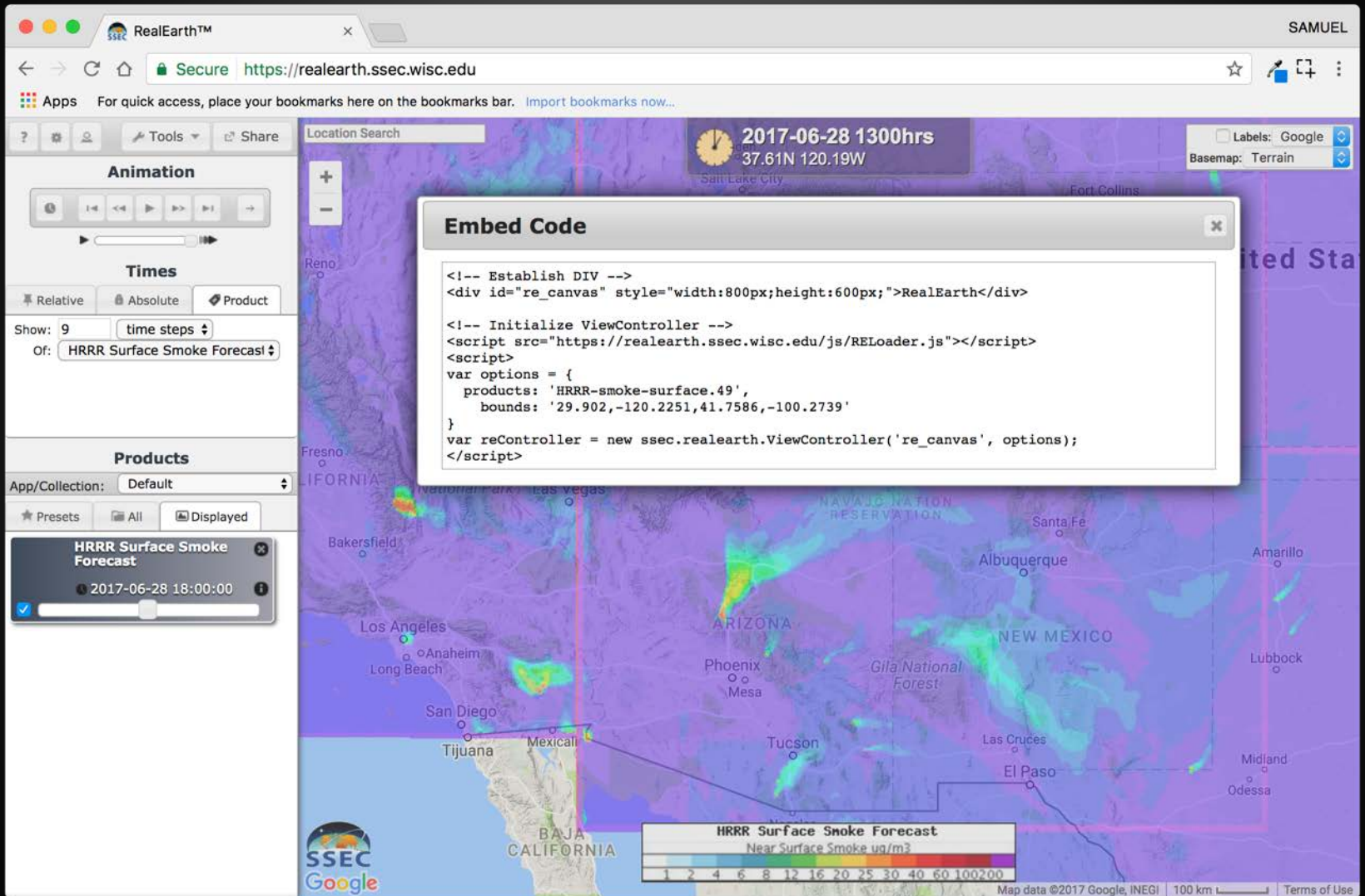
HRRR Surface Smoke Forecast
Near Surface Smoke ug/m³

1 2 4 6 8 12 16 20 25 30 40 60 100 200

Map data ©2017 Google, INEGI 100 km Terms of Use

<http://realearth.ssec.wisc.edu>

Basic Features



<http://realearth.ssec.wisc.edu>

Basic Features

Search

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AMERICA VIEW

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LANDSAT 8 VIEWER

This viewer is powered by **RealEarth™** at Wisconsin State Sea Grant Center.

The past 17 days of Landsat Look "Natural" Color and displayed for scenes for the whole Earth. Use keyboard back and forth in time. Right-click and select "Probe" to view Landsat scenes from either USGS or Amazon (Amazon behind USGS acquisition and may generate a empty image).

Location Search: 2017-06-28 05:55 UTC, 39.00N 98.41W

Map data ©2017 Google, INEGI | 1000

Open this view in the [full RealEarth™ interface](#).

Education Outreach

Copyright © 2016 AmericaView: A Nationwide Consortium

LakeSat.org

Statewide :: News & Press :: Interactive Map :: Map Poster :: About the Map :: Landsat Lake Images

Location Search: 2004-07-15 12:00UTC, 45.67N 90.33W

Show Controls: Labels: Lines, Basemap: Terrain

Map data ©2017 Google 50 km

Terms of Use Report a map error

Two dates are available: 2000, and 2004. Use your keyboard's left and right arrow keys to move between them.

LakeSat Home :: Field Spectroradiometry :: Statewide Lake Clarity :: SLOI :: MODIS Server :: ERSC :: UW-Madison

Environmental Remote Sensing Center :: University of Wisconsin-Madison
1225 W Dayton St, Floor 12 :: Madison, WI 53706
LakeSat Questions: [Sam Batzli](#)

SPRINGER THE UNIVERSITY OF WISCONSIN Sea Grant GLIM WISCONSIN VIEW

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TECHNOLOGY LINKS

[Technology](#)

- [AVMSS](#)
- [EODN](#)
- [Imagery and Data](#)
- [Landsat 8 Viewer](#)
- [TexasView NAIP](#)

running **RealEarth™**

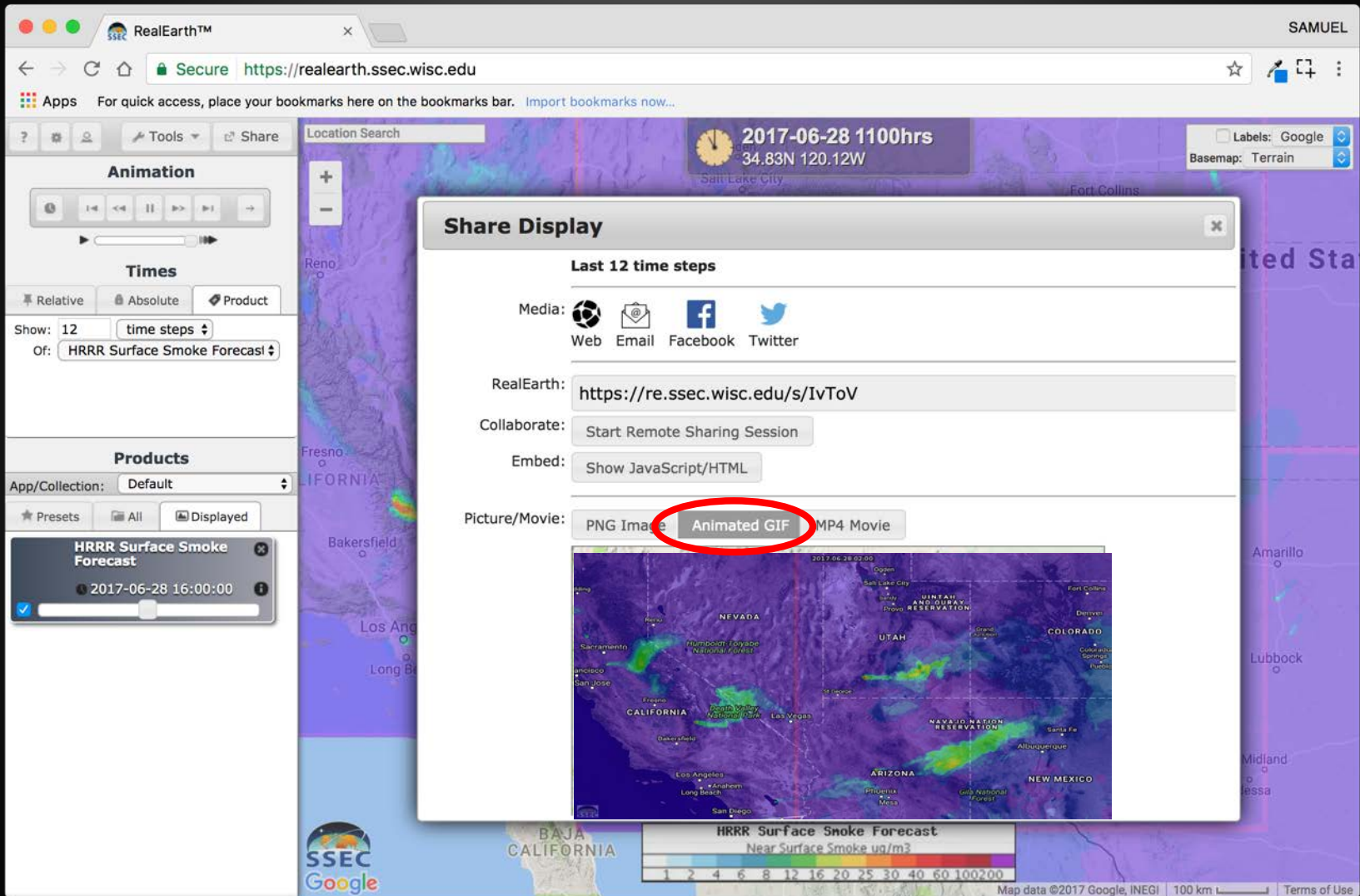
Show Controls: Labels: Lines, Basemap: Terrain

