

2017 2nd International Symposium on
Spatiotemporal Computing
Harvard University

Making Temporal Search More Central in a Spatial Data Infrastructure

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NATIONAL
ENDOWMENT
FOR THE
HUMANITIES

Thesis

- Time is an underutilized dimension for improving search in geosystems.
- Straightforward methods exist which can be transformative for research.

(Better use of the Temporal is just one of several ways in which SDIs can be modernized.)

GeoPlatform Search UI

GeoPlatform Map Viewer Help Sign In

Browse Layers

Search Layers

Search for layers by name

Sort Layers

Name Ascending

Layer sources

20081015 Omar 11x17 0800Update2	4
2013 Vessel Density	1
Atlantic Coast Regional Area	798
BISON	5309
BLM REA COP 2010 Colorado Plateau (COP) Estimate of Current Terrestrial Intactness	118

Layer types

All Amphibians (Amphibia)	388
All Gymnosperms (Gymnospermae)	244
All Mammals (Mammalia)	800
All Mustards (Brassicaceae)	761
All Oaks (Quercus)	167
All Reptiles (Reptilia)	612
All Seed Birds (Passeriformes)	847

Available Layers

Select layers below to view them on the preview map at right.

25933 results 10 per page 1 - 10

1 Meter	<input type="checkbox"/>
USGS TNM Elevation Availability (NED), a-16, ngda, elevation, 3DEP, national elevation dataset, NED, digital	
1 Meter	<input type="checkbox"/>
USGS TNM Elevation Availability (NED), a-16, ngda, elevation, 3DEP, national elevation dataset, NED, digital	
1 arc-second	<input type="checkbox"/>
USGS TNM Elevation Availability (NED), a-16, ngda, elevation, 3DEP, national elevation dataset, NED, digital	
1 arc-second	<input type="checkbox"/>
USGS TNM Elevation Availability (NED), a-16, ngda, elevation, 3DEP, national elevation dataset, NED, digital	
1 arc-second	<input type="checkbox"/>
USGS TNM Elevation Availability (NED), a-16, ngda, elevation, 3DEP, national elevation dataset, NED, digital	
1 arc-second	<input type="checkbox"/>
USGS TNM Elevation Availability (NED), a-16, ngda, elevation, 3DEP, national elevation dataset, NED, digital	
1 meter	<input type="checkbox"/>
USGS TNM Elevation Availability (NED), a-16, ngda, elevation, 3DEP, national elevation dataset, NED, digital	
1 meter	<input type="checkbox"/>
USGS TNM Elevation Availability (NED), a-16, ngda, elevation, 3DEP, national elevation dataset, NED, digital	
1-Month Standardized Precipitation Index	<input type="checkbox"/>
Climate Indices, indices	
1-Month Standardized Precipitation Index	<input type="checkbox"/>
Climate Indices, indices	

Preview

Leaflet | Map data (c) OpenStreetMap contributors

Please be patient, some layers may take several seconds to appear.

Constrain the list of layers using geographic extents or named places

Specify a named location

Completely within requested extent?

Previewed Layers

Layers listed below are shown in the preview map above. Click 'Apply' at the top of this panel to add them all to the current map.

No layers selected

GeoNode Search UI

GeoNode Layers Maps Documents People Groups Search Sign in

Explore Layers Upload Layers

Cart

Add resources through the 'Add to cart' buttons.

Create a map

Filters Clear

TEXT

Search by text

TYPE

Vector 178

Remote 3

CATEGORIES

KEYWORDS

OWNERS

DATE

Date begins after:

Date ends before:

REGIONS

EXTENT

Total: 178

alaska

No abstract provided

admin 31 Jul 2017 54 0 3 Create a Map

srb_rails

No abstract provided

admin 29 Jun 2017 174 0 0 Create a Map

srb_water_lines_dcw

No abstract provided

admin 29 Jun 2017 78 0 0 Create a Map

srb_water_areas_dcw

No abstract provided

admin 29 Jun 2017 23 0 0 Create a Map

Systems we have been working on

1. WorldMap – General purpose public mapping platform. In existence since 2012.
2. The Billion Object Platform (BOP) – Prototype to lower barriers to access to big streaming datasets. Recently released.

