



Current and Emerging K-16 and Public Outreach Resources from UCAR

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CMMAP Team Meeting, Berkeley, CA
Wednesday, January 12, 2011



Overview

- Focus of UCAR EO's activities
 - SOARS – undergrad/graduate education and workforce development
 - Windows to the Universe - web-based outreach
 - Illustrations, microworlds, toy models, visualizations
 - K-12 - teacher professional development
- Broadening/deepening collaborations
- Demo/discussion of a visualization
- Kinesthetic activity – the dynamic nature of systems

SOARS – an undergraduate to grad bridge program

Broadening participation in the atmospheric and related sciences

Main program strategies

- Authentic research experiences
- Mentoring
- Supportive community



Past CMMAP protégés

- 4 CMMAP-supported protégés have entered graduate school and one in CMMAP-related research at CSU
- 1 CMMAP-supported protégé is applying to graduate programs currently
- CMMAP supported protégés include
 - 5 Females and 2 Male
 - 2 African-Americans, 4 Latino, 1 Asian



SOARS & CMMAP 2011-2016



- Opportunities for students in science education
- 2 students per summer
- SOARS partnership with NEON and WHOI
- Internship opportunities for high school students
- Participatory research

SOARS application deadline Feb 1
Please encourage your students to apply!

www.soars.ucar.edu



Extensive Outreach through W2U



Brought to you by the National Earth Science Teachers Association

English Español Beginner Intermediate Advanced

Sun Earth Solar System Space Sciences Culture People Games Teachers more...

www.windows2universe.org

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Anti-crepuscular rays are beams of sunlight that appear to converge on a point opposite the sun. They are similar to crepuscular rays, but are seen opposite the sun in the sky. Anti-crepuscular rays are most frequently visible near sunrise or sunset. This photo of anti-crepuscular rays was taken at sunset in Boulder, Colorado. Crepuscular rays are usually much brighter than anti-crepuscular rays.

Image Courtesy of Carlye Calvin

1 2 3 4 5 6 7

Welcome to Windows to the Universe - your portal to discovery! Explore the wealth of information available here to learn about the [Earth](#) and [Space](#) sciences and related topics in the humanities including [mythology](#), [art](#), [poetry](#), and more.



