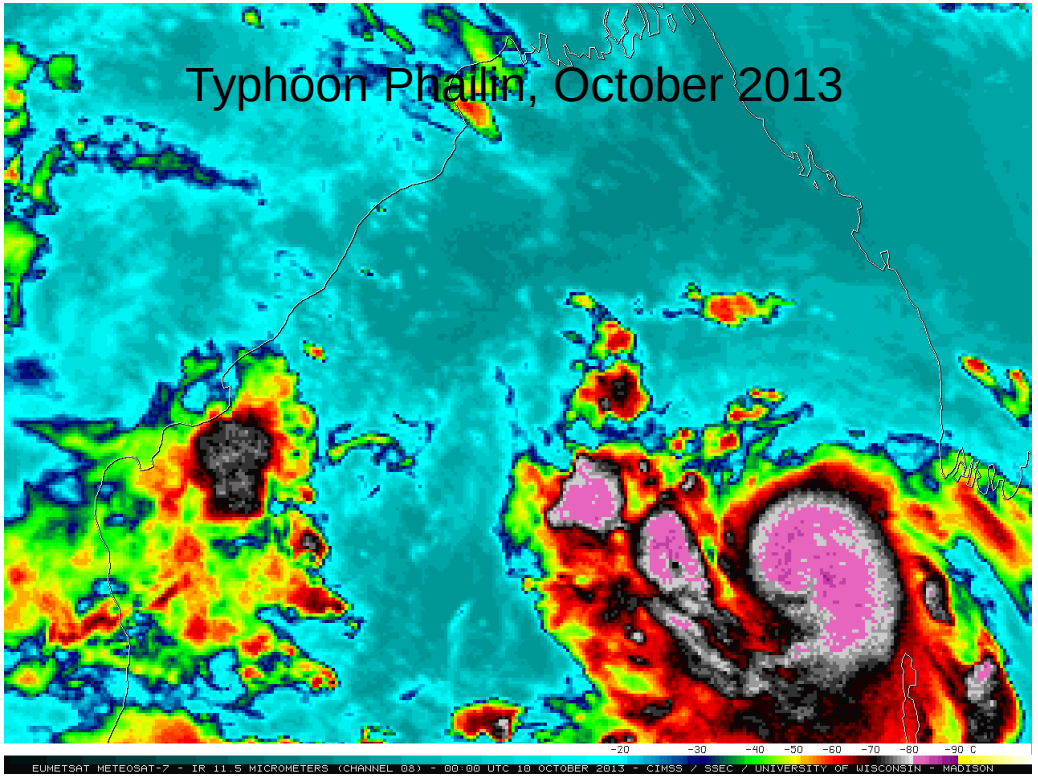
Using Data in the Earth and Space Science Classroom to Engage Students as Real Scientists

Roberta Johnson, Richard Jones, Joe Monaco,
Wendy Van Norden, and Michael Passow,
(National Earth Science Teachers Association)
My NASA Data - Preston Lewis (NASA Langley)
Climate Literacy and Energy Awareness Network (CLEAN)
CHANGE Viewer – CIESIN
Earth System Information Partnership (ESIP)

Fall 2014

Overview

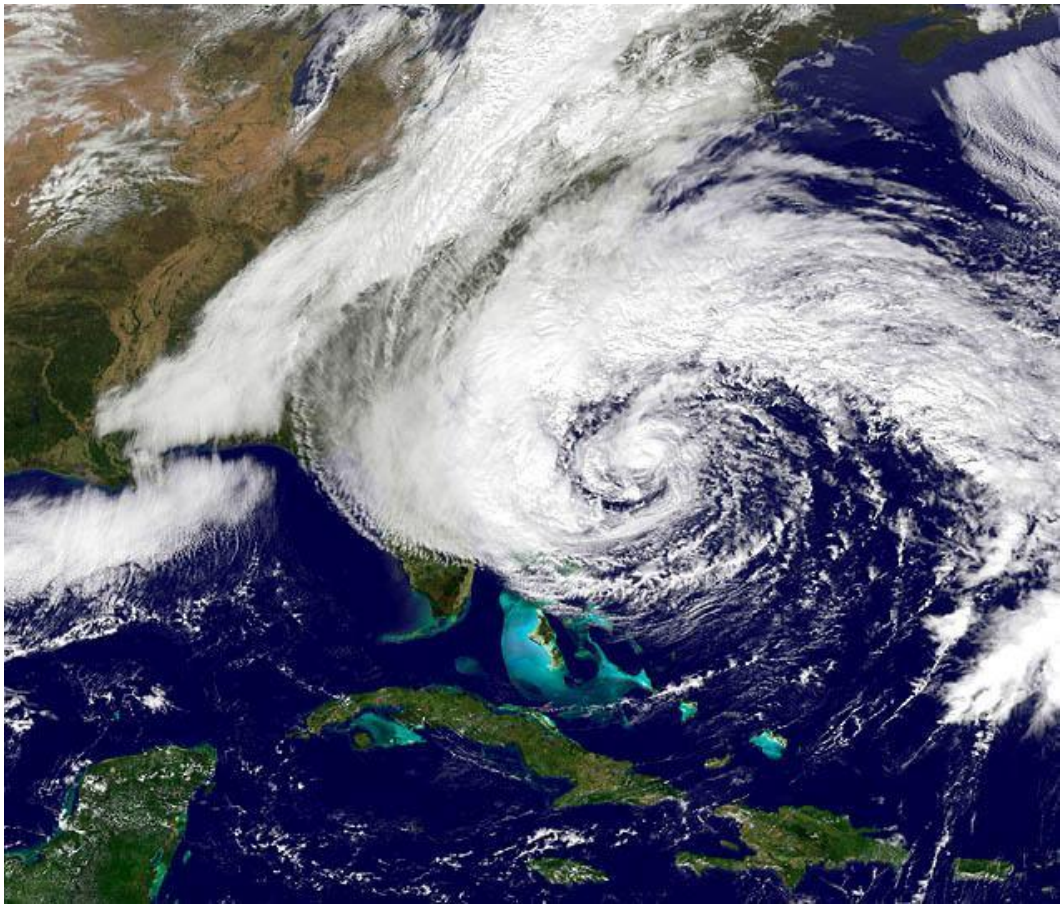
- NGSS Relevance
- Modeling the Path of a Hurricane – the Linear Motion Approach
- Hurricanes as Heat Engines (My NASA Data)
- Hurricanes and Impacts (CHANGE Viewer)
- Hurricanes and CLEAN



NGSS Relevance

- *NGSS PE MS-ESS3.2*: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- *NGSS PE HS-ESS3.1*: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- Science and Engineering Practices: Analyzing and Interpreting Data; Using Mathematics and Computational Thinking; Constructing Explanations
- Crosscutting Concepts: Cause and Effect; Systems and System Models; Stability and Change

Hurricanes Along the East Coast

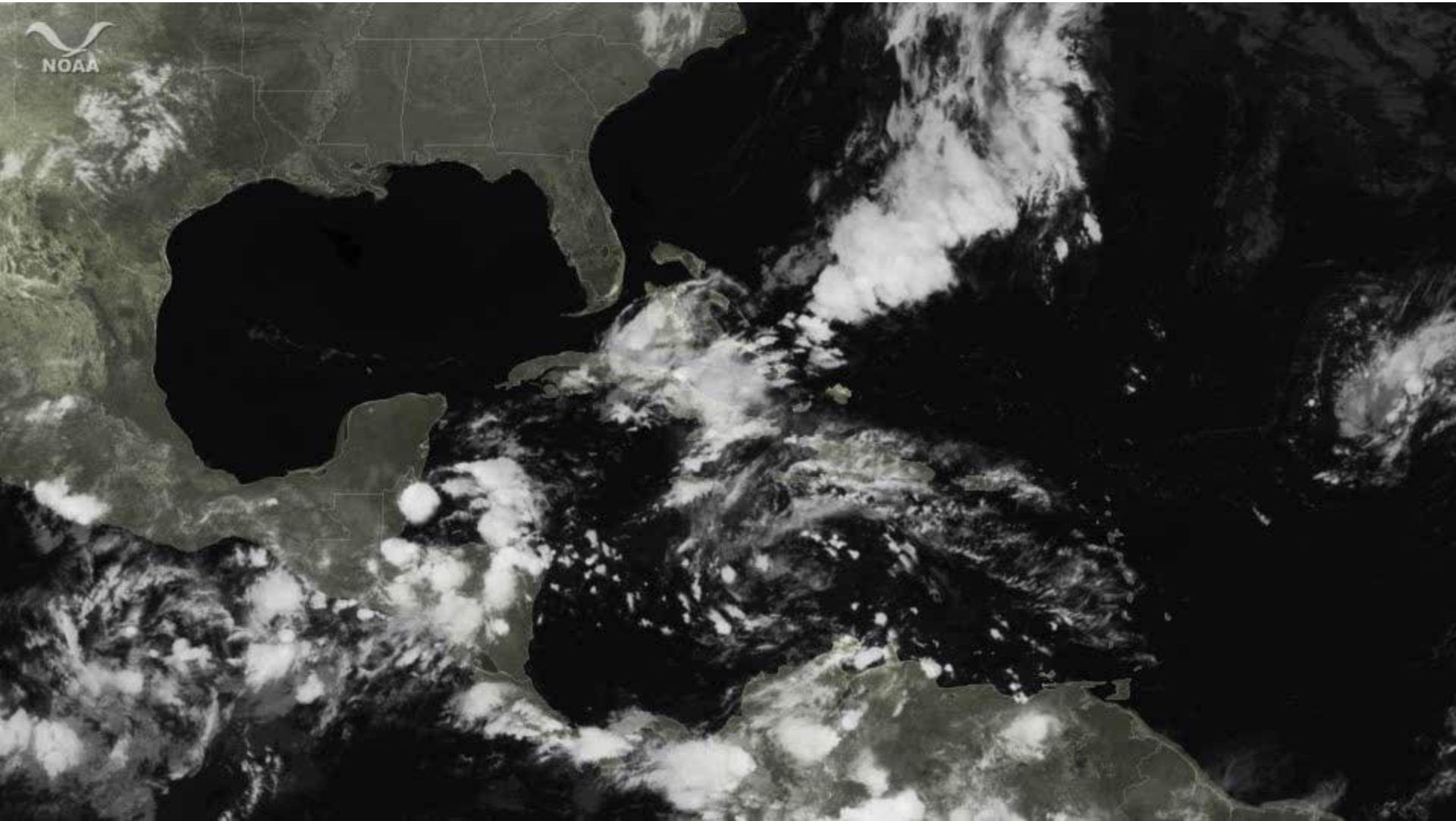


Hurricane Sandy
Picture: www.nydailynews.com

Hurricanes are no strangers to students who live along the East Coast...

Hurricane Sandy

October 21, 2012 0345Z through October 31, 2012 1315Z

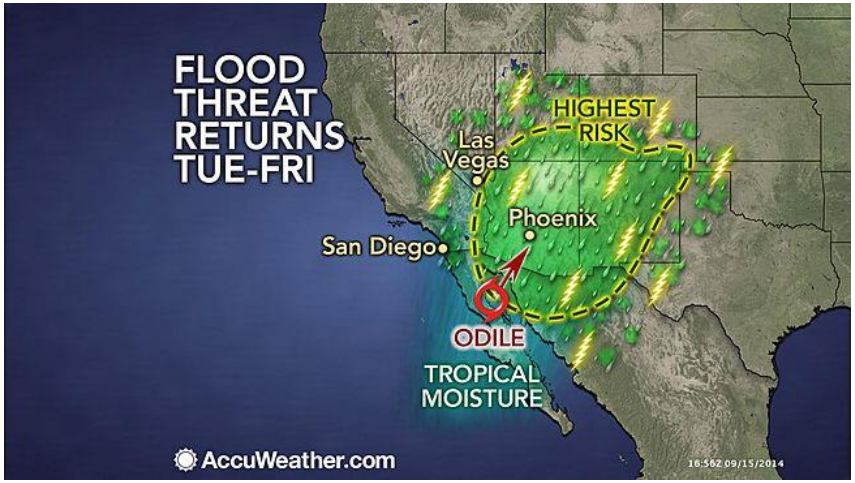


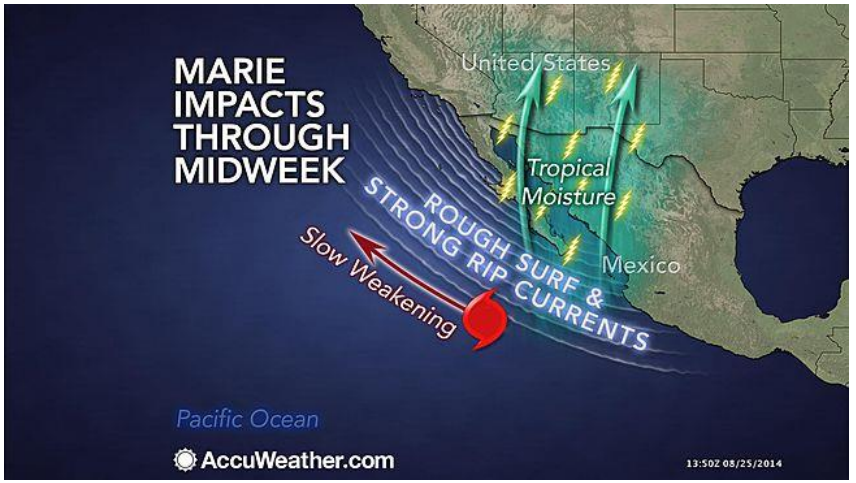
…and certainly not immune to the destructive consequences of such powerful storms!

A rollercoaster is battered by waves near a storm-destroyed pier off the New Jersey coast in this aerial photograph provided by the US Air ForcePicture: EPA/MASTER SGT. MARK OLSEN / US AIR FORCE

California Hurricanes?

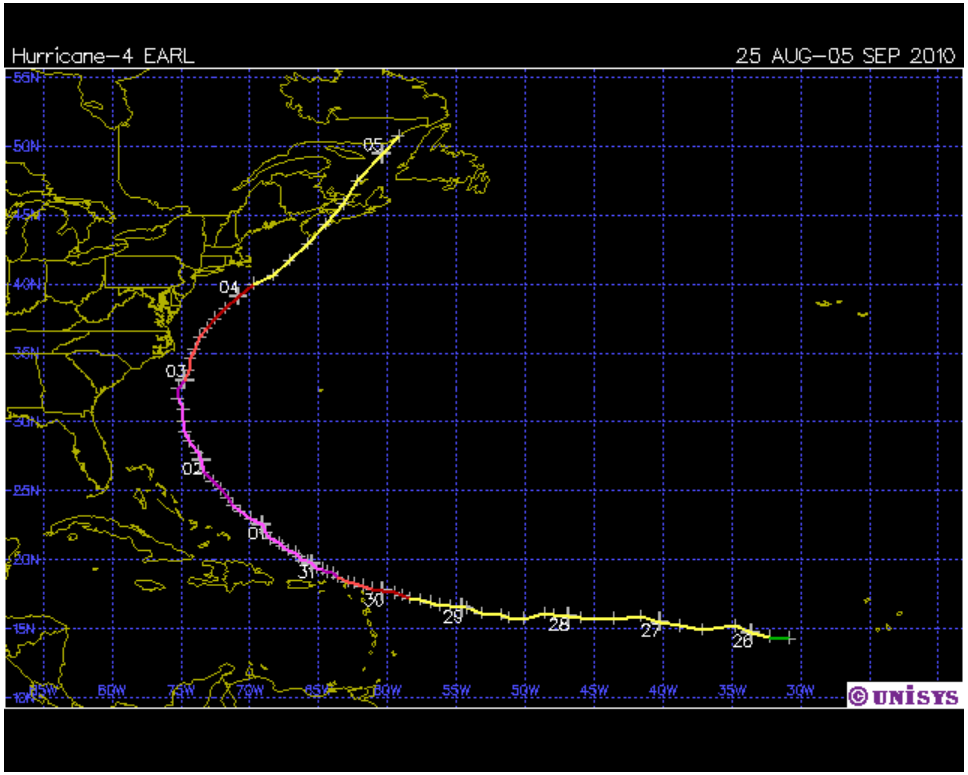
Odile May Impact Weather in Southern California (Sept 15, 2014)

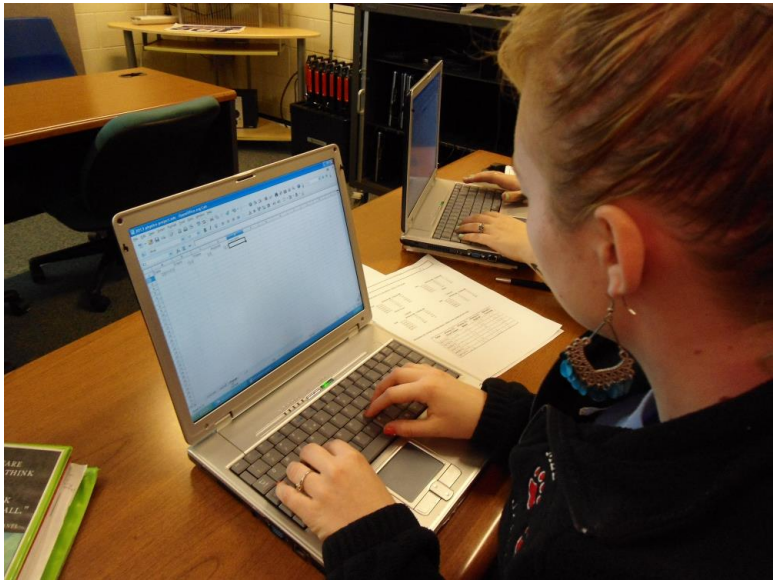




Marie's Wave Action Floods Seal Beach (Nov. 17, 2014)

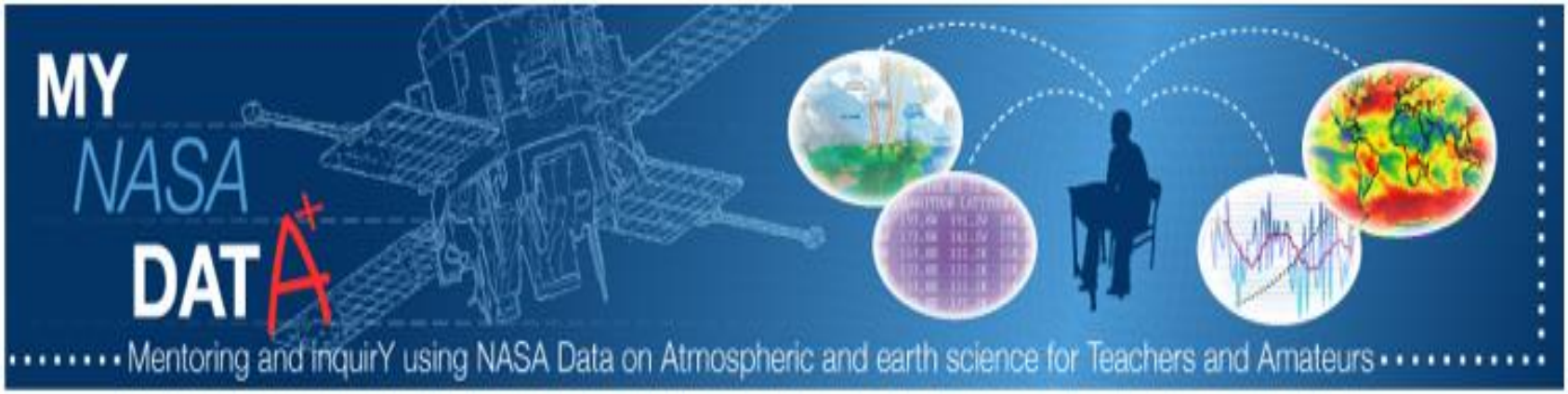
Modeling the path and energy of a hurricane is a great way to integrate core ideas and cross cutting concepts in mathematics, science, and technology.