Map data ©2017 Google 50 km

Terms of Use

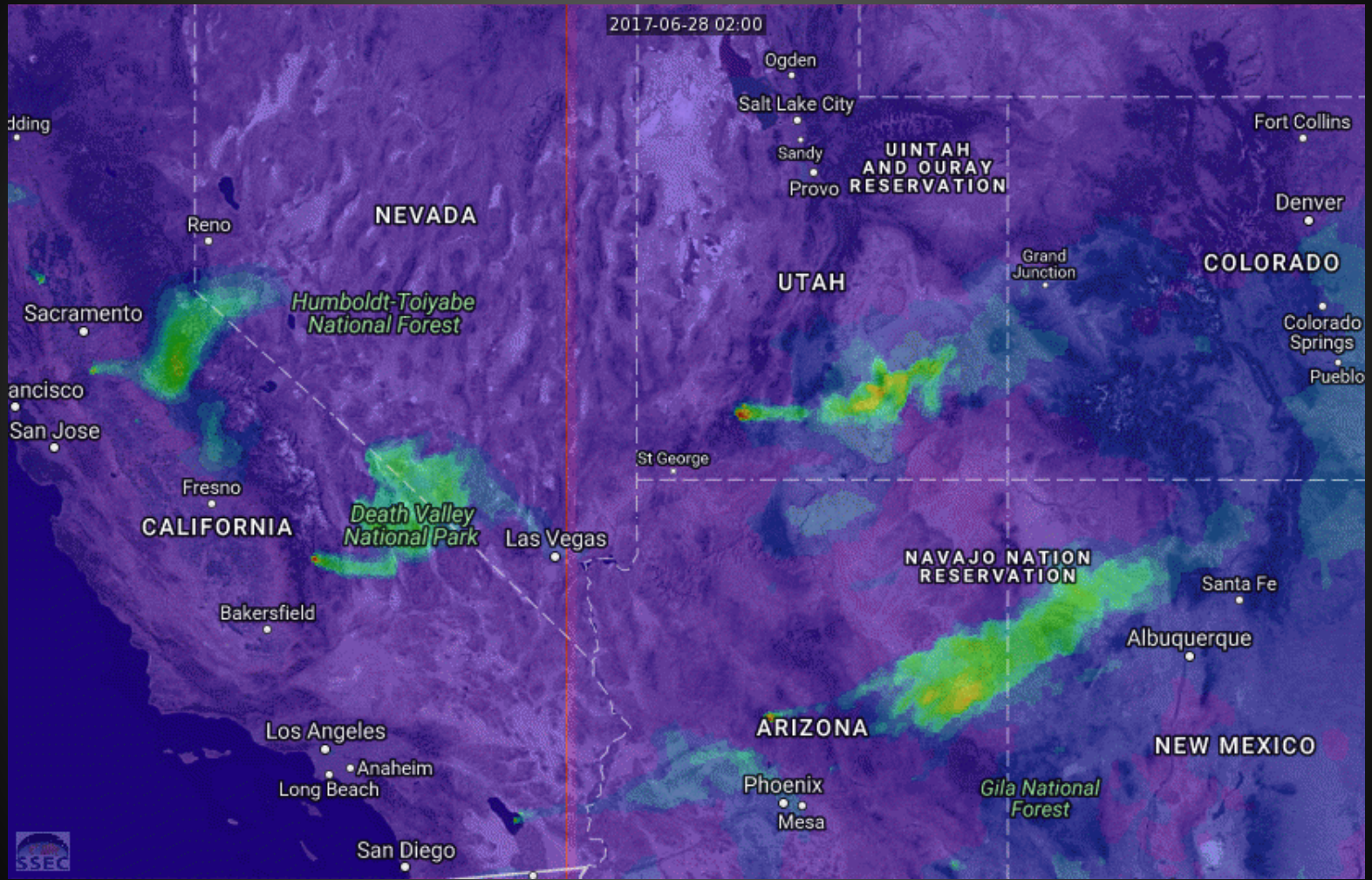
Research Technology Working Groups

Basic Features



<http://realearth.ssec.wisc.edu>

Basic Features



<https://realearth.ssec.wisc.edu>

Basic Features

The screenshot displays the RealEarth™ web application interface. The main map shows a smoke forecast over the western United States, with a color scale for 'Near Surface Smoke ug/m3' ranging from 1 to 100.00. A 'Share Display' dialog box is open, providing sharing options for the current view. The dialog box includes a red circle highlighting the WMS, Google Earth, and GeoTIFF links. The background interface includes a 'Location Search' bar, a clock showing '2017-06-28 1300hrs', and various controls for animation, times, and products.

Share Display

WMS: [HRRR Surface Smoke Forecast](#)
Google Earth: [KML file](#)
GeoTIFF: [GeoTIFF file](#)

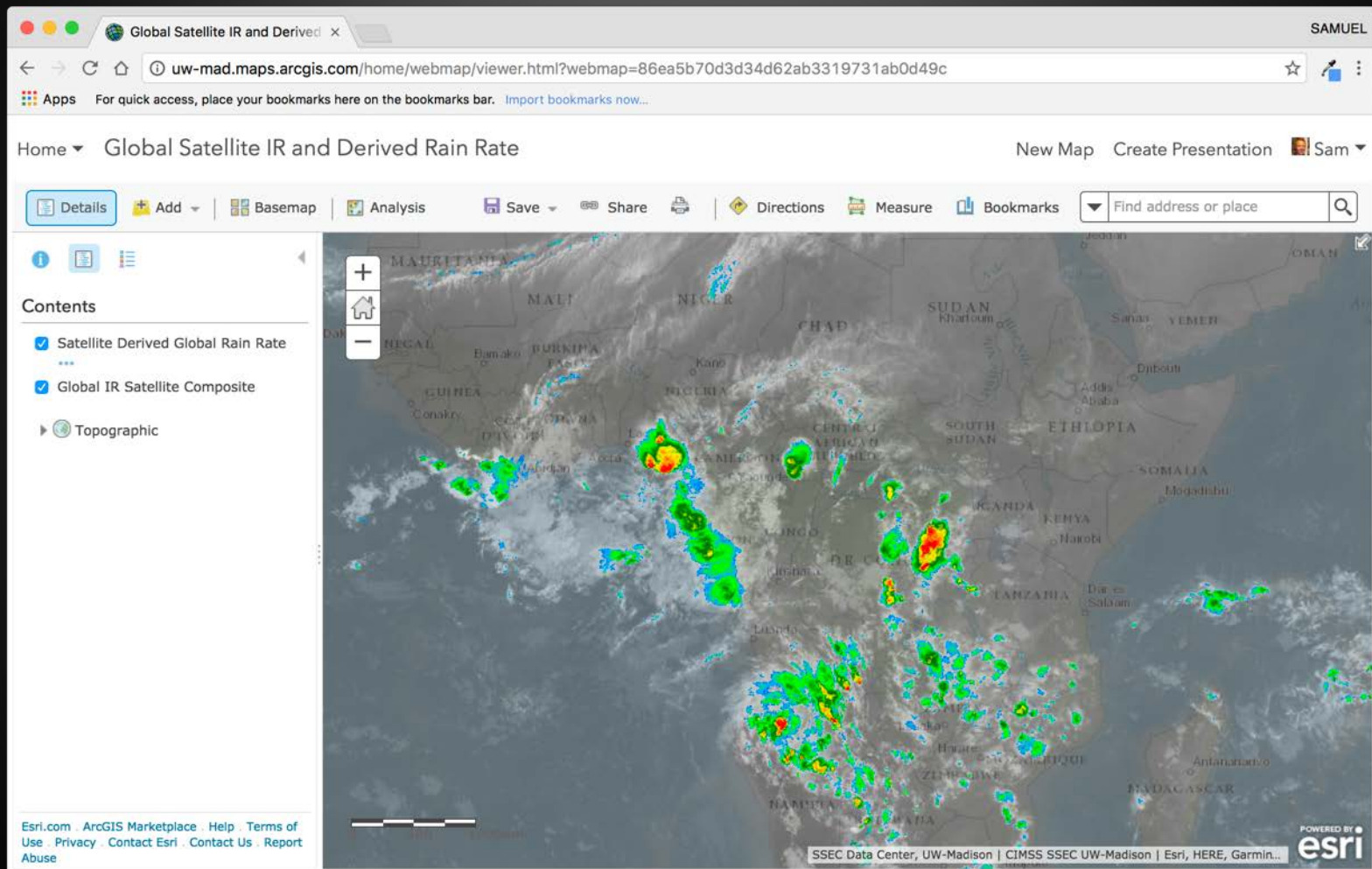
X/Y/Z Template: [HRRR Surface Smoke Forecast](#)
<https://realearth.ssec.wisc.edu/tiles/HRRR-smoke-surface/20170628/180000/{z}/{y}.png>