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ATMOSPHERE

Layers

Weather

Climate

Polar Atmosphere

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Air Pollution

Ozone Holes

Modeling

Arts and Culture

Atmosphere News

Games/Activities

Images

Teaching Resources

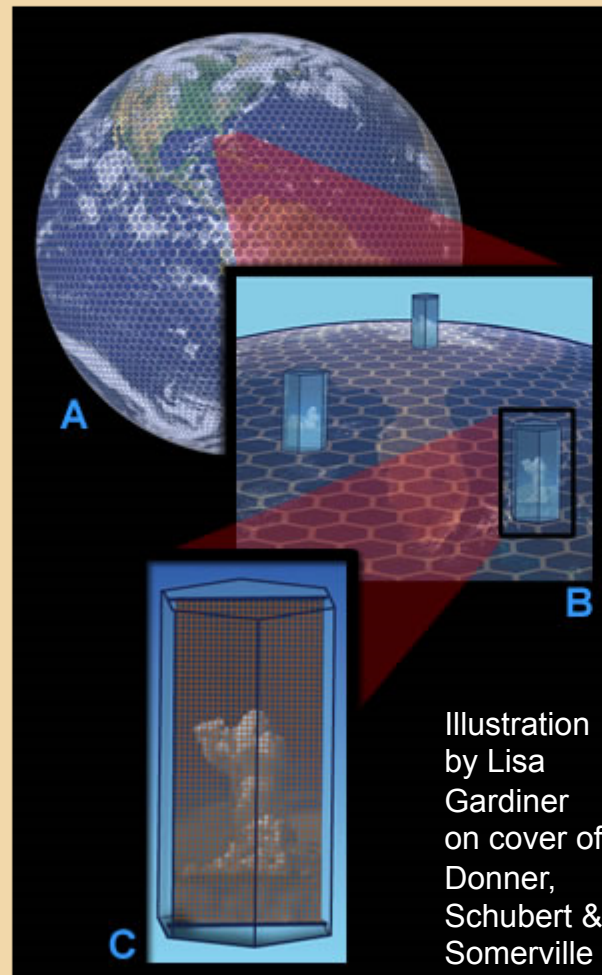
Science Literacy
Framework

Illustration
by Lisa
Gardiner
on cover of
Donner,
Schubert &
Somerville

At a large scale, the CMMAP model divides Earth into hexagons of equal size (A). The model calculations focus on the atmospheric events within each hexagon


CMMAP - Studying Clouds and Climate

Clouds are an important part of Earth's weather and climate. Scientists use computer models to study our planet's climate. These computer models include models of clouds. It's hard to model clouds because these models need to include both large and small things. Some parts of cloud models need to explain very big things like hurricanes that can be more than a hundred miles across. Other parts of cloud models need to explain very small things like raindrops and snowflakes.

CMMAP (pronounced "see-map") stands for the Center for Multi-Scale Modeling of Atmospheric Processes. CMMAP scientists are working on a new way to model the climate that will help us to better understand the roles clouds play today and in the future as our climate changes. Climate model grid cells are usually about the size of the state of Delaware. The problem with modeling clouds is that they are much smaller than this, and there could be thousands of clouds in an area the size of Delaware at any given time.

One solution that CMMAP scientists are working on is to make the grid cells small enough to simulate clouds. This has been done using cells the size of city blocks. Although these models do a good job simulating clouds that are realistic, they are very slow. Even the fastest computers in the world are too slow to simulate global climate with city-block-sized cells. Someday this will be possible, but that is many years away.



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WEATHER

Weather Fronts

Clouds

Thunderstorms

Tornadoes

Hurricanes

Heat Waves

Blizzards

Urban Weather

Atmospheric Optics

Instruments

Arts and Culture

Games/Activities

Images

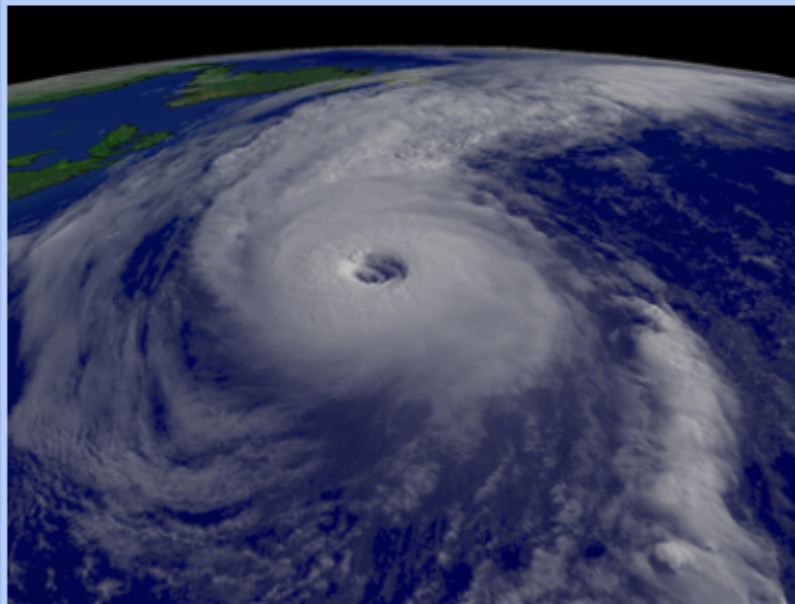
Literacy Framework

Weather

Weather is the state of the [atmosphere](#) at a given time and place. Most weather takes place in the [troposphere](#), the lowest layer of the atmosphere.