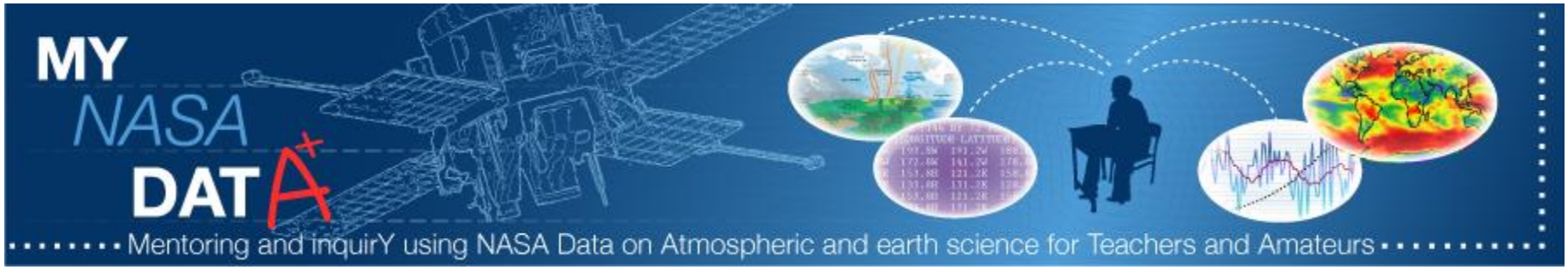
Effective “impact” on student learning... no pun intended

Welcome to …



Preston Lewis
Science Systems and Applications Incorporated

What is MY NASA DATA?



- Involve students in real science.
- Enable K-12 teachers and students, as well as citizen scientists, to explore the large volumes of data that NASA collects about the Earth from space.
- *Students use scientific inquiry and math skills as they access and display microsets of the Earth System.*

http://mynasadata.larc.nasa.gov

MY NASA DATA

Mentoring and inquirY using NASA Data on Atmospheric and earth science for Teachers and Amateurs

What is MND

UNDER CONSTRUCTION
Visit the old site: MY NASA DATA - Old Site MY NASA DATA (MND) is a tool that allows anyone to make use of satellite data that was previously unavailable. Through the use of MND's Live Access Server (LAS) a multitude of charts, plots and graphs can be generated using a wide variety of constraints. This site provides a large number of lesson plans with a wide variety of topics, all with the students in mind. Not only can you use our lesson plans, you can use the LAS to improve the ones that you are currently implementing in your classroom.

Google™ Custom Search

Photos

Events

Connect

Apps

MY NASA DATA

- Home
- Live Access Server
- Lesson Plans
- Data Sources

Popular Searches

Misson

News from MY NASA DATA, the Science Directorate, and S'COOL

Earth Science Week 2012: Meet Dr. Dalia Kirschbaum

NASA Educators Online Network is offering Free Webinar Series throughout the Month of October (2012).

Elementary

Middle School

High School

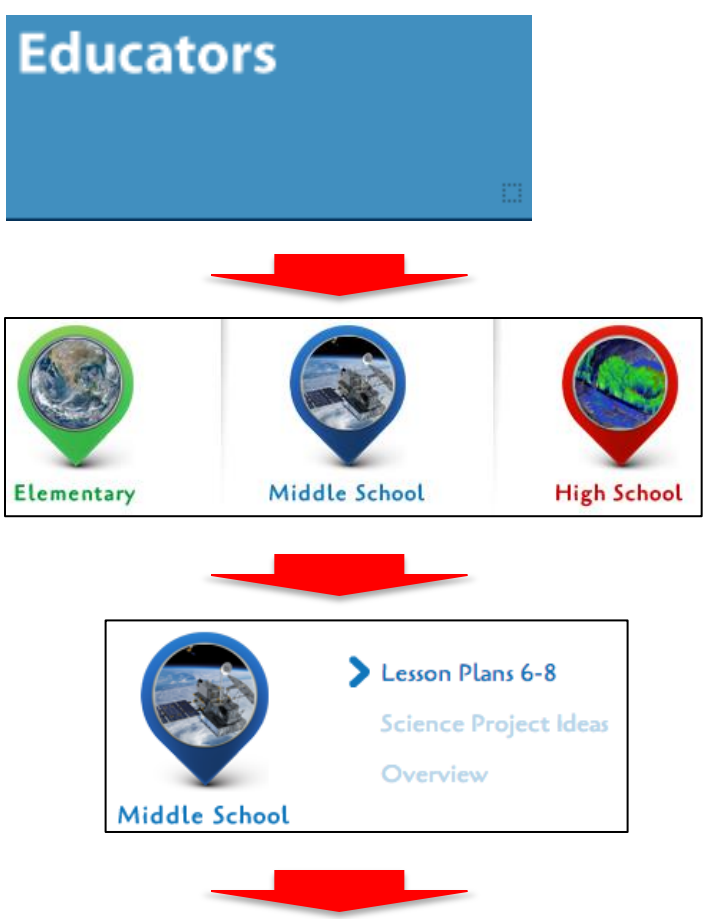
Educators

Teachers learning to use the sun photometer in Puerto Rico

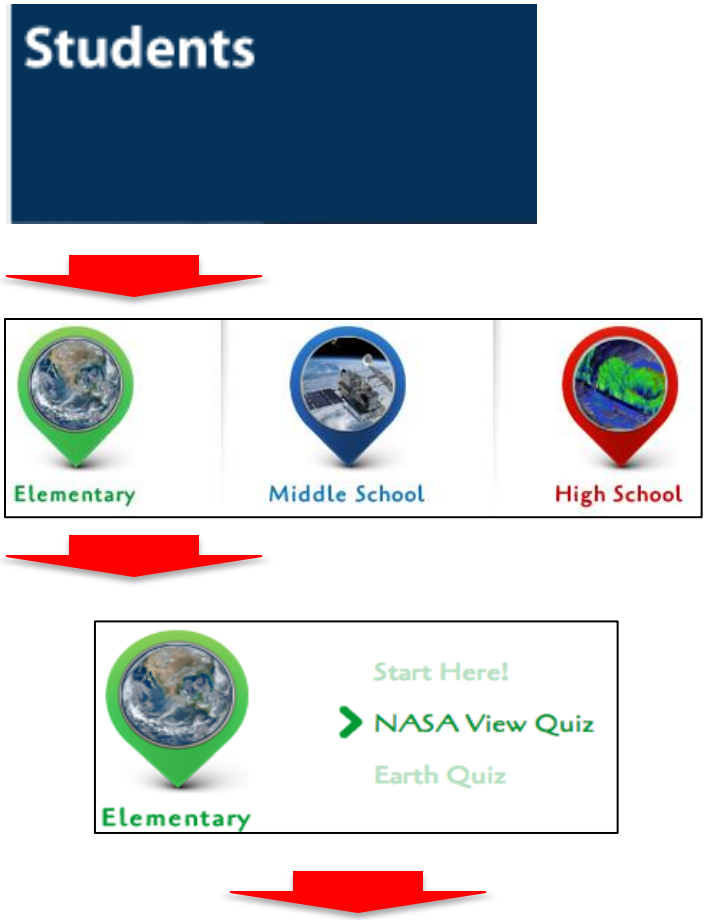
MY NASA DATA is an online avenue whereby educators can bring NASA data into their classroom and provide students with real-world science experiences. One of the main goals of the MY NASA DATA project is to remove the barriers (such as file size, format, and complicated computer tools) that prevent the use of authentic NASA Earth Science data in the classroom. The principal activity of the project is to create "microsets" from large scientific data sets, and to wrap these with tools, lesson plans, and supporting documentation so that a teacher can use the information in the classroom. Microsets may be a single parameter for the whole globe, or a time series for a single location, and they may be static or made on the fly as students explore a topic. A few examples of possible parameters to investigate include the atmosphere, vegetation, aerosols, snow and ice cover, and the oceans.

In addition to the microsets, the MY NASA DATA website offers a growing collection of over 120 standard based lesson plans to help teachers get started with data exploration. Some of the lessons were developed by the MY NASA DATA team, while others have been contributed by educators who have used the MY NASA DATA website. All lessons identify relevant national or

Site Architecture: Linear Path to follow



Only contains teacher items:
- Standards
- Background information
- Tools
- Many other teacher-only items



Only contains Student items:
- Science Project ideas/starters
- Activities (Inquiry and PBL)
- Glossaries and quizzes
- Geared towards science students

MY NASA DATA

- Home
- Live Access Server
- Lesson Plans
- Data Sources

Student Menu

- Students
- Science Glossary
- Science Project Ideas

Students
- Elementary – Students
- Middle School – Students
- High School – Students

Resources

- Activities
- Science Processes
- Radiation & Energy
- Orbits
- Weather and Climate
- Classroom Management
- Lesson Plan Form
- Computer Tools

Google™ Custom Search

– Students

…he different images to learn how NASA collects, stores and shares data.

MY NASA DATA has been designed to provide you with access to climate data being collected b… NASA Satellites. Whether conducting a science project or gathering information, MY NASA DATA brings …al-world data to you in a format that allows you to select specific factors that you would like to investigate. Che… out the videos below to learn more about the A-Train Satellites currently collecting data as they orbit the E…th in addition to various other NASA Missions and Projects that you might find interesting.

Coming Soon:

1. WebQuest: Using MY NASA DATA
2. Science Glossary App
3. Feature Projects Submitted by Students
4. INTEL Link for science project resources

Middle School Student Interacti

High School Student Interactive:

Vegetation

Vegetation refers to the plant life that can be found in a particular region. This term does not refer to any specific plant type, but to all the plants in a place or region.

Do leaves reflect light back into space?

Our Earth

The Earth is a complex system of interconnected processes that feed off of each other. More specifically it is the third planet from the sun that was formed appx 4.55 billion years ago, and now supports human, plant and animal life.

How do rivers impact the nutrient amounts in a bay?

Snow Cover

The amount of snow and ice cover detected on the surface of the Earth from satellite observations. A key challenge to this observation is the detection of clouds, which can look confusingly like snow or ice when viewed from space.

Is the amount of ice in the arctic circle changing?

Sea Surface Temp

The temperature of the very top layer of water (or the effective temperature of a thicker layer that includes the top) of Earth's oceans and other large bodies of water.

Is it possible for the temperature in the Gulf of Mexico to affect the weather along the East coast?

Precipitation

Precipitation is considered water that falls from clouds to the ground. This can be in the form of rain, snow, sleet, hail, etc.

How much water is available in the atmosphere for precipitation?

Clouds

Clouds are collections of water (in liquid or ice phase) in the atmosphere that are often classified by their shape and height.

Are there enough contrails in the sky to affect the temperature on the ground?

Carbon Monoxide

A clear odorless gas formed from the incomplete combustion of carbon-based fuels. Carbon monoxide is a short lived gas in the lower layer of the atmosphere.

What is the result of population density on the amount of carbon monoxide?

Aerosols

Aerosols are small liquid or solid particles dispersed in the atmosphere. Large quantities are often regarded as pollutants in the form of haze and smoke.

Are Hurricanes in the Atlantic and Aerosols related?

High School Student Interactive:

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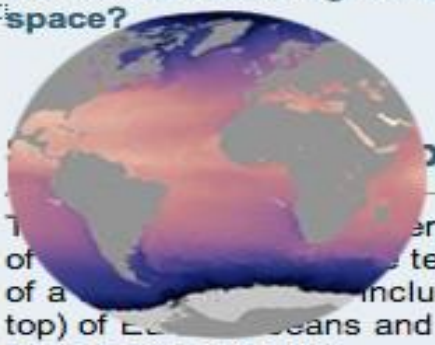

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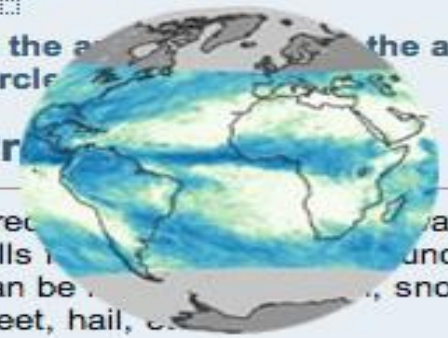

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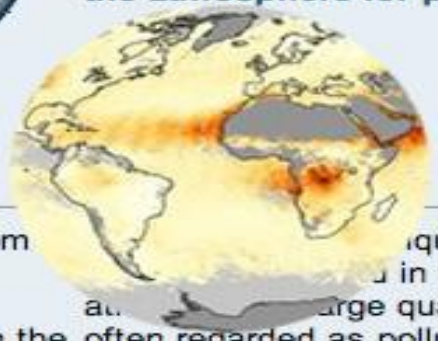

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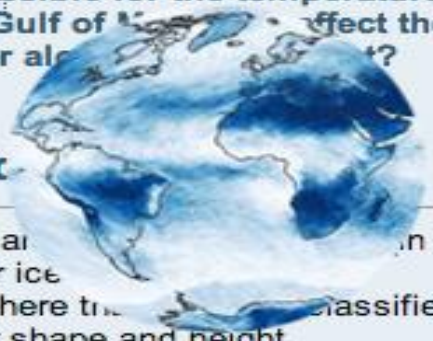

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Carbon Monoxide

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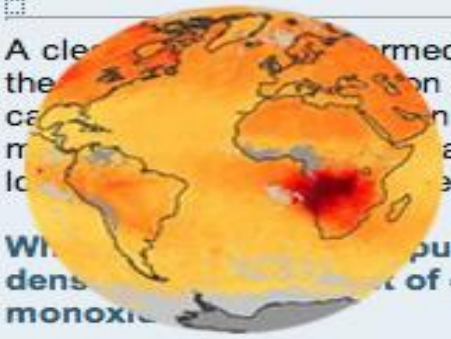

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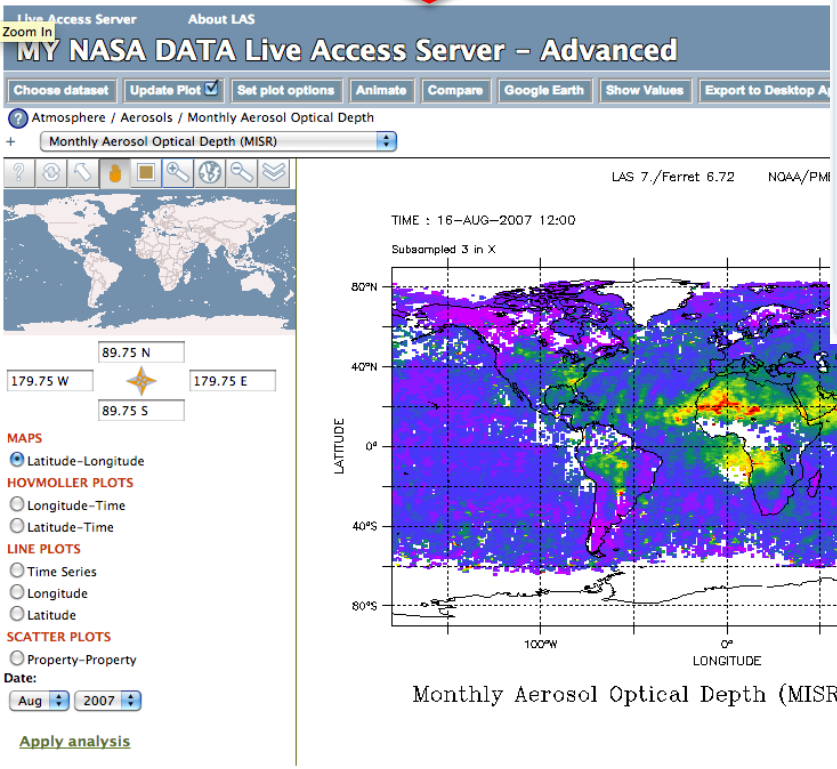
Are Hurricanes in the Atlantic and Aerosols related?

Student interactive will take students to lessons and data:

Live Access Server: Aerosols



Lesson Search by LAS Parameter

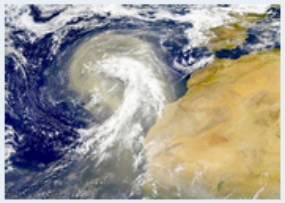
Please make a selection from the drop down menu below to access our lesson plans by the parameter names used in the Live Access Server (LAS). If you do not know which parameter you would like to use, you can browse the Live Access Server Sample Images to find a description of some of the parameters available in the LAS.

