



Understanding is just a
visualization away...

Lorie M. Liebrock

Nico Marrero

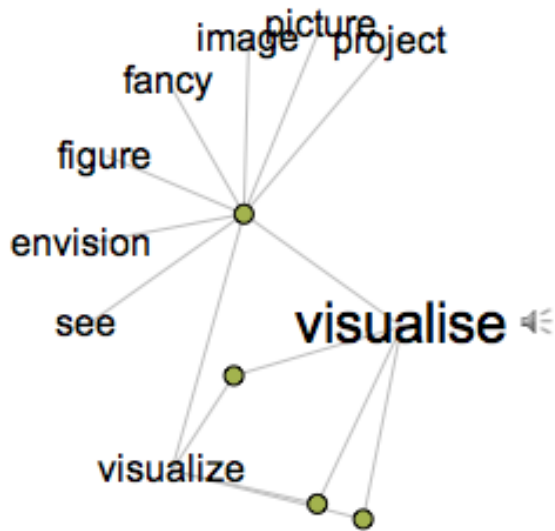
Eunice Perez

Benjamin Turrubiates

Jesse Crawford

Diego Trujillo

What is it...



vi·su·al·i·za·tion *noun* \,vi-zhə-wə-lə-'zā-shən, \,vi-zhə-lə-, \,vizh-wə-lə-

Definition of VISUALIZATION

- 1: formation of mental visual images
- 2: the act or process of interpreting in visual terms or of putting into visible form

...

Visual Thesaurus &
Merriam Webster online




Introduction

- Characterization of Visualization
 - Information Visualization
 - Scientific Visualization
- Data Types and Characteristics
- Characterization of Techniques
- Visualization Evaluation

Let's start simple...

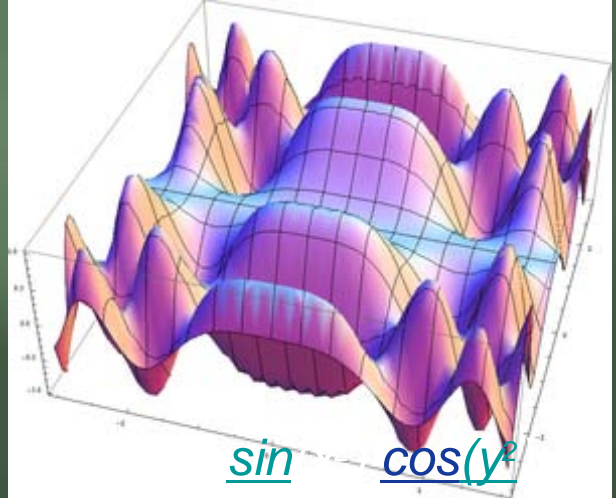
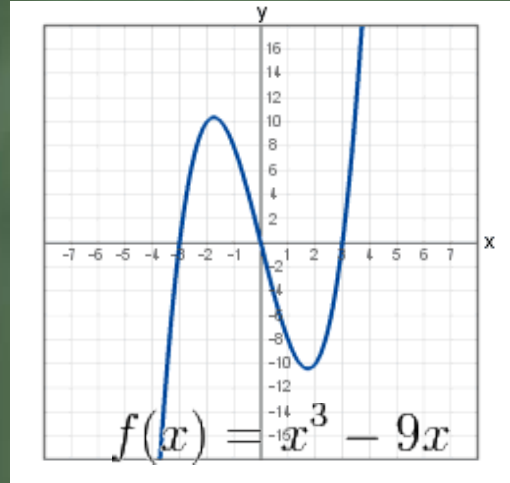
Bar Line Area



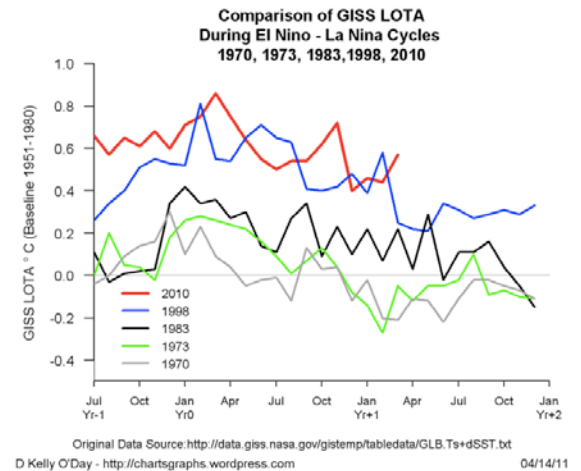
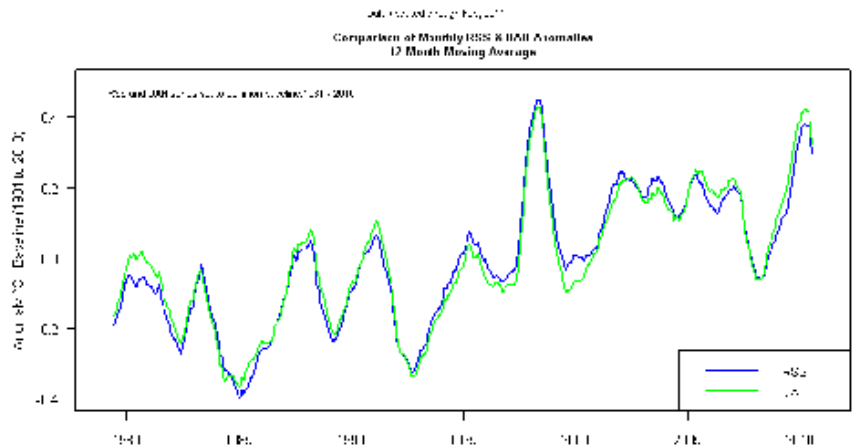
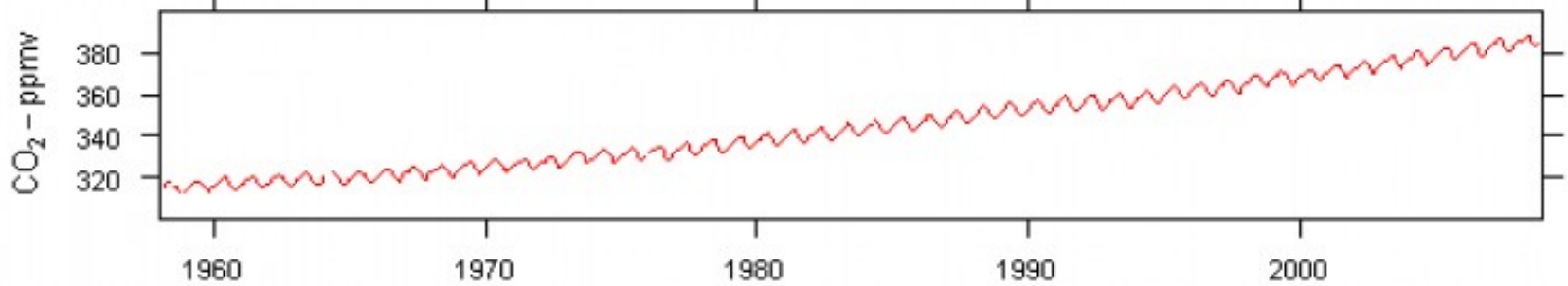
Pie XY