Weather is measured and described in a variety of ways by meteorologists, scientists who study and predict weather. Air [temperature](#) and [pressure](#), the amount and type of [precipitation](#), the strength and direction of [wind](#), and the [types of clouds](#) are all described in a weather report.

Weather changes each day because the air in our [atmosphere](#) is always moving, distributing energy from the [Sun](#). In most places in the world, the types of weather events also vary throughout the year as [seasons](#) change.



Hurricane Alex, a [category 3](#) storm at its strongest, traveled north along the east coast of North America in August 2004 causing [flooding](#), strong [waves](#), and rip tides along the coast. [Hurricanes form](#) in the tropics over warm ocean water and die down when they [move](#) over land or out of the tropics. These storms are called hurricanes in the Atlantic and typhoons or tropical cyclones in other areas of the world.

Courtesy of NOAA

1

2

3

4

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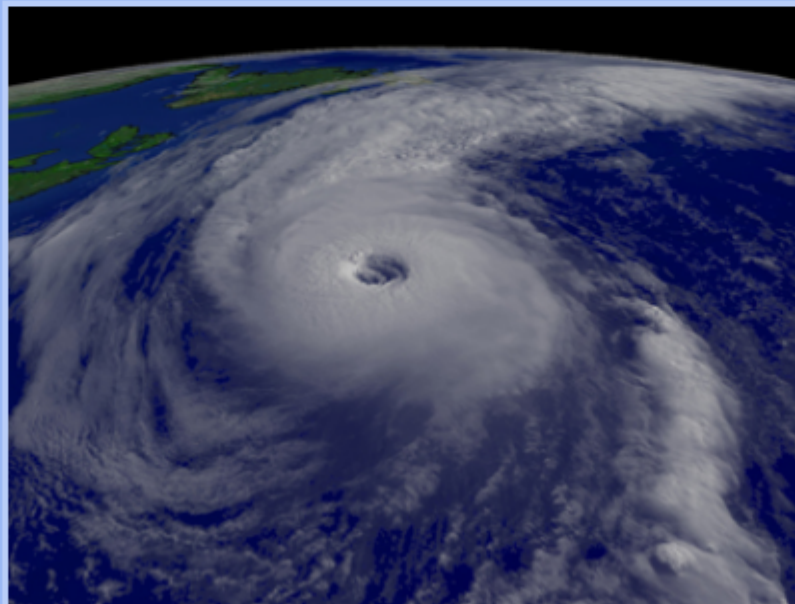
ESTADOS DEL TIEMPO

[Frentes](#)[Nubes](#)[Tempestades](#)[Tornados](#)[Huracanes](#)[Olas de Calor](#)[Ventiscas](#)[Zonas Urbanas](#)[Óptica atmosférica](#)[Instrumentos](#)[Arte y Cultura](#)[Juegos/Actividades](#)[Imágenes](#)[Marco de Instrucción](#)

Estado del tiempo es la condición en que se encuentra la [atmósfera](#) en un determinado momento y lugar. La mayoría de los estados del tiempo ocurren en la [troposfera](#), la capa más baja de la atmósfera.

Los meteorólogos, científicos que estudian y predicen los estados del tiempo, miden y describen los estados del tiempo de muchas maneras. La [temperatura](#) y la [presión](#) del aire, la cantidad y el tipo de [precipitación](#), la fuerza y la dirección del [viento](#), y los [tipos de nubes](#), son todos factores descritos en un informe del estado del tiempo.

Los estados del tiempo cambian todos los días porque el aire en nuestra [atmósfera](#) está siempre en movimiento y distribuye la energía del [Sol](#). En casi todo el mundo, los tipos de eventos de los estados del tiempo varían a lo largo del año a medida que van cambiando las [estaciones](#).



El huracán Alex, una tormenta [categoría 3](#), viajó a lo largo de la costa este de Norte América en agosto 2004, causando [inundaciones](#), fuertes [olas](#), y Corrientes marinas intensas. Los [huracanes se forman](#) sobre los océanos cálidos de los trópicos, y se debilitan y mueren cuando se [mueven](#) sobre tierra o fuera de los trópicos. Estas tormentas son llamadas huracanes en el Atlántico, y tifones o tormentas tropicales en otros lugares.