SELECT CATEGORY: Aerosols — Look up parameters

PARAMETER: Select one parameter and then click search

Search for Lesson Plans

Parameter Name: Monthly Aerosol Optical Depth (MISR)

Lesson Title	Grade Level	Lesson Purpose	
Tropical Atlantic Aerosols View Lesson Plan	8	Students will use real satellite data to determine where the greatest concentrations of aerosols are located during the course of a year in the tropical Atlantic region and their source of origin.	
Lesson Title	Grade Level	Lesson Purpose	
Using MY NASA DATA to Determine Volcanic Activity View Lesson Plan	8-12	To use NASA satellite data of optical depth as a tool to determine volcanic activity on Reunion Island during 2000-2001	

Lesson Plan Search: Aerosols

search Y NASA DATA

Google™ Custom Search

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- Live Access Server
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Lesson Menu

MY NASA DATA Lesson Plans

The collection of MY NASA DATA lesson plans is intended to provide the educator with a variety of specific examples, incorporating a more "teacher-directed" strategy, of how authentic satellite data can be integrated into the curriculum.

The majority of MY NASA DATA lessons were developed by classroom teachers to use real NASA data in their curriculum. Other lessons were developed by the MY NASA DATA team as examples of lessons using microsets from the Data Access page.

Featured on the Science Project Ideas section of our website are examples of a more "student-directed" strategy, with an inquiry-based research approach for using authentic data.

If you are a visitor to the MY NASA DATA site, these illustrations of how other teachers have used authentic satellite data as a resource may serve as an inspiration. We invite you to use them as is or to create your own lesson from the rich data resource that the LAS provides. If you create your own lesson, please consider sharing it with other educators through this ever-growing list.

CLICK the buttons on the left of the page to see the various lessons that are available by grade level. Please note that some lessons can be adapted to a lower or higher grade-band.

- Search by Live Access Server Parameter
- Search by Environmental Science Topic
- Search by Data Category
- Search by Virginia SOL
- Search by National Science Education Standards

MY NASA DATA

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Google™ Custom Search

Lesson Search by LAS Parameter

Please make a selection from the drop down menu below to access our lesson plans by the parameter names used in the Live Access Server (LAS). If you do not know which parameter you would like to use, you can browse the Live Access Server Sample Images to find a description of some of the parameters available in the LAS.

SELECT CATEGORY

- ✓ Choose one
- Aerosols
- Air Quality
- Atmospheric Pressure
- Atmospheric Radiation
- Atmospheric Temperature
- Atmospheric Water Vapor
- Clouds
- Precipitation
- Biosphere
- Cryosphere
- Surface Conditions
- Surface Cover
- Surface Radiation
- Oceans

Look up parameters

Search for Lesson Plans

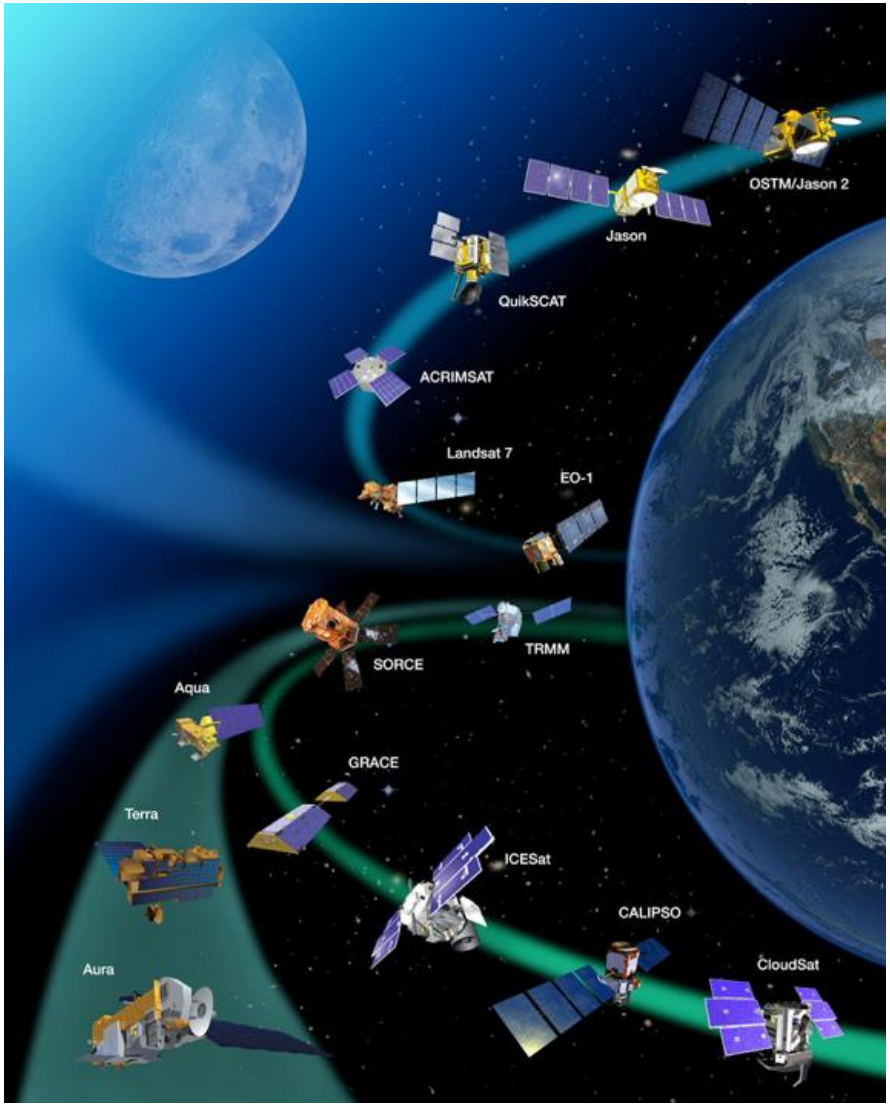
Lesson plan and data visualization made easy for the classroom through the Live Access Server

Preston Lewis, SSAI/NASA Langley Research Center

What types of data do we have?

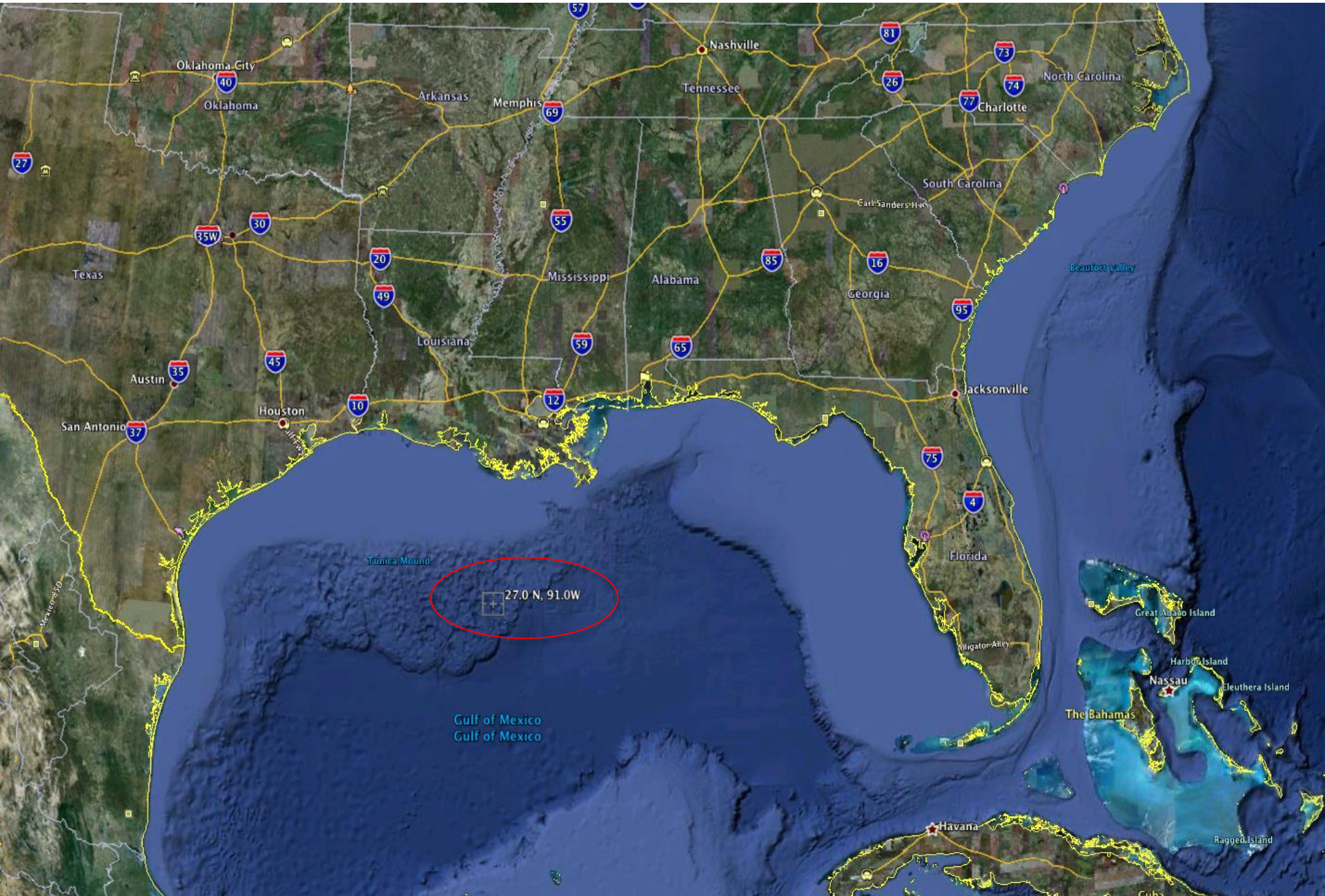
- Atmosphere
- Biosphere
- Cryosphere
- Land Surfaces

- Oceans

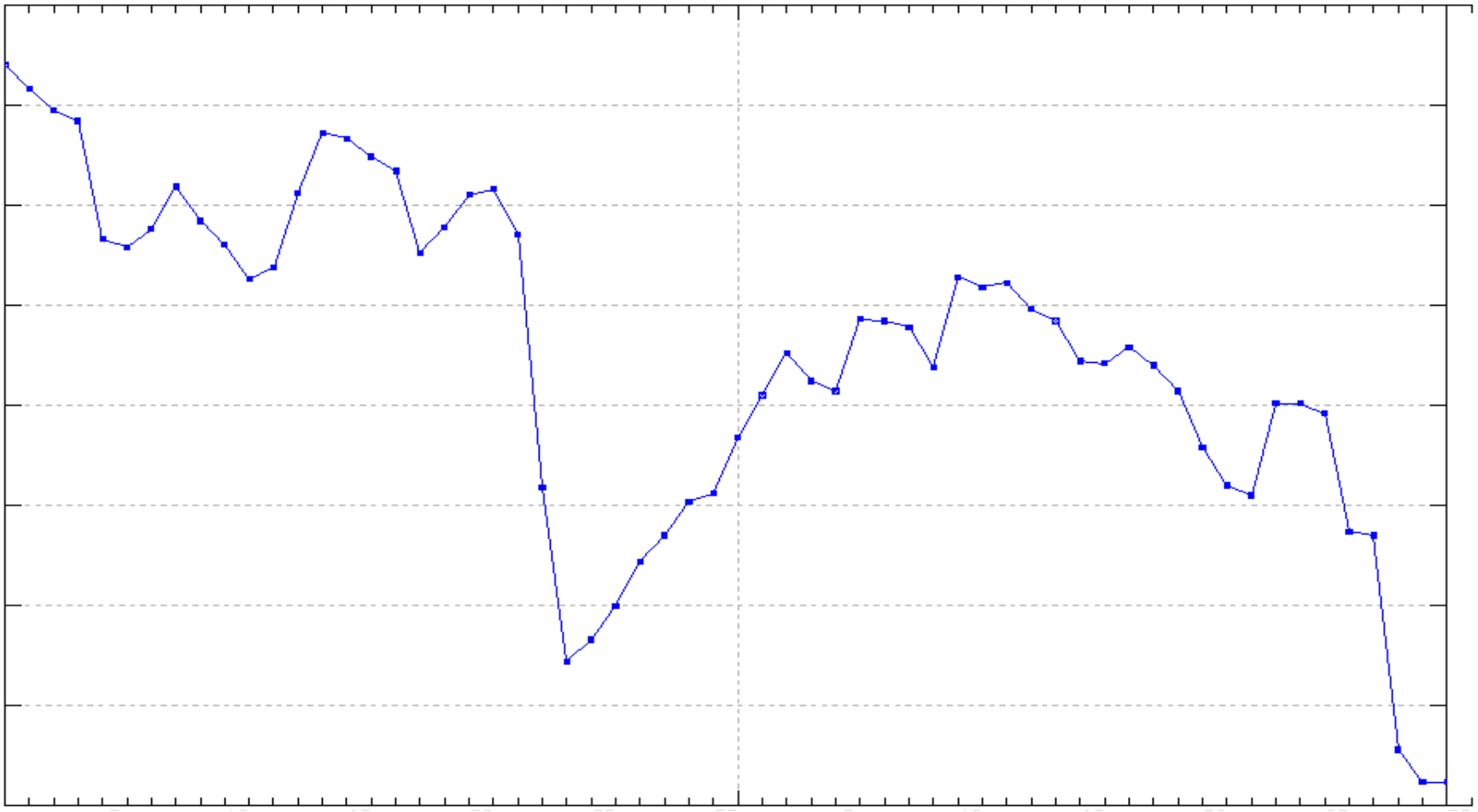


The satellites of NASA's Earth Observing System monitor daily events and long term changes. (NASA image by Jenny Mottar.)

Lets look at a time series plot for a spot along Rita's path (Sept 1- Oct 30)



What Could this be a plot of?



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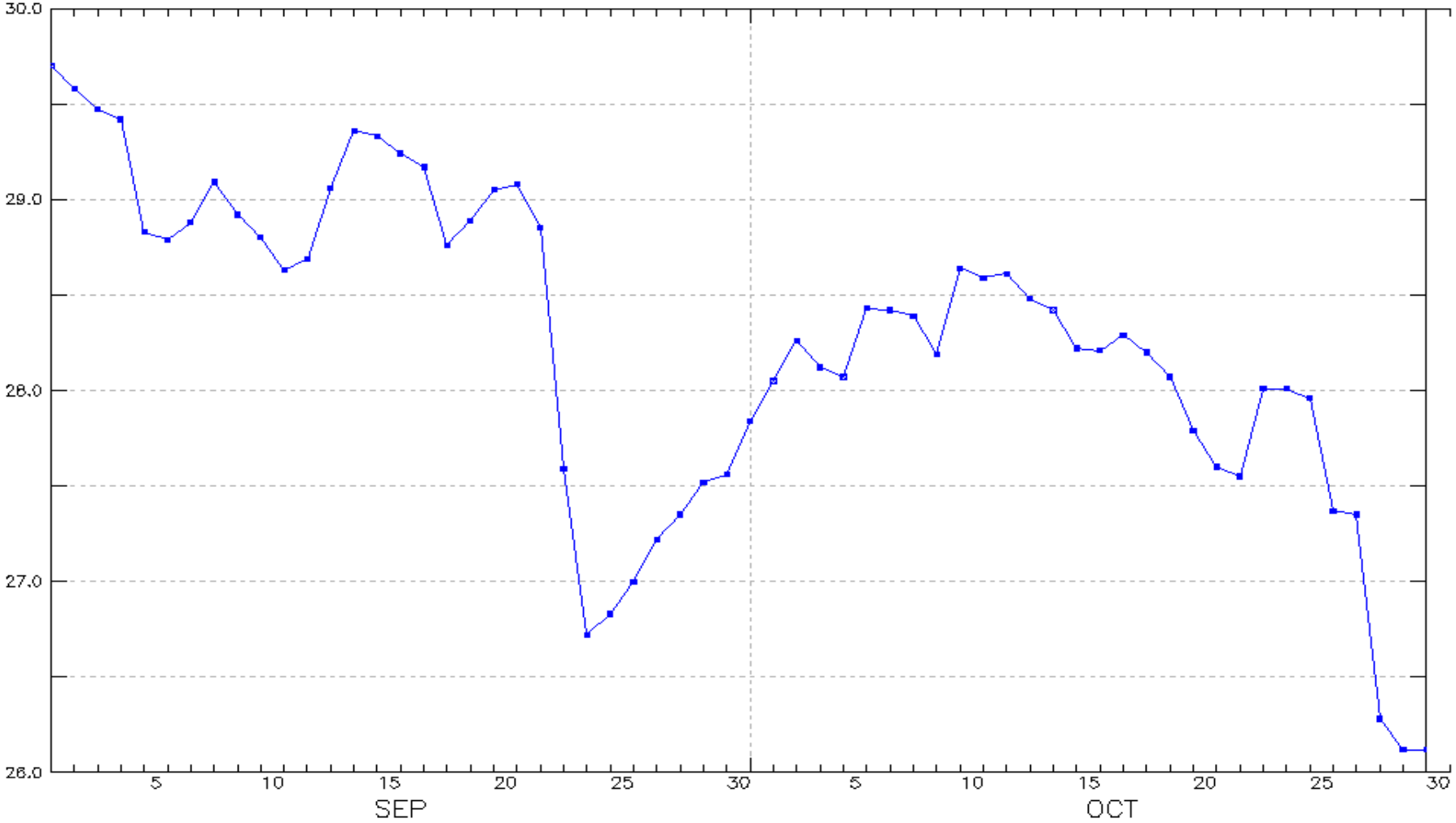
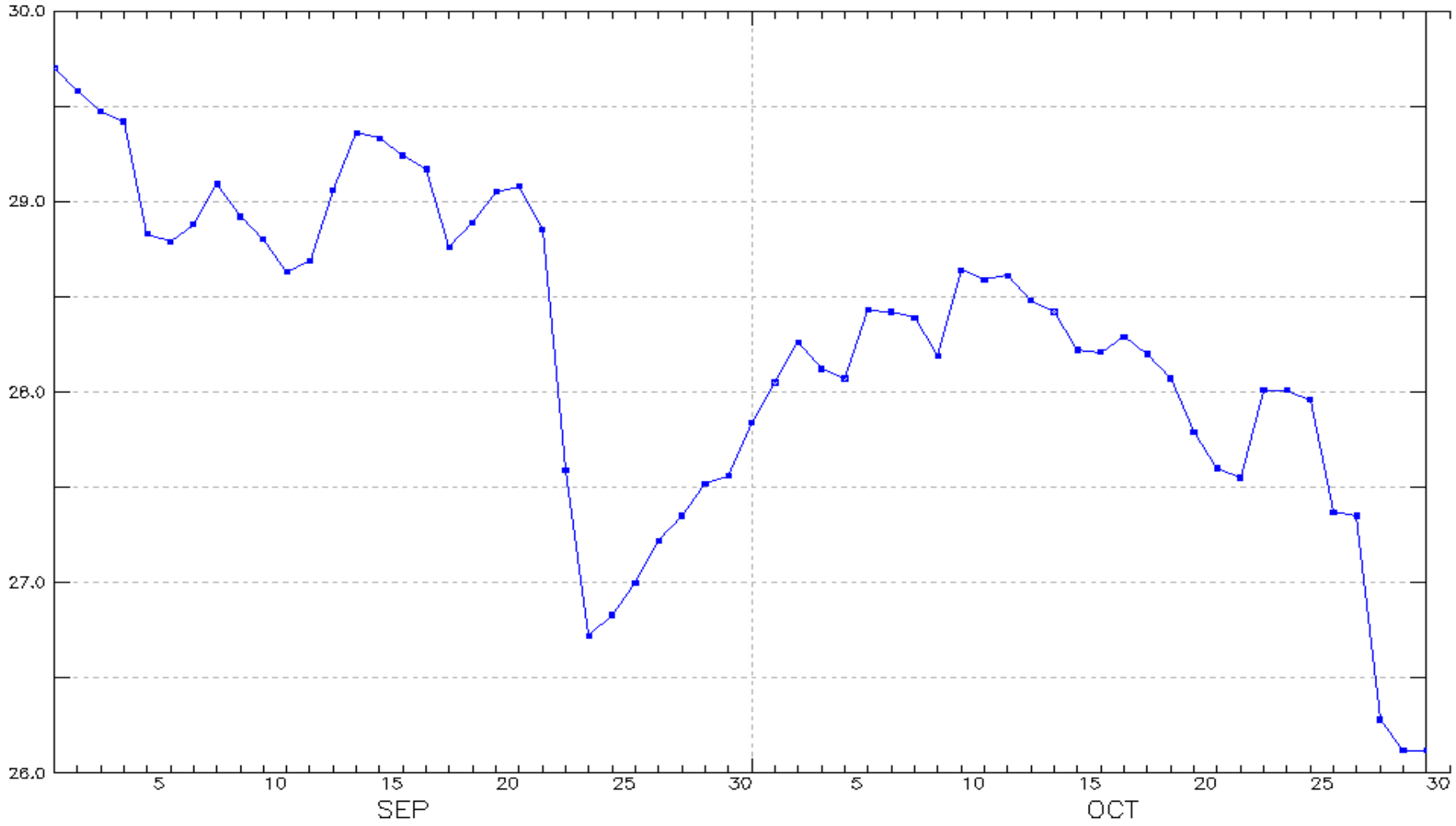


