Options for Bringing the VOCALS Campaign to the Public, Students, and Educators

R. M. Johnson
UCAR Education and Outreach

Some options for VOCALS EO

- Leverage high traffic bilingual Windows to the Universe website (>18 million users per year)
- Potential for teachers to work with campaign scientists to learn about research
- “Postcards from the Field” allows campaign participants to post informal postcards to the website that share progress
  - Teacher workshops?
  - Student visits to campaign ops center?

- Experience with MILAGRO campaign…

MILAGRO

Megacity Initiative: Local and Global Research Observations

Intensive campaign to study gases and aerosol pollution in and around Mexico City, March 2006

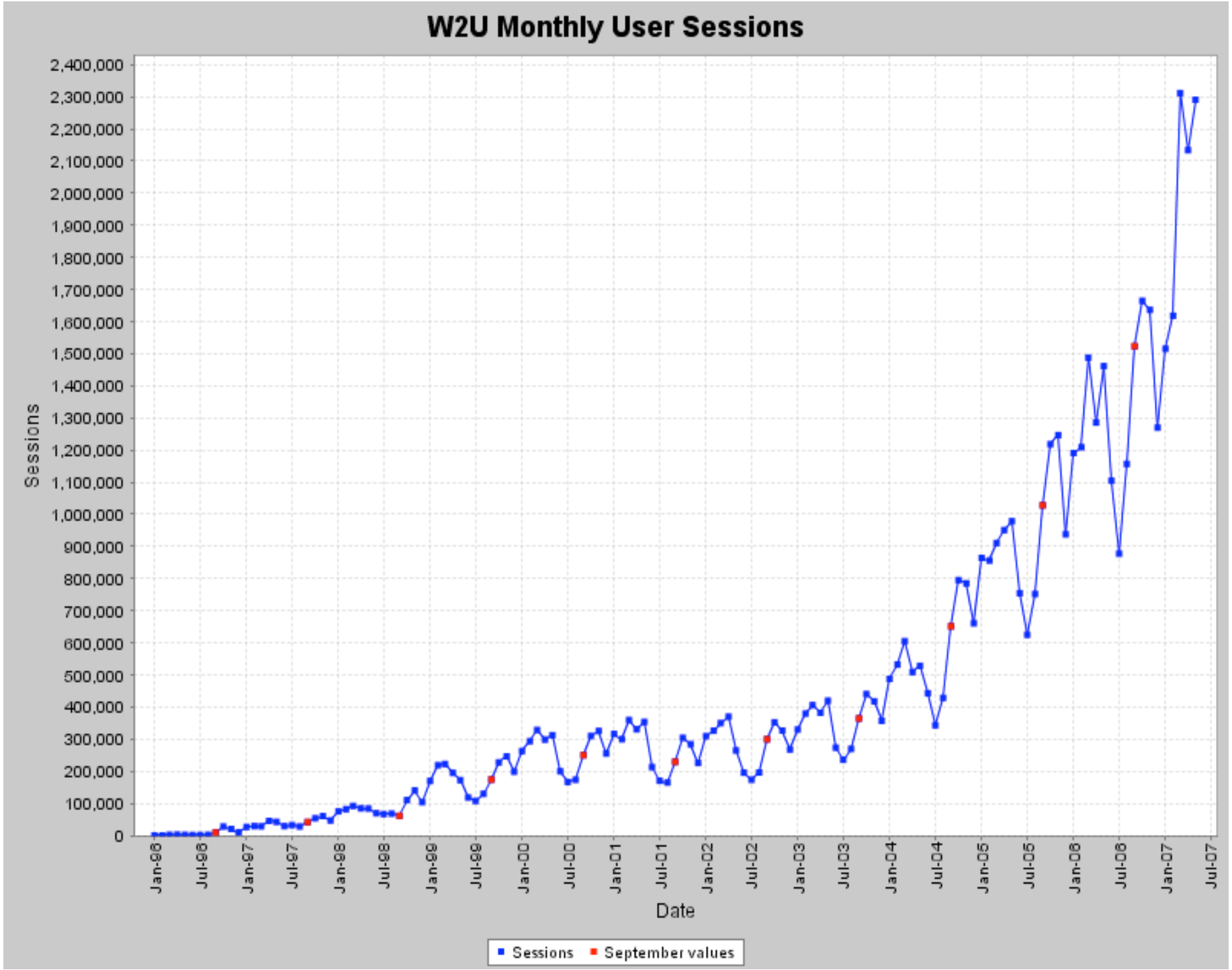
- Transport of air pollutants from urban to regional and global environments impacts health, ecosystems, visibility, weather, greenhouse forcing
  - How are polluting agents eliminated from the atmosphere?
  - What are the regional and world-wide impacts of urban plumes?
- Numerous scientific participants from institutions across Mexico, Europe, US

- Collaborative effort to build a web-portal to MILAGRO on Windows to the Universe

Windows to the Universe

- Over 7000 interlinked web pages at three levels in English and Spanish
- Content spans Earth and space sciences, with connections to related fields (arts and humanities)
- Over 18 million visitors to website in past 12 months (~136 million page views)
  - Reached ~85 – 90K visitors per day in March
  - ~25% of traffic to Spanish version of website

- New monthly newsletter reaches 7100+ educators from 135 countries around the world (bilingual)
- Over 100 classroom activities for teachers
- Supported through 7 different specific development efforts by NCAR, NSF, and NASA (including CMMAP)