Different systems, common need to improve search

1. WorldMap (Many Datasets) - Thousands of data layers with imperfect metadata.
2. BOP (One Big Dataset) - A billion georeferenced, time stamped tweets.

List of enhancements to be discussed

- Time Miner for unstructured text metadata
- Sorting BC / AD dates
- Time bar for date range definition
- Logarithmic time bar increments
- Dynamic temporal histogram
- Ability to zoom on temporal histogram

Python TimeMiner to enrich metadata

- Metadata for map layers is often inconsistent for time referencing.
- Standard ways of describing date/time such as ISO 8601 are rarely used.
- Temporal characteristics mentioned as unstructured text in the title, abstract, and elsewhere.

Initial simple TimeMiner Logic

1. Look for date in the date range section of the metadata and choose the earlier date. (Date: from Metadata)
2. If there is no #1 above, look for 4 digit numbers in title first, then abstract, which are less than or equal to 2017 (present year) (Date: Detected)
3. If there IS a date in #2 above, check to see whether there is a CE or AD or BCE or BC after it and apply math accordingly (Date: Detected)
4. If there IS NO #2 above, look for 1, 2, or 3 digit numbers with associated CE, AD, BCE, BC, and apply math accordingly (Date: Detected)

Another technique: Historic Periods

Example: Chinese Dynasties

- Xia, Hsia ca. 2100-1600 BCE
- Shang ca. 1600-1050 BCE
- Zhou, Chou ca. 1046-256 BCE
- Qin, Ch'in 221-206 BCE
- Han 206 BCE-220 CE
- Sui 581-618 CE
- Tang, T'ang 618-906
- Song, Sung 960-1279
- Yuan 1279-1368
- Ming 1368-1644
- Qing, Ch'ing 1644-1912