ArcGIS Template: [HRRR Surface Smoke Forecast](#)
<https://realearth.ssec.wisc.edu/tiles/HRRR-smoke-surface/20170628/180000/{level}/{col}/{row}.png>

<https://realearth.ssec.wisc.edu/?products=HRRR-smoke-surface.49¢er=36.05303591622904,-110.24951171874999&zoom=6&width=908&height=668&timeproduct=HRRR-smoke-surface×pan=-9t&ani...>

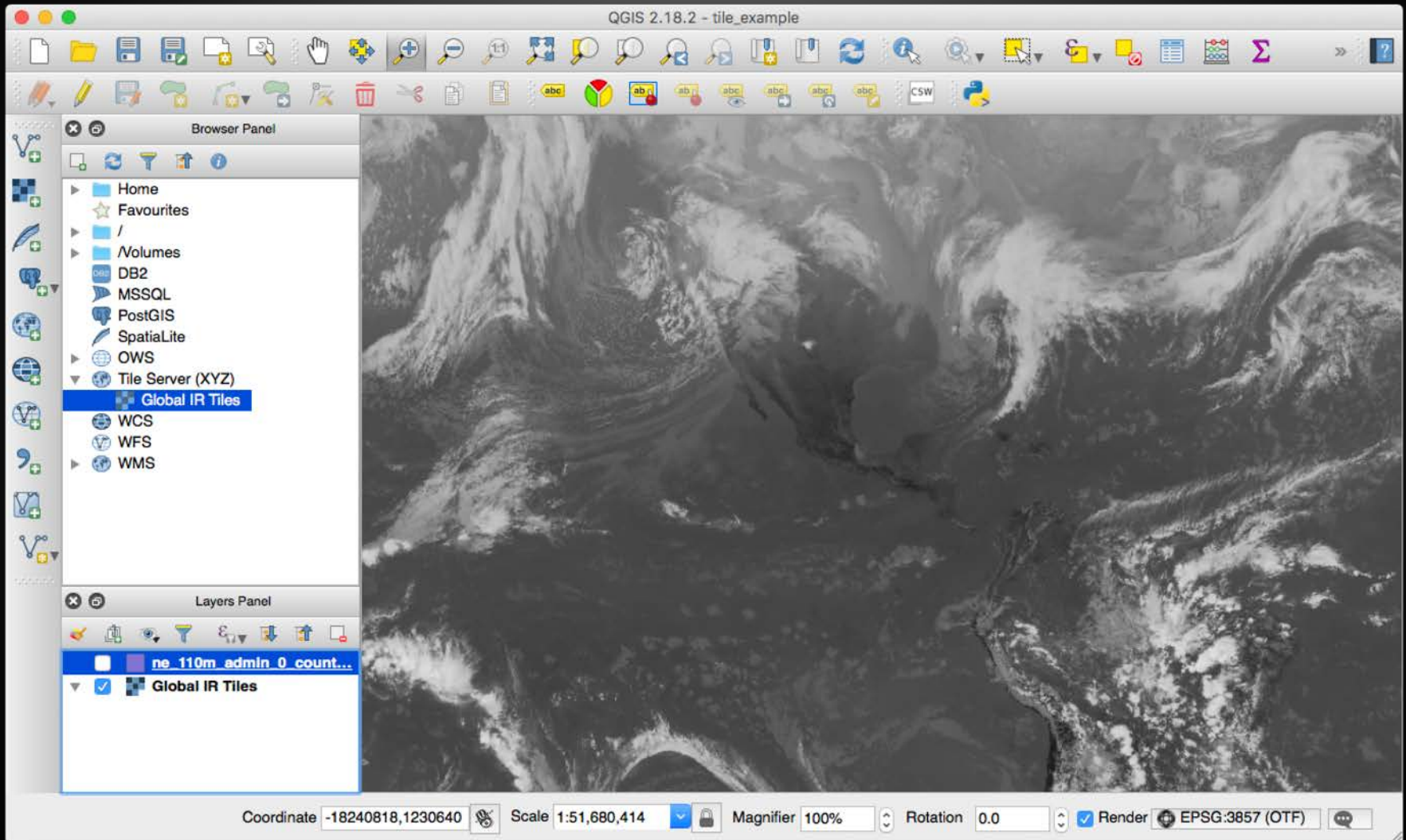
<https://realearth.ssec.wisc.edu>

ArcGIS Online Example

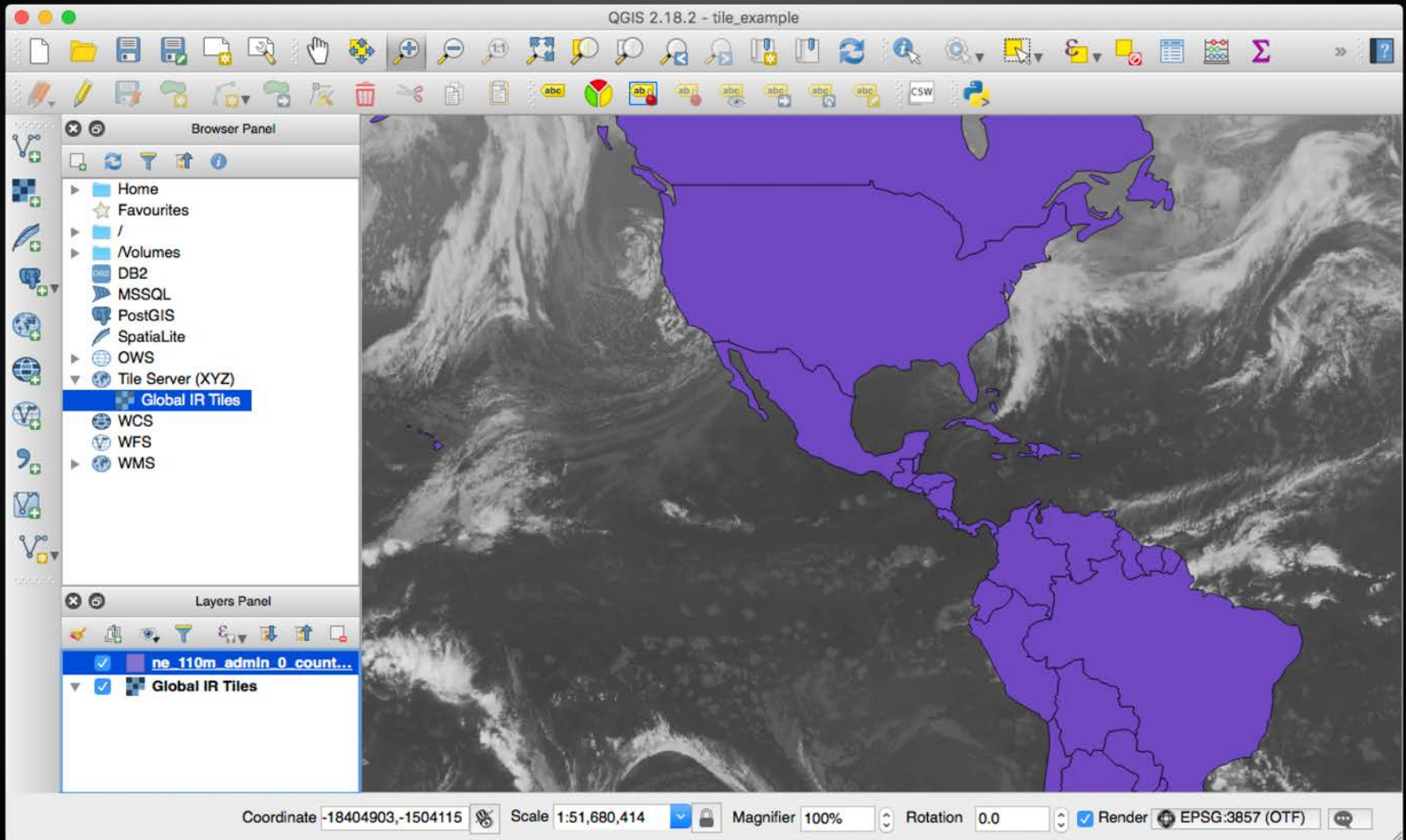


<http://arcg.is/2kkAWCi>

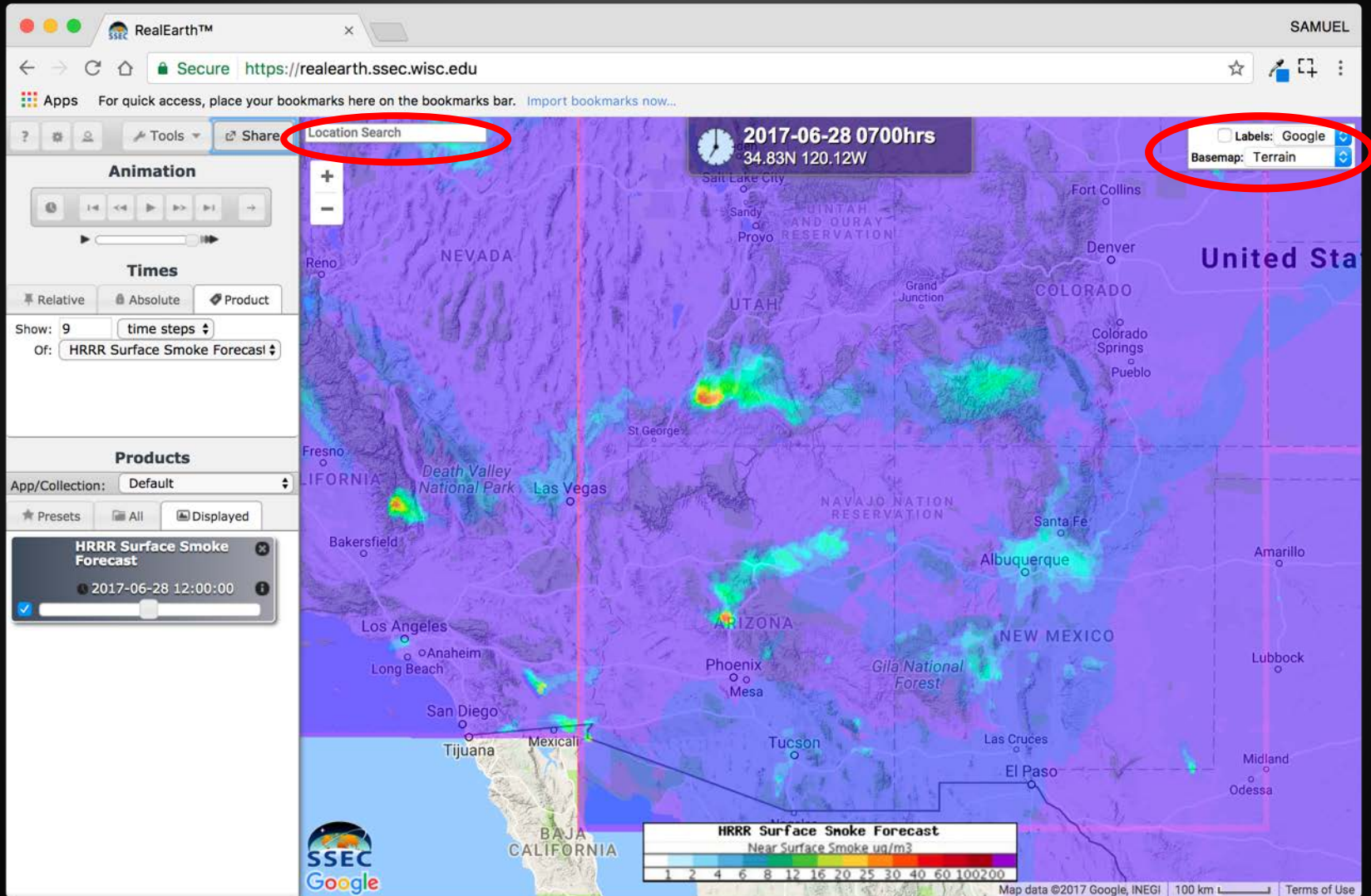
QGIS Example



QGIS Example

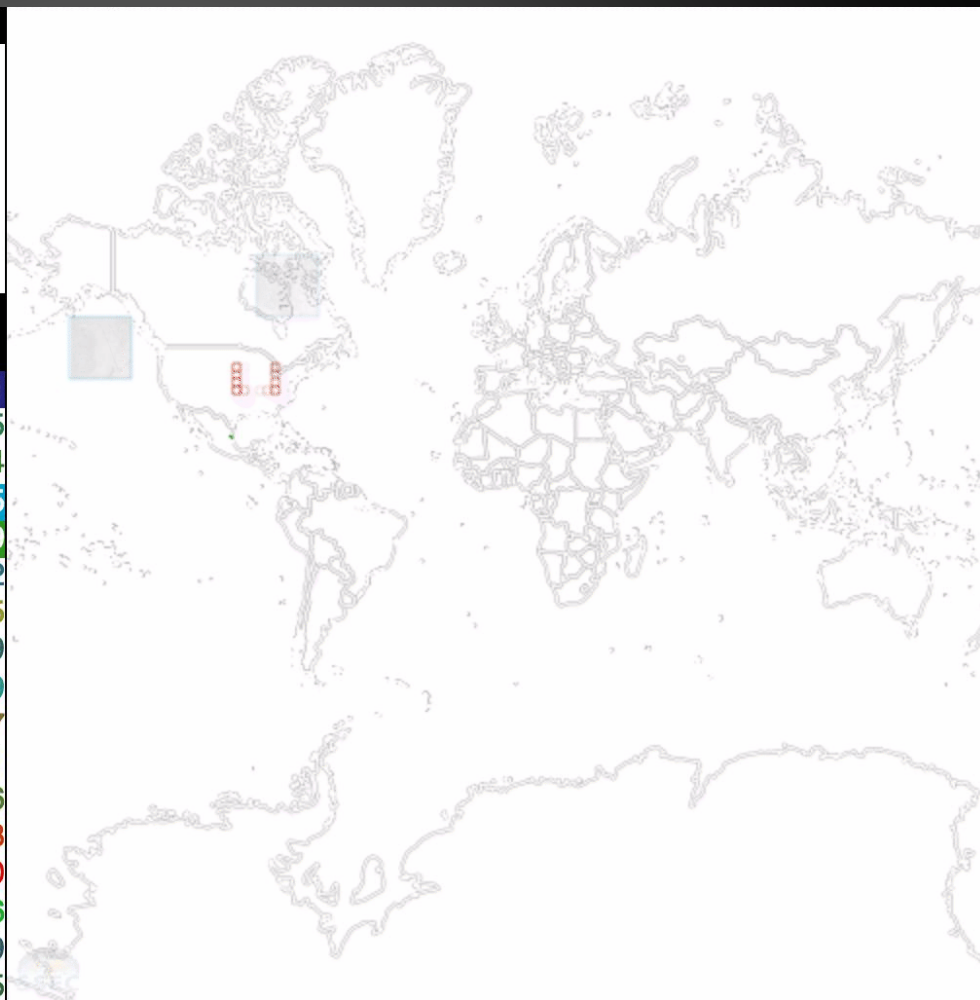
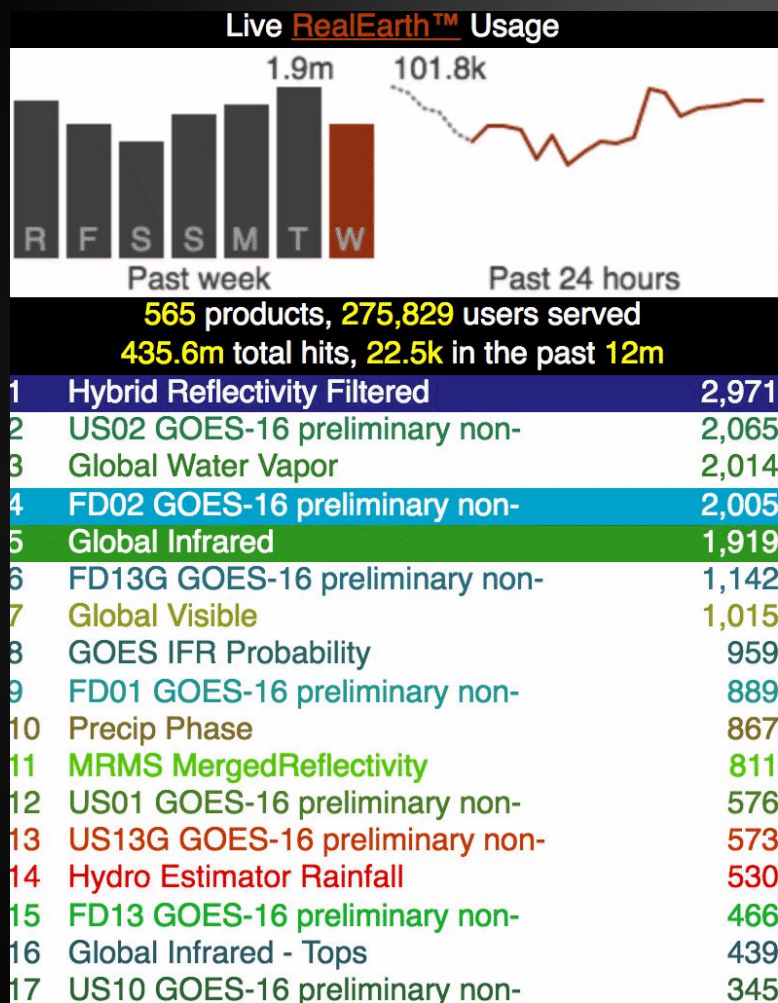