Cortesía de NOAA

[1](#)[2](#)[3](#)[4](#)

Windows to the Universe Image Galleries

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 - + [Space Weather](#)
 - + [Space Missions](#)
 - + [Mythology and Art](#)
 - + [People](#)
 - + [Field Campaigns](#)

Earth - Atmosphere - Atmospheric Optics



This image of a double rainbow was taken in



A green flash can be seen at sunrise and



A sun pillar is a glittering vertical shaft of ...



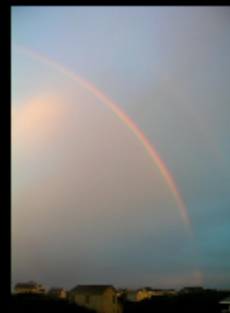
A silver lining, which sometimes can be seen



At sunrise or sunset, the sky may appear r



When direct sunlight strikes falling rain, a ...



For a rainbow to form, water droplets must be



This photograph shows polar stratospheric



These mystifying clouds are called Polar ...



A perihelia (sun dog) bright patch or ...



Halos form when light from the sun or moon is



This photograph was taken from the window



Crepuscular rays poking through clouds create a



Solar winds and other forms of solar activity ...



Anti-crepuscular rays are beams of sunlight

Atmospheric graphics and virtual labs

atmospheric layers and composition

Windows to the Universe®

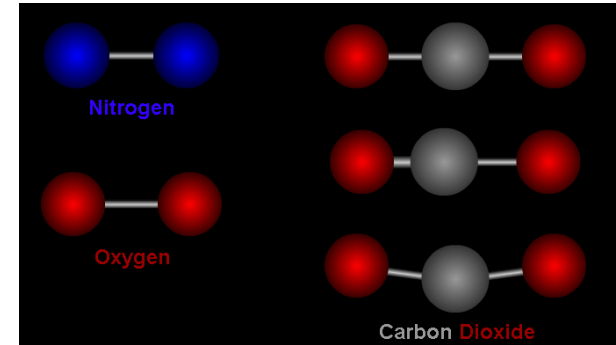
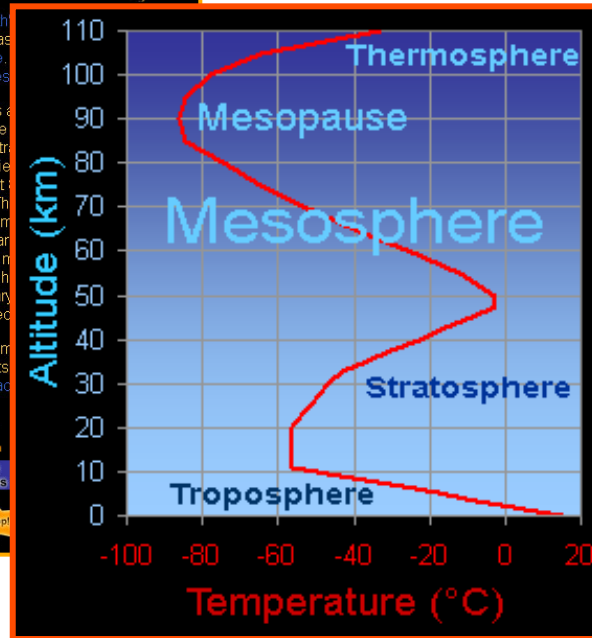
Beginner Intermediate Advanced

The Stratosphere

The stratosphere is a layer of Earth's atmosphere, the second layer, above the troposphere and below the mesosphere. The top of the stratosphere occurs at an altitude. The boundary between the mesosphere above is called the stratopause. The bottom of the stratosphere varies with seasons, occurring between about 10 miles, or 26,000 to 53,000 feet. The stratosphere is around 16 km (10 miles) Earth's surface near the equator, and slightly lower in winter at mid- and high latitudes, and around 8 km (5 miles) Earth's surface near the equator, and slightly higher in the summer. The boundary between the stratosphere and the troposphere below is called the tropopause.