W2U Monthly User Sessions
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2,400,000
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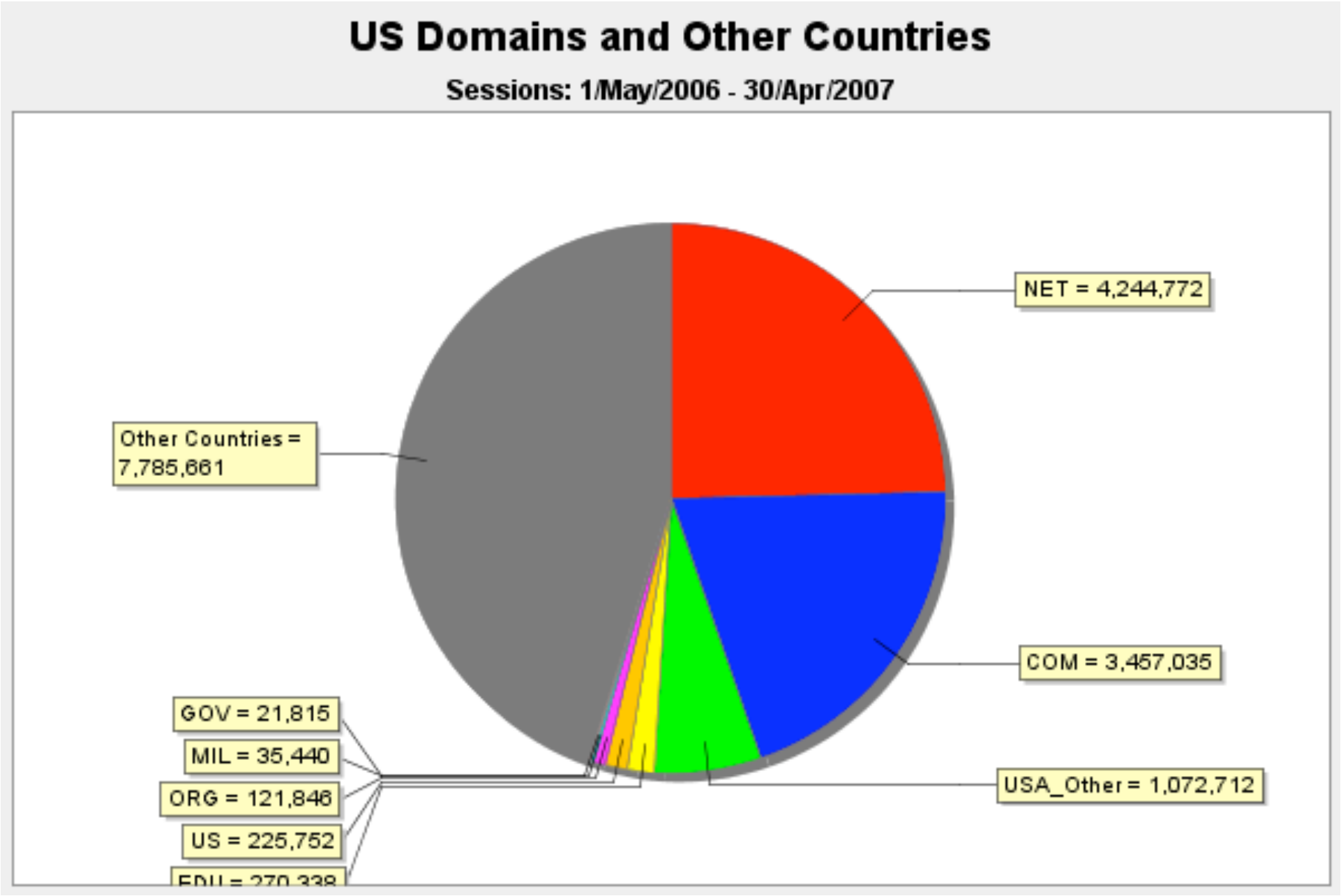
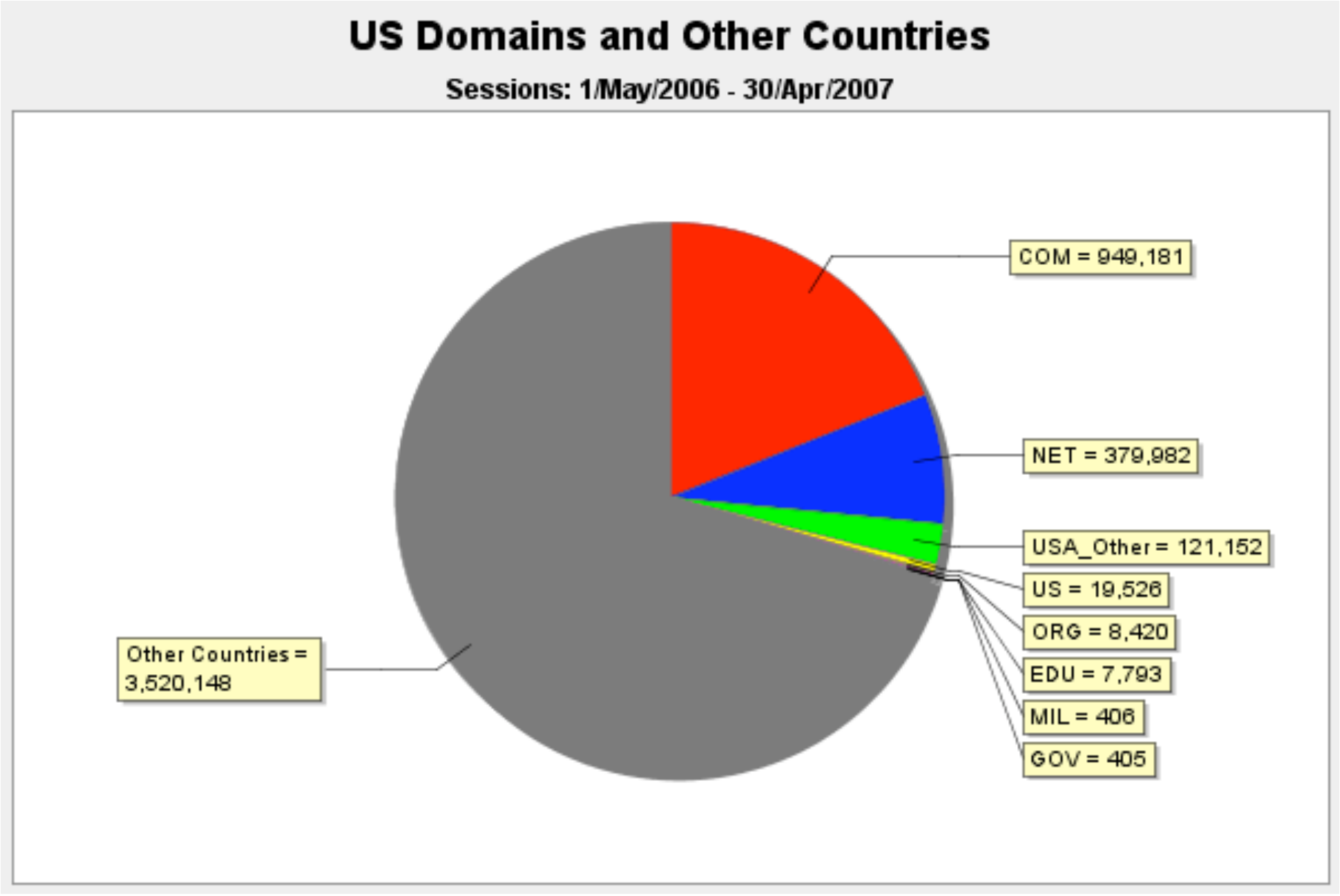
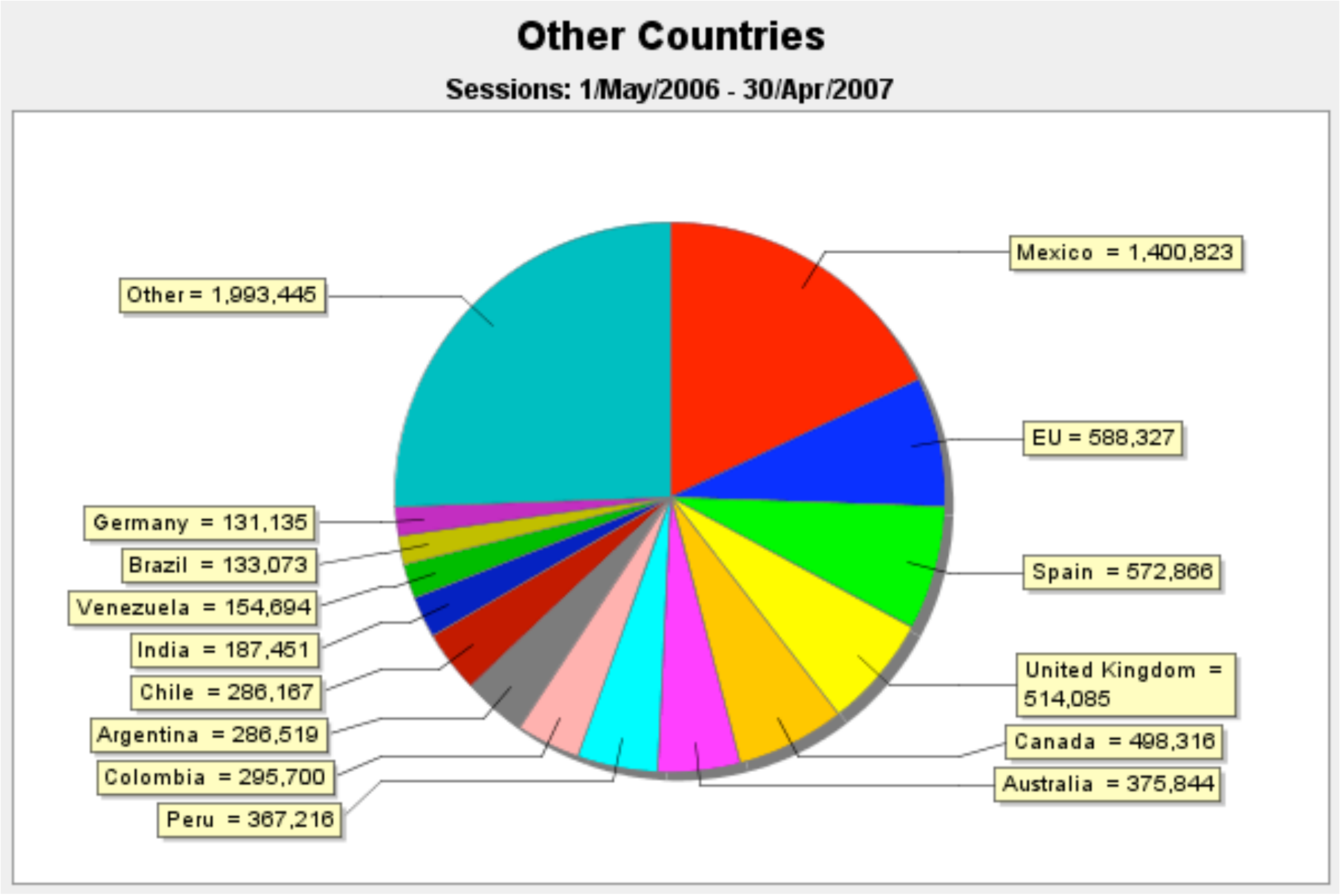
~55% Tráfico de EE.UU