Please select a graph type to begin

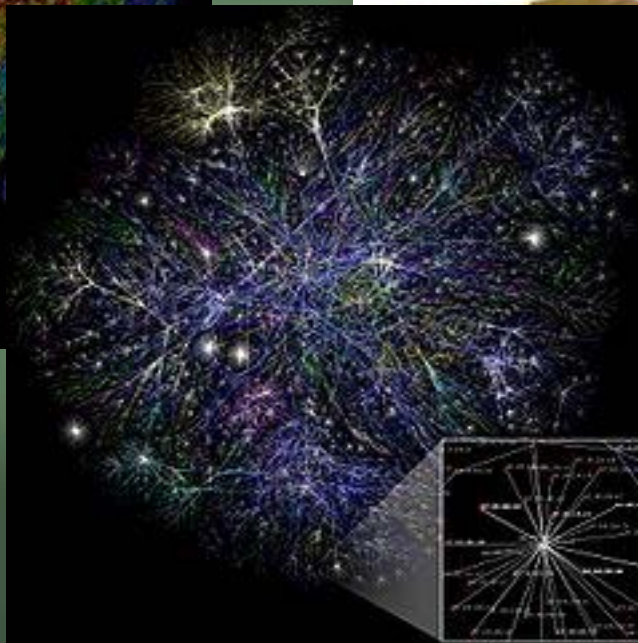
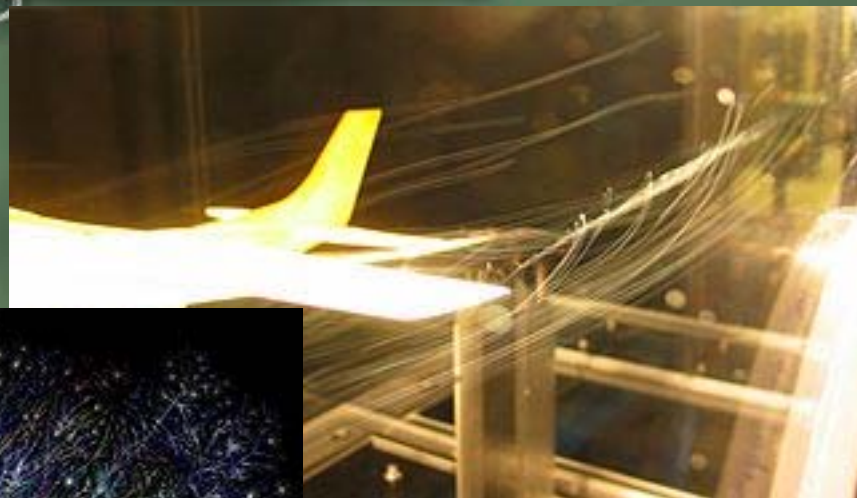
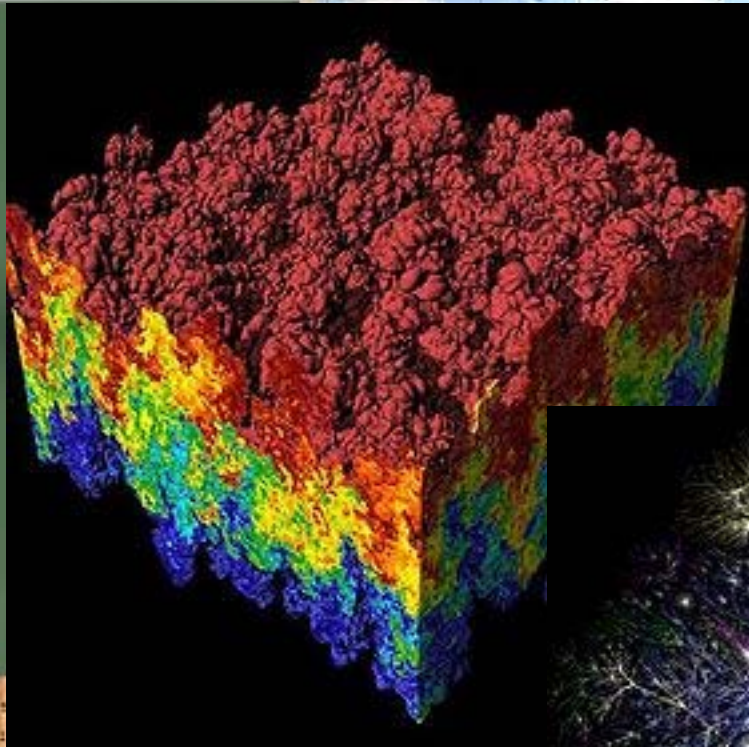
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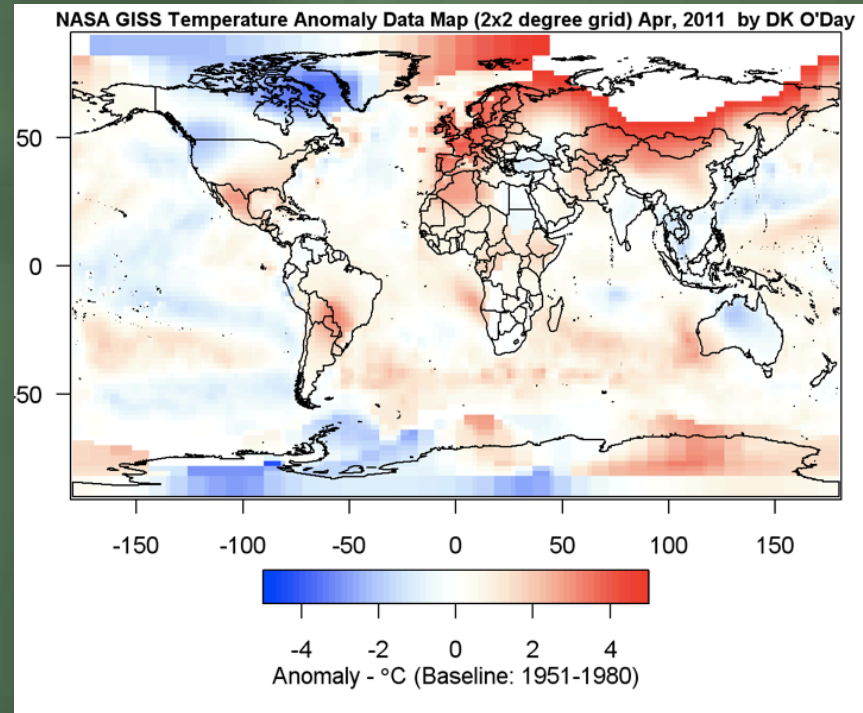
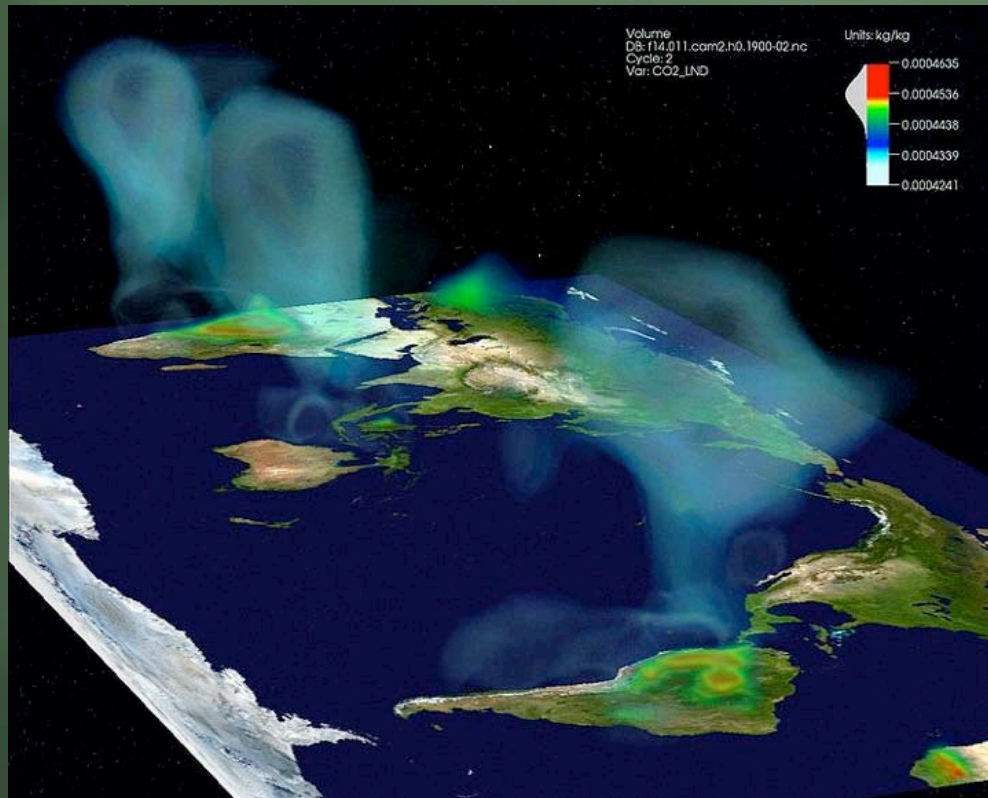
Climate Change



Visualization +



Climate Change +



Consider how good...

- How do we evaluate the quality of a visualization?
 - Does it rapidly convey information
 - Is better insight achieved more quickly with less training?
- Criteria: effectiveness, satisfaction, accuracy, repeatability, robustness, and insight.



Sea Surface Temperature



Eunice Perez





Data

- ⇒ Source: The International Research Institute for Climate and Society (IRI)
 - ⇒ <http://portal.iri.columbia.edu/>
 - ⇒ IRI has data ranging from surface temperatures and precipitation levels to atmospheric circulation
 - ⇒ The dataset used here contains global sea surface temperatures obtained from ship, buoy and bias-corrected satellite data for January of 1996
 - ⇒ Dataset Title: NOAA NCEP EMC CMB GLOBAL Reyn_Smith



Topics



Regions



Resources



Current Feature Climate Information Crucial to Help Reduce Risk and Limit Disaster Damage

Forecasts can play an invaluable role in helping humanitarian agencies and governments plan for and prevent disasters, according to the latest *Climate and Society* publication released by the IRI and its international partners.



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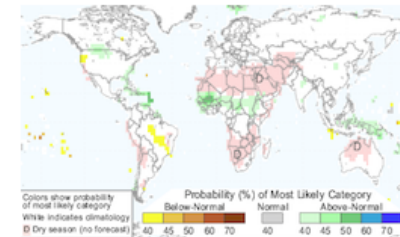
We use a science-based approach to enhance society's capability to understand, anticipate and manage the impacts of climate in order to improve human welfare and the environment, especially in developing countries.

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The IRI was established as a cooperative agreement between NOAA's Climate Program Office and Columbia University. It is part of The Earth Institute, Columbia University, and is located at the Lamont Campus.

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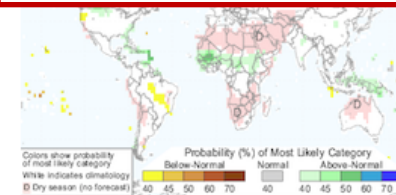
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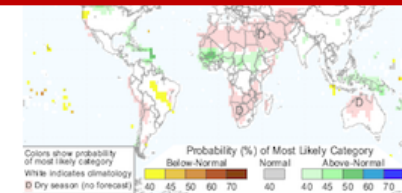
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expert

Finding Datasets

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Browse Maproom

By Category

By Source

By Search

Help Resources

Tutorial

Statistical Analysis Tutorial

Ingrid Function Documentation

Questions and Answers



help

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The IRI/LDEO Climate Data Library contains over 300 datasets from a variety of earth science disciplines and climate-related topics. It is a powerful tool that offers the following capabilities at no cost to the user:

- access any number of datasets;
- create analyses of data ranging from simple averaging to more advanced EOF analyses using the Ingrid Data Analysis Language;
- monitor present climate conditions with maps and analyses in the [Maproom](#);
- create visual representations of data, including animations;
- download data in a variety of commonly-used [formats](#), including GIS-compatible formats.

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What's New

[CPC Unified Gauge-Based Analysis of Global Daily Precipitation](#) The Climate Prediction Center (CPC) Unified Gauge-Based Analysis of Global Daily Precipitation is an optimal interpolation objective analysis of global daily station precipitation data available at the CPC. It is divided into a retrospective version (RETRO) covering 1979 to 2005, derived from more than 30,000 gauges, and a real-time version (REALTIME) covering 2006 to present, derived from approximately 17,000 gauges. The grid resolution is 0.5 deg. lat/lon. The data set also includes information on the gauge network density and country-to-country variations in the daily reporting period.

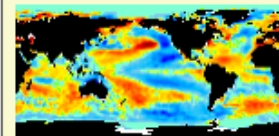
Published: Thu, 09 Jun 2011 13:46:58 GMT

[NOAA NCEP EMC CFSv2](#) Climate Forecast System Version2 is now available as both hindcasts and realtime updates. 9-month hindcasts initiated from every 5th day and run from all 4 cycles of that day, beginning from Jan 1 of each year, over a 29 year period from 1982-2010. These hindcasts are available either as monthly sets of 24-28 ensemble members (ENSEMBLE), or starts every 5 days of four ensemble members (MONTHLY). Realtime updates are daily starts of four ensemble members (MONTHLY_REALTIME).

Published: Mon, 23 May 2011 21:14:54 GMT

[Latest Versions of Global Precipitation Climatology Centre \(GPCC\) Precipitation Products](#) GPCC Monitoring Product Version 3, GPCC Normals Version 2010, and the GPCC Full Data Reanalysis Version 5 global gridded precipitation analyses based upon station precipitation data have been added.

Monitoring Global Climate



[Map Room](#)

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[ENSO Web](#)

Information about El Niño-Southern Oscillation.