Ozone, an unusual type of oxygen molecule, is abundant in the stratosphere, heats the air by absorbing energy from incoming ultraviolet radiation.

Navigation: HOME, Search, Kids, Teachers, Sun, Venus, Mars, Asteroid, Jupiter, Saturn, Mercury, Earth, Myths, History & People, News, Arts, Images, Tours, Life, Geology, Physics, Space Weather, Missions, Help, Site Map, About the Site, Contact Us, Membership, Sponsorship, Settings, Credits.



virtual ballooning activity

Launch Balloon

New Flight

Flights remaining: 2

New Game

Start Recording Altitude: 50 km

Altitude Recording Interval: 3 km

Home Screen

Settings

Show Pressure Show Temperature

WINDOWS TO THE UNIVERSE

Teacher Resources
Lesson Plans and Activities for the Classroom
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| | |
|----------------------------|---|
| Title: | Virtual Ballooning to Explore Earth's Atmosphere |
| Summary: | Students will use software to launch virtual weather balloons and collect data about Earth's atmosphere. |
| Source: | Windows to the Universe activity by Randy Russell. Available online at: www.windows.ucar.edu/tour/link=/teacher_resources/graphs/teach_balloon_atmostrata.html |
| Grade level: | 6-12 |
| Time: | 1 hour |
| Student Learning Outcomes: | <ul style="list-style-type: none"> Students will be able to describe how temperature and air pressure vary with altitude in Earth's atmosphere. Students will design a research plan and make decisions in the process of conducting a simple experiment or "research project". Students will learn about layers of Earth's atmosphere, electromagnetic radiation, the ozone layer, and the Greenhouse Effect. |
| Lesson format: | Computer and paper-and-pencil based activity. |



Clouds in Art

Which type of cloud do you see in this painting?
Compare with the photographs in the Cloud Finder.



This painting, by nineteenth-century French Impressionist painter **Camille Pissarro**, is called **Route de Louveciennes**. Louveciennes is a village near Paris, France. There are puffy little cumulus clouds in the sky above the town. Check the Cloud Finder to learn more.

More Cloud Paintings

Credits

For Teachers

Cloud Finder



Cloud Photos:

Cumulus clouds are puffy like cotton balls. They tend to have defined edges against the sky. The clouds in Pissarro's painting have distinct edges and cumulus shapes.

Connecting Science & Humanities

The Sky is Low, The Clouds Are Mean, a poem by Emily Dickinson



This painting by British artist J.M.W. Turner called Seascap Study No. 21, he has painted a rain cloud dark like this one and called it 'The Great Storm'. Click on image for full size. Public domain/Wikipedia

The Sky Is Low, The Clouds Are Mean

The sky is low, the clouds are mean,
A travelling flake of snow
Across a barn or through a rut
Debates if it will go.

Tawhiri, Maori God of Wind and Storms



Maori wood carving at the Arataki Visitor Centre, Auckland, New Zealand
Click on image for full size (110 Kb)
Public domain image/Wikipedia Commons

Tawhiri was very angry with his brothers. They disagreed about whether their parents, [Rangi](#) (the sky) and [Papa](#) (the Earth), should be separated. His brothers won, [sky](#) and [Earth](#) were separated, and Tawhiri was furious.

As the god of [wind](#) and [storms](#), Tawhiri had a way to retaliate against his brothers. He hid in the sky and plotted his revenge.

From his place in the sky he sent [thunderstorms](#) and [hurricanes](#) to his brother Tane-mahuta, the god of forests. The tall trees of the forests cracked and fell.

He sent storms over the [oceans](#) to punish his brother Tangaroa, the god of the sea. Waves and whirlpools of water upset the oceans.