OPeNDAP URL: http://mynasadata.larc.nasa.gov/thredds/dodsC/avhrr_sst_agg
DATA SET: oceans
VARIABLE: Daily Sea Surface Temperature (GHRSST) (Celsius)
LONGITUDE : 90.1W(-90.1)
LATITUDE : 26.9N
YEAR : 2005

LAS 8./Ferret 6.842 NOAA/PMEL



Daily Sea Surface Temperature (GHRSST)

MY NASA DATA

Home
Explore DATA (LAS)
Lesson Plans
Data Sources

Lesson Menu

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~90 Minute Lessons – Sorted by Grade
Multi-Day Lesson Plans
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Search by Environmental Science Topic
Search by Data Category
Search by National Science Education Standards
Search by Virginia SOL

Translate MND
Select Language

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Hurricanes As Heat Engines

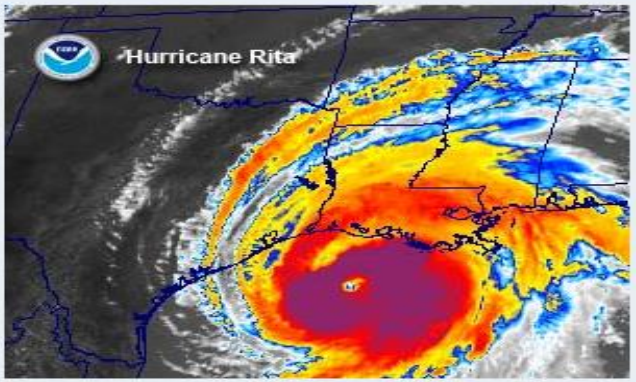


Image courtesy NOAA

Purpose: To examine authentic sea surface temperature data to explore how hurricanes extract heat energy from the ocean surface

Grade Level: 6 – 12

Estimated Time for Completing Activity: 50 minutes

Learning Outcomes:

- Students will practice finding data via the Internet.
- Students will practice making line plots and data maps.
- Students will understand how hurricanes gain energy from the ocean surface.

Prerequisite

- Introduction to weather or hurricanes
- Familiarity with accessing the Internet
- Familiarity with finding coordinates on a map

Tools

Vocabulary:

- coordinates
- heat
- latitude
- longitude
- MCSST
- sea surface temperature
- upwelling

Lesson Links:

- Live Access Server (LAS)
- Summary of the 2005 Atlantic Hurricane Season from NCDC
- The Path of Hurricane Rita from NOAA
- NASA Hurricane page
- Line plot at 27N, 90W
- SST map on September 26, 2005
- JPL State of the Ocean
- Other NASA Hurricane Data Tool
- Path of Hurricane Bertha
- Paperless version of the lesson

Background:

MY NASA DATA Live Access Server - Advanced

Help

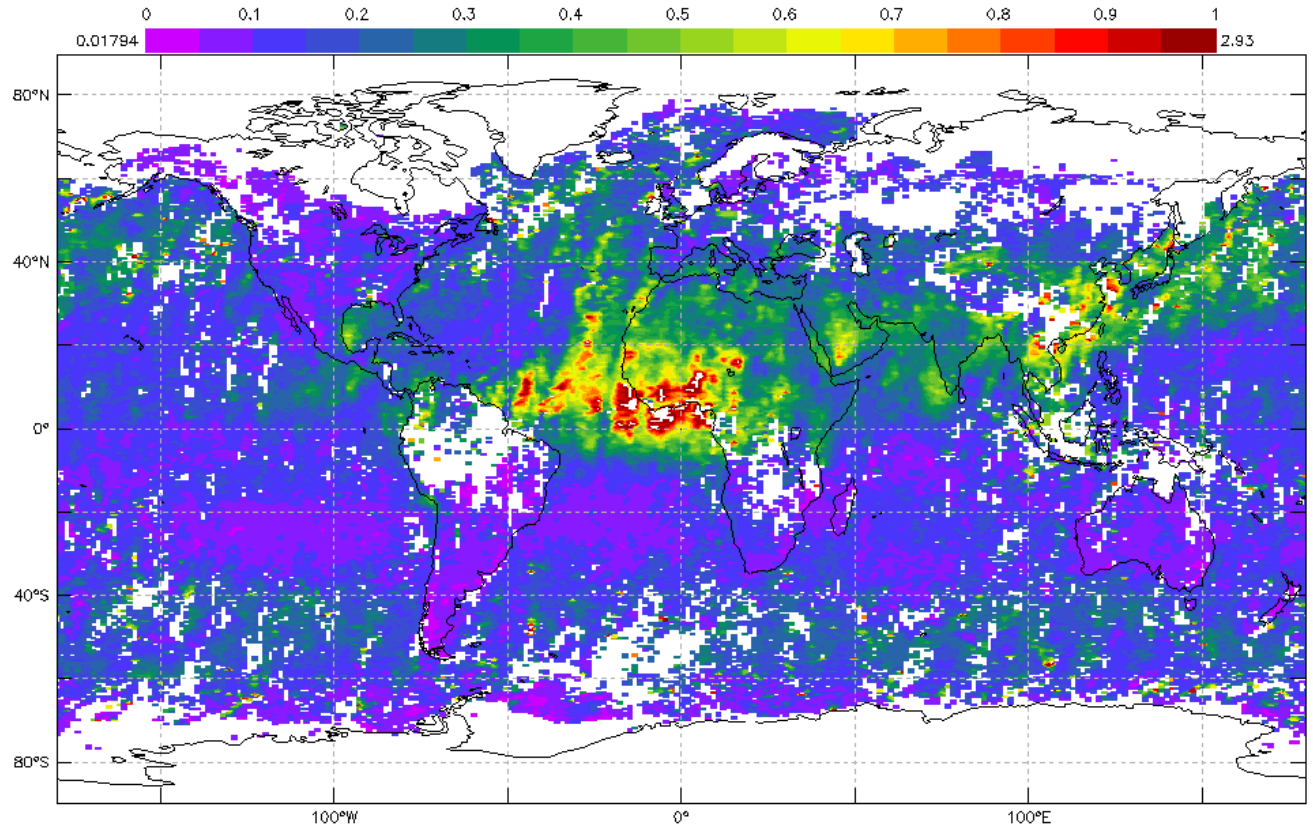
Data Set | Update Plot | < | One Plot | Annotations | Plot Options

Print... | Animate | Correlation Viewer | Google Earth | Show Values | Export to Desktop Application | Save As...

OPeNDAP URL: http://mynasadata.larc.nasa.gov/thredds/dodsC/MISR_AER_aggregation
DATASET: aerosols
VARIABLE: Monthly Aerosol Optical Depth (MISR) (dimensionless)
TIME : 16-MAR-2000 11:59

- Subsampled 3 in X

LAS 8./Ferret 6.842 NOAA/PMEL



89.75 N
179.75 W
179.75 E
89.75 S

Compute: None
over: Area

Maps
- Latitude-Longitude

Line Plots
- Time
- Longitude
- Latitude

Hofmuller Plots
- Longitude-time
- Latitude-time

+ Monthly Aerosol Optical Depth (MISR)

Date/Time: 2000 Mar

MY NASA DATA Live Access Server - Advanced

Help

Show Values | Export to Desktop Application | Save As...

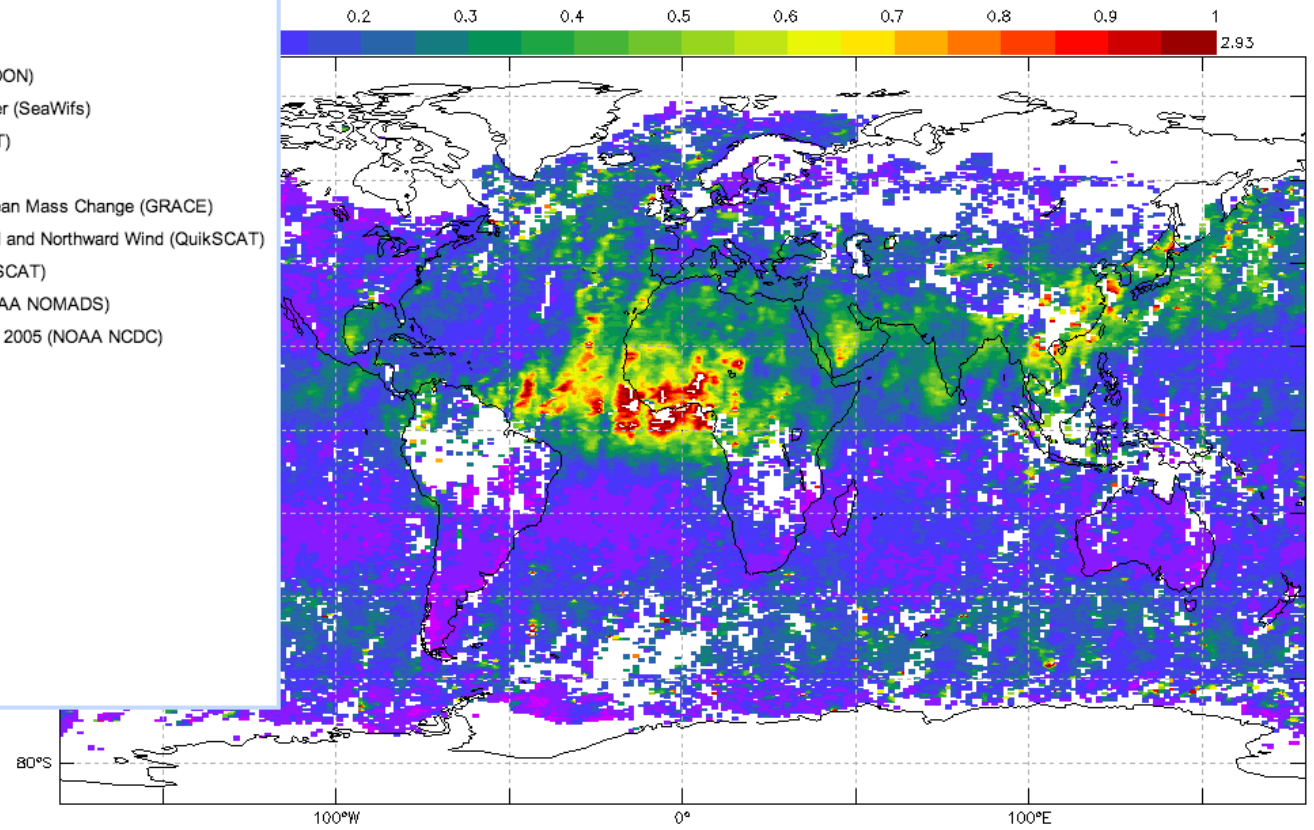
close

- Atmosphere
- Atmospheric Radiation
- Biosphere
- Cryosphere
- Land Surface
- Oceans
  - 5-day Sea Level Height (TOPEX/POSEIDON)
  - Concentration Of Chlorophyll In Sea Water (SeaWifs)
  - Daily Sea Surface Temperature (GHRSST)
  - Eastward Near-Surface Wind
  - Monthly Equivalent Water Thickness Ocean Mass Change (GRACE)
  - Monthly Near-Surface Vector of Eastward and Northward Wind (QuikSCAT)
  - Monthly Near-Surface Wind Speed (QuikSCAT)
  - Monthly Ocean Wind Speed Vectors (NOAA NOMADS)
  - Monthly Wind Speed Climatology 1995 to 2005 (NOAA NCDC)
  - Northward Near-Surface Wind
  - Wind Speed - U Component - Monthly
  - Wind Speed - V Component - Monthly
- Surface Meteorology and Solar Energy

ta.larc.nasa.gov/thredds/dodsC/MISR_AER_aggregation

ical Depth (MISR) (dimensionless)

LAS 8./Ferret 6.842 NOAA/PMEL



+ Monthly Aerosol Optical Depth (MISR)

Date/Time: 2000 Mar

MY NASA DATA Live Access Server - Advanced

Help

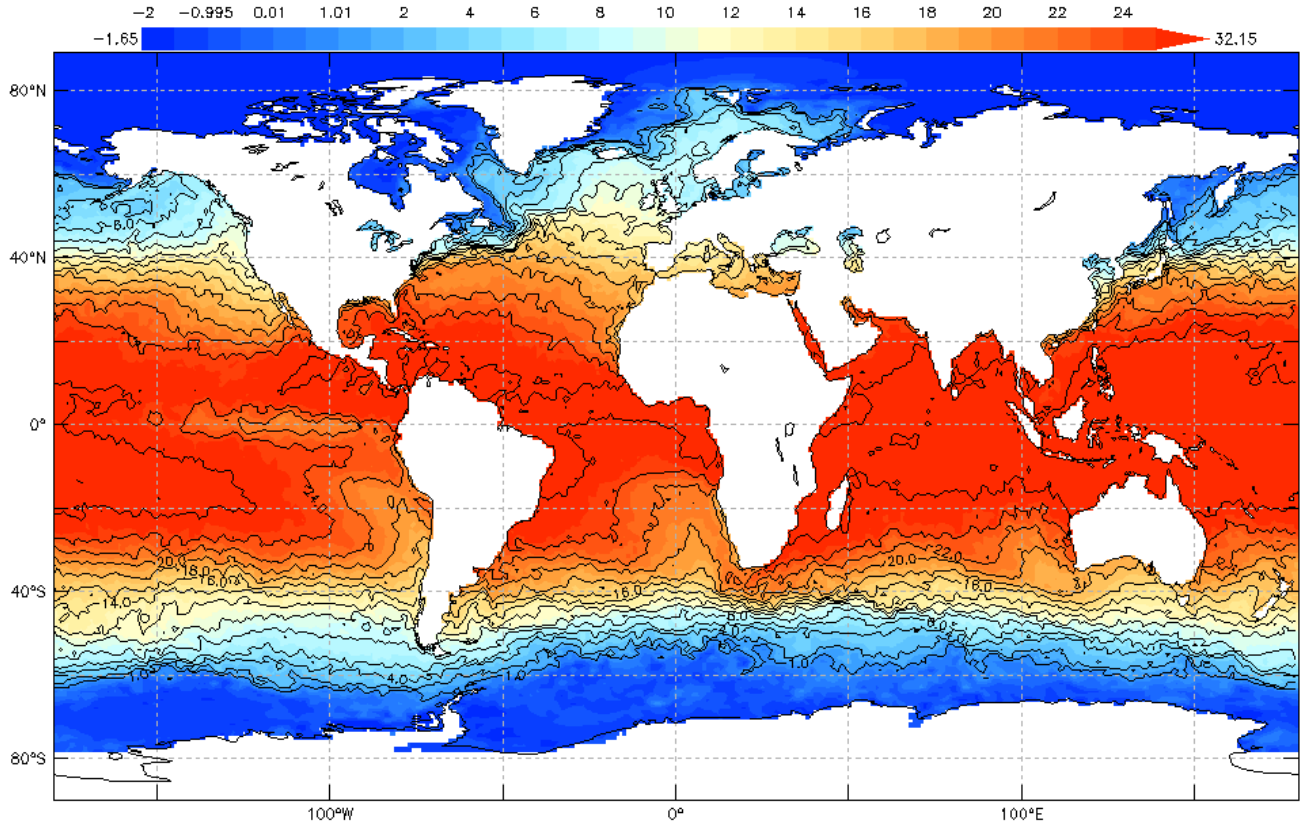
Data Set | Update Plot | < | One Plot | Annotations | Plot Options

Print... | Animate | Correlation Viewer | Google Earth | Show Values | Export to Desktop Application | Save As...