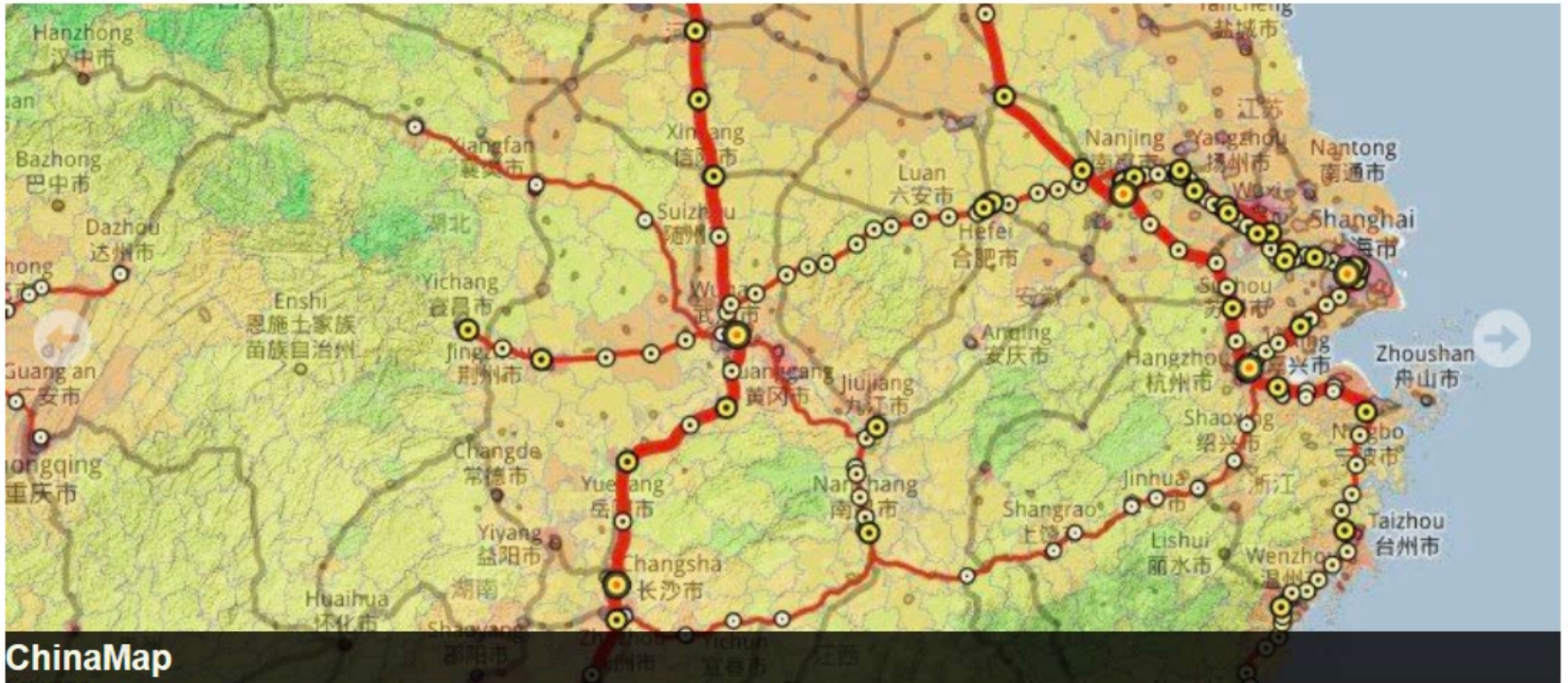
Source: http://afe.easia.columbia.edu/timelines/china_timeline.htm

WorldMap Search Demo

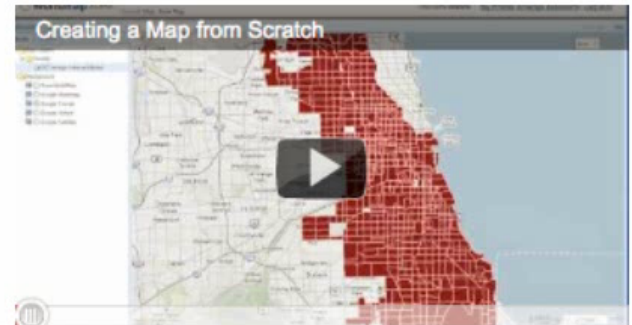
Create a Map