He sent storms to his brothers Haumia-tikitiki and Rongo-ma-tane, the gods of food. These brothers were protected by their mother the Earth. She held them close and they were not harmed by the storms Tawhiri sent.

The last brother, Tu-matauenga, withstood the wind and storms that Tawhiri sent. This brother was the god of fierce humans.

Tawhiri had thirteen [cloud](#) children who lived in the sky. Some of the cloud children were dark and stormy and others were light and puffy. He was also the father of [rain](#), mist, and fog.

The story of Tawhiri and his family is a part of the mythology of the Maori people from New Zealand and eastern Polynesia.



Disseminating LSOP Videos

Videos about Clouds, Weather, and Climate

These videos cover various topics related to clouds, weather, and climate. They were created by the [Little Shop of Physics](#) (LSOP) and the [CMMAP Project](#).



[Cotton Candy and Windmills](#)

A machine for making cotton candy illustrates how air pressure, wind, and a bit of spin control the flow of air around our planet... and make for a tasty treat!

Length: 3 minutes 13 seconds



[Convection Cells Move Air Around](#)

Warm air rises; cool air sinks. This process of convection moves air around in our atmosphere, causing winds to blow.

Length: 3 minutes 5 seconds



[Global Winds](#)

Convection moves warm and cold air around. Global winds on our planet are also influenced by Earth's spin. Brian demonstrates this with a spinning bowl and dry ice.

Length: 5 minutes 39 seconds



[Global Atmospheric Circulation Model](#)

Taka Ito, an oceanographer at Colorado State University, uses a spinning water tank with warm and cold water to demonstrate global circulation of wind and how Earth's spin affects the wind.

Length: 2 minutes 4 seconds

About
20,400
page views
from nearly
10,000
"visitors"
over past 13
months

Last modified November 15, 2010 by [Randy Russell](#).

UCAR
EDUCATION
AND OUTREACH

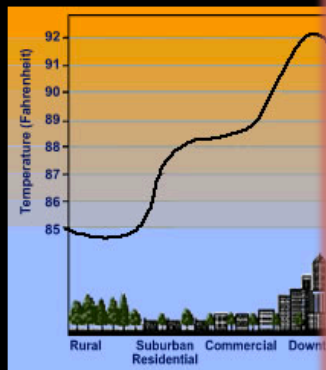
Training Teachers about Weather, Climate, Modeling, and Sustainability

Weather in Urban Areas



Heavy affect

The Urban Heat Island




This cross section through a typical urban-rural area shows that temperatures are usually lower at the urban-rural interface than in the downtown areas. Click on image for full size (74 Kb) Lisa Gardiner / Windows to the Universe the Lawrence Berkeley National Lab

Urban areas can help reduce global warming by reflecting sunlight. Click on image for full size (74 Kb) Courtesy of the University of California Atmospheric Research Center

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WINDOWS TO THE UNIVERSE

Teacher Resources
 Lesson Plans and Activities for the Classroom
www.windows.ucar.edu

Title: Feeling the Heat
Summary: Students learn about the urban heat island effect by investigating which


WINDOWS TO THE UNIVERSE

Teacher Resources
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Source:
Grade level:
Time:

Student Learning Outcomes:

Title: CO2: How Much Do You Spew?
Summary: Students analyze the energy consumption of a