OPeNDAP URL: http://mynasadata.larc.nasa.gov/thredds/dodsC/avhrr_sst_agg
DATASET: oceans
VARIABLE: Daily Sea Surface Temperature (GHRSST) (Celsius)
TIME : 01-JAN-2000 00:00

- Subsampled 4 in X, 4 in Y

LAS 8./Ferret 6.842 NOAA/PMEL



90 N
180 W
180 W
90 S

Compute: None
over: Area

Maps
- (•) Latitude-Longitude

Line Plots
- ( ) Time
- ( ) Longitude
- ( ) Latitude

Hofmuller Plots
- ( ) Longitude-time
- ( ) Latitude-time

\+ Daily Sea Surface Temperature (GHRSST)

Date/Time: 2000 Jan 01

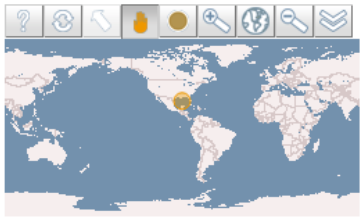
MY NASA DATA Live Access Server - Advanced

Help

Data Set | Update Plot | <

One Plot | Annotations

Plot Options



27 N

90 W | 90 W

27 N

Start date/time: 2005 | Sep | 01

End date/time: 2005 | Oct | 30

Compute: None

over: Area

Maps

- Latitude-Longitude

Line Plots

- Time
- Longitude
- Latitude

Hofmuller Plots

- Longitude-time
- Latitude-time

Print... | Animate | Correlation Viewer | Google Earth | Show Values | Export to Desktop Application | Save As...

OPeNDAP URL: http://mynasadata.larc.nasa.gov/thredds/dodsC/avhrr_sst_agg

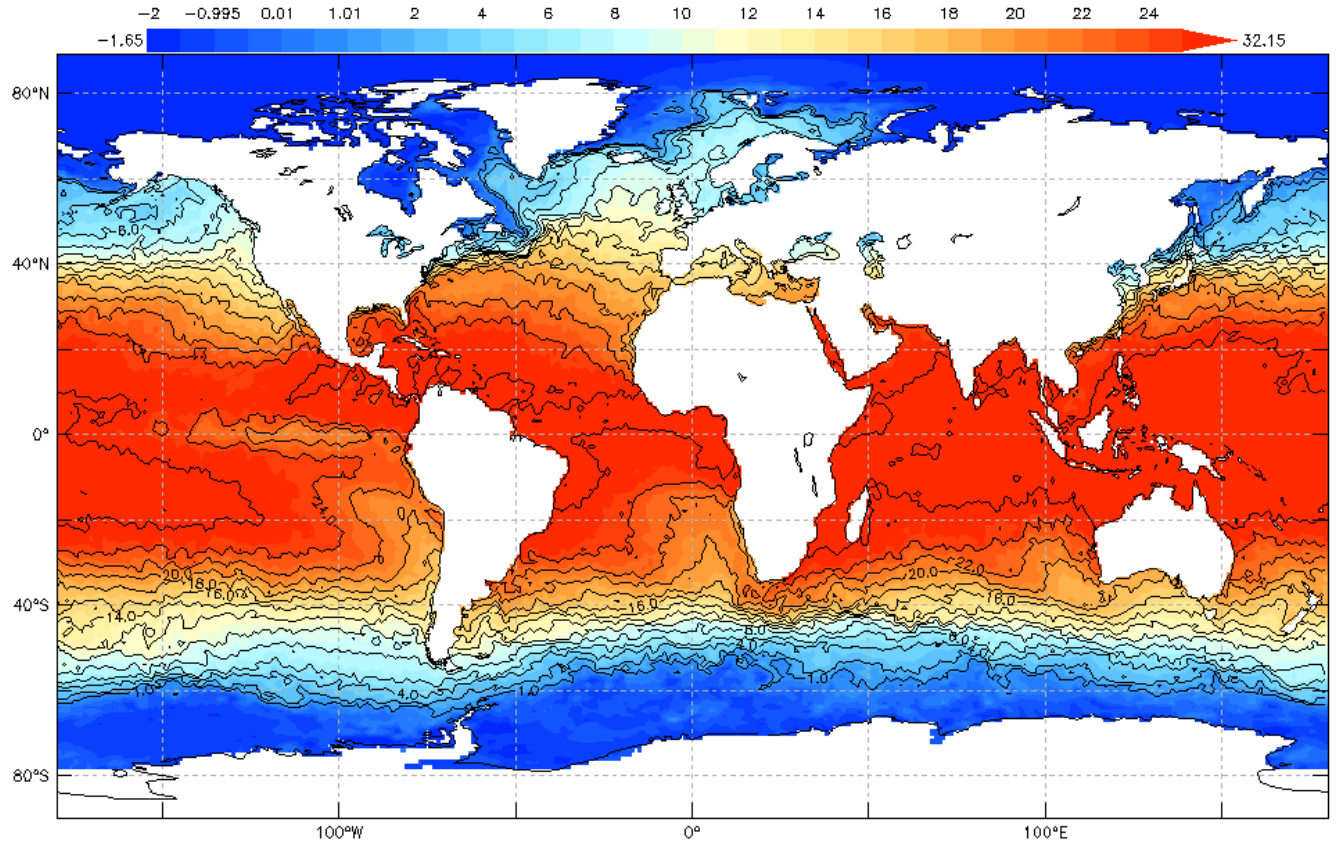
DATASET: oceans

VARIABLE: Daily Sea Surface Temperature (GHRSST) (Celsius)

TIME : 01-JAN-2000 00:00

- Subsampled 4 in X, 4 in Y

LAS 8./Ferret 6.842 NOAA/PMEL



\+ | Daily Sea Surface Temperature (GHRSST)

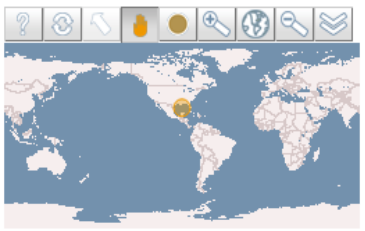
MY NASA DATA Live Access Server - Advanced

Help

Data Set | Update Plot | <

One Plot | Annotations

Plot Options



27 N
90 W 90 W
27 N

Start date/time: 2005 Sep 01
End date/time: 2005 Oct 30

Compute: None
over: Area

Maps
- Latitude-Longitude

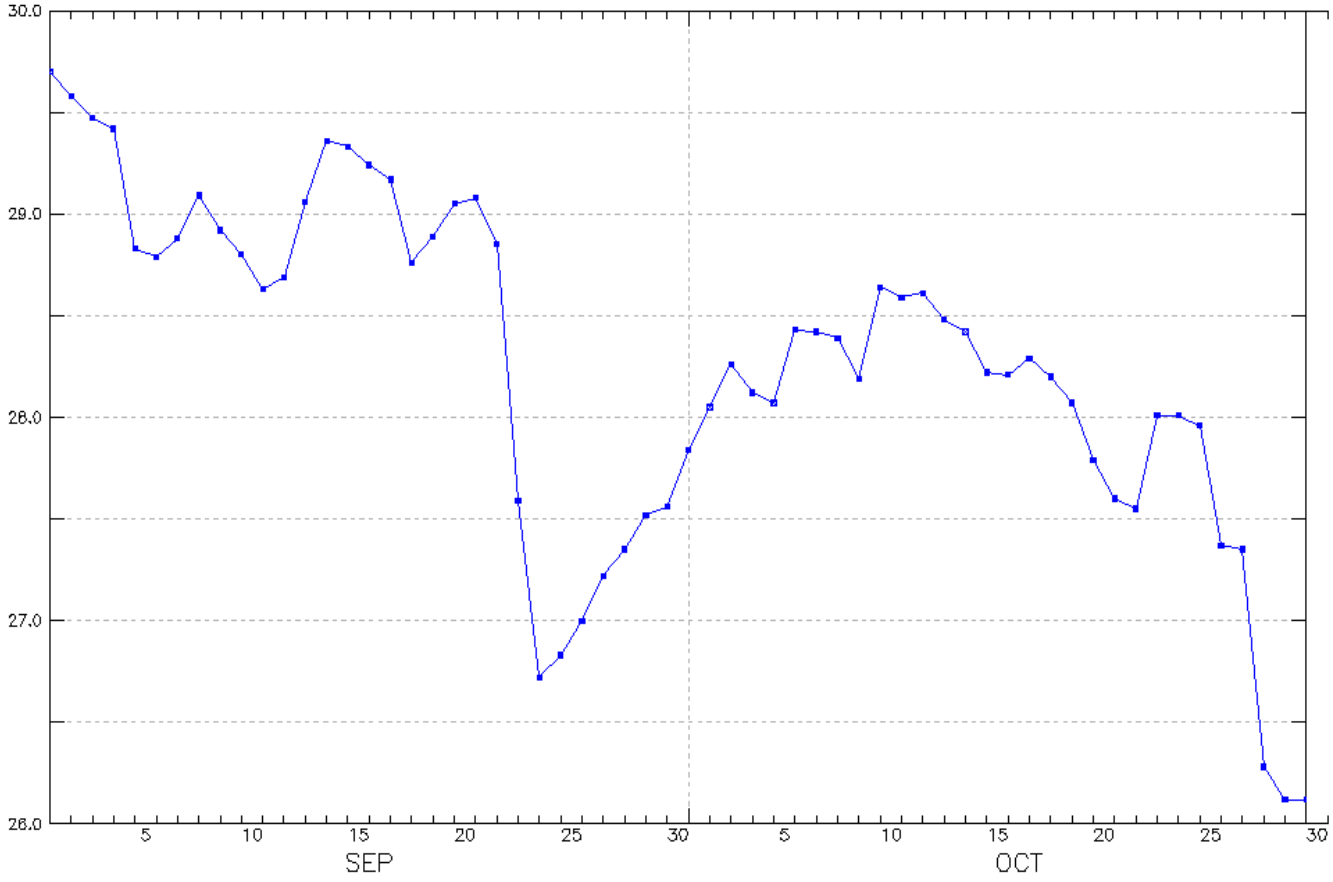
Line Plots
- Time
- Longitude
- Latitude

Hofmuller Plots
- Longitude-time
- Latitude-time

Print... | Animate | Correlation Viewer | Google Earth | Show Values | Export to Desktop Application | Save As...

OPeNDAP URL: http://mynasadata.larc.nasa.gov/thredds/dodsC/avhrr_sst_agg
DATA SET: oceans
VARIABLE: Daily Sea Surface Temperature (GHRSST) (Celsius)
LONGITUDE : 90.1W(-90.1)
LATITUDE : 26.9N
YEAR : 2005

LAS 8./Ferret 6.842 NOAA/PMEL



\+ Daily Sea Surface Temperature (GHRSST)

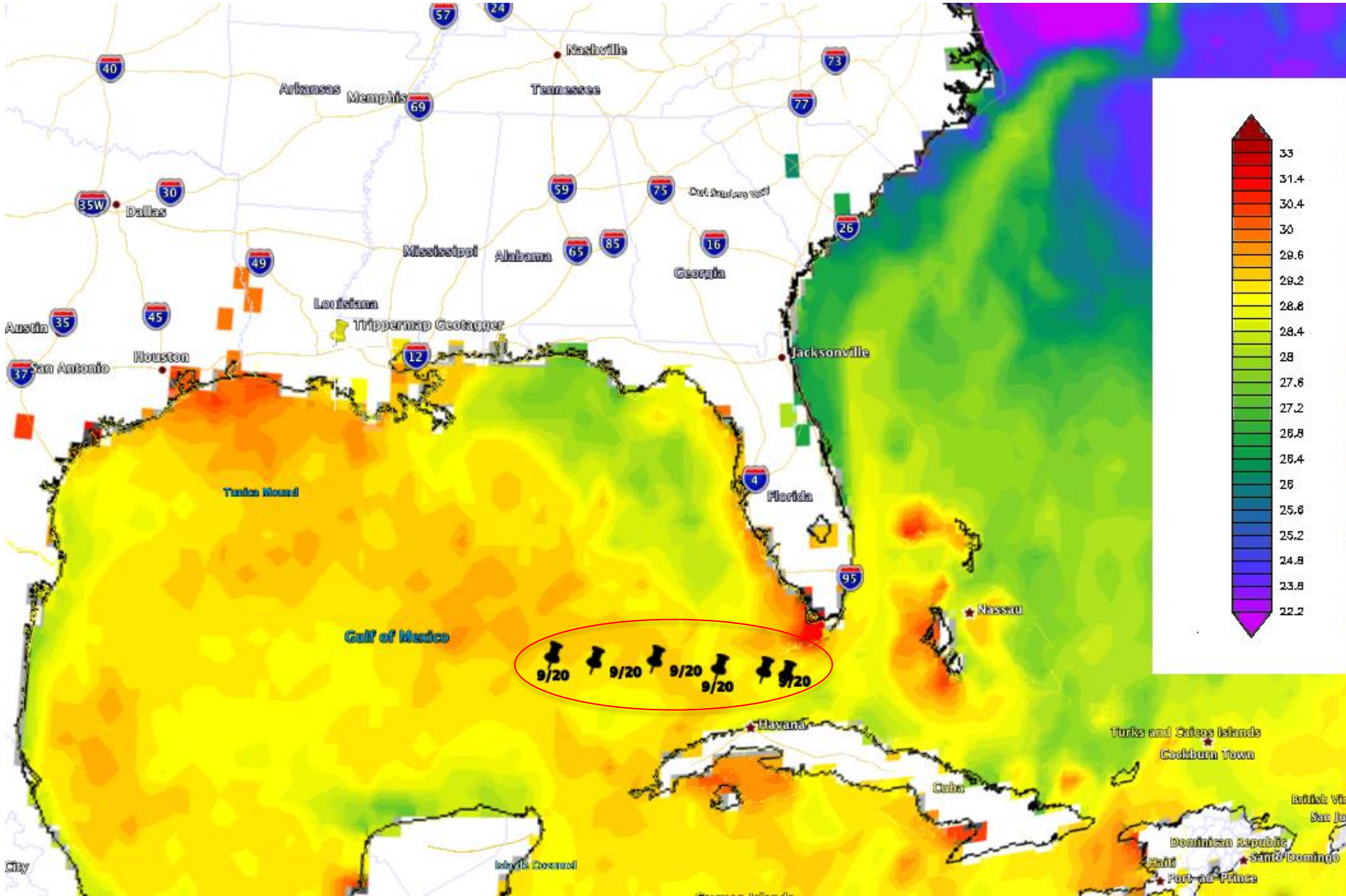
Part II

What to look for:

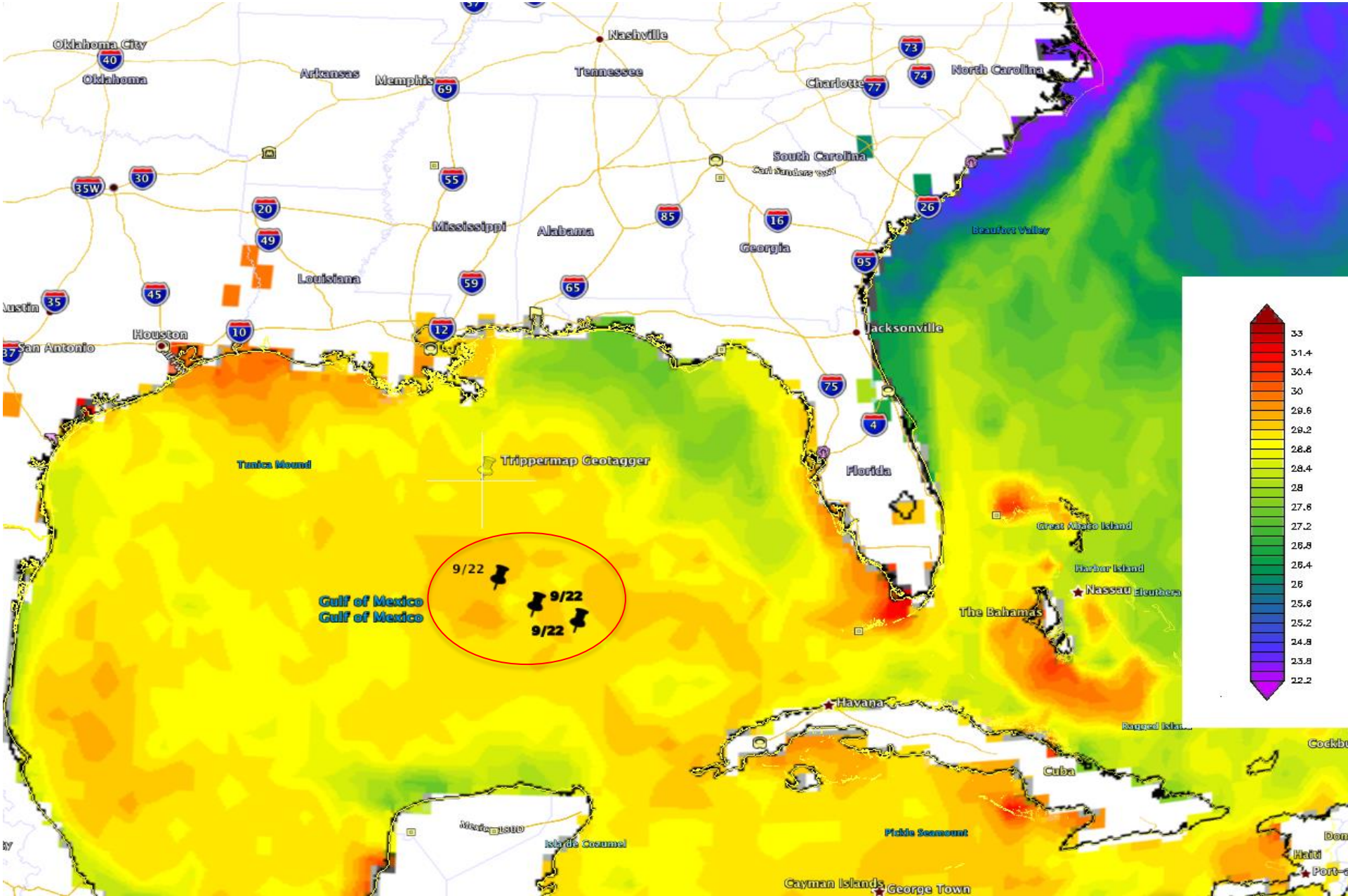
- Changing sea surface temperatures as shown in the color plots to follow

- Length of time it took for the water temperature to change (is there a delay or is there a sudden change in temp?)