View a Map

About



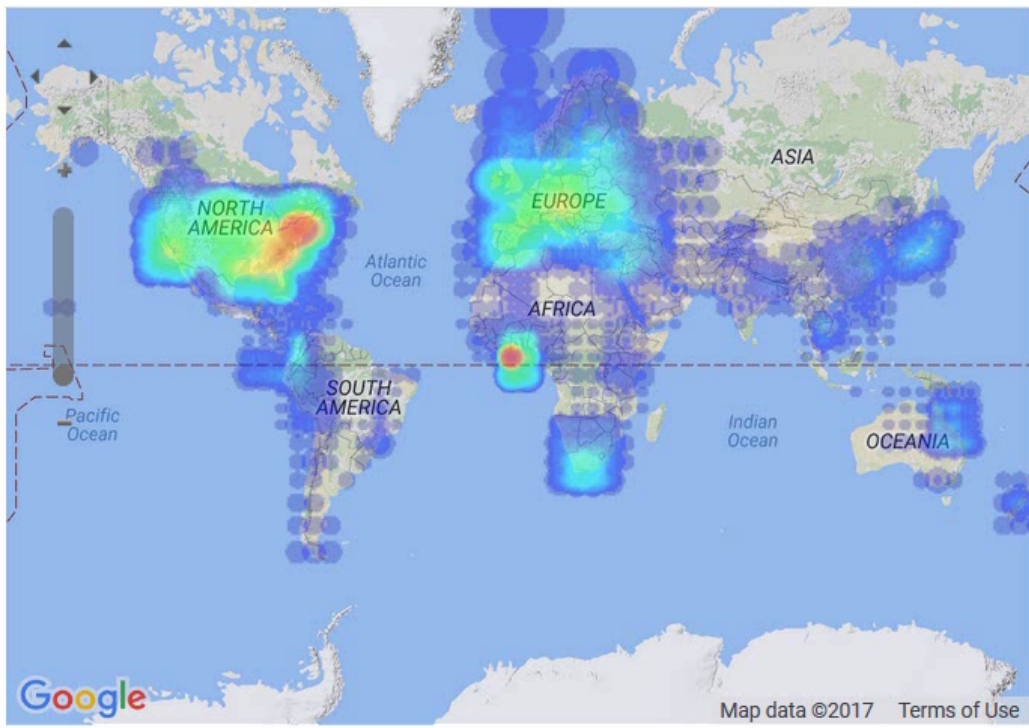
Build your own mapping portal and publish it to the world or to just a few collaborators. WorldMap is open source software.