Basic Features



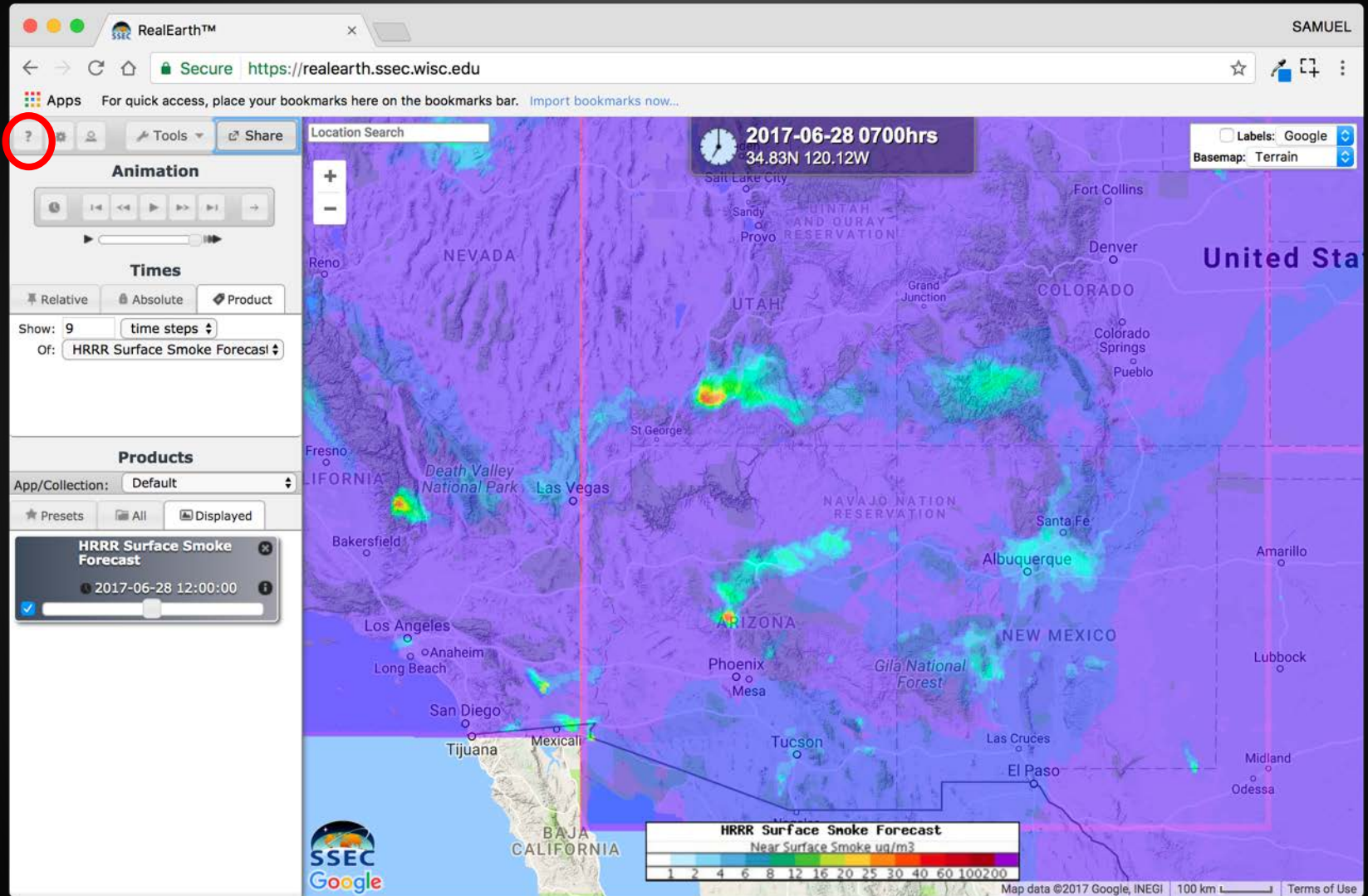
<https://realearth.ssec.wisc.edu>

RealEarth™ Metrics



<https://www.ssec.wisc.edu/realearth/live/realearth/>

Basic Features



<https://realearth.ssec.wisc.edu>

Basic Features

The screenshot shows the RealEarth™ web application interface. The browser address bar displays the URL <https://realearth.ssec.wisc.edu>. The interface includes a sidebar with controls for Animation, Times, and Products. The main display area shows a map of California with a smoke forecast overlay. A 'Help' pop-up window is open, displaying the following sections:

- Help**
- Legends**

Legends are shown at the bottom center of the display, and are stacked in the same order that the corresponding Product Layers are stacked in the display. Click on the legends to toggle them on/off. Note that not all Products have Legends.
- Probing Data**
- Imagery**

Right-clicking in the main display will present a menu with the option to Probe all displayed Products at the click location and nominal date/time. Probing occurs on the server, and appropriate probes must be provided by the data providers. The layout of the Probe result is not enforced.
- Shapes**

Hovering over a shape will show a tooltip with quick information about the object (if defined in the Product), and clicking on a shape (point/line/polygon) will show a pop-up window with information about the object.
- Documentation**
 - [Complete Documentation](#)
- Contact**
 - realearth@ssec.wisc.edu

The 'Complete Documentation' link is circled in red. The map shows a smoke forecast overlay with a color scale from 1 to 200 ug/m3. The sidebar includes controls for Animation, Times, and Products. The top right corner shows the user name 'SAMUEL'.

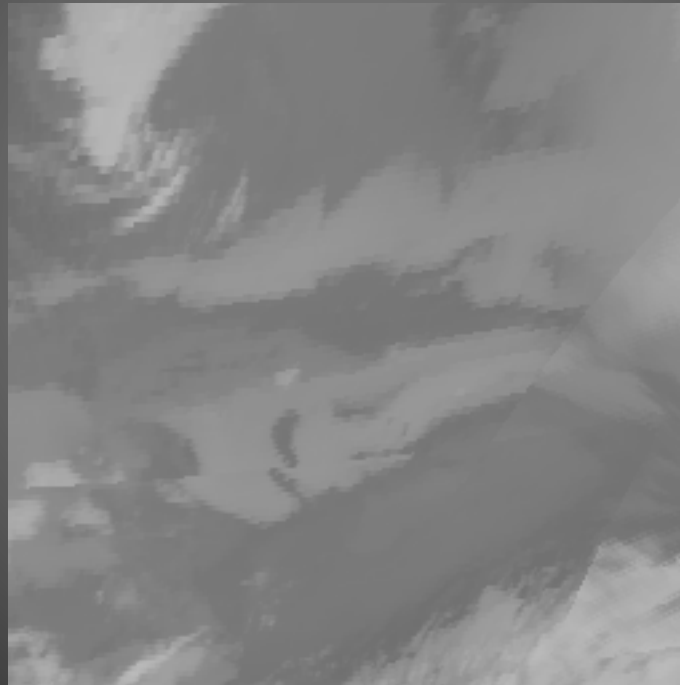
<https://realearth.ssec.wisc.edu>

Advanced Features

<https://realearth.ssec.wisc.edu>


Advanced Features

<https://realearth.ssec.wisc.edu/tiles/globalir/20170629/050000/4/5/4.png>



<https://realearth.ssec.wisc.edu>

Uploads

 RealEarth™ Upload

Upload Form

File: Choose File No file chosen

Name (A-Z, dash):

Date (YYYYMMDD):

Time (HHMMSS):

☐ Part of a larger product
☐ Overwrite existing product

Upload

Accepted formats include:

- GeoTIFF
- GeoJSON
- Shapefile
- McIDAS-X AREA

Shell Script

Use the [re_upload script](#) to automate uploads from the commandline

Usage

```
re_upload [-hufpcrv] [-k key|file] [-s server:port] file [name] [date] [time]

-h: Show help
-u: Check for update
    Version: 20

-f: Force overwrite if there is a conflict
-p: Designate file as part of a larger product

-k: Specify the upload key or file

-c: Add random sleep to mitigate concurrent uploads (eg. cron jobs)
-r: Send through head node
-s: Specify the server and port
    Default: realearth.ssec.wisc.edu

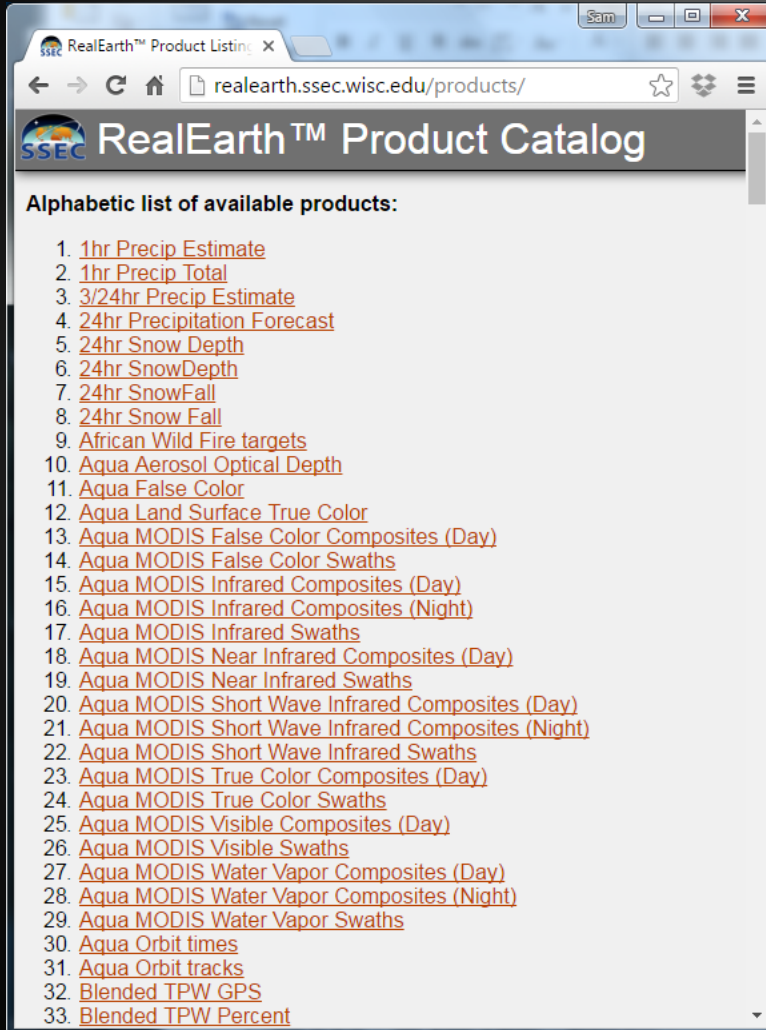
-v: Be verbose

file: Path to file
      Format: /path/to/[name]_[YYYYMMDD]_[HHMMSS].???

name: Specify the product name
```