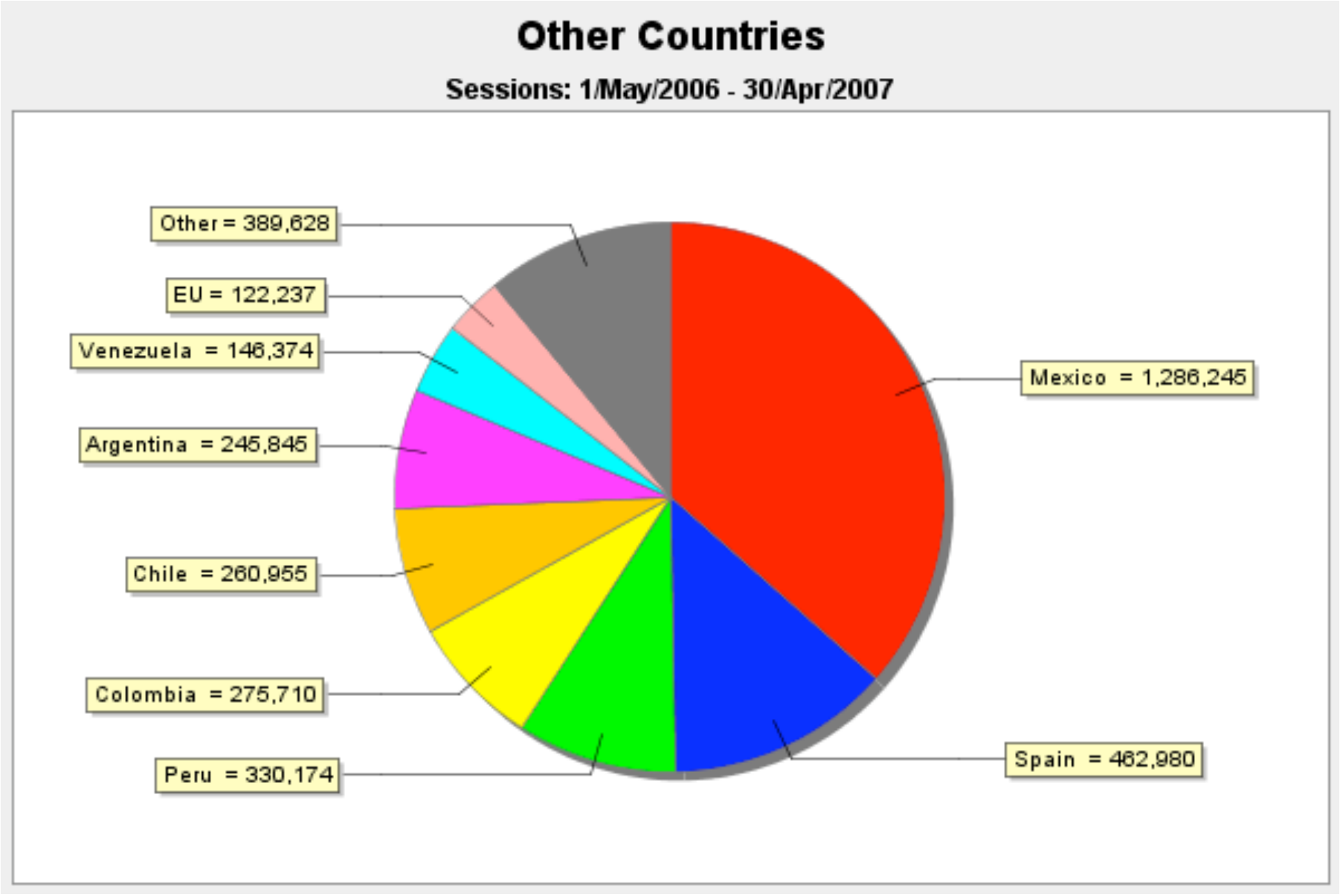
~30% del tráfico a la sección de Español proviene de EE.UU