Data Library

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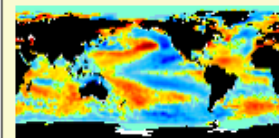
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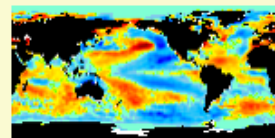
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Dataset Search

Analysis none

... 12 choices ...

Disease none

[Malaria](#) (17)

[Meningitis](#) (9)

Institution none

... 66 choices ...

Location none

... 8 choices ...

Person none

... 767 choices ...

Phenomena none

... 7 choices ...

Project none

... 8 choices ...

Quantity none

[Apparent Oxygen](#)

[Utilization](#) (41)

[Area](#) (9)

[Atmospheric CO2](#) (5)

[Biomass](#) (38)

[Basist wetness index](#)

(4)

[Classification](#) (74)

[Climate Indices](#) (74)

[Cloud Work Function](#)

(1)

[Count](#) (140)

[Depth](#) (14)

[Dissolved](#)

[Concentration](#) (355)

[Divergence](#) (18)

[delta O18](#) (3)

[Elevation](#) (44)

[Error: Percent of Mean](#)

(71)

[Evapotranspiration](#) (12)

[EVI](#) (15)

[FAPAR](#) (3)

[Soil Moisture Content](#)

(52)

[Specific Humidity](#) (85)

[Speed](#) (208)

[Streamfunction](#) (7)

[Stress](#) (322)

[Temperature](#) (2483)

[Thickness](#) (38)

[Time](#) (165)

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[Velocity](#) (799)

[Velocity Potential](#) (7)

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[WASP](#) (21)

[Water Evaporation](#)

[Amount](#) (3)

[Water Path](#) (29)

[Wet Day Frequency](#) (5)

[Wind Direction](#) (5)

[WSP](#)

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Search Results (534):

534 datasets meet criteria ([show datasets](#))

Dataset Search

Analysis none

... 12 choices ...

Disease none

[Malaria](#) (17)

[Meningitis](#) (9)

Institution none

... 66 choices ...

Location none

Person none

Phenomena none

Project none

Quantity none

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[how datasets](#))



Dataset Search

Quantity: **Temperature** >
 Sea Surface Temperature ,
Total Temperature (42)

Realm: **Planetary Surface** >
Water Surface > **Sea Surface** (42)

Spatial Resolution: **Gridded** (42)
... 10 choices ...

Vertical Location: **Surface** (42)

Institution
... 7 choices ...

Analysis none
[Climatology](#) (6) [Variance](#) (3)
[Forecast](#) (5)

Person none
... 31 choices ...

Time none
[Monthly](#) (24) [Weekly](#) (4)
[Pentad](#) (4)

Time Span none
... 13 choices ...

Search Results (34):

34 datasets meet criteria ([show datasets](#))

Dataset Search

Quantity: **Temperature** >
 Sea Surface Temperature ,
Total Temperature (42)

Realm: **Planetary Surface** >
Water Surface > **Sea Surface** (42)

Spatial Resolution: **Gridded** (42)
... 10 choices ...

Vertical Location: **Surface** (42)

Institution

... 7 choices ...

Analysis none

[Climatology](#) (6) [Variance](#) (3)
[Forecast](#) (5)

Person none

... 31 choices ...

Time none

[Monthly](#) (24) [Weekly](#) (4)
[Pentad](#) (4)

Time Span none

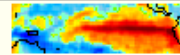
... 13 choices ...

Search Results (34):

34 datasets meet criteria ([show datasets](#))

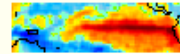
NOAA NCEP CPC CA_SST updates Sea Surface Temperature

updates Sea Surface Temperature from NOAA NCEP CPC CA_SST: Constructed Analog Sea Surface Temperature Forecasts. Resolution: 2.5x2.5; Longitude: global; Latitude: global;



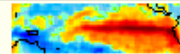
NOAA NCEP CPC CA_SST v200708 Sea Surface Temperature

Sea Surface Temperature from NOAA NCEP CPC CA_SST v200708: SST hindcasts/forecasts released Aug 2007. Resolution: 2.5x2.5; Longitude: global; Latitude: global; Members: 12;



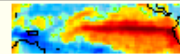
NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv1 climatology Sea Surface Temperature

climatology Sea Surface Temperature from NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv1: Sea surface temperature fields blended from ship, buoy and bias-corrected satellite data (Reynolds and Smith 1994). Resolution: 1x1; Longitude: global; Latitude: global; Time: [Jan,Dec]; monthly



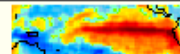
NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2 climatology c6190 Sea Surface Temperature

climatology c6190 Sea Surface Temperature from NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2: SST fields updated from version 1 with more COADS data, new sea-ice to SST conversion algorithm, and 1971-2000 climatology. Resolution: 1x1; Longitude: global; Latitude: global; Time: [Jan,Dec]; monthly



NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2 climatology c7100 Sea Surface Temperature

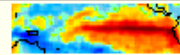
climatology c7100 Sea Surface Temperature from NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2: SST fields updated from version 1 with more COADS data, new sea-ice to SST conversion algorithm, and 1971-2000 climatology. Resolution: 1x1; Longitude: global; Latitude: global; Time: [Jan,Dec]; monthly



NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2 monthly Sea Surface Temperature

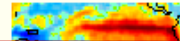
NOAA NCEP CPC CA_SST updates Sea Surface Temperature

updates Sea Surface Temperature from NOAA NCEP CPC CA_SST: Constructed Analog Sea Surface Temperature Forecasts. Resolution: 2.5x2.5; Longitude: global; Latitude: global;



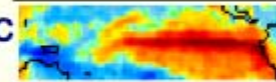
NOAA NCEP CPC CA_SST v200708 Sea Surface Temperature

Sea Surface Temperature from NOAA NCEP CPC



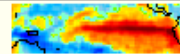
IGOSS nmc Reyn_SmithOlv1 climatology Sea Surface Temperature

climatology Sea Surface Temperature from IGOSS nmc Reyn_SmithOlv1: Sea surface temperature fields blended from ship, buoy and bias-corrected satellite data (Reynolds and Smith 1994). Resolution: 1x1; Longitude: global; Latitude: global; Time: [Jan,Dec]; monthly



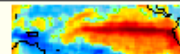
NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2 climatology c6190 Sea Surface Temperature

climatology c6190 Sea Surface Temperature from NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2: SST fields updated from version 1 with more COADS data, new sea-ice to SST conversion algorithm, and 1971-2000 climatology. Resolution: 1x1; Longitude: global; Latitude: global; Time: [Jan,Dec]; monthly



NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2 climatology c7100 Sea Surface Temperature

climatology c7100 Sea Surface Temperature from NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2: SST fields updated from version 1 with more COADS data, new sea-ice to SST conversion algorithm, and 1971-2000 climatology. Resolution: 1x1; Longitude: global; Latitude: global; Time: [Jan,Dec]; monthly



NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2 monthly Sea Surface Temperature



Visualization

- Source: IRI/LDEO Climate Data Library Visualization Toolset
 - <http://iridl.ldeo.columbia.edu/>
 - Has existing visualizations and tools to create new visualizations of IRI/LDEO data
 - The next visualization shows surface temperatures overlaid on a global map with a smooth color gradient

IRI

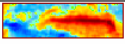

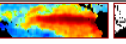
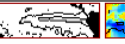
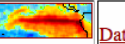
Data Library

Finding Data
Tutorial
Questions and Answers
Function Documentation

NOAA NCEP
EMC CMB
GLOBAL
Reyn_SmithOiv1
climatology
documentation

help

NOAA NCEP EMC CMB GLOBAL Reyn_SmithOiv1 climatology sst options

NEW Views      old Viewer

Help Expert Mode

Data Selection Filters Data Files Tables

served from [IRI/LDEO Climate Data Library](#)

... NOAA NCEP EMC CMB GLOBAL Reyn_SmithOiv1 climatology* Sea Surface Temperature

NOAA NCEP EMC CMB GLOBAL Reyn_SmithOiv1 climatology sst: Sea Surface Temperature data

climatology Sea Surface Temperature from NOAA NCEP EMC CMB GLOBAL Reyn_SmithOiv1: Sea surface temperature fields blended from ship, buoy and bias-corrected satellite data (Reynolds and Smith 1994).

Independent Variables (Grids)

- Time*
- grid: /T (months since 01-Jan) periodic (Jan) to (Dec) by 1. N= 12 pts :grid
- Longitude*
- grid: /X (degree_east) periodic (179.5W) to (179.5E) by 1. N= 360 pts :grid
- Latitude*
- grid: /Y (degree_north) ordered (89.5S) to (89.5N) by 1. N= 180 pts :grid

Other Info

CE
35

colorscalename
sstcolorscale

CS
-2

iridl:hasSemantics
iridl:climatology

labelinterval
5.

PLOTCOAST
1

scale_max
35

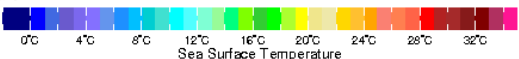
scale_min
-2

units
Celsius_scale

standard units*
degree_Kelvin above 273.15

history
Climatological sea surface temperature (blended from ship and buoy, data (1950-1979)).

colorscale



0°C 4°C 8°C 12°C 16°C 20°C 24°C 28°C 32°C
Sea Surface Temperature

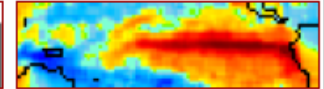
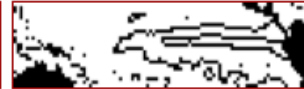
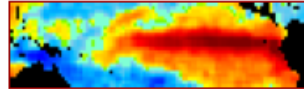
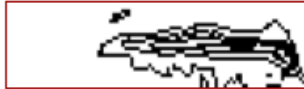
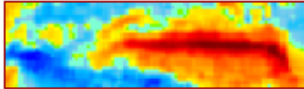
References

Reynolds, R. W. and T. M. Smith 1995: A high-resolution global sea surface temperature climatology. J. Climate, 8, 1571–1583

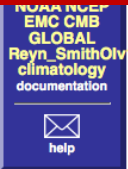
Last updated: Thu, 12 Jul 2007 14:19:26 GMT

IGOSS nmc Reyn_SmithOiv1 climatology sst options

NEW Views



old Viewer



climatology Sea Surface Temperature from NOAA NCEP EMC CMB GLOBAL Reyn_SmithOiv1: Sea surface temperature fields blended from ship, buoy and bias-corrected satellite data (Reynolds and Smith 1994).