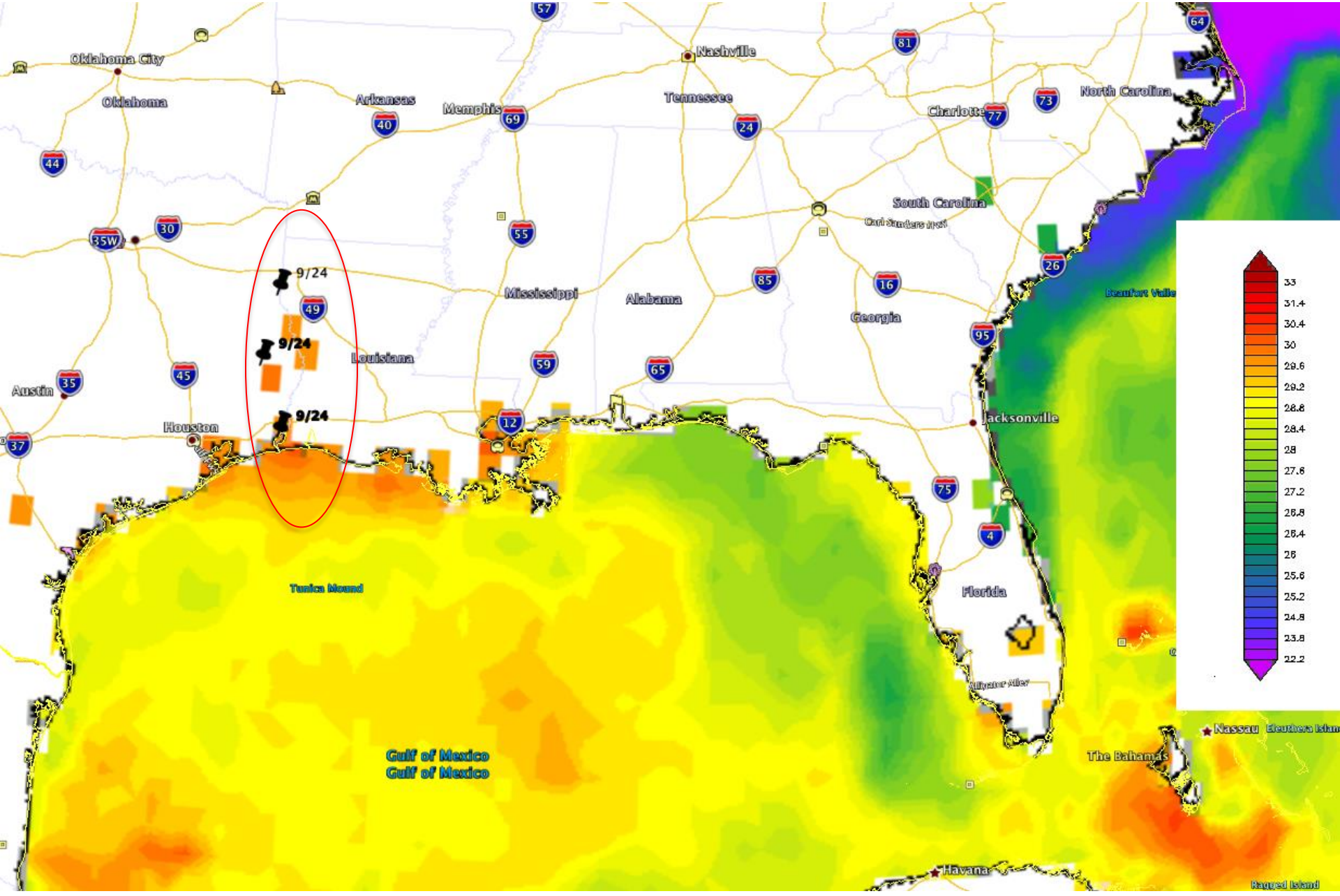
September 20, 2005



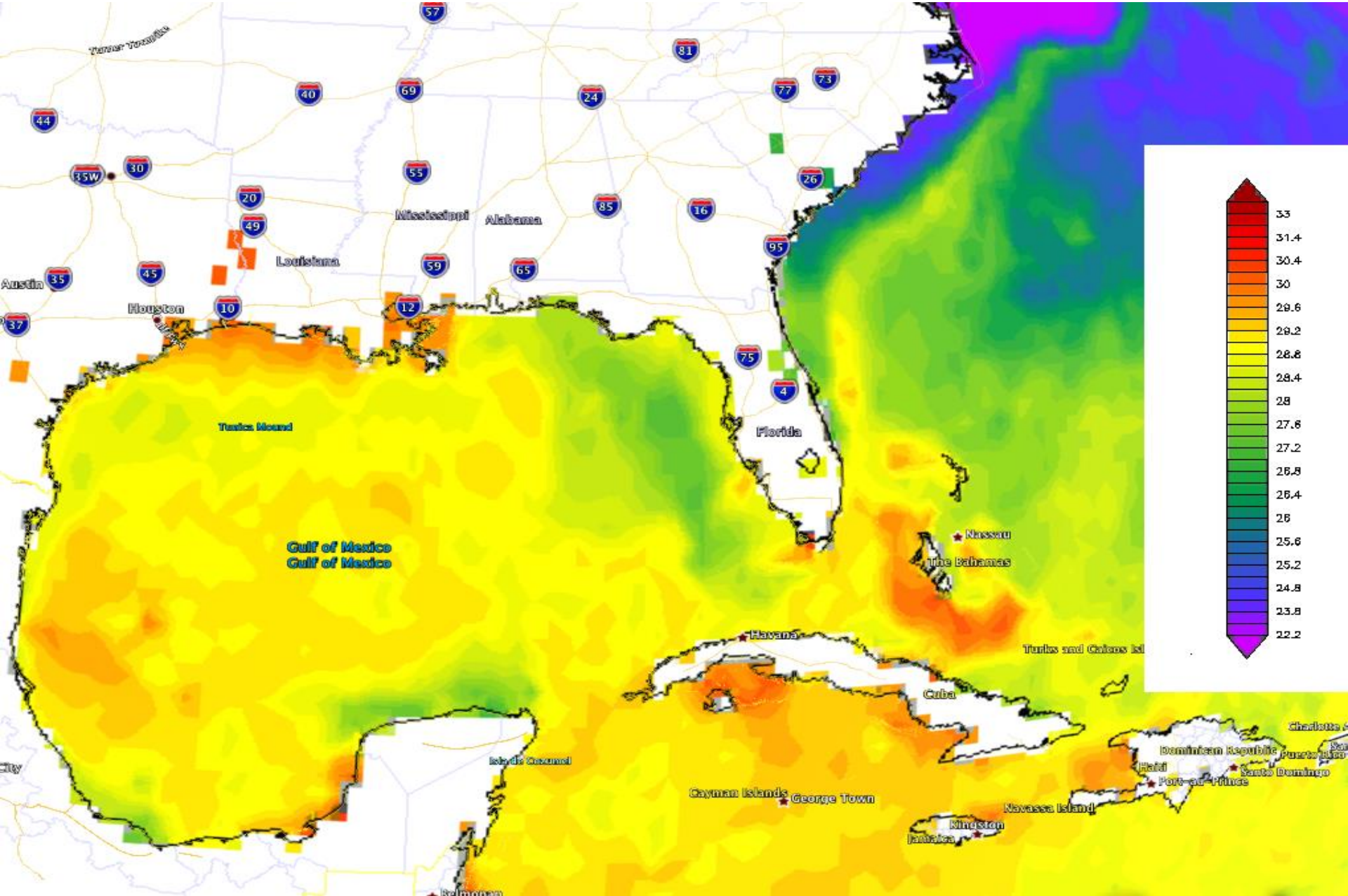
September 22, 2005



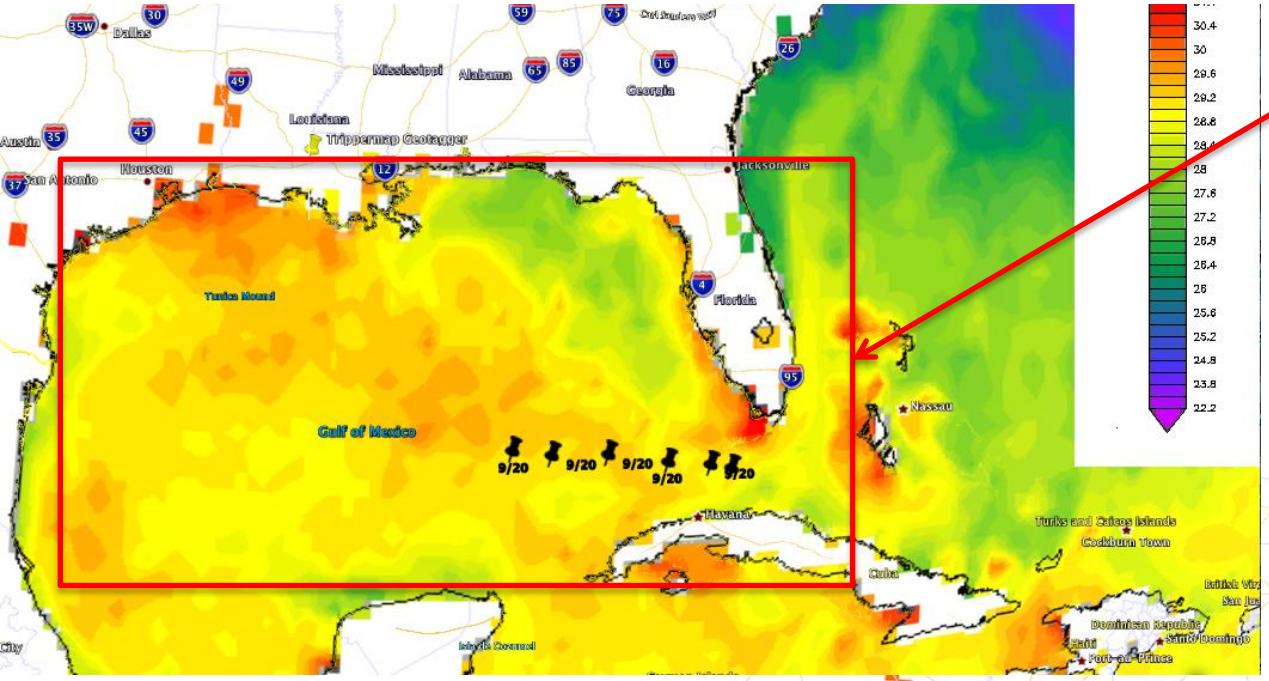
September 24, 2005



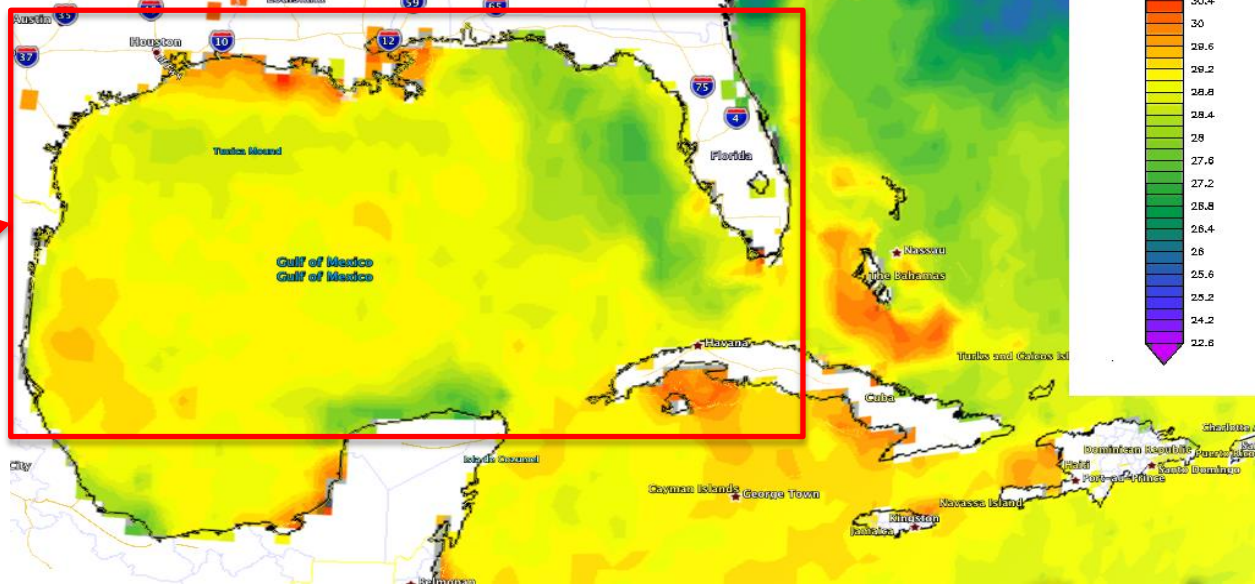
September 27, 2005



A Side by Side Comparison



September 20, 2005



September 28, 2005

Lesson Questions

1. Did you see any evidence of lowered sea surface temperature in the data maps?
2. Did you notice any delay between the hurricane passage and the effect on SST?
3. What conclusions can you make about how hurricanes extract heat energy from the ocean?

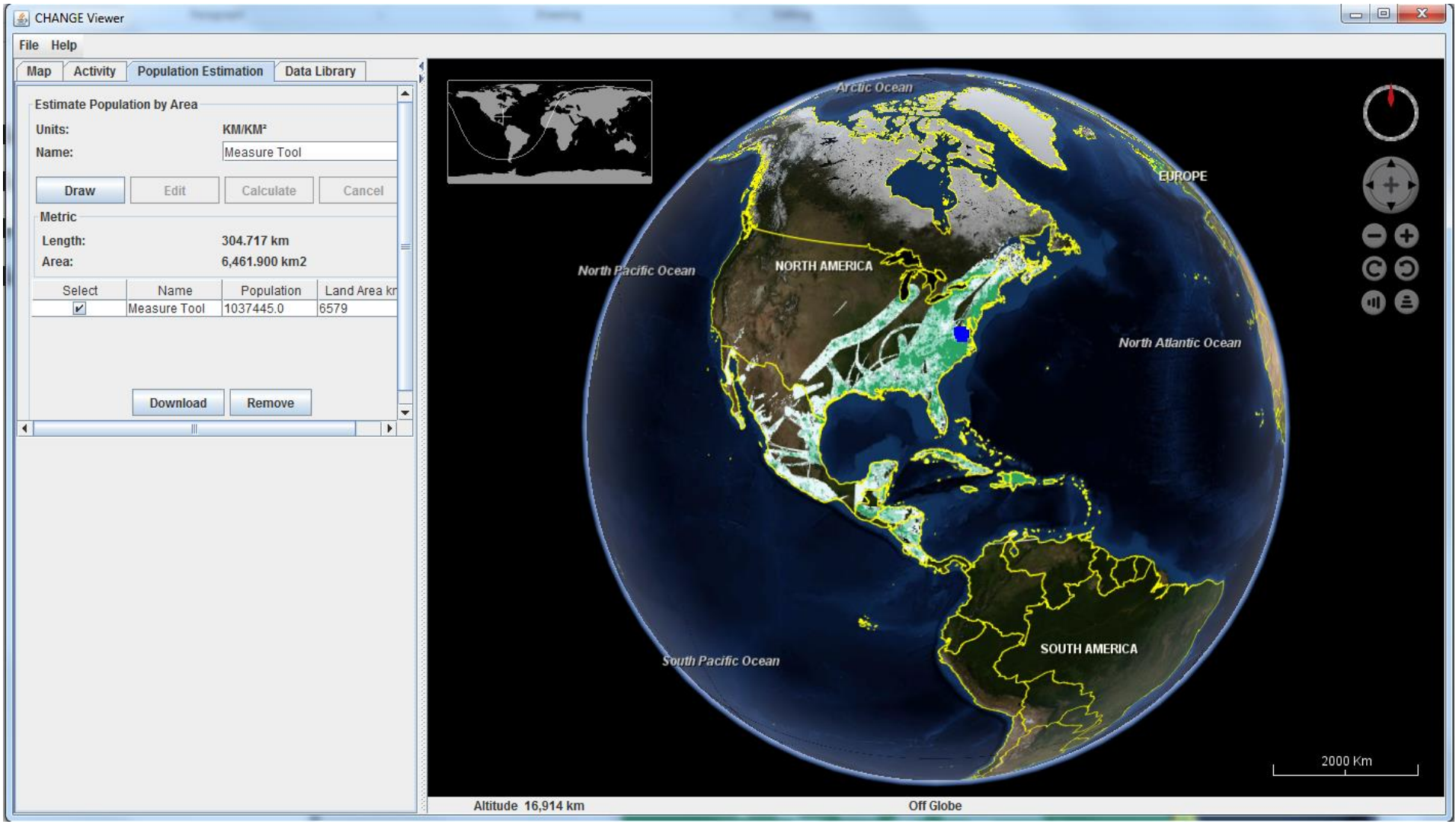
Accessing, Measuring, and Analyzing Economic Loss from Cyclones with the Climate and Health ANalysis for Global Education Viewer (CHANGE Viewer)

Robert R. Downs
Center for International Earth Science Information Network (CIESIN)
Columbia University

- Free computer and web-based educational tool
  - Runs on Windows and Mac computers.
  - Requires a modern graphics card with up-to-date driver, Java Runtime Environment 1.6.0 or later, 2GB RAM, 30MB available hard disk space, and an internet connection.
- Enables access, analysis, and visualization of Earth science data
  - Data are obtained from the NASA Socioeconomic Data and Applications Center (SEDAC) & other sources.
  - Description and download link are available at the http://www.ciesin.columbia.edu/gcce/ URL.
- Developed by CIESIN, Columbia University, and IAGT, Cayuga Community College, with support from the NASA Innovations in Climate Education Initiative.
  - Additional information is available at the http://www.climatechangehumanhealth.org/changeviewer/ URL.