Over 18 million sessions over past 12 months



Spanish website is used extensively in Latin America and Spain



Evolution of the MILAGRO EO Project

- October 2005 - Developed concept for education and outreach portal for MILAGRO campaign, in collaboration with MILAGRO scientists, submitted to National Science Foundation
- January 2006 – Began development of MILAGRO Education and Outreach portal:
  - Created ~60 web-pages to support (leveraging hundreds more already on the site)
  - Created new interface for scientists/teachers to submit Postcards
- End of February 2006:
  - Trained ~7 scientist/teachers on how to use interface in Mexico City
  - Spur-of-the-moment workshop for ~60 teachers in Veracruz arranged through meetings with the Secretary of Education in Veracruz
- March 2006
  - 1 March - Opened MILAGRO portal to the public
  - Teachers and students welcomed at the Field Operations Center in Veracruz for daily briefings throughout the month
- To date, ~1 million page views to the content developed for the MILAGRO portal

MILAGRO EO Content

- About MILAGRO: campaign, instruments, aircraft
- Air Pollution: Effects – health, visibility, acid rain, water resources, property, forests/wildlife, tragedy of the commons; transport
- Atmospheric chemistry – 14 molecules
- Atmospheric structure
- Connections to climate change – greenhouse gases, nitrogen cycle, carbon cycle
- Scientists and Educators – bios from 9 participants
- Postcards from the Field – 34 posted over the month
- Links to resources for kids and teachers (including related curricula)

Introduction to Milagro - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://www.windows.ucar.edu/tour/link=/milagro/milagro_intro.html

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Studying air pollutants in Mexico City, the world's second largest city.