Independent Variables (Grids)

Time

grid: /T (months since 01-Jan) periodic (Jan) to (Dec) by 1. N= 12 pts :grid

Longitude

grid: /X (degree_east) periodic (179.5W) to (179.5E) by 1. N= 360 pts :grid

Latitude

grid: /Y (degree_north) ordered (89.5S) to (89.5N) by 1. N= 180 pts :grid

Other Info

CE

35

colorscalename

sstcolorscale

CS

-2

iridl:hasSemantics

iridl:climatology

labelinterval

5.

PLOTCOAST

1

scale_max

35

scale_min

-2

units

Celsius_scale

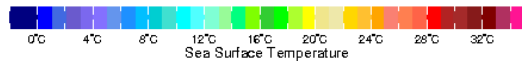
standard units*

degree_Kelvin above 273.15

history

Climatological sea surface temperature (blended from ship and buoy, data (1950-1979)).

colorscale



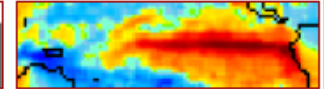
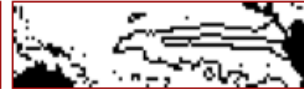
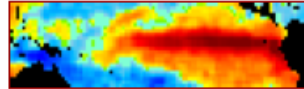
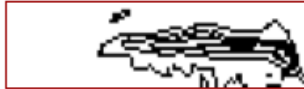
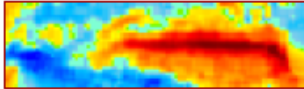
References

Reynolds, R. W. and T. M. Smith 1995: A high-resolution global sea surface temperature climatology. J. Climate, 8, 1571–1583

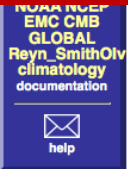
Last updated: Thu, 12 Jul 2007 14:19:26 GMT

IGOSS nmc Reyn_SmithOiv1 climatology sst options

NEW Views



old Viewer



climatology Sea Surface Temperature from NOAA NCEP EMC CMB GLOBAL Reyn_SmithOiv1: Sea surface temperature fields blended from ship, buoy and bias-corrected satellite data (Reynolds and Smith 1994).

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Latitude

grid: /Y (degree_north) ordered (89.5S) to (89.5N) by 1. N= 180 pts :grid

Other Info

CE

35

colorscalename

sstcolorscale

CS

-2

iridl:hasSemantics

iridl:climatology

labelinterval

5.

PLOTCOAST

1

scale_max

35

scale_min

-2

units

Celsius_scale

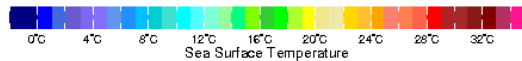
standard units*

degree_Kelvin above 273.15

history

Climatological sea surface temperature (blended from ship and buoy, data (1950-1979)).

colorscale



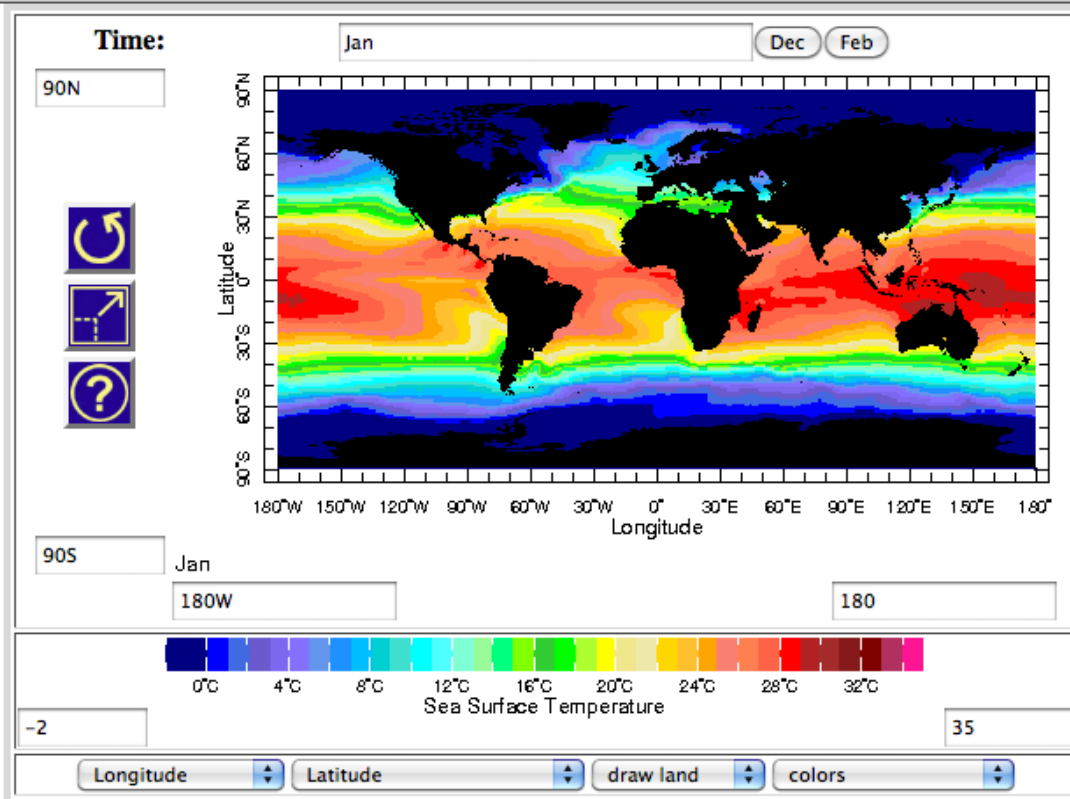
References

Reynolds, R. W. and T. M. Smith 1995: A high-resolution global sea surface temperature climatology. J. Climate, 8, 1571–1583

Last updated: Thu, 12 Jul 2007 14:19:26 GMT

Data Visualized

Jan	-179.5	-178.5	-177.5	-176.5	-175.5	-174.5	-173.5	-172.5	-171.5	-170.5	-169.5
-89.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-88.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-87.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-86.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-85.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-84.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-83.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-82.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
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-80.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-79.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-78.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
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-76.5	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-75.5	-1.77	-1.78	-1.78	-1.78	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-74.5	-1.74	-1.75	-1.75	-1.76	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79	-1.79
-73.5	-1.7	-1.71	-1.71	-1.73	-1.78	-1.78	-1.78	-1.78	-1.79	-1.79	-1.79
-72.5	-1.65	-1.65	-1.66	-1.67	-1.75	-1.76	-1.76	-1.76	-1.77	-1.77	-1.77
-71.5	-1.53	-1.54	-1.54	-1.56	-1.65	-1.66	-1.67	-1.67	-1.7	-1.7	-1.7
-70.5	-1.45	-1.47	-1.48	-1.5	-1.59	-1.61	-1.61	-1.62	-1.63	-1.63	-1.63
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-68.5	-1.27	-1.28	-1.29	-1.31	-1.4	-1.42	-1.43	-1.43	-1.39	-1.38	-1.38



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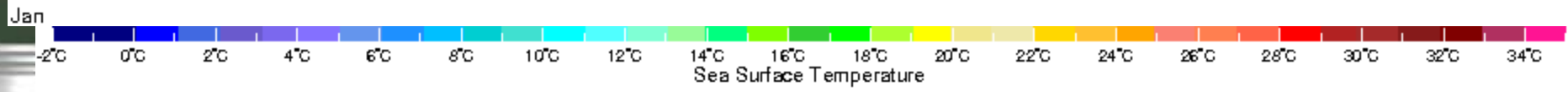
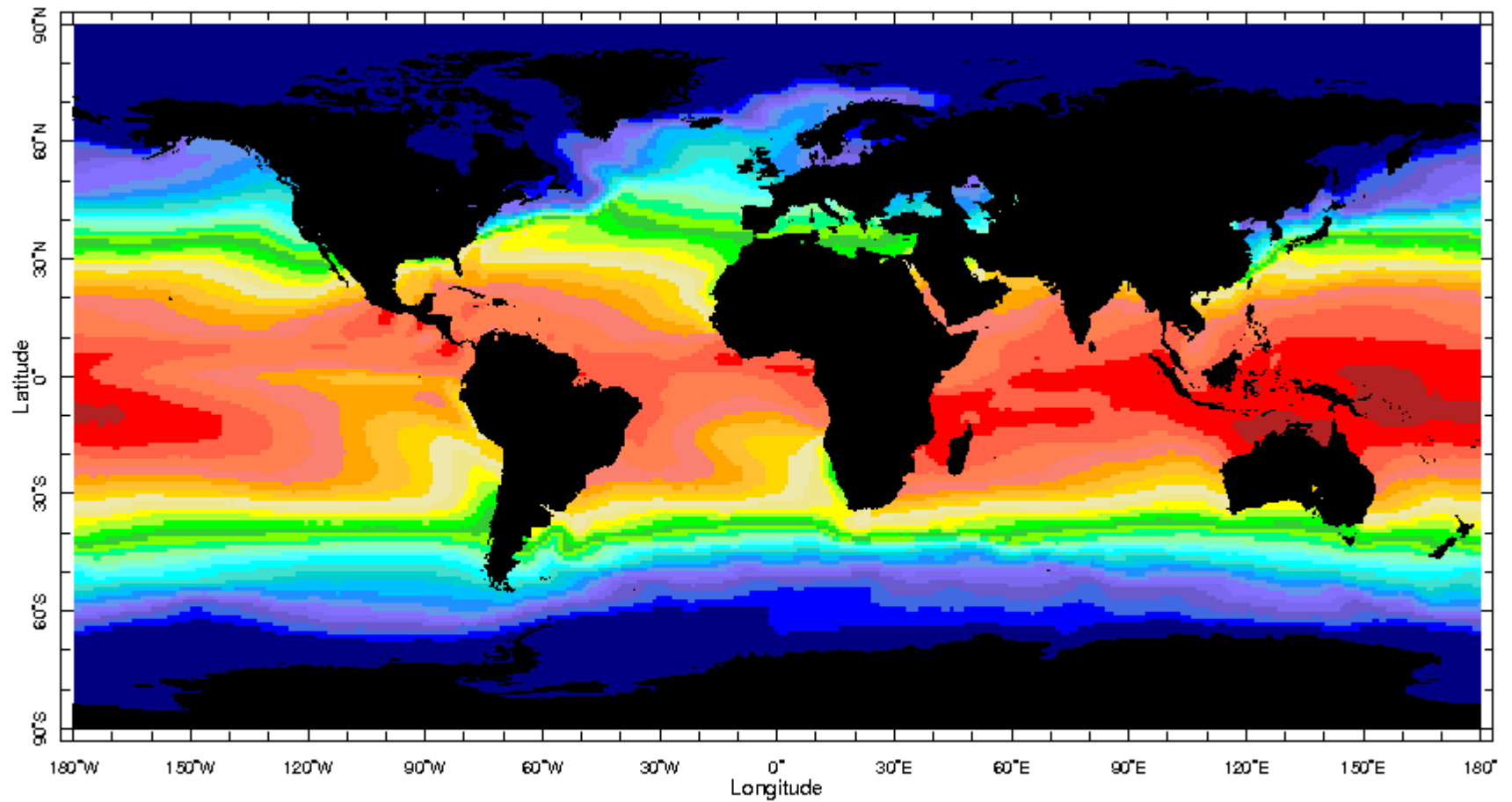
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Label starts with