<http://realearth.ssec.wisc.edu/upload/>

Product Catalog



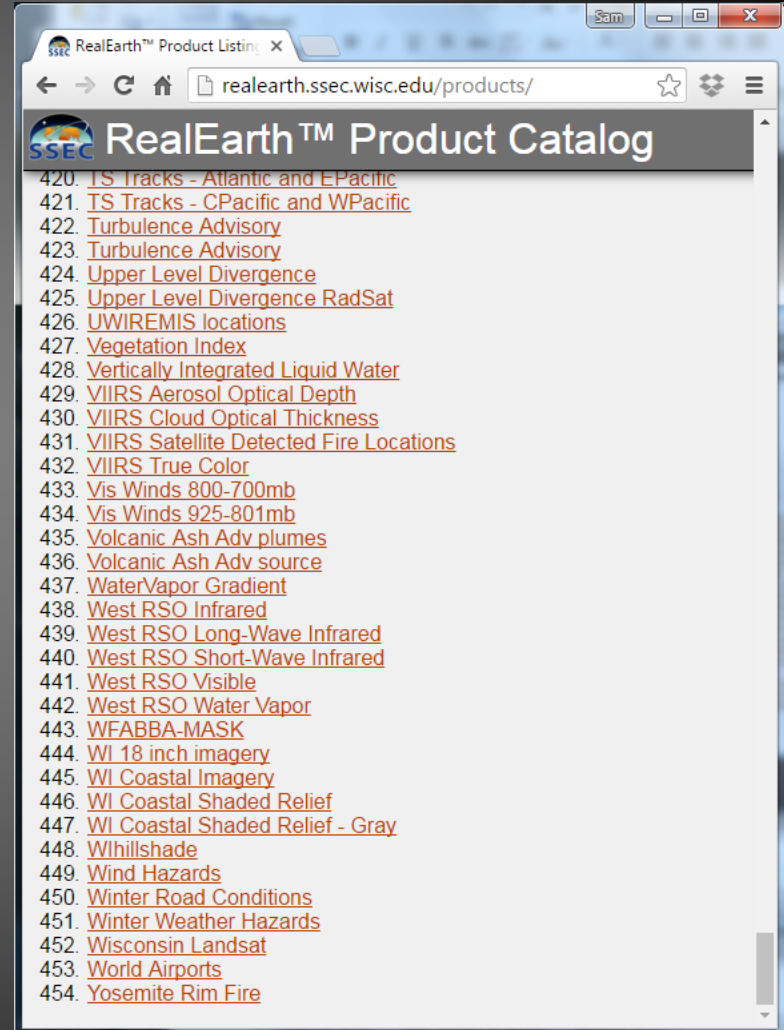
RealEarth™ Product Listing

realearth.ssec.wisc.edu/products/

RealEarth™ Product Catalog

Alphabetic list of available products:

1. [1hr Precip Estimate](#)
2. [1hr Precip Total](#)
3. [3/24hr Precip Estimate](#)
4. [24hr Precipitation Forecast](#)
5. [24hr Snow Depth](#)
6. [24hr SnowDepth](#)
7. [24hr SnowFall](#)
8. [24hr Snow Fall](#)
9. [African Wild Fire targets](#)
10. [Aqua Aerosol Optical Depth](#)
11. [Aqua False Color](#)
12. [Aqua Land Surface True Color](#)
13. [Aqua MODIS False Color Composites \(Day\)](#)
14. [Aqua MODIS False Color Swaths](#)
15. [Aqua MODIS Infrared Composites \(Day\)](#)
16. [Aqua MODIS Infrared Composites \(Night\)](#)
17. [Aqua MODIS Infrared Swaths](#)
18. [Aqua MODIS Near Infrared Composites \(Day\)](#)
19. [Aqua MODIS Near Infrared Swaths](#)
20. [Aqua MODIS Short Wave Infrared Composites \(Day\)](#)
21. [Aqua MODIS Short Wave Infrared Composites \(Night\)](#)
22. [Aqua MODIS Short Wave Infrared Swaths](#)
23. [Aqua MODIS True Color Composites \(Day\)](#)
24. [Aqua MODIS True Color Swaths](#)
25. [Aqua MODIS Visible Composites \(Day\)](#)
26. [Aqua MODIS Visible Swaths](#)
27. [Aqua MODIS Water Vapor Composites \(Day\)](#)
28. [Aqua MODIS Water Vapor Composites \(Night\)](#)
29. [Aqua MODIS Water Vapor Swaths](#)
30. [Aqua Orbit times](#)
31. [Aqua Orbit tracks](#)
32. [Blended TPW GPS](#)
33. [Blended TPW Percent](#)