MILAGRO

Megacity Initiative: Local and Global Research Observations

Spanish English

About MILAGRO | Air Pollution | Effects on Us | People | Field Reports | Research Results | Kids! | Educators | Links | Gallery

Windows to the Universe | Beginner | Intermediate | Advanced

Introduction to Milagro

This image shows the location of the country of Mexico and its capital, Mexico City. Mexico City is where the MILAGRO campaign will take place.
Click on image for full size (437 Kb)

MILAGRO stands for Megacity Initiative: Local and Global Research Observations. What that really means is that a team of researchers from around the world is in Mexico City to study the atmosphere there. The MILAGRO field campaign started in March 2006.

During MILAGRO, the scientists are using airplanes, radars, weather balloons, computers, and dozens of scientific instruments to study the atmosphere in and around Mexico City. Their purpose is to learn more about the air pollution that is given off by very large cities called megacities.

Air pollution affects visibility, human health, agriculture, and ecosystems. As cities around the world grow bigger than ever before, scientists are discovering that urban air pollution is powerful enough to affect Earth's weather and climate.

The MILAGRO team is focusing on how the air pollution particles released inside Mexico City change as the wind blows them downwind of the city. They also want to understand how chemistry in the atmosphere changes the pollution as it moves away from the city.

The researchers hope they can apply what they learn in Mexico City to other megacities around the world. They chose to hold MILAGRO in Mexico City because it ranks among the world's top three largest cities and has very polluted air.

Many people aren't familiar with field campaigns like MILAGRO. A field campaign is when a team of researchers—usually scientists, technicians, engineers and more—undertakes a large scientific research project in a certain location. Field campaigns can be large, lasting for weeks and involving many different people and different scientific instruments. After the campaign, the researchers often spend months and even years analyzing the data they got during the project.

Done

Introducción a Milagro - Mozilla Firefox

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Go

Estudiando agentes contaminantes del aire en la Ciudad de México, 2da. ciudad más grande del mundo

MILAGRO

MILAGRO

Megacity Initiative: Local and Global Research Observations*

**Iniciativa de megaciudad, Observaciones de investigación local y global*

Español Ingles

Acerca de MILAGRO | Contaminación del aire | Efectos sobre nosotros | Gente | Reportes de Campo | Resultados de Investigación | ¡Niños! | Educadores | Enlaces | Galería

Windows to the Universe

Principiante | Intermedio | Avanzado

Introducción a Milagro

Los enlaces en color anaranjado lo llevan a las páginas en Inglés, que aún no han sido traducidas al Español.

Esta imagen muestra dónde se encuentran México y su capital, la Ciudad de México. La Ciudad de México es el lugar donde se llevará a cabo la campaña MILAGRO.

MILAGRO significa: Iniciativa de Megaciudad: Observaciones de Investigación Global y Local (por sus siglas en Inglés: Megacity Initiative: Local and Global Research Observations). Esto realmente significa que actualmente hay en Ciuda de México, un equipo de científicos provenientes de todo el mundo, que está allí para estudiar la atmósfera de la ciudad. Este proyecto comenzó en marzo del 2006.

Durante la campaña MILAGRO, los científicos usarán aviones, radares, globos climatológicos, computadoras, y docenas de instrumentos científicos que estudiarán la atmósfera de la ciudad y de sus alrededores. Su propósito es el aprender más acerca de la contaminación del aire que se genera en grandes ciudades conocidas como, megaciudades.

La contaminación del aire afecta la visibilidad, la salud de las personas, la agricultura y los ecosistemas. A medida que las ciudades de todo el mundo está creciendo más rapidamente que antes, los científicos están descubriendo que la contaminación del aire que se genera en las ciudades es lo suficientemente potente como para afectar los estados del tiempo y clima de todo el planeta.

El equipo de Milagro se enfoca en cómo cambian las partículas de contaminació

Ozone in the Troposphere

Ozone peaks in urban areas during late afternoons.
Click on image for full size (23K)
Courtesy of UCAR

Did you know that ozone is found in two different layers of the atmosphere? You may have heard of the ozone hole problem - that is a lack of ozone in the stratosphere (the 2nd layer of the Earth's atomsphere). But ozone is also found in the troposphere, the first layer of the Earth's atmosphere. In the troposphere, ozone is NOT wanted! It can actually do a lot of damage.

Ozone is released naturally in the troposphere by plants and soil. These are such small amounts that they are not harmful to the health of humans, animals or the environment.

Ozone that increases because of certain human activities does become a problem at ground level and this is what we think of as 'bad' ozone. With increasing populations, more automobiles, and more industry (power plants and refineries in particular), there's more ozone in the lower atmosphere. Since 1900, the amount of ozone near the Earth's surface has more than doubled. In urban areas in the Northern Hemisphere, high ozone levels usually occur during the warm, sunny, summer months (from May through September). Typically, ozone levels reach their peak in mid to late afternoon, after the Sun has had time to react fully with the exhaust fumes from the morning rush hours. A hot, sunny, still day is the perfect environment for ozone pollution production. In early evening, the sunlight's intensity decreases and ground level ozone begins to decrease again.

When ozone pollution reaches high levels, pollution alerts are issued telling people with breathing problems to take extra precautions or to remain indoors. That's no fun! Smog can damage lung tissues, impair an athlete's performance, create more frequent attacks for individuals with asthma, cause eye irritation, chest pain, coughing, nausea, headaches and chest congestion. It can even worsen heart disease, bronchitis, and emphysema.