animation frame times (1/100 s): first 25 middle 25 final 200

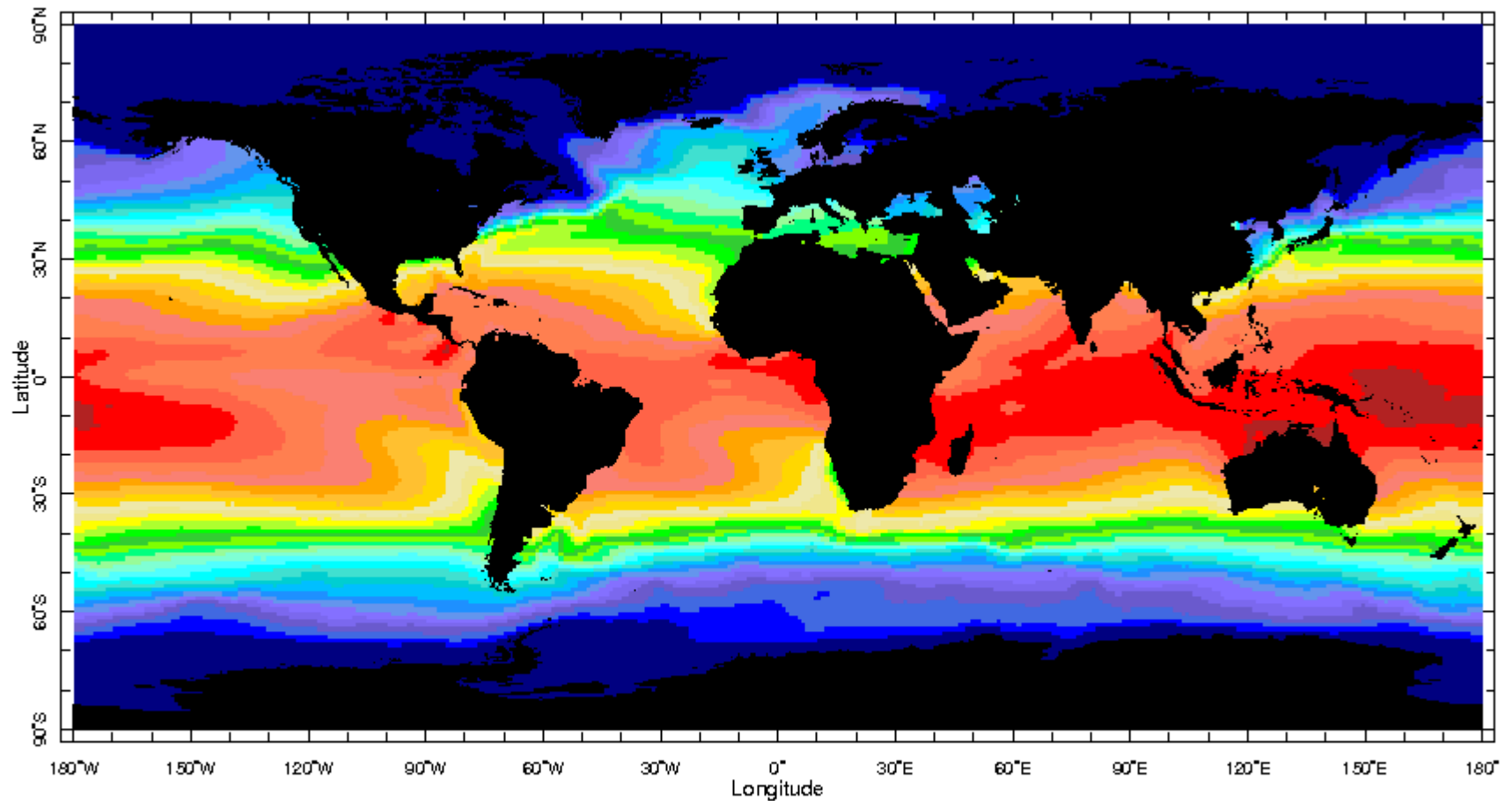
Get Data	Entire Dataset	<input type="button" value="data in view"/>	Export	Edit	<input type="button" value="plot"/>	<input type="button" value="program"/>
Page Formats	<input type="button" value="documented page"/>	<input type="button" value="plain page"/>	<input type="button" value="linked pdf"/>	<input type="button" value="cut and paste link"/>	<input type="button" value="simple"/>	<input type="button" value="verbose"/>
Just the Figure Formats	PS	PS w/preamble	PDF	JPEG	GIF	PNG
Just the Scale Formats	PS	PS w/preamble	PDF	JPEG	GIF	PNG

Sea Surface Temperature Visualization



Dataset Title: NOAA NCEP EMC CMB GLOBAL Reyn_Smith

Sea Surface Temperature Visualization



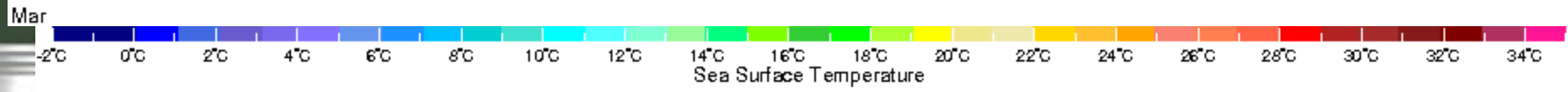
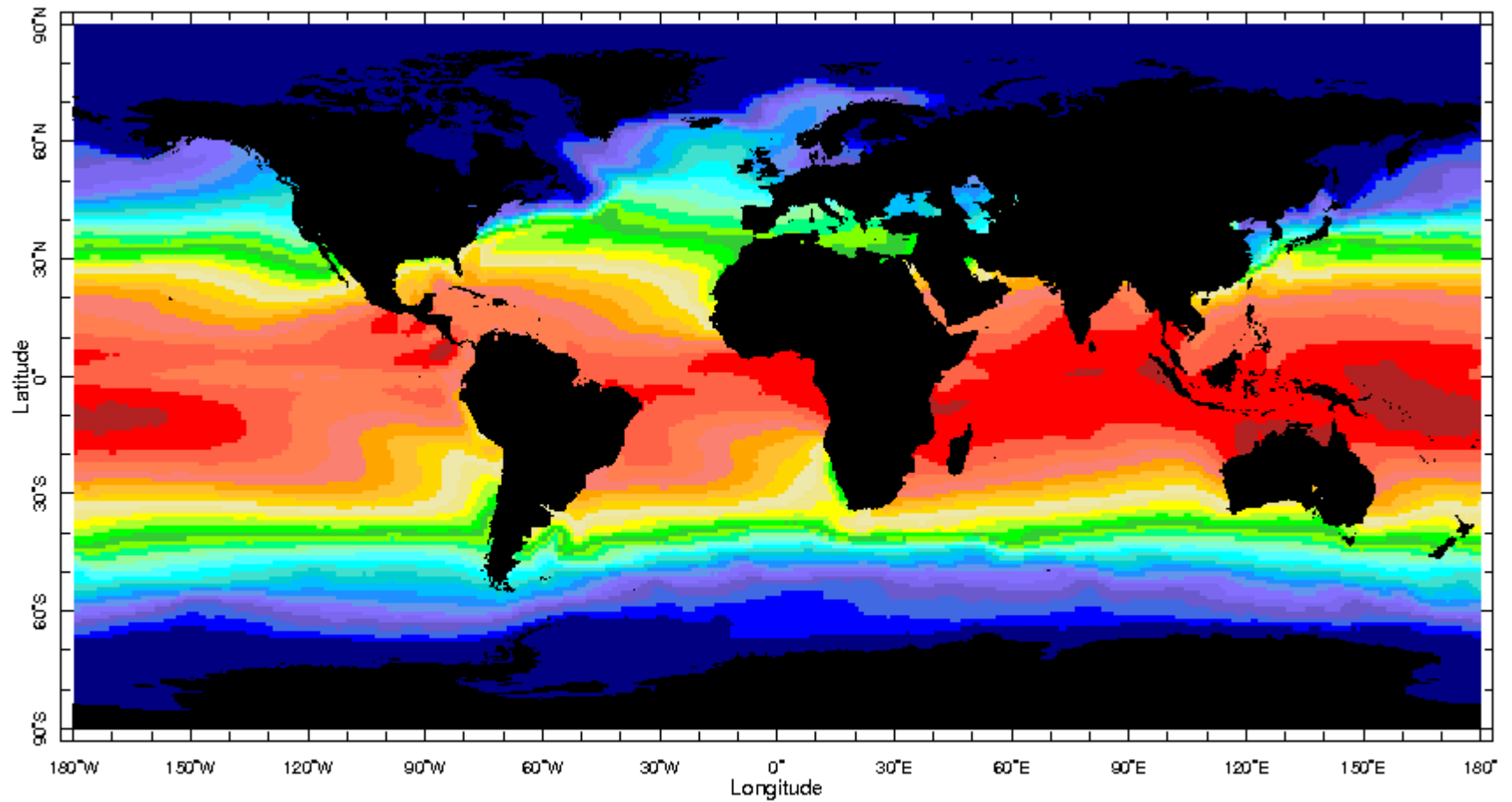
Feb