RealEarth™ Product Listing

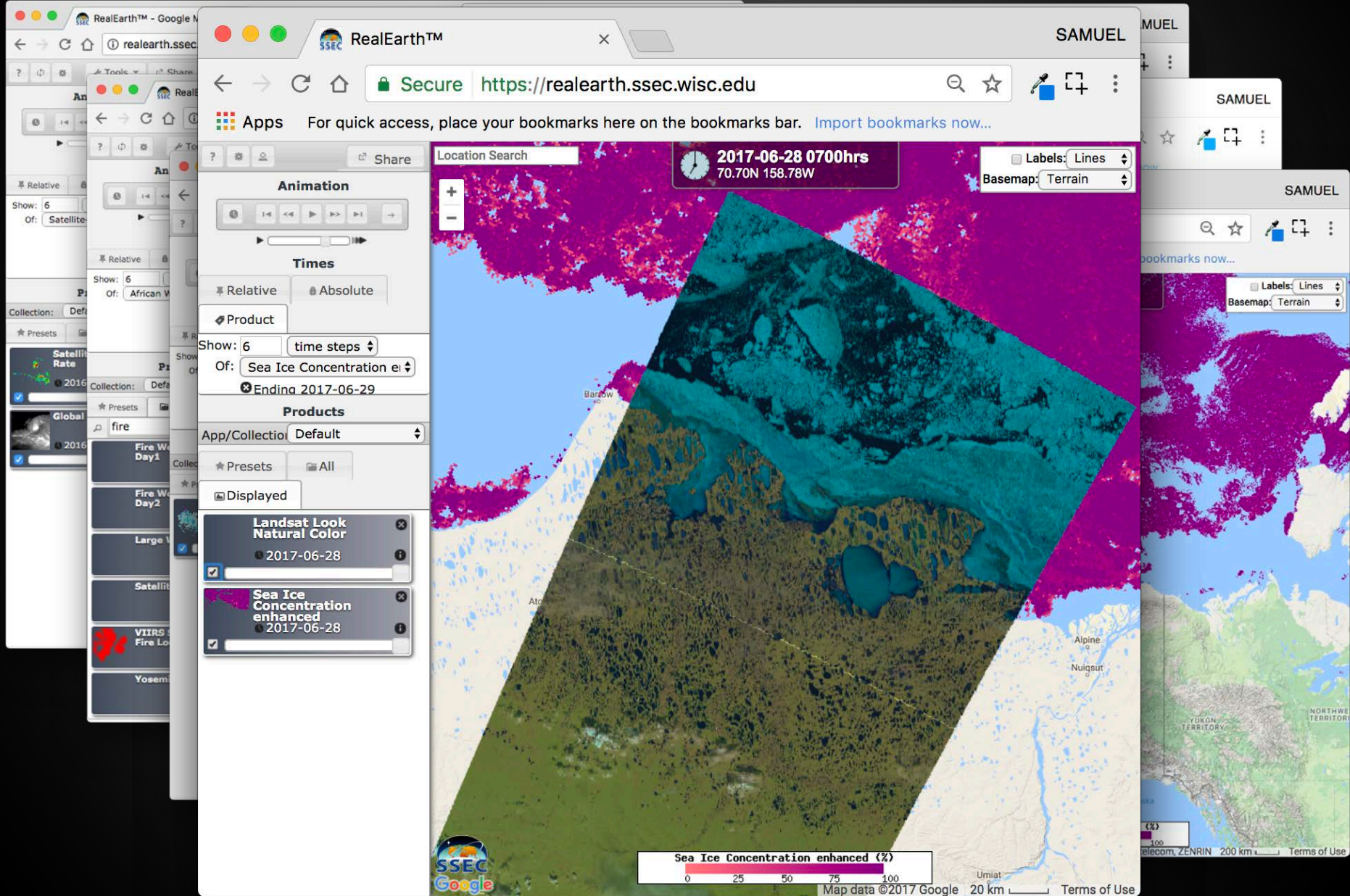
realearth.ssec.wisc.edu/products/

RealEarth™ Product Catalog

420. [TS Tracks - Atlantic and EPacific](#)
421. [TS Tracks - CPacific and WPacific](#)
422. [Turbulence Advisory](#)
423. [Turbulence Advisory](#)
424. [Upper Level Divergence](#)
425. [Upper Level Divergence RadSat](#)
426. [UWIREMIS locations](#)
427. [Vegetation Index](#)
428. [Vertically Integrated Liquid Water](#)
429. [VIIRS Aerosol Optical Depth](#)
430. [VIIRS Cloud Optical Thickness](#)
431. [VIIRS Satellite Detected Fire Locations](#)
432. [VIIRS True Color](#)
433. [Vis Winds 800-700mb](#)
434. [Vis Winds 925-801mb](#)
435. [Volcanic Ash Adv plumes](#)
436. [Volcanic Ash Adv source](#)
437. [WaterVapor Gradient](#)
438. [West RSO Infrared](#)
439. [West RSO Long-Wave Infrared](#)
440. [West RSO Short-Wave Infrared](#)
441. [West RSO Visible](#)
442. [West RSO Water Vapor](#)
443. [WFABBA-MASK](#)
444. [WI 18 inch imagery](#)
445. [WI Coastal Imagery](#)
446. [WI Coastal Shaded Relief](#)
447. [WI Coastal Shaded Relief - Gray](#)
448. [WIhillshade](#)
449. [Wind Hazards](#)
450. [Winter Road Conditions](#)
451. [Winter Weather Hazards](#)
452. [Wisconsin Landsat](#)
453. [World Airports](#)
454. [Yosemite Rim Fire](#)

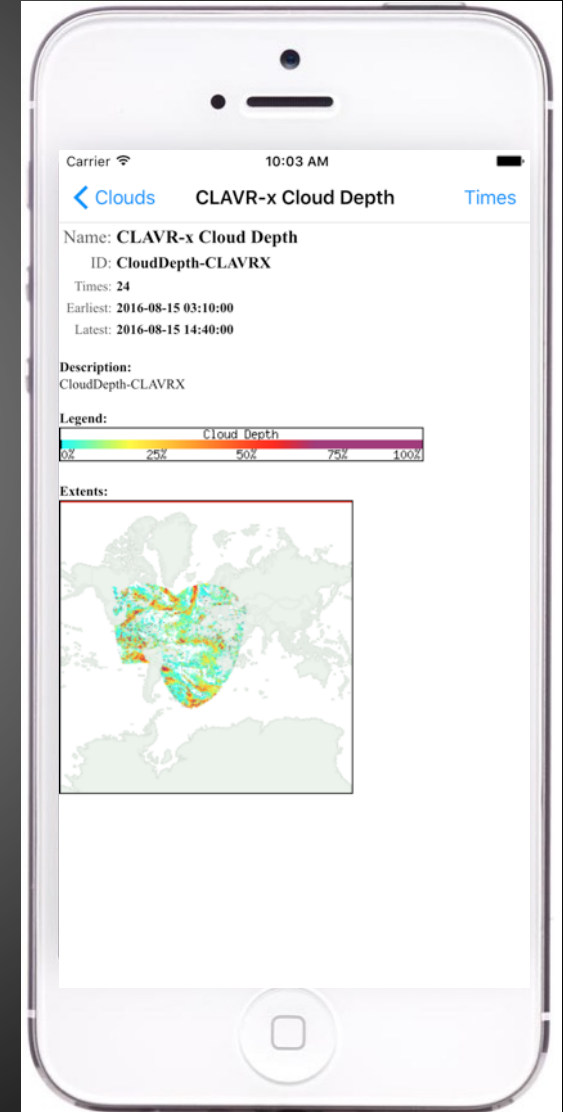
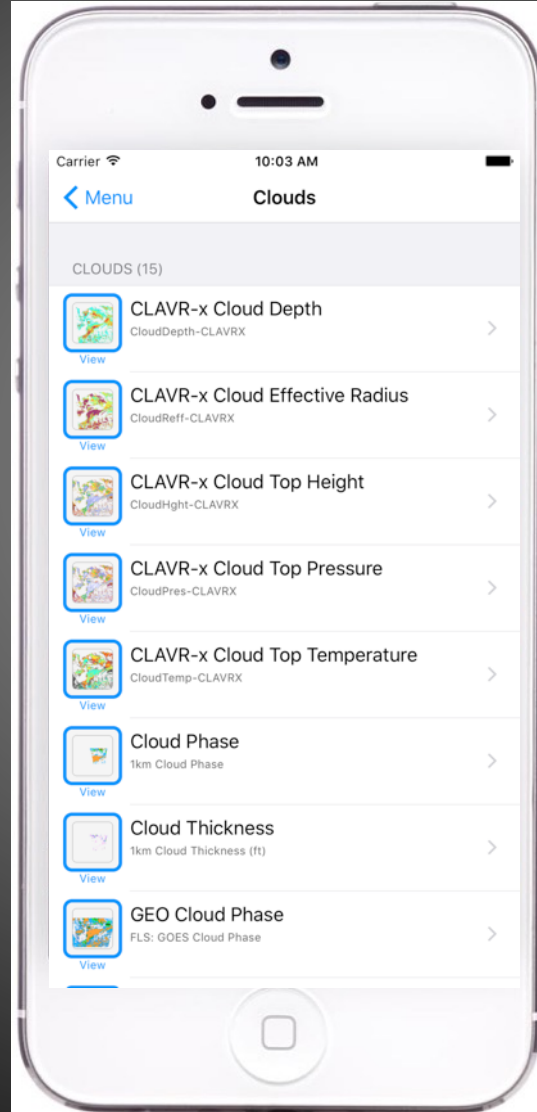
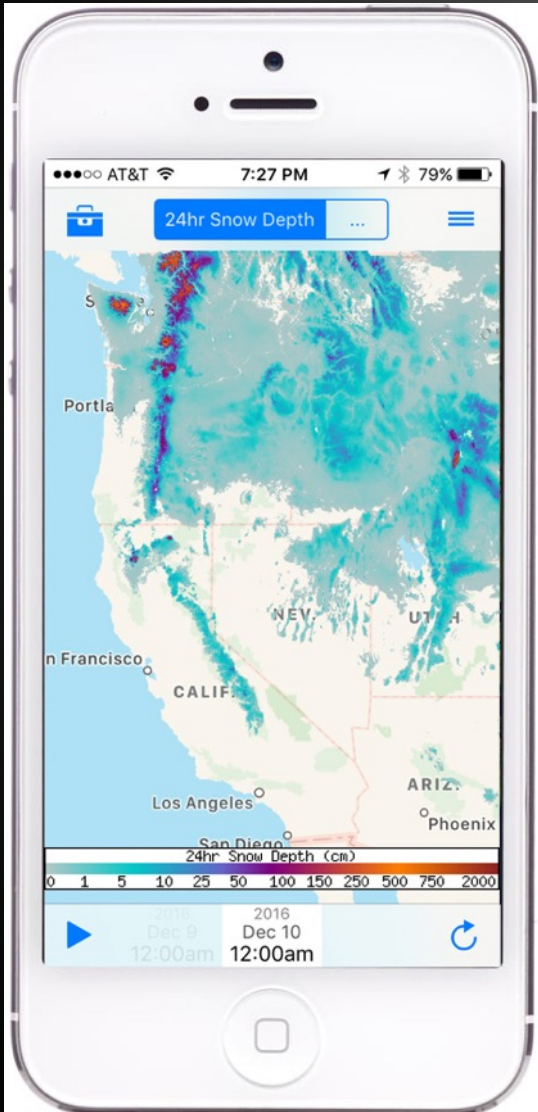
<https://realearth.ssec.wisc.edu/products>