Ozone in the Troposphere - Mozilla Firefox

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Go

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Ozone in the Troposphere

Ozone peaks in urban areas during late afternoons.
Click on image for full size (23K)
Courtesy of UCAR

Did you know that ozone is found in two different layers of the atmosphere? You may have heard of the ozone hole problem - that is where ozone is missing in the stratosphere (the 2nd layer of the Earth's atomsphere). But ozone is also found in the troposphere, the first layer of the Earth's atmosphere. In the troposphere, ozone is NOT wanted! It can actually do a lot of damage.

Driving cars and burning fossil fuels (like coal and oil) produces more ozone in that first layer of the atmosphere. This is what we call 'bad' ozone!

It is bad because ozone helps create smog or pollution that can be harmful to people, animals and even plants! When ozone pollution reaches high levels, pollution alerts are put out telling people with breathing problems to stay inside. That's no fun! Smog can damage lung tissues, impair an athlete's performance, increase attacks for people with asthma, and give people headaches.

Rubber, cloth and certain paints may be damaged by ozone. Some elastic materials can become brittle and crack (take a look at old rubber bands!).

How do we help get rid of all of this "bad" ozone? You can help every day by choosing to take the bus or walk to

Slide 21 of 35 | Default Design | English (U.S.)

Ozone in the Troposphere

Ozone peaks in urban areas during late afternoons.
Click on image for full size (23K)
Courtesy of UCAR

10% of the ozone in the Earth's atmosphere is found in the troposphere, the first layer of the Earth's atmosphere. In the troposphere, ozone is not wanted. Ozone is even more scarce in the troposphere than the stratosphere with concentrations of about 0.02 to 0.3 parts per million (ppm). But even in such small doses, this molecule can do a lot of damage.

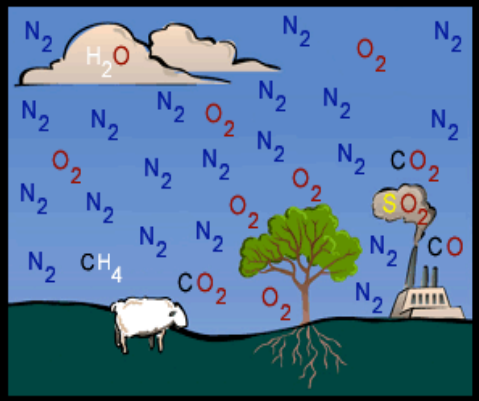
Ozone does occur naturally at ground-level in low concentrations. The two major sources of natural ground-level ozone are hydrocarbons, which are released by plants and soil, and small amounts of stratospheric ozone, which occasionally migrate down to the Earth's surface. Neither of these sources contributes enough ozone to be considered a threat to the health of humans or the environment.

Ozone that is a byproduct of certain human activities does become a problem at ground level and this is what we think of as 'bad' ozone. With increasing populations, more automobiles, and more industry, there's more ozone in the lower atmosphere. Since 1900, the amount of ozone near the Earth's surface has more than doubled. Unlike most other air pollutants, ozone is not directly emitted from any one source. Tropospheric ozone is formed by the interaction of sunlight, particularly ultraviolet light, with hydrocarbons and nitrogen oxides, which are emitted by automobiles, gasoline vapors, fossil fuel power plants, refineries, and certain other industries. In urban areas in the Northern Hemisphere, high ozone levels usually occur during the warm, sunny, summer months (from May through September). Typically, ozone levels reach their peak in mid to late afternoon, after the Sun has had time to react fully with the exhaust fumes from the morning rush hours. A hot, sunny, still day is the perfect environment for ozone pollution production. In early evening, the sunlight's intensity decreases and the photochemical production process that forms ground level ozone begins to subside.

When ozone pollution reaches high levels, pollution alerts are issued urging people with respiratory problems to take extra precautions or to remain indoors. Smog can damage respiratory tissues through inhalation. Ozone has been linked to tissue decay, the promotion of scar tissue formation, and cell damage by oxidation. It can impair an athlete's performance, create more frequent attacks for individuals with asthma, cause eye irritation, chest pain, coughing, nausea, headaches and chest congestion. It can worsen heart disease, bronchitis, and emphysema.

Rubber, textile dyes, fibers, and certain paints may be weakened or damaged by exposure to ozone. Some elastic materials can become brittle and crack, while paints

Atmospheric Chemistry of Earth's Troposphere



This cartoon shows some of the gases in Earth's troposphere. There is more nitrogen (N_2) than anything else. There is also a lot of oxygen (O_2). The cartoon also shows carbon dioxide (CO_2), water vapor (H_2O), methane (CH_4), sulfur dioxide (SO_2), and carbon monoxide (CO).
Click on image for full size (52 Kb JPEG)
Image courtesy UCAR, modified by Windows to the Universe staff (Randy Russell).

When you think of chemistry, do you think about mixing colored liquids in test tubes and maybe making an explosion... or at least a nice puff of smoke? Did you know that a lot of chemistry happens in Earth's atmosphere? There are many different kinds of chemicals in the air. Those chemicals often combine with each other in chemical reactions, making new and different chemicals. This is called "atmospheric chemistry".

Earth's atmosphere has different layers. The lowest layer is called the troposphere. We live in the troposphere. This page explains about atmospheric chemistry in the troposphere.

Most of the gas in our atmosphere is nitrogen. About 4/5ths of the air is nitrogen. What about the other 1/5th? Almost all of it is oxygen, the stuff in the air we need to breathe. There are also very small amounts of a bunch of other chemicals.

Have you heard of greenhouse gases? They are kinds of gases that trap the heat from sunlight in our atmosphere. Earth would be very cold if we didn't have any greenhouse gases. Carbon dioxide and methane are two very important greenhouse gases.