Source:
Grade level: 6 - 9

Time: Two to three class periods

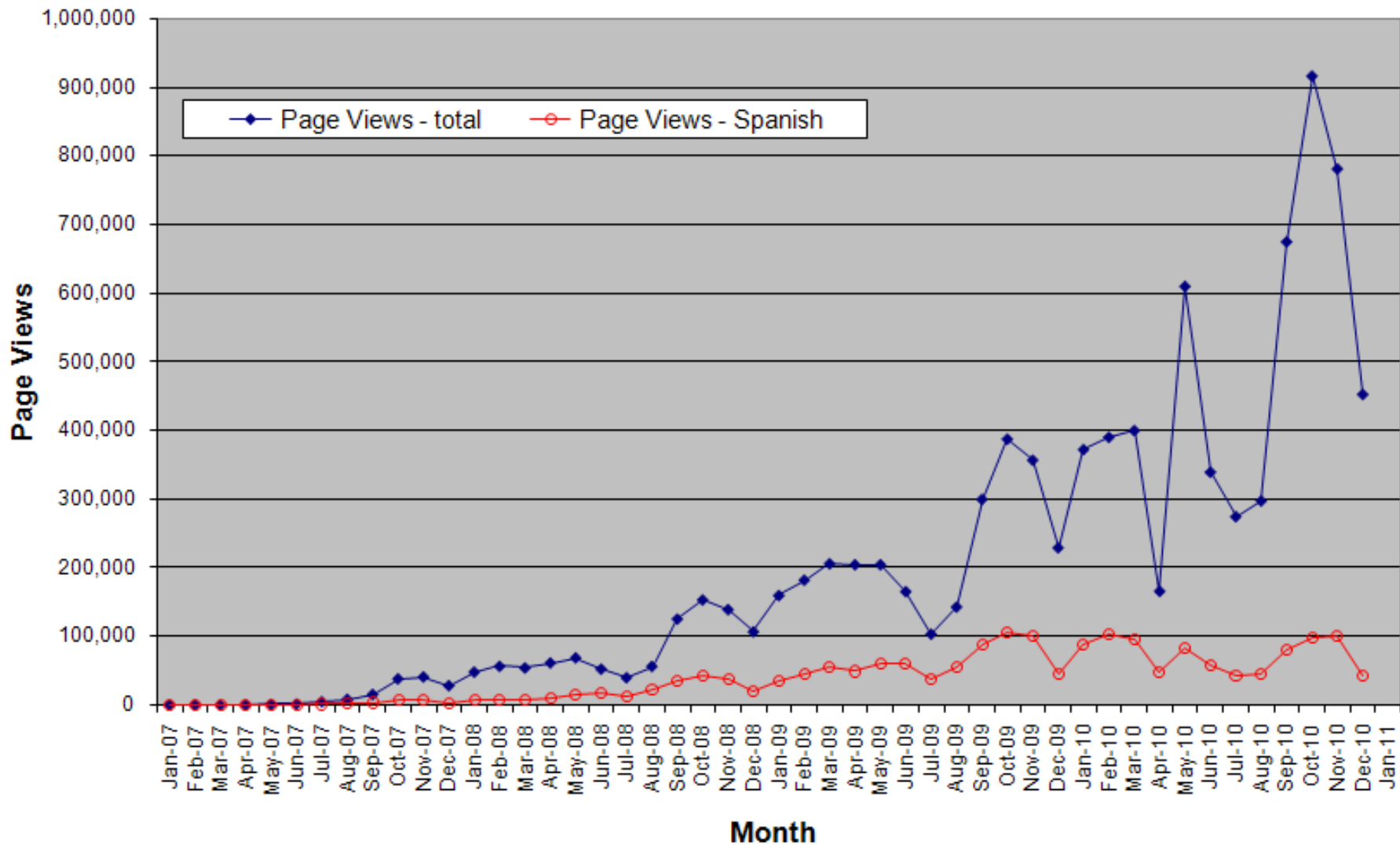
Lesson format:
National Standards Addressed:

Student Learning Outcomes:

- Students will be able to describe the 6 regions where hurricanes happen.
- Students will graph and interpret data to learn that different regions have varying numbers of hurricanes.
- Students will be able to explain that hurricanes happen during the warmest times of year and in regions that have warm sea surface temperatures.
- Students will graph and interpret data about how hurricanes have changed over recent decades as

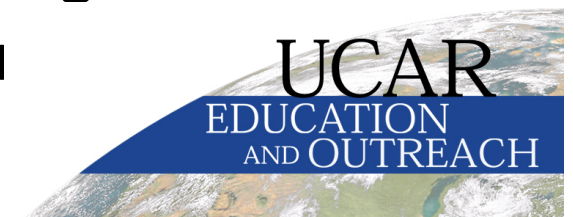


Monthly W2U CMMAP Page Views



News!