Sea Surface Temperature

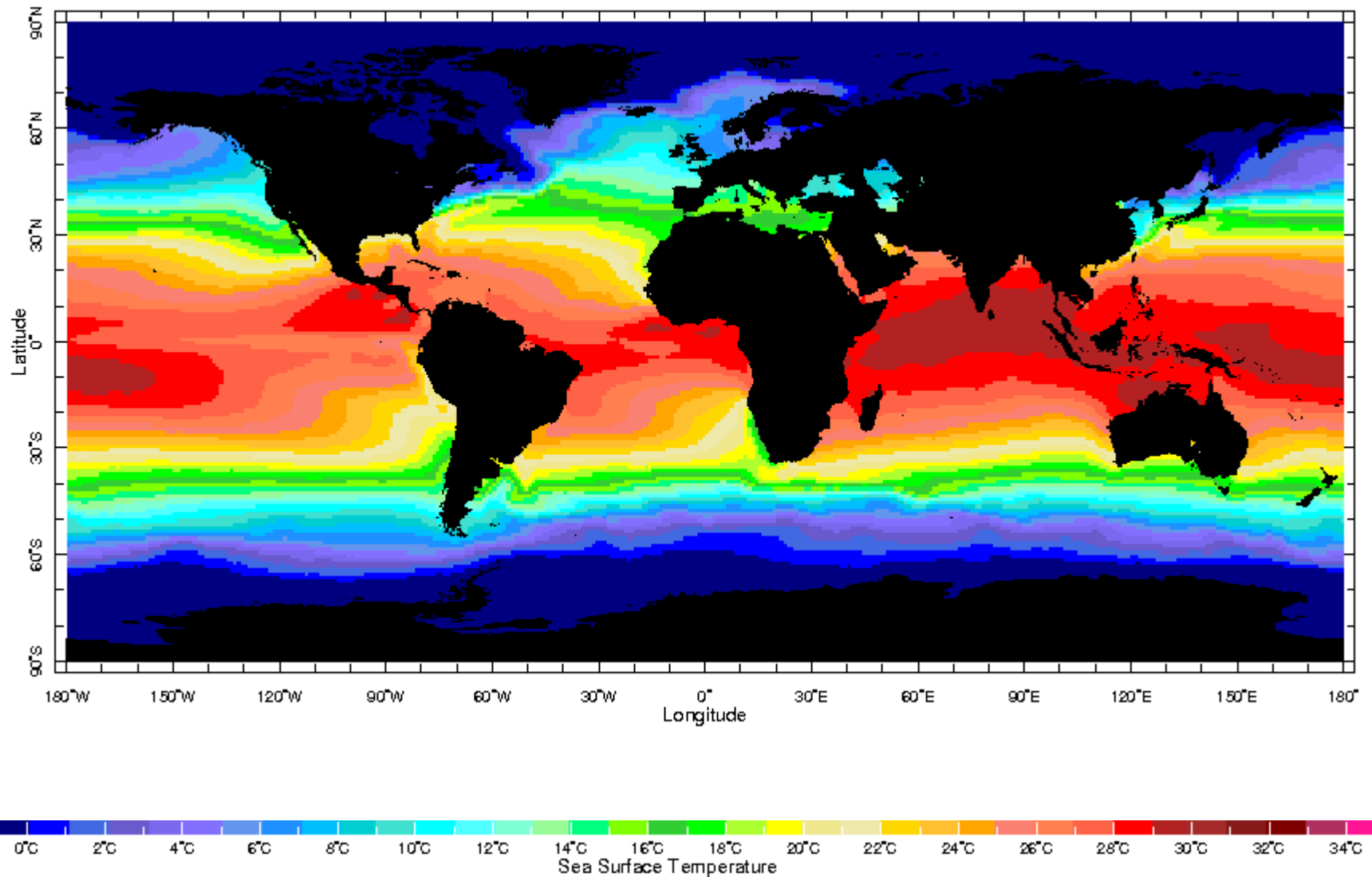
Dataset Title: NOAA NCEP EMC CMB GLOBAL Reyn_Smith

Sea Surface Temperature Visualization



Dataset Title: NOAA NCEP EMC CMB GLOBAL Reyn_Smith

Sea Surface Temperature Visualization



Dataset Title: NOAA NCEP EMC CMB GLOBAL Reyn_Smith



Analysis

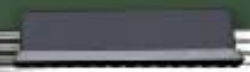
- The highest temperatures recorded were between Africa the central Pacific Ocean
- Interesting hotspots were found south of Mexico and off the western coast of Central America



Energy Use Data



Benjamin Turrubiates





Data

- ⇒ Source: Google Public Data Explorer
 - ⇒ <http://www.google.com/publicdata/home>
 - ⇒ Aggregates public datasets
 - ⇒ This dataset is from the World Bank's records on energy usage per country
 - ⇒ Dataset Title: World Development Indicators: Energy Use (kg of oil equivalent per capita)

Visualization

- ⇒ Source: Google Public Data Explorer
 - ⇒ Once a dataset is selected, visualization options for that dataset are shown
 - ⇒ Visualization type: line graph, bar chart, map overlay, and bubble chart
 - ⇒ Country Selection (or World)
 - ⇒ Customizable Timeline

Choosing Dataset

Google public data explorer
labs

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[Directory](#)
[My Datasets](#)
[Help](#)

Dataset Directory

[World Bank, World Development Indicators](#)
World Bank, World Development Indicators

[IFs Forecast - Version 6.41](#)

Frederick S. Pardee Center for International Futures

[Human Development Indicators](#)

Human Development Report 2010, United Nations Development Programme (UNDP)

[International Monetary Fund, April 2011 World Economic Outlook](#)

IMF, April 2011 WEO

[Global Greenhouse Gas Emissions by Country, Economic Sector, and Gas](#)

World Resources Institute

[OECD Factbook 2010](#)

OECD Factbook 2010

[Unemployment in Europe \(monthly\)](#)

Eurostat

[Harmonized Index of Consumer Prices in Europe](#)

Eurostat

[Minimum Wage in Europe](#)

Eurostat

← **Parent directory of Energy Use dataset.**

- The dataset directory holds groups of datasets. Our dataset is from the World Bank directory

More datasets

Google public data explorer
labs

World Bank, World Development Indicators

Sort by

› Topic

Name

Compare by

› Any (58)

Country (58)

Language

English

World Bank, subset of World Development Indicators (WDI)

[More info »](#)

Data from [World Bank, World Development Indicators](#) - Last updated: Jul 21, 2011

Economy

[Agriculture, value added \(% of GDP\)](#)

[Cash surplus/deficit \(% of GDP\)](#)

[Exports as percent of GDP](#)

[GDP deflator change](#)

[GDP growth rate](#)

[GDP per capita \(current US\\$\)](#)

[Gross Domestic Product](#)

[Gross capital formation \(% of GDP\)](#)

[Imports as percent of GDP](#)

[Industry, value added \(% of GDP\)](#)

[Revenue, excluding grants \(% of GDP\)](#)

[Services, etc., value added \(% of GDP\)](#)

Environment

[Agricultural land \(% of land area\)](#)

[CO2 emissions \(kt\)](#)

[CO2 emissions per capita](#)

[Electricity consumption per capita](#)

[Energy use per capita](#) ← Our Dataset

[Forest area \(sq. km\)](#)

- This dataset directory contains many different datasets.
- Here we use “Energy use per capita.”

Visualization Options

World Bank World Development Indicators > Visualization

← Line Graph, Bar Chart, Map Overlay, Bubble Chart

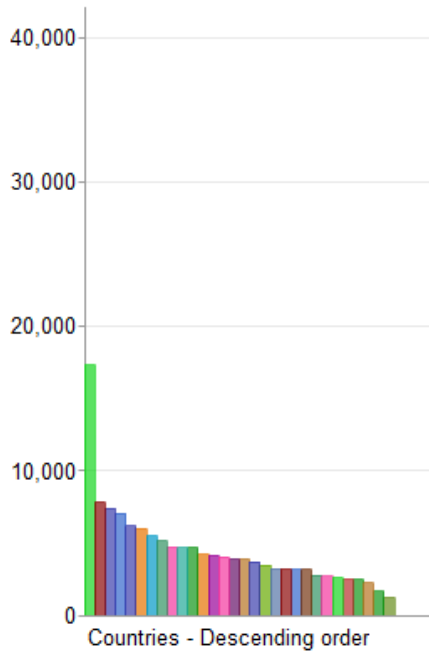
Compare Countries

- Afghanistan
- Albania
- Algeria
- American Samoa
- Andorra
- Angola
- Antigua and Barbuda
- Argentina
- Armenia
- Aruba
- Australia
- Austria
- Azerbaijan
- Bahamas, The
- Bahrain
- Bangladesh
- Barbados
- Belarus
- Belgium

Country Selection Pane

Energy use per capita

Data Set Selector



Select data for color

- Default colors
- Same colors
- Unique colors
 - By categories
 - Region
 - Income Level
 - Lending Type
 - By data
 - Economy
 - Environment
 - Global links

Unique colors

Selected and non-selected bars will all have unique colors.

OK Cancel

Color Scheme Options (Affects Graph/Chart)

Customizable Timeline



Play button on timeline allows one to view the change in real-time.