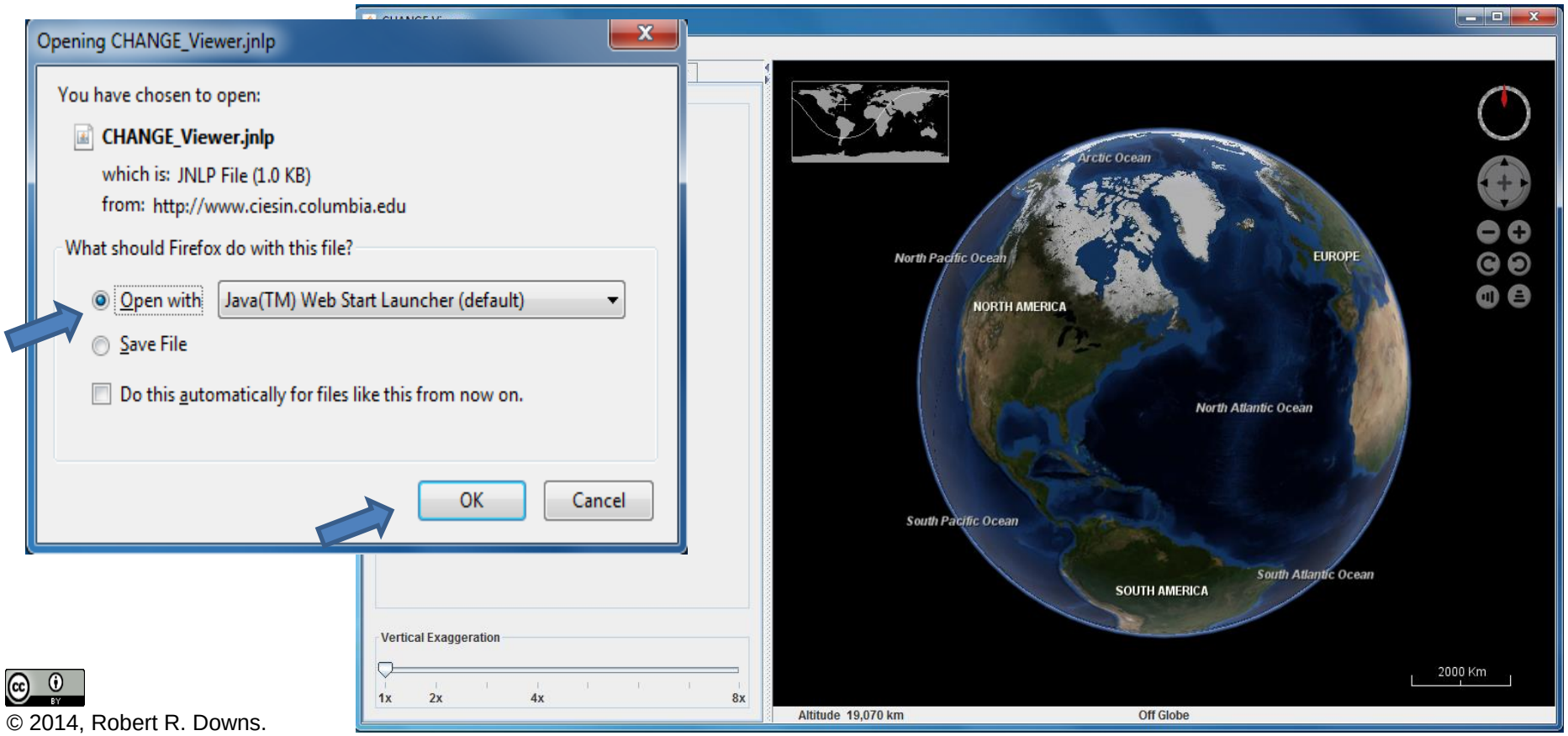
© 2014, Robert R. Downs.

Based on :Visualizing Data with the CHANGE Viewer (Downs, 2013).


CHANGE Viewer
File Help
Map Activity Population Estimation Data Library
Estimate Population by Area
Units: KM/KM²
Name: Measure Tool
Draw Edit Calculate Cancel
Metric
Length: 304.717 km
Area: 6,461.900 km2
Select Name Population Land Area kr
Measure Tool 1037445.0 6579
Download Remove
Arctic Ocean
EUROPE
North Pacific Ocean
NORTH AMERICA
North Atlantic Ocean
South Pacific Ocean
SOUTH AMERICA
2000 Km
Altitude 16,914 km
Off Globe

Installing the CHANGE Viewer

- On your computer, use a browser to access the http://www.ciesin.columbia.edu/gcce/ URL.
- On the CHANGE Viewer web page, click on the image or the CHANGE Viewer installation link.
- In the dialog box that appears, click on Open with Java radio button and the OK button.
- The CHANGE Viewer window and globe will appear within a few seconds.



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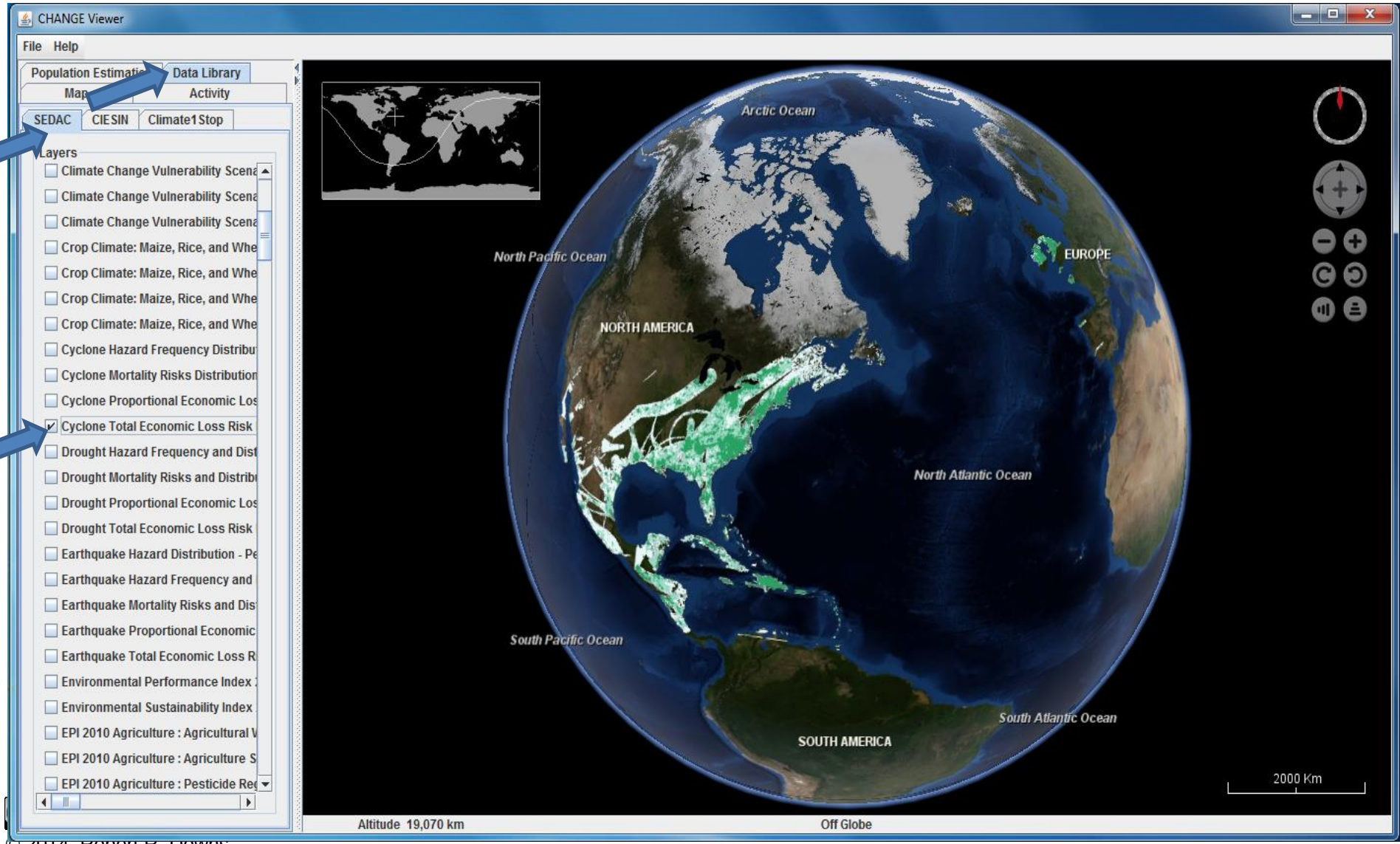
Accessing Data on Economic Loss Risk from Cyclones

- Click on the Data Library Tab and then click on the SEDAC tab.
- Click on the Layer: Cyclone Total Economic Loss Risk.



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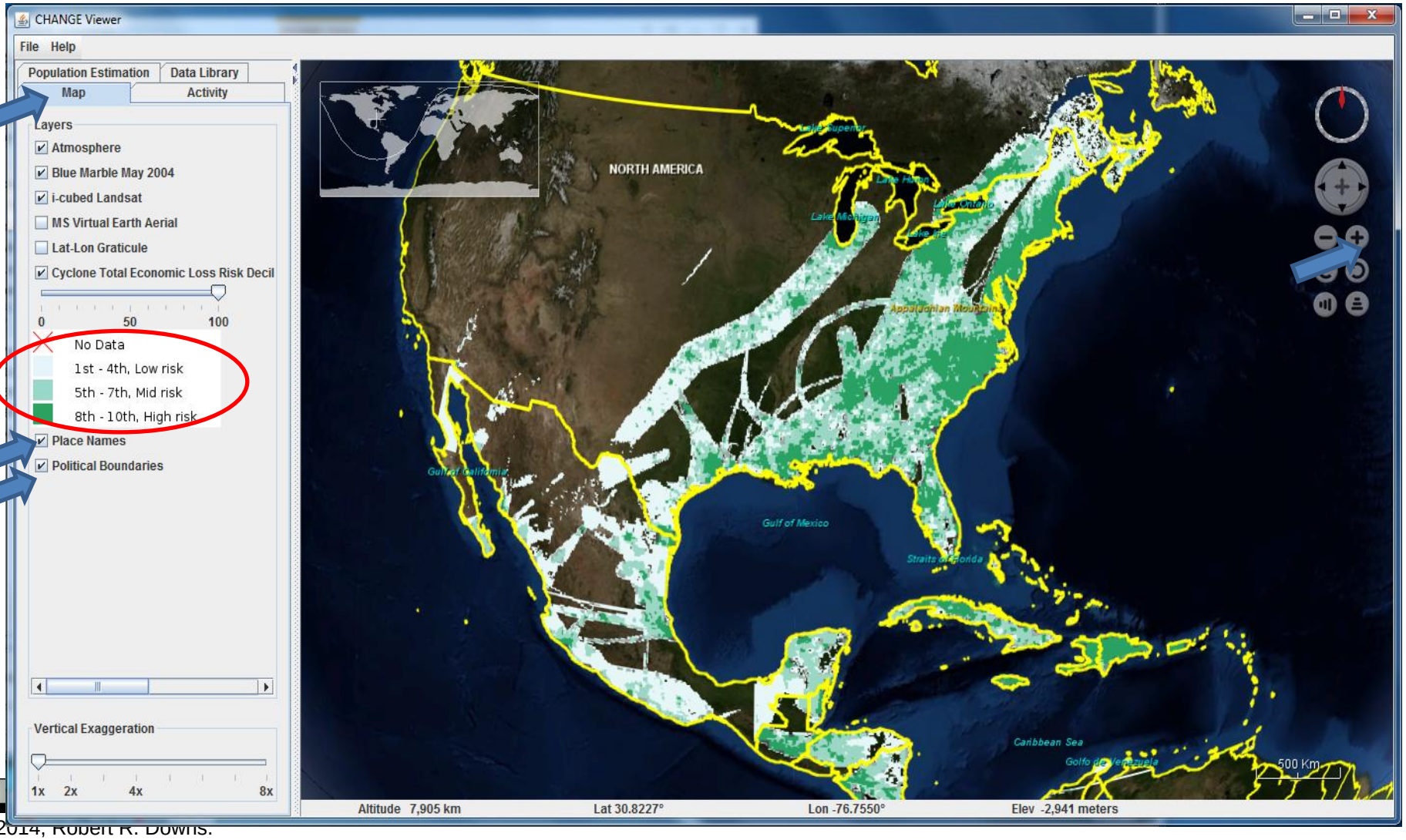
Analyzing Economic Loss Risk from Cyclones for a Continent

- Click on the Map tab and click on the radio buttons for Place Names and Political Boundaries.
- Click on North America to rotate the globe and click the + sign to zoom in.
- Compare the map and the color scale to identify areas of low medium, and high risk.



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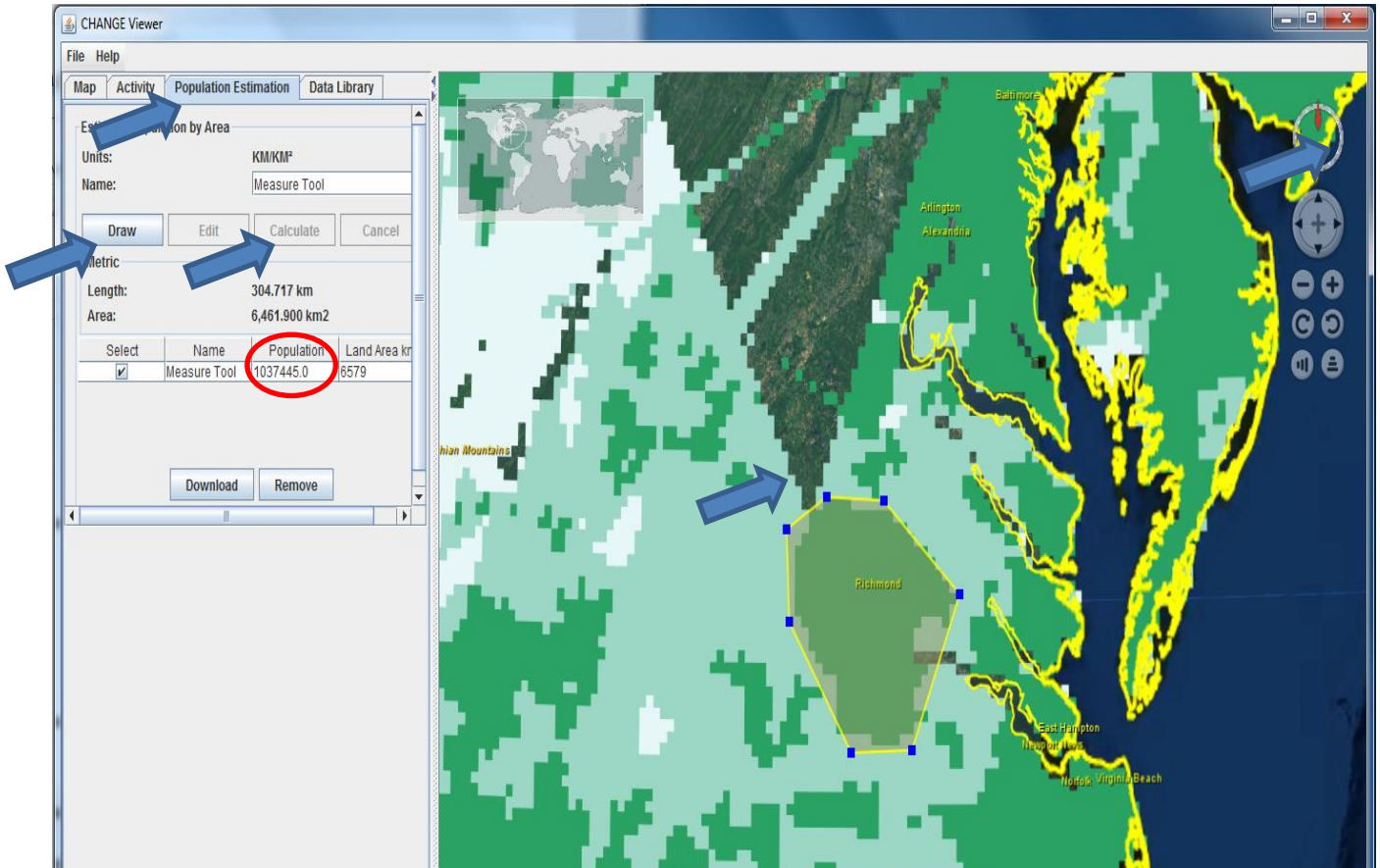
Measuring Economic Loss Risk from Cyclones for a Location

- Click the + sign and click on the Mid-Atlantic region of the United States to find Richmond, Virginia, on the map.
- Click on the Population Estimation tab and the Draw button.
- Click around the dark green area surrounding Richmond to draw a polygon around the area of high risk.
- Click Calculate to estimate the population around Richmond at high risk of economic loss from cyclones.