Some of the chemicals in the air come from pollution. When we burn coal in a factory or gasoline in our cars, we make air pollution. Coal and oil have sulfur in them. When they burn, they make chemicals called sulfur oxides. These can turn into sulfuric acid when they mix with water droplets in the air. These droplets of acid can fall to the ground as acid rain. Cars and trucks also give off chemicals called nitrogen oxides. Nitrogen oxides combine with other chemicals to make smog. They also help make nitric acid, which is another acid in acid rain.

Nature also does things to change the chemistry of the troposphere. Volcanoes, lightning, and wildfires all add chemicals to the air or change the ones that are already there. Energy from sunlight can make chemical reactions happen, changing one gas into another. Some chemicals move in cycles between the atmosphere, living creatures, and the oceans. The Carbon Cycle and the Nitrogen Cycles are two important cycles that change the chemistry of the atmosphere.

Nitrogen - Mozilla Firefox

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http://www.windows.ucar.edu/tour/link=/physical_science/chemistry/nitrogen_molecular.html

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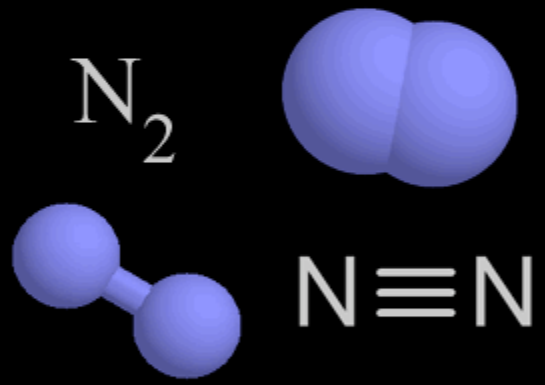
Nitrogen



Here are four different ways chemists use to show a molecule of nitrogen. In colored molecule models like these, nitrogen is usually blue.
Click on image for full size (20 Kb GIF)
Windows to the Universe original artwork by Randy Russell.

There is more nitrogen gas in the air than any other kind of gas. About 4/5ths of Earth's atmo

A molecule of nitrogen gas is made up of two nitrogen atoms. Some other kinds of importan them, too.

Nitric oxide (NO) and nitrogen dioxide (NO_2) are molecules that have nitrogen atoms in them cause air pollution. They are made in the engines of cars and other places. They also help m help make peroxyacetyl nitrate (PAN), which is a nasty chemical in smog. They also help ma acid rain.

Nitrogen atoms are important parts of living creatures. The Nitrogen Cycle explains how nitro environment, including living things like you and me!

Postcards from the Field
The MILAGRO example

- Scientists/educators have found this interface “extremely easy” to use
- We are expanding application to other field projects (Penguin project), and can make available to other scientists to share their research with the public

Dr. Dara Salcedo - Mozilla Firefox

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Dr. Dara Salcedo

I am originally from Mexico City were I grew up and eventually got my Bachelor's degr college, I had many questions about molecules, reactions, colors, substances, and I th be answered in my classes. Soon, I realized that every time a question was answered By the time I got my degree, I knew that doing science to answer questions is a never Cambridge, MA to get my PhD. I chose the field of Atmospheric Chemistry because i understand the environment. Also, I like to think that the research I do will be useful for that will protect our health and environment. Now, I live in Cuernavaca, a city south fro city of the eternal spring" because it has a very mild weather and you can always find

During MILAGRO, I will be at T0 measuring particles. The objective is to learn about t and to deduce their history (where they were emitted and how they were transformed do the latter without the help of other colleagues measuring gases, temperature, wind about the MILAGRO project: every research group is doing a different measurement; together will be able to understand air pollution better (like pieces of a puzzle that forn

When I am not doing science, I enjoy to be at home, cooking, hiking and going to the husband and we use every opportunity we have. This photo was taken last year in Sidney, Australia. Next April, we are going to visit some deserved trip after all the hard work in March during MILAGRO).

Postcard from the Field - Mozilla Firefox

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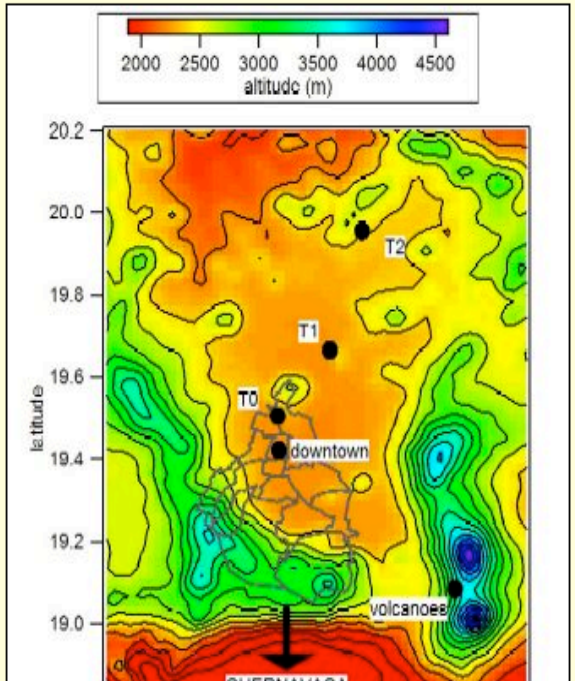
Postcards from the Field MILAGRO



From: Dara Salcedo

T0, March 20, 2006

Map of Mexico City

Here is a map of the Valley of Mexico, where Mexico City is situated. As you can see, Mexico City is surrounded by mountains in the south, east and west, which is very unfortunate because the mountains make it very difficult for the wind to vent the city. Hence, all the emissions from cars and industries are trapped within the valley and air pollution can reach very high levels.