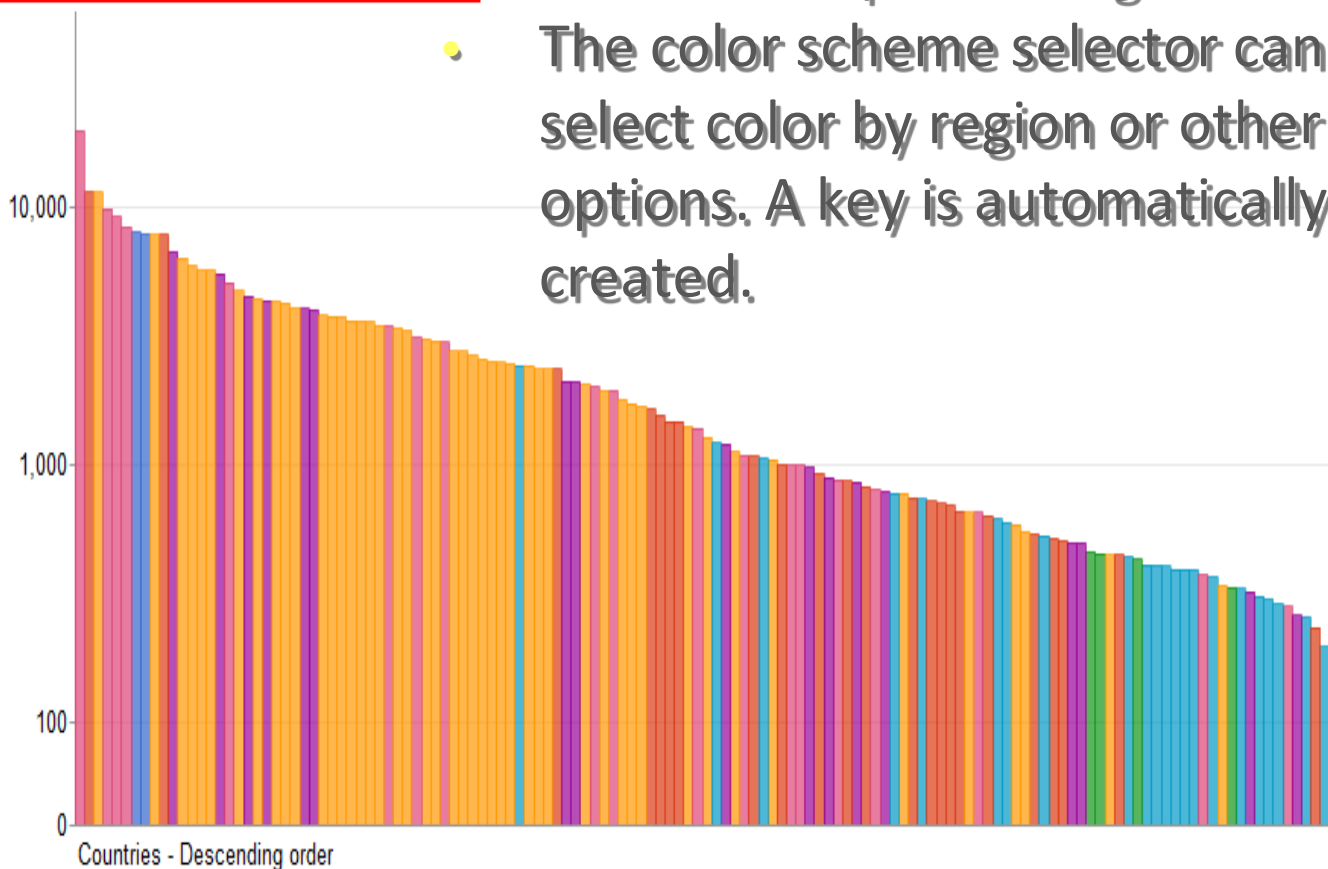
2009



Compare Countries

Energy use per capita - Log

- Afghanistan
- Albania
- Algeria
- American Samoa
- Andorra
- Angola
- Antigua and Barbuda
- Argentina
- Armenia
- Aruba
- Australia
- Austria
- Azerbaijan
- Bahamas, The
- Bahrain
- Bangladesh
- Barbados
- Belarus
- Belgium



Color Region

- Sub-Saharan Africa
- East Asia & Pacific
- Europe & Central Asia
- Latin America & Caribbean
- Middle East & North Africa
- North America
- South Asia

A logarithmic scale may be better for representing data. The color scheme selector can select color by region or other options. A key is automatically created.



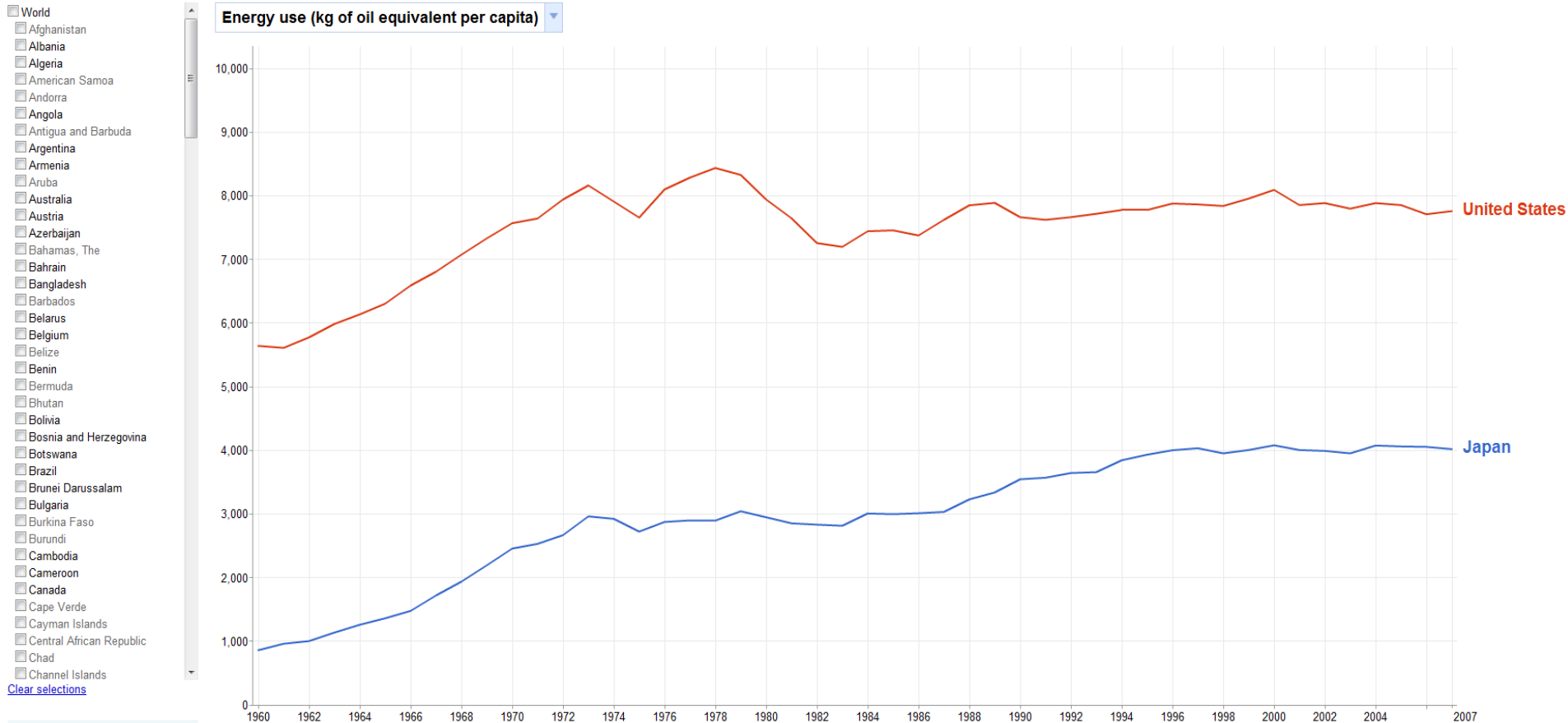
2001



Energy Use Visualization

World Development Indicators (subset) > Visualization

[Home](#) [List](#) [Print](#) [Share](#)



Data from: [World Bank](#)
Last updated: Jan 9, 2011

[Show time settings](#)

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Analysis

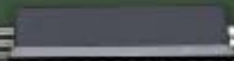
- ⇒ For the last 30 years, US per capita energy expenditures have been roughly double Japan's per capita energy expenditure



Greenhouse Gas Emissions



Jesse Crawford





Data



New Mexico Government Greenhouse Gas (GHG) Inventory



<http://nmclimatechange.us/>



Most state GHG Inventories are available online



Many are linked directly from the EPA



www.epa.gov/statelocalclimate/local/local-examples/ghg-inventory.html



Or Google “<state> GHG Inventory”

Climate Change Control...

Table 2 GHG Emissions for New Mexico Production Basis

GHG Emissions for New Mexico - Production Basis (Million Metric Tons CO ₂ e)	1990 CCAG Estimate	2000 CCAG Estimate	2000 NMED Estimate	2007 NMED Estimate
Electricity Production	29.3	33.0	31.9	31.4
Coal	27.9	30.5	29.0	28.1
Natural Gas	1.4	2.5	2.9	3.3
Petroleum	0.0	0.0	0.0	0.0
Residential/Commercial /Non-Fossil Industrial (RCI)	7.0	7.3	6.6	6.2
Coal	0.1	0.2	0.2	0.2
Natural Gas	3.8	4.6	4.6	3.9
Petroleum	3.1	2.5	1.8	2.2
Transportation	11.0	14.2	13.5	15.1

Visualization Software

⇒ Source: ManyEyes

⇒ <http://manyeyes.alphaworks.ibm.com/manyeyes/>

⇒ Allows users to upload data and create visualizations easily in a web browser

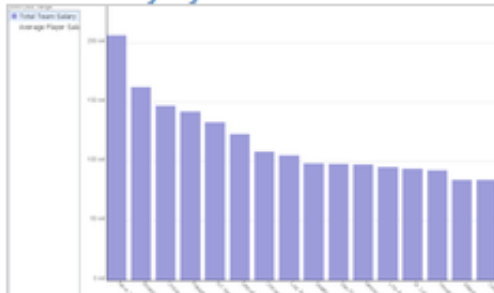
⇒ Tutorial available at NMT EPSCoR Website (<http://www.cs.nmt.edu/~epscor>) under Visualization

⇒ The visualization here uses a treemap to show relative GHG emissions by sector

Many Eyes

Try our featured visualizations

MLB Salary by Team 2010



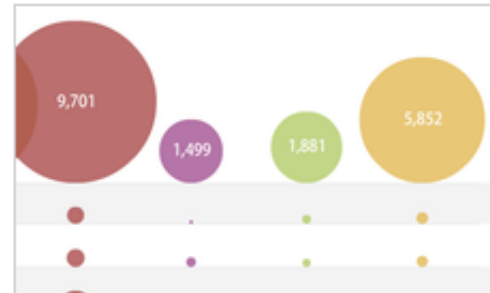
Each Major League Baseball Team's Payroll for the 2010 Season
by Anonymous

Revenue in India's Mobile Sector



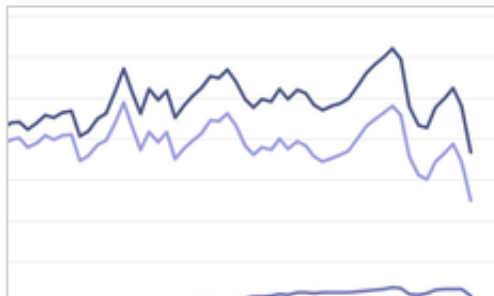
Market Share of Revenue and Change, 09-10 vs 10-11
by frick

Number of Cattle Slaughtered from bTB



UK, Jan- Mar 2011.
by Will_FW

US Taxes as Percentage of Personal Income



1929-2009
by David Joerg

Browser Market Share



Percent, 1994 Q1 - 2010 Q3
by frank_molenaar

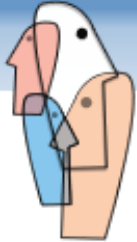
Who Holds the Debt



Greece, Ireland and Portugal
by kostasgeorgiyoj

Register

Many Eyes



An experiment brought to you by IBM Research and the IBM Cognos software group

Register for Many Eyes

Registration requires you to verify the email address which will be used to identify you. An email will be sent to the address entered below.