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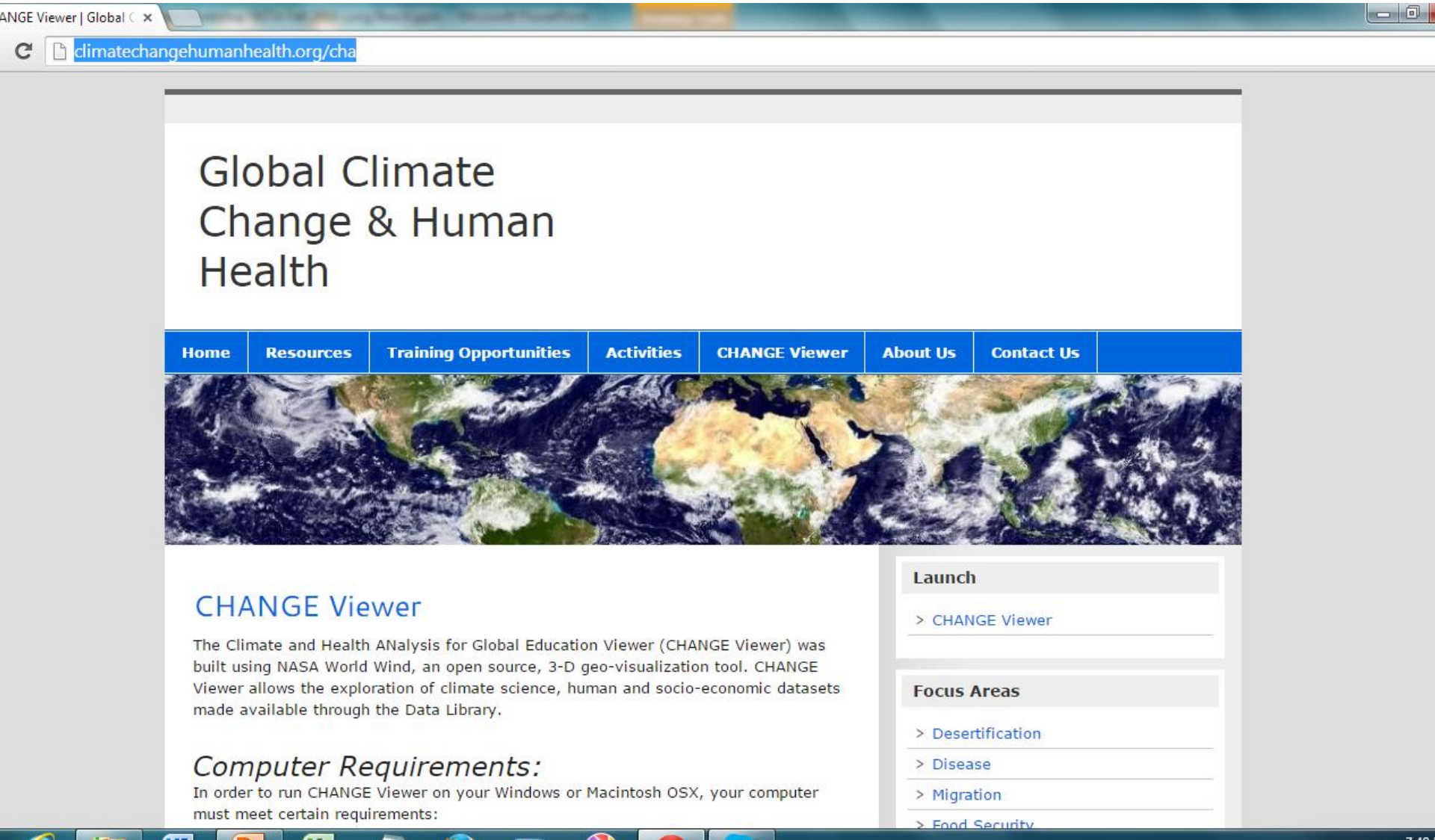
Climate Change Human Health

http://climatechangehumanhealth.org/cha



Lessons: Rising Sea Level

CHANGE Viewer | Global | Rising Sea Levels | Global

www.climatechangehumanhealth.org/activities/sealevel/

Rising Sea Levels

Download Activity (PDF) Download Activity (Word)

Download Answer Sheet (PDF) Download Answer Sheet (Word)

Download Background PDF

BACKGROUND

Rising Sea Levels

Climate change has had a significant impact on global sea levels; as the global temperature increases, the height of sea levels does as well. Throughout the earth's history, the sea level has been hundreds of feet higher and lower than today's present height, due to the natural climate cycle of ice ages and interglacial periods (1). These climate cycles produce warm and cool periods on earth, and during these warmer periods, the sea level rises. However, human-induced climate change and warming has led to an accelerated rise in sea levels.

Rising sea levels will infiltrate coastal cities and urban populations will be force to migration either temporarily or permanently. Image Source: http://www.migrationpolicy.org/programs/migrants-

7:49 PM
12/3/2014

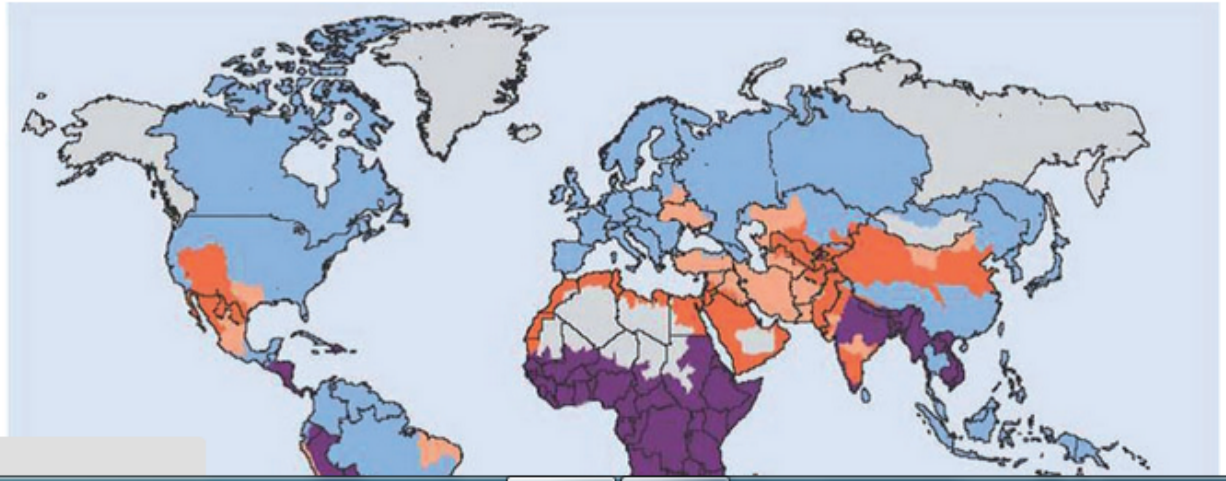
Water Resources

Download Background PDF Download Water Resources Activity PDF Download Water Resources Activity Word Doc Download Water Resources Answer Sheet PDF Download Water Resources Answer Key Word Doc

BACKGROUND

Climate change has a profound impact on freshwater resources: all regions of the world show an overall net negative impact from climate change on water resources and freshwater ecosystems. Areas in which runoff is projected to decline are likely to face a reduction in the value of the services provided by water resources. In fact, a country with more than approximately 1,700 cubic meters of renewable fresh water per person per year will generally experience only intermittent or localized water shortages. As the amount of available fresh water sinks below this level, countries begin to experience "water stress"-that is, water supply problems tend to become chronic and widespread.[1] The beneficial impacts of increased annual runoff in other areas are likely to be tempered in some areas by negative effects of increased precipitation variability and seasonal runoff shifts on water supply, water quality and flood risks.[2]

The 2006 United Nations Human Development Report notes some staggering facts about the impact of water on human health which is being directly impacted by climate change.[3] As a result of the reduced availability and accessibility to freshwater sources, people across the globe will be affected in a myriad of ways. Four themes are highlighted in discussions of freshwater resources: access to water, development, impact on children's health and the role of women.



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CLIMATE LITERACY & ENERGY AWARENESS NETWORK

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A collection of 600+ free, ready-to-use resources rigorously reviewed by educators and scientists.

Suitable for secondary through higher education classrooms.

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Featured Resources

Ice Core Secrets Could Reveal Answers to Global Warming

This video featu research conduc at University of Colorado's Institute of Arctic and Alpine Research, which studies isotopes of hydrogen trapped in ice cores to understand climate changes in the past.

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- Guidance in Teaching Climate and Energy
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Guidance in Teaching Climate and Energy Science

Background information, pedagogic approaches, links to relevant educational resources in the CLEAN collection.

cleanet.org/index.html

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Educational Resources: Search the CLEAN Collection

Scientifically and pedagogically reviewed digital resources for teaching about climate science, climate change, and energy awareness

hurricane search

Help

Results 1 – 10 of 611 matches

Getting to the Core of Climate Change
http://tea.armadaproject.org/activity/leppik/gettingtoth...
This is a lab about evidence for past climate change as captured in ice sheets of Greenland and Antarctica. Students investigate climate changes going back thousands of years by graphing and ...

Refine the Results

Resource Type
- Activity 234 matches
- Short Demonstration/Experiment 10 matches
- Visualization 138 matches
- Video 232 matches

Climate and Energy Topics
- Climate System 236 matches

Educational Resources: Search the CLEAN Collection

Scientifically and pedagogically reviewed digital resources for teaching about climate science, clim
awareness

hurricane search

Help

Show all pages

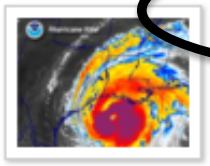
Current Search Limits

Searching for: **hurricane** Remove this limit

Results 1 – 10 of **10 matches**

Investigating the Effect of Warmer Temperatures on Hurricanes
http://serc.carleton.edu/NAGTWorkshops/hurricanes/activi...
In this activity learners investigate the link between ocean temperatures and hurricane intensity, analyze instrumental and historical data, and explore possible future changes.

Aerial Photography and Mapping ... Plan: Images of Katrina
http://oceanservice.noaa.gov/education/lessons/k... .html
This activity from NOAA Ocea... ...ce is about using aerial photographs to assess the impact of extreme weather events such as Hurric... ...atrina. The activity features aerial views of Biloxi, MS ...



Hurricanes as Heat Engines
http://mynasadata.larc.nasa.gov/lesson-plan-stand-alone...
In this activity, students examine the effects of hurricanes on sea surface temperature using NASA data. They examine authentic sea surface temperature data to explore how hurricanes extract heat ...

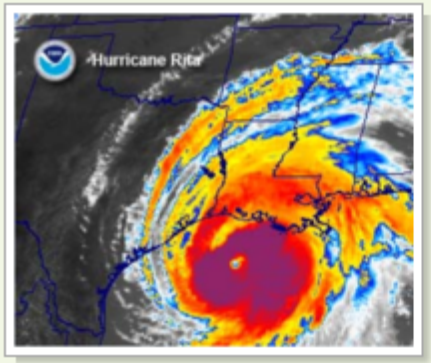
Wind Story
http://www.pbslearningmedia.org/resource/psu06-e21.sci.w...
This animation presents the characteristics of wind power as a source of clean energy. The force of moving air generates electricity, by rotating blades around a rotor. The motion of the rotor turns ...

Hurricanes as Heat Engines

http://mynasadata.larc.nasa.gov/lesson-plans/stand-alone-lessons/?page_id=474?&passid=50

My NASA Data, NASA

Jump to this Activity »



In this activity, students examine effects of hurricanes on sea surface temperature using NASA data. They examine authentic sea surface temperature data to explore how hurricanes extract heat energy from the ocean surface.

Activity takes about one to two 50-minute class periods, depending on how much background material instructors decide to provide.

Discuss this Resource»

Learn more about Teaching Climate Literacy and Energy Awareness»

Notes From Our Reviewers

The CLEAN collection is hand-picked and rigorously reviewed for scientific accuracy and classroom effectiveness. Read what our review team had to say about this resource below or learn more about how CLEAN reviews teaching materials

Teaching Tips | Science | Pedagogy | Technical Details

Teaching Tips

- Potentially, user could examine other hurricanes during that time frame to see if there are similar effects.
- Educator should go through this entire exercise before introducing it to their students, as a good knowledge of the material and familiarity with the LAS (Live Action Server) will be helpful when questions arise.
- Although NASA categorizes this lesson as being appropriate for grades 6-12, it would need substantial scaffolding in order to be understood in a middle school class and is most appropriate for high school students.

About the Science

- The passage of a hurricane causes a large transfer of heat between the ocean surface and the

Topics

Thermohaline Circulation
See more on this topic.

Ocean and Climate
See more on this topic.

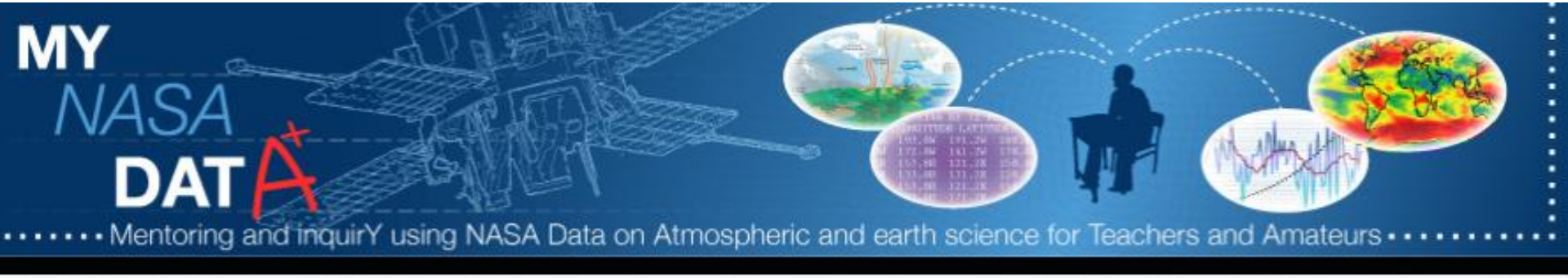
Measurements and Observations
See more on this topic.

Hurricanes and Storms
See more on this topic.

Grade Level

High School (9-12)
See more at this grade level.

College Lower (13-14)
See more at this grade level.



MY NASA DATA

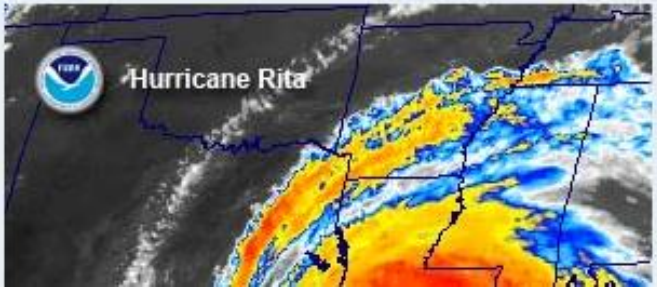
- Home
- Explore DATA (LAS)
- Lesson Plans
- Data Sources

Translate MND

Select Language

Google™ Custom Search

Hurricanes As Heat Engines



Purpose: To examine authentic sea surface temperature data to explore how hurricanes extract heat energy from the ocean surface

Come check out CLEAN!

http://cleanet.org/index.html

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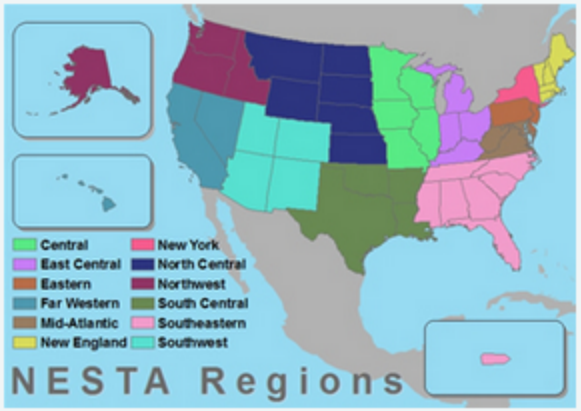
Schedule of NESTA/W2U workshops at the Fall NSTA Conferences

Our Space Science and Astronomy Education web seminar series is now complete. All web seminars have been recorded and are available for free on the Windows to the Universe Web Seminar page. Powerpoints presented in the web seminars are available for download by Windows to the Universe Educators on this same page.

The National Earth Science Teachers Association is a nonprofit 501(c)(3) educational organization, founded in 1985, whose mission is to facilitate and advance excellence in Earth and Space Science education. NESTA's purpose is the advancement, stimulation, extension, improvement, and coordination of Earth Science education at all educational levels. NESTA is an organization made up of and governed by classroom teachers, and extends its influence through association with other professional societies and organizations. We always welcome new members - JOIN NESTA today!

Visit our About NESTA pages to find out more about our organization. Links below the banner at the top of this page, as well as in the navigation panel to the left, provide links to NESTA resources and services. NESTA members can login in the box at the right to access resources available only to Members, such as our publications (The Earth Scientist, NESTA E-News), My NESTA, Teacher Employment, and



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Username *
rmjohnsn

Password *
••••••••

- Create new account
- Request new password

Log in

Upcoming Events

Members - Log in for access to the full calendar of upcoming events

Earth Science Week 2014: 'Earth's Connected Systems'
10/12/2014 - 8:00am

STANYS Earth Science Breakfast
11/04/2014 - 7:00am

Harnessing the Power of Earth System Science for Developing Science Practices and Crosscutting Concepts
10/17/2014 - 9:30am

Harnessing the Power of Earth System Science for Developing Science Practices and Crosscutting Concepts
11/07/2014 - 8:00am

ng Eart ×

rth2class.org/site/

earth2class
bringing science to the classroom

E2C · Earth Science Curriculum Units and Teaching Tips · Selected Teacher Websites & Other · Integrating Educational Technologies · Spatial Thinking · Selected Science Ed Organizations/ Calendar of · Science Education Standards/ Exams/Safety · E2C in Brazil

Earth2Class (Earth to Class)

E2C is a unique science/math/technology resource for K-12 teachers, students, the general public, and geoscientists. It is a collaboration among researchers and an Earth Sc the Lamont-Doherty Earth Observatory of Columbia University; technology integration specialists from Colégio Bandeirantes, São Paulo, Brasil; and classroom teachers from Jersey, and elsewhere.

E2C centers around "Saturday Workshops for Educators" held at Columbia's Lamont Campus in Palisades N.Y. One key feature to E2C is involvement of LDEO scientists. Th through workshops, web site postings, and e-mail allow teachers and students access to cutting-edge research which can be used to develop learning activities directly linke problems," and provide scientists with an effective format to disseminate their discoveries more broadly. Since 1998, we have provided more than 120 Workshops featuring scientists.

2014 – 2015 Earth2Class Workshops

"Trees, Climate, and Societal Relevance: A Case Study in Mongolia" with Caroline Leland and Mukund Palat Rao (Sep 2014)

"How Have Glaciers Behaved in Patagonia in the Past?" with Michael Kaplan (Oct 2014)

"How does the land affect climate?" with Alexis Berg (10 Jan 2015)

Questions?