Towards the south, on the other side of the mountains, is Cuernavaca, where I live.

Air Pollution Sources

MILAGRO EO Surprises

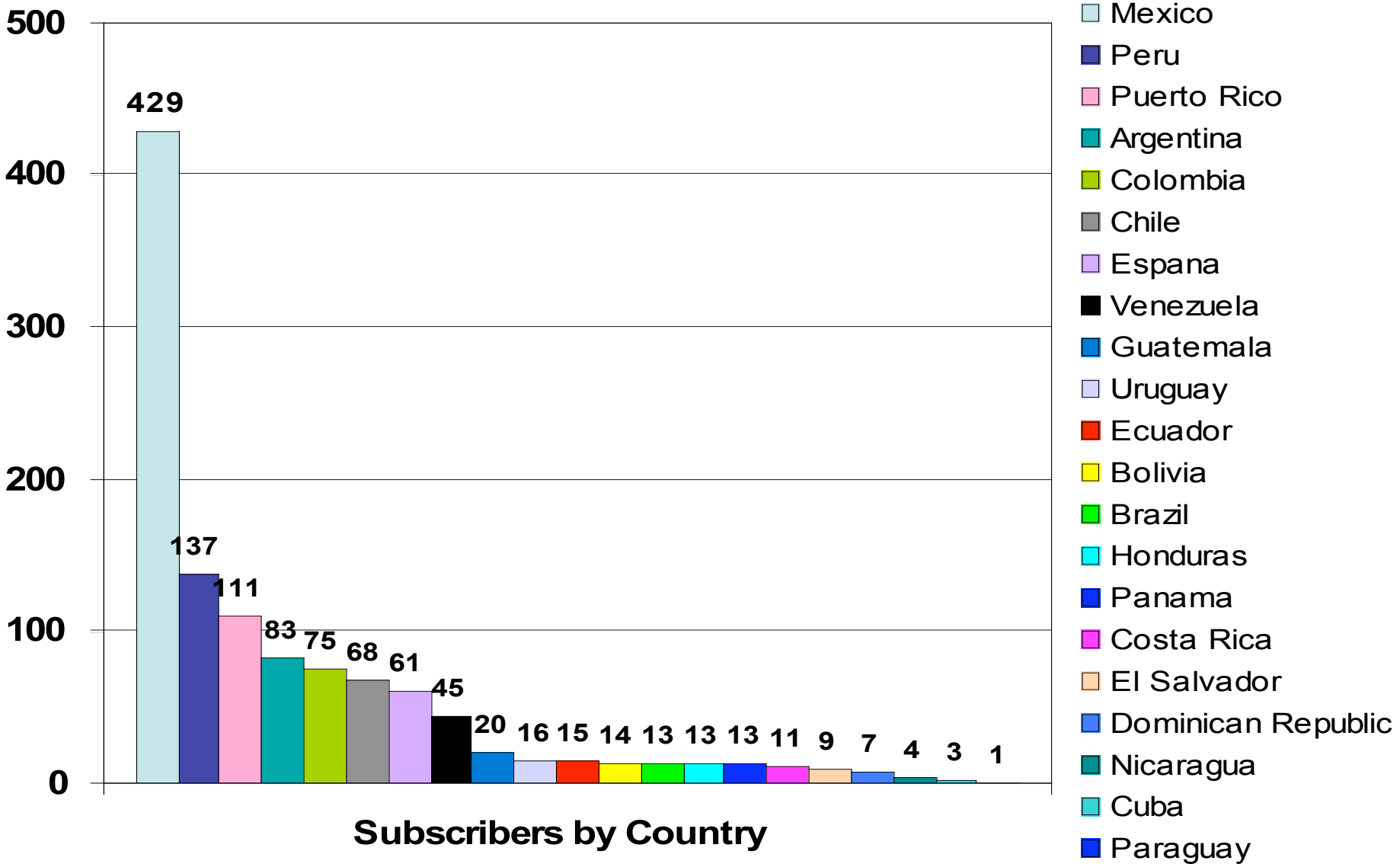
- Spontaneous teacher workshop in Veracruz
- Daily student visits to operations center during the campaign, >500 students

Some VOCALS Science Highlights

1. Importance of clouds in climate change - the number one problem with our understanding how much the earth will warm in response to increasing greenhouse gases
   - Leverages existing climate section and CMMAP effort
2. Understanding how tiny aerosol particles can influence the coverage of clouds
   - Leverages MILAGRO and CMMAP efforts
3. Importance of oceanic upwelling to coastal fisheries, especially in Chile and Peru
   - Leverages existing content on the site on oceans

7 June 2007
IV Congreso Iberoamericano de Educared
Santiago, Chile

1000 Chilean teachers in attendance, many of whom have signed up for our newsletter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Subscribers by Country
Mexico
Peru
Puerto Rico
Argentina
Colombia
Chile
Espana
Venezuela
Guatemala
Uruguay
Ecuador
Bolivia
Brazil
Honduras
Panama
Costa Rica
El Salvador
Dominican Republic
Nicaragua
Cuba
Paraguay

Steps Forward

- Decide what level of effort desired for VOCALS education and outreach
- Decide what scientists involved in VOCALS would like to be involved
- Depending on level of effort and elements of educational program, submit proposal(s?) to fund effort – discussions with NSF
- Work should begin 6-9 months before campaign begins to have materials ready in time (to avoid MILAGRO “crunch mode”)

For more information

- Contact Roberta Johnson at rmjohnsn@ucar.edu