SEARCH Upload Layer Create Layer Rectify Layer Submit a Map Service

Keyword Source All Layers

from year to year



Title	Source	Dat...
Champlain's map of New Fran...	maps.nypl.org	1632
Russia Isaac Massa 1632	mapwarper.net	1632
Poland Lithuania 1635	warp.worldm...	1635
America / Jodocus Hondius ex...	maps.nypl.org	1635
Terra Firma et Novum Regnum...	mapwarper.net	1635
Bern, Switzerland 1638 Merian	warp.worldm...	1638
America Septentrionalis.	maps.nypl.org	1639
Vingboons map of Manhattan, ...	maps.nypl.org	1639
Nova Anglia, Novum Belgium, e...	maps.nypl.org	1639
Heda1640s	worldmap.ha...	1640
Kalf 1640s	worldmap.ha...	1640
WillemHeda1640	worldmap.ha...	1640
Claesz1640s	worldmap.ha...	1640
DeHeem1640s	worldmap.ha...	1640

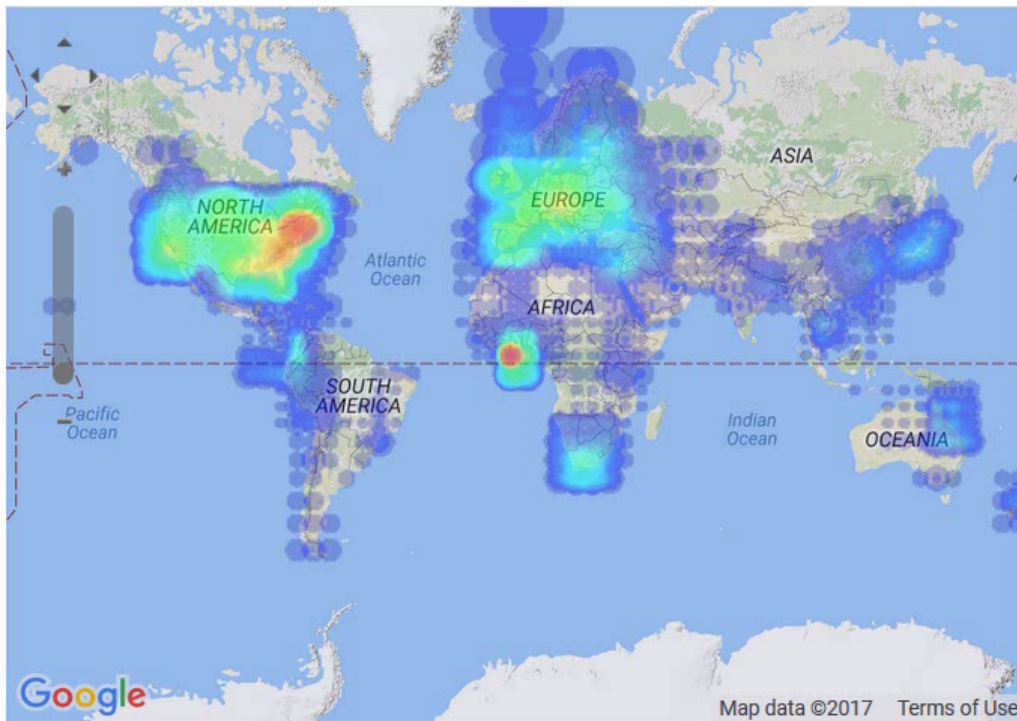
Showing 1001-1200 of 112557

No Layers Selected

SEARCH Upload Layer Create Layer Rectify Layer Submit a Map Service

Keyword Source All Layers Search Reset

from year 5000M BCE to year Future



Title	Source	Date
IndexLetIdent	gis.icao.int	2016
OSM: 4000 un-tagged probable...	worldmap.ha...	None
asianame	gis.icao.int	2016
Major World Watersheds	water.discom...	2016
Major World Watersheds	water.discom...	2016
Major World Watersheds	water.discom...	2007
WRI Major Watersheds of the ...	worldmap.ha...	2016
{ERS_port_nb}	maratlas.dis...	2016
00	maratlas.dis...	2016
{ERS_port_nb}	maratlas.dis...	2016
657 Crude Oil Refineries - Retr...	worldmap.ha...	2006
Oil Refineries from IndustryAbout	worldmap.ha...	2016
AGEAR	gis.icao.int	2016
AGEAR	gis.icao.int	2016