- Windows has moved from UCAR to the National Earth Science Teacher Association (NESTA)
- CSU will become a W2U Institutional Partner
- Online audience for CMMAP will continue to grow through
 - Training LSOP and CMMAP educators/scientists to submit resources to W2U
 - Announcements about CMMAP through e-newsletter to thousands of educators



Collaborations: Web Seminars Coming in 2011-2015

Featuring CMMAP Teachers Weather and Climate Workshop

The screenshot shows the NSTA Learning Center website. At the top, there are navigation links: "Back to NSTA.org", "Contact Us", "Help", and "Feedback". The main header features the NSTA Learning Center logo and a search bar with the text "Search the Learning Center". Below the header is a navigation menu with links for "Home", "My PD Tools", "Subjects", "Learning Resources & Opportunities", "Discussion Forums", and "Education Administrator".

The main content area is titled "Web Seminars" and features a large banner with the text "Take part in 90-minute, live, online seminars." and a play button icon labeled "Play Multimedia Overview". To the right of the banner is a video player showing a woman at a computer with several windows open, including one titled "What caused the damage to this coral?".

Below the banner, there is a text block describing NSTA Web Seminars: "NSTA Web Seminars are free, 90-minute, live professional development experiences that use online learning technologies to allow participants to interact with nationally acclaimed experts, NSTA Press authors, and scientists, engineers, and education specialists from NSTA partner organizations. [Register Today!](#)"

To the right of this text is a thumbnail for a seminar titled "Mars, like Earth, is in 'Goldilocks' zone for habitable planets" with a NASA logo. The thumbnail image shows a row of planets with a red arrow pointing to Mars.

On the left side of the page, there is a "LOGIN" section with a welcome message "Welcome, Susan" and a "Log Out" link. Below this is a "LIVE SUPPORT OFFLINE" section with a "Leave a message" button and a link to "Hours of Operation". Further down is an "ADVANCED SEARCH" section with a link to "Advanced Search". At the bottom left, there is a section for "NSTA WEB SEMINARS" with the text "LIVE INTERACTIVE LEARNING @ YOUR DESKTOP" and a link to "ARCHIVES BY SUBJECT".

Collaborations: CMMAP-LSOP-UCAR EO AMS Weatherfest, Seattle, January 23

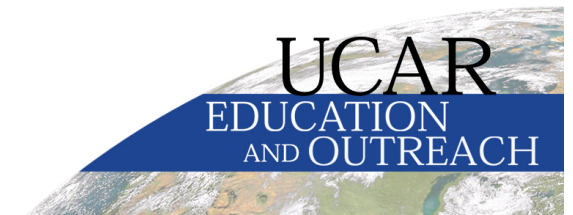


Collaborations: SOARS protégés training as educators



Collaborations: UCAR Community

- CMMAP Educational partners
 - Exploring closer alignment of themes and products between LSOP and UCAR EO
 - Testing EO's and LSOP new CMMAP resources in NCAR Mesa Lab public visitor program
 - A new NCAR Weather Gallery exhibit and website to provide an outlet for CMMAP science and resources
- UCAR-wide
 - Ongoing contributions of CMMAP scientists to education resource development
 - Expanded science communications experiences for young scientists
 - Closer connections of UCAR EO with COMET, GLOBE, and digital libraries (NSDL and DLESE)
 - Exploring proposal development partnerships with UCAR members



CLOUD ZOOM

demonstration and discussion

- What concepts would be interesting to explore with this tool?
- What phenomena and images do you suggest to represent at specific spatial scales?
- How could CLOUD ZOOM be made most useful to you in your undergraduate courses?

Send ideas to:
rrussell@ucar.edu