Email address:

Please verify that you are human

(type the code from the image)

Accessible Captcha

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- [Visualizations](#)
- [Data sets](#)
- [Comments](#)
- [Topic centers](#)

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- [Upload a data set](#)
- [Create a topic center](#)
- [Register](#)

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- [Quick start](#)
- [Visualization types](#)
- [Data format and style](#)
- [About Many Eyes](#)
- [FAQ](#)
- [Blog](#)

After registration options

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- Topic centers
- My stuff
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Visualization Types

See relationships among data points

-  Scatterplot
-  Matrix Chart
-  Network Diagram




Compare a set of values

-  Bar Chart
-  Block Histogram
-  Bubble Chart

Track rises and falls over time

-  Line Graph
-  Stack Graph
-  Stack Graph for Categories

See the parts of a whole

-  Pie Chart
-  Treemap
-  Treemap for Comparisons

Analyze a text

-  Word Tree
-  Tag Cloud
-  Phrase Net
-  Word Cloud Generator

Sample data

An example data set suitable for a treemap is:

Type	Food	Sales	Profit margin
Fruit	Banana	1456	12
Fruit	Lemon	23	-6
Fruit	Orange	981	12
Meat	Pork	111	2
Meat	Beef	442	6
Meat	Chicken	1456	77

Format data

	A	B	C	D	E
1	Category	Source	1990	2000	
2	Electricity	Coal	27.9	30.5	
3	Electricity	Natural Gas	1.4	2.5	
4	Electricity	Petroleum	0	0	
5	Residential	Coal	0.1	0.2	
6	Residential	Natural Gas	3.8	4.6	
7	Residential	Petroleum	3.1	2.5	
8	Transportation	Transportation	11	14.2	
9	Fossil Fuel Production	Natural Gas	12.7	17	
10	Fossil Fuel Production	Oil	2.3	2.3	
11	Fossil Fuel Production	Coal	0.2	0.2	
12	Industrial	ODS Substitutes	.	0.5	
13	Industrial	Semi-Conductor PFCs	0.1	0.5	
14	Industrial	SF6 from Electrics	0.2	0.1	
15	Industrial	Cement, Misc.	0.2	0.4	
16	Waste	Solid Waste	0	1	
17	Waste	Wastewater	0.3	0.3	
18	Agriculture	Manure Mgmt	1.8	3.5	

Next upload data

Explore

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Participate

- Create a visualization
- Upload a data set
- Create a topic center

Learn more

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- Data format and style
- About Many Eyes
- FAQ
- Blog

Copy and paste

2] Paste the data:

click the rectangle below, and type control-V (Windows) or command-V (Macintosh). For files of a megabyte or more, there may be a delay while reading the data.

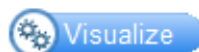
Category	Source	1990	2000
Electricity	Coal	27.9	30.5
Electricity	Natural Gas	1.4	2.5
Electricity	Petroleum	0	0
Residential	Coal	0.1	0.2
Residential	Natural Gas	3.8	4.6
Residential	Petroleum	3.1	2.5
Transportation	Transportation	11	14.2
Fossil Fuel Production	Natural Gas	12.7	17

Clear

Uploaded data

View as text

	Category	Source	1990	2000
1	Electricity	Coal	27.9	30.5
2	Electricity	Natural Gas	1.4	2.5
3	Electricity	Petroleum	0	0
4	Residential	Coal	0.1	0.2
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12	Industrial	Semi-Conductor PFCs	0.1	0.5
13	Industrial	SF6 from Electrics	0.2	0.1
14	Industrial	Cement, Misc.	0.2	0.4
...

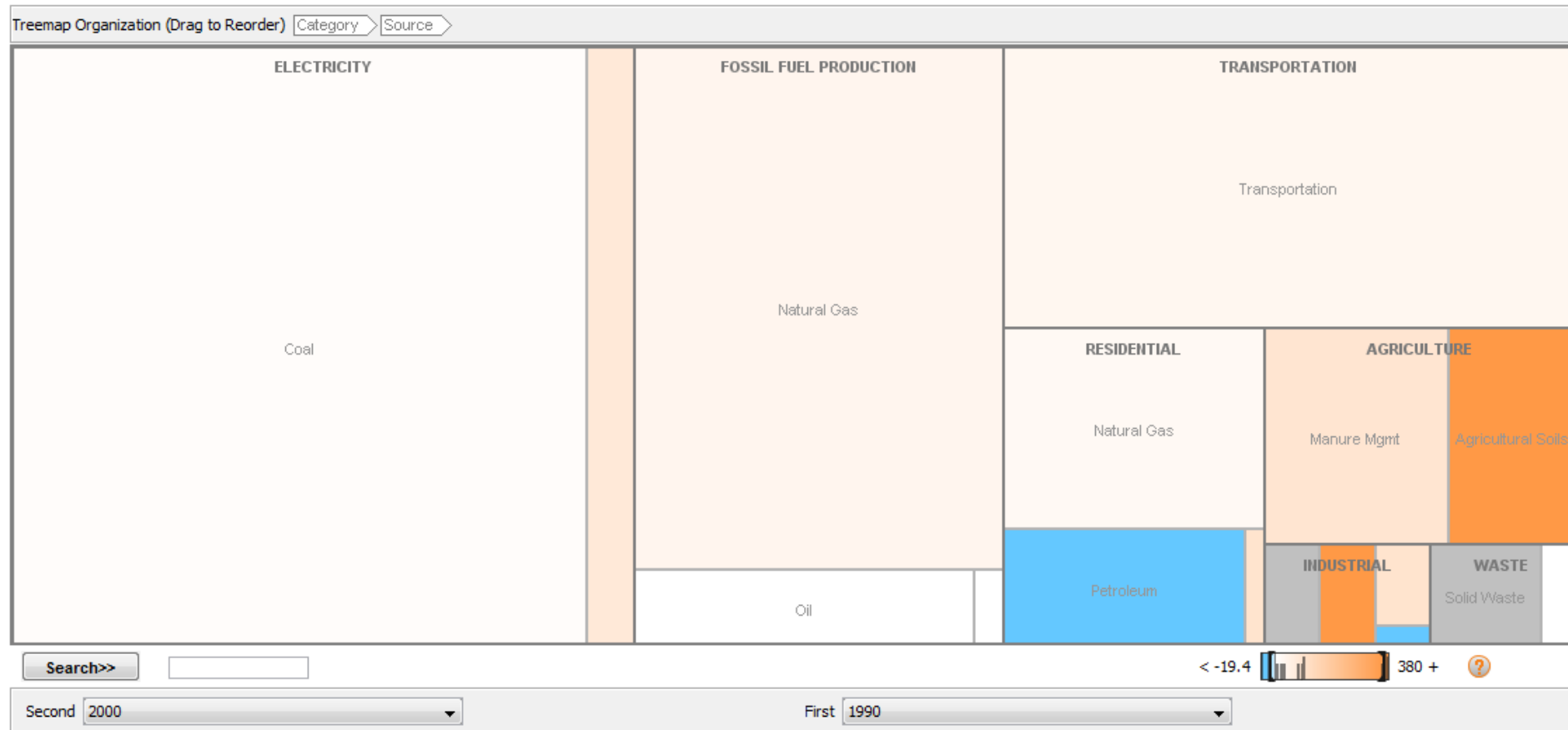


Visualization

Customizing Treemap for Comparisons

Data set: NM GHG Emissions (CCAG) 1990-2000 (Version 1)

Your visualization will look like this:



Analysis

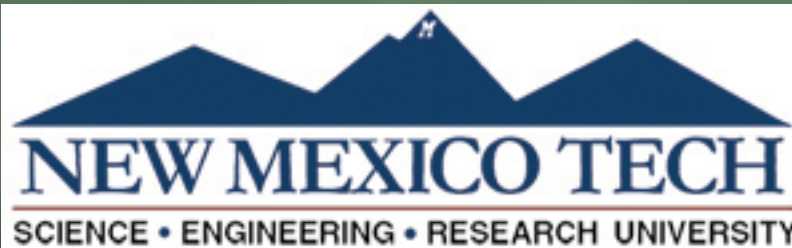
- Electricity from coal is the biggest contributor of GHGs.

For more...



New Mexico Tech EPSCoR

Educational Outreach Throughout New Mexico



<http://www.cs.nmt.edu/~epscor>

Participants...



Jerry Esquivel



Theresa Apodaca




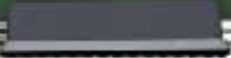

Leigh Hedderman



Valerie Salas



Databases

- ⇒ Energy and climate change policy
 - ⇒ Climate change data
- 
- 
- 


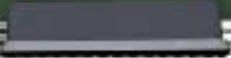



Visualization

- ⇒ Tools
 - ⇒ Workshops
 - ⇒ Tutorials
 - ⇒ Databases
 - ⇒ Examples
- 


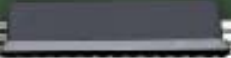



Climate Change

- ⇒ Resources for understanding and teaching climate change.
 - ⇒ Government Agencies
 - ⇒ For kids and teenagers
 - ⇒ Scholarships
 - ⇒ Professional Training
 - ⇒ Projects
 - ⇒ Non-government organizations
 - ⇒ Educator's resources
 - ⇒ ...
- 
- 
- 



STEM

- Tools
 - Student resources
 - Educator resources
 - Student opportunities
- 
- 
- 

References

Reading:

A Tour through the Visualization Zoo, Jeffrey Heer, Michael Bostock, and Vadim Ogievetsky, acmQueue, May 2010

Exploration:

- Explore the "50 Great Examples of Data Visualization" at www.webdesignerdepot.com/2009/06/50-great-examples-of-data-visualization/
- Many Eyes manyeyes.alphaworks.ibm.com/manyeyes/

Helen Wright

Introduction to Scientific Visualization

 Springer

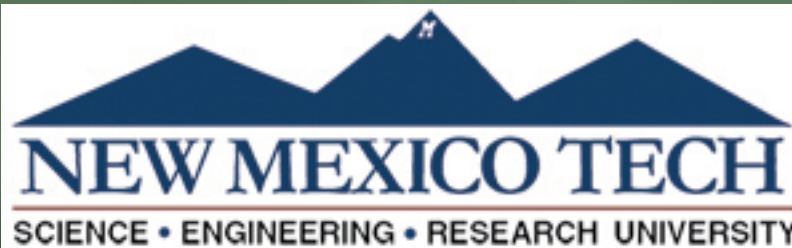


Questions



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