Prev Next Showing 1-200 of 112557

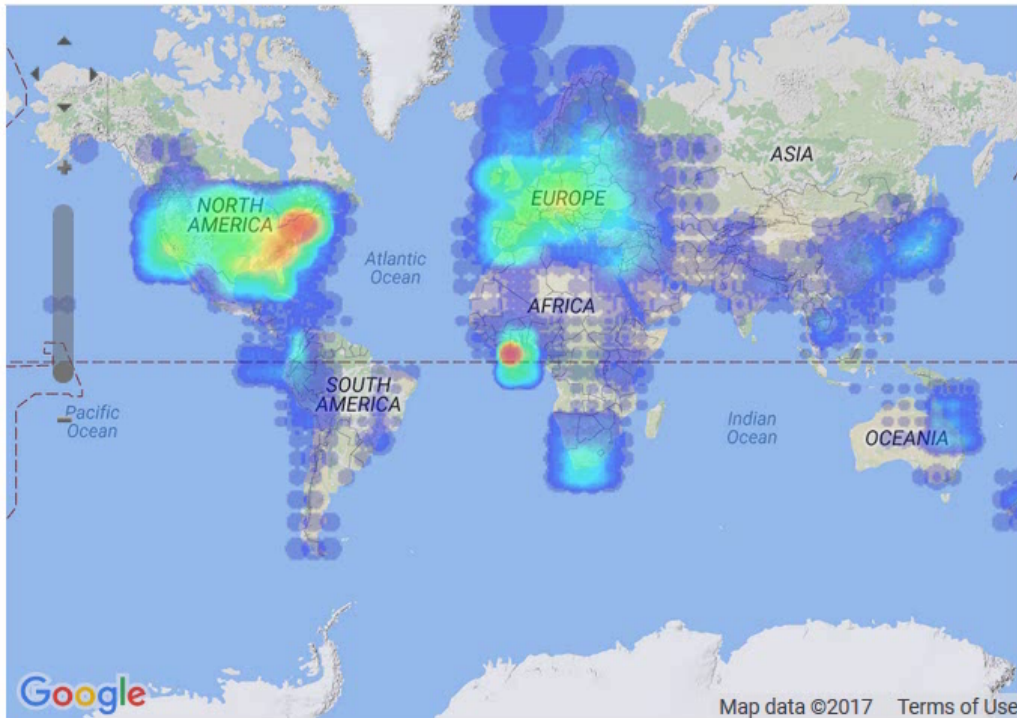
No Layers Selected

Clear Selected Add To Map

SEARCH Upload Layer Create Layer Rectify Layer Submit a Map Service

Keyword Source All Layers Search Reset

from year 5000M BCE to year Future



Title	Source	Date
IndexLetIdent	gis.icao.int	2016
OSM: 4000 un-tagged probable...	worldmap.ha...	None
asianame	gis.icao.int	2016
Major World Watersheds	water.discom...	2016
Major World Watersheds	water.discom...	2016
Major World Watersheds	water.discom...	2007
WRI Major Watersheds of the ...	worldmap.ha...	2016
{ERS_port_nb}	maratlas.dis...	2016
00	maratlas.dis...	2016
{ERS_port_nb}	maratlas.dis...	2016
657 Crude Oil Refineries - Retr...	worldmap.ha...	2006
Oil Refineries from IndustryAbout	worldmap.ha...	2016
AGEAR	gis.icao.int	2016
AGEAR	gis.icao.int	2016

Prev Next Showing 1-200 of 112557

No Layers Selected

Clear Selected Add To Map

Enter keyword

Suggestions

From To

[2016-01-02T01:00:00 TO 2017-06-22T00:00:00]



@user

Suggestions

@victoriarocha__
 recaregando 🇵🇷 @ Cachoeira Pedreira <https://t.co/IF90zhAuf>
 Jun 16, 2017 4:13:39 PM

@thecurejsoul
 Thanks to @hellolisafi handling my house chores, i was able to have ample time to work on my... <https://t.co/GNsdRj7gXz>
 Apr 4, 2017 6:25:55 AM

@BPEarth
 #17572
 Camopi, French Guiana
 map: <https://t.co/1qgL064q0c> <https://t.co/O4Ai2DzWAP>
 May 18, 2017 9:13:16 AM

@dscovr_epic
 14:46 on Wednesday March 29th, over Brazil <https://t.co/9PqRNZ3UDc>
 Mar 30, 2017 6:09:07 PM