Examples

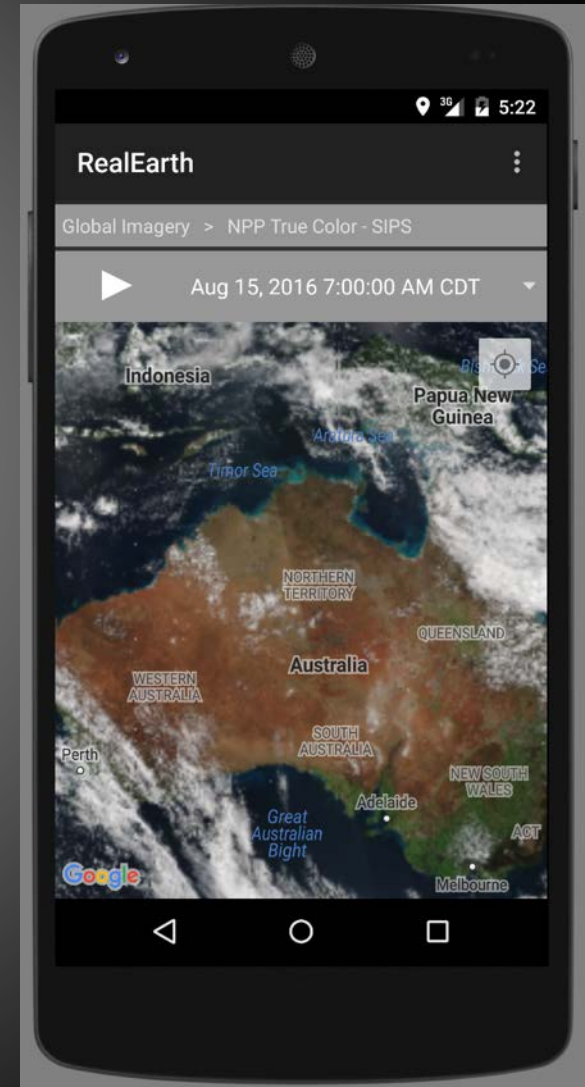
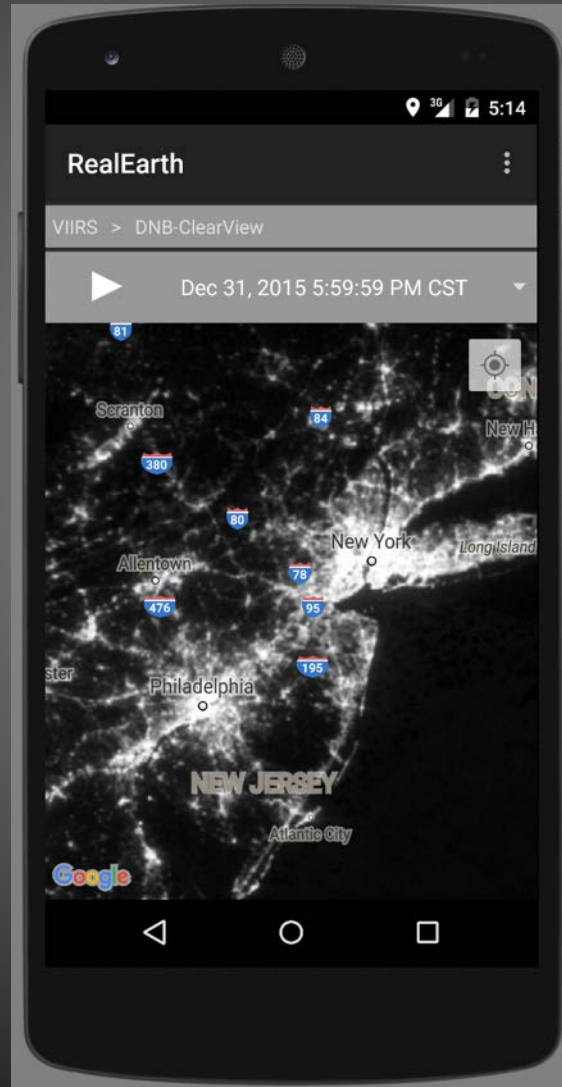
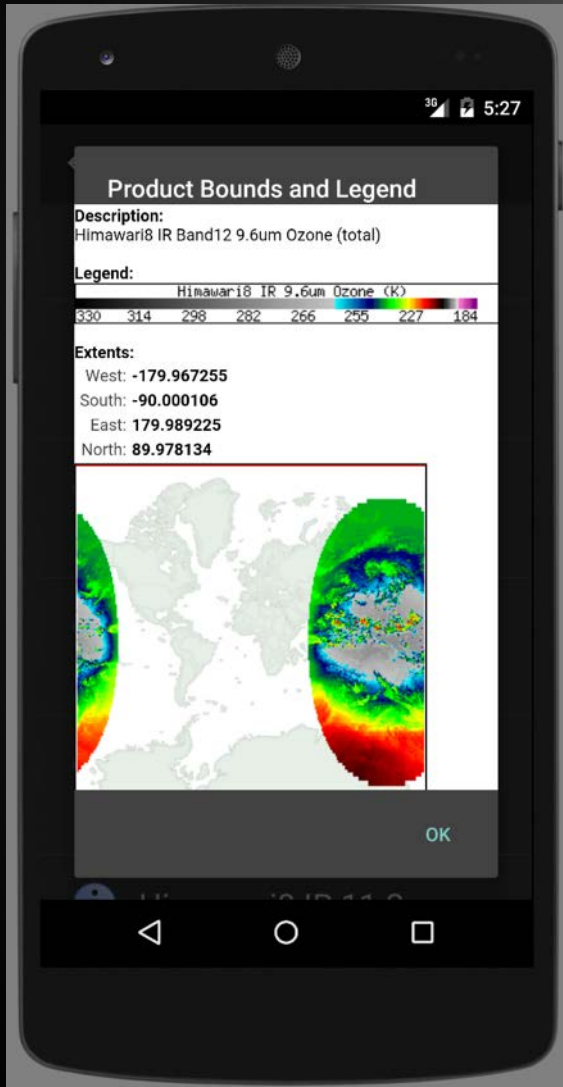


RealEarth App on iOS

Available on the
App Store



RealEarth App on Android



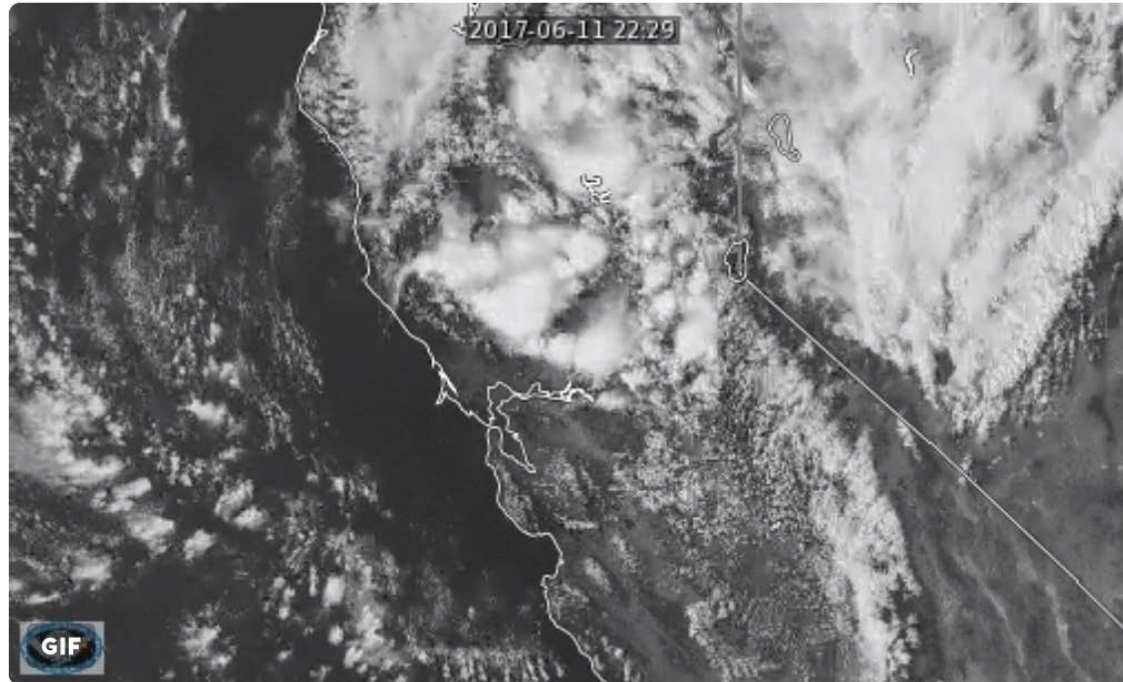
RealEarth on Twitter

US Dept of Interior and 1 other follow



Dan Brekke @danbrekke · Jun 11

GOES-16 imagery of thunderstorms building over N. Calif. Sunday afternoon. Via RealEarth: re.ssec.wisc.edu/s/ev12l #cawx



RealEarth on Apple Watch

- Twitter... or notifications.



Coming soon...

- GOES App (by NOAA Satellite Conference in NYC July 17-20)
- ISEE App (JPSS)

Answering the “So What” Question

There are many visualization options out there. **Why does RealEarth™ matter?** RealEarth does not do everything... but it fills a niche **because** users can do **ALL** of these things:

1. **Consolidate and Compare:** visualize satellite imagery and related data from atmospheric, oceanic, and earth science domains in a unified map interface
2. **Animate:** animate meteorological and GIS data
3. **Locate:** in mobile interfaces, users can locate themselves within the data they are viewing
4. **Extend:** users can:
 - a) **add** their own data to RealEarth™ with an upload interface or script;
 - b) **integrate** RealEarth™ visualizations into their own websites and applications with our API;
 - c) **download** a RealEarth™ VM and run their own system independently or with others;
 - d) **develop** new ways to visualize (e.g. polar projection vs Mercator)
5. **Share:** Web, Email, Twitter, Facebook, KML, WMS, XYZ, ArcGIS Online
6. **Collaborate:** Shared multi-user sessions

Special Thanks

- Dave Parker, Nick Bearson, Russ Dengel, Tommy Jasmin
- SSEC Directors for startup funds
- Jerry Robaidek, Kathy Strabala, Liam Gumley, Dave Hoese, Allen Huang
- NOAA for GOES App and JPSS-ISEE
- All the scientists and programmers who have shared with us the content for our 565+ data layers