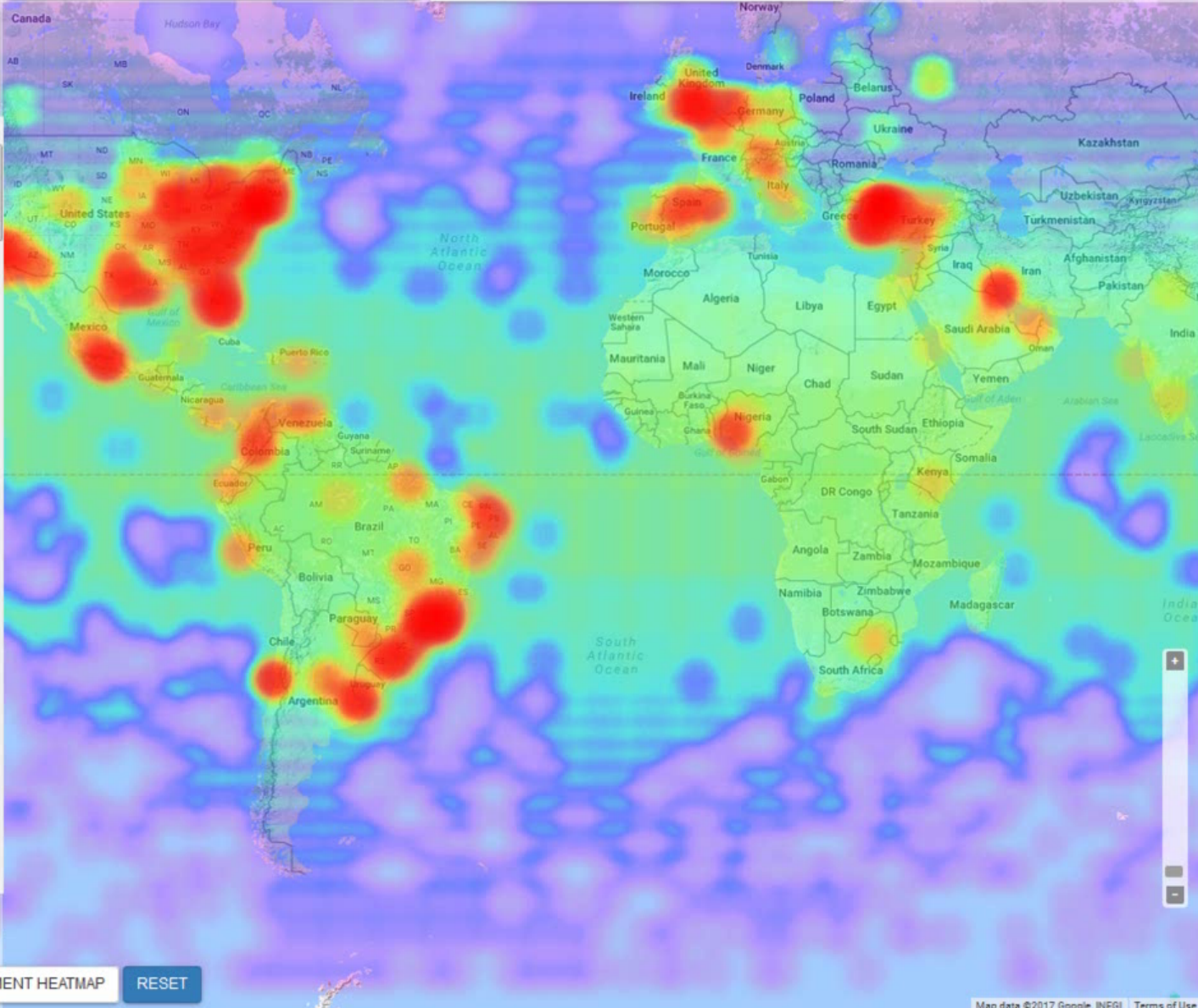
@BPEarth
 #16326
 Laranjal do Jari - State of Amapá, Brazil
 map: <https://t.co/UwUov0CYG> <https://t.co/8d5sCfFWo>
 Feb 28, 2017 9:02:44 PM

@stephyloke
 🇫🇷 @ Bienvenue, French Guiana <https://t.co/OxQmdclGXs>
 Feb 13, 2016 3:54:17 AM

@mohamaddaniel07
 Appreciation post to _wajok semoga dipanjangkan umur dan dimewahkan... <https://t.co/BFSje7V8YY>
 Apr 9, 2017 3:31:17 AM

@geoaleph

Results for keyword: 163990755



2000 km

DATAVERSE DOWNLOAD BASEMAPS SENTIMENT HEATMAP **RESET**

Conclusion

- Most spatial data describes events in time though often not explicitly.
- When data does have a time component it is often not easily accessed.
- An opportunity exists to increase the value of existing data by:
 1. Making latent temporal information explicit using enrichment techniques
 2. Implementing UI/backend enhancements on existing systems
 3. Increase research on space/time data exploration

More information

WorldMap / HHypermap

- Information <http://gis.harvard.edu/publications/implementing-open-source-spatiotemporal-search-platform-spatial-data-infrastructures>
- Source code <https://github.com/cga-harvard/HHypermap>

BOP

- Information <http://gis.harvard.edu/services/project-consultation/project-resume/billion-object-platform-bop>
- Source code <https://github.com/cga-harvard/hhypermap-bop>

Thank you

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