



AIRS Outreach

Science Team Meeting Oct 2008 - Sharon Ray



*AMS New Orleans
Climate Day Los Angeles
JPL Open House*



The New AIRS Web Site

Launched 9/29/08

Check out the new AIRS web site at airs.jpl.nasa.gov



The screenshot shows the AIRS web site interface. At the top, there is a NASA logo and the text "Jet Propulsion Laboratory California Institute of Technology". Below this is a navigation bar with links for "JPL HOME", "EARTH", "SOLAR SYSTEM", "STARS & GALAXIES", and "SCIENCE & TECHNOLOGY". The main content area is divided into several sections:

- Left Sidebar:** Contains a vertical menu with links for "Home", "Overview", "Science", "Technology", "Data Products", "Multimedia", "Documents", and "Directory". There is also a search box and a "Ask AIRS" section.
- Top Right:** A "Weather and Climate from Space" banner with the text "Atmospheric Infrared Sounder".
- Center:** A "Press Release: New Maps of CO2" section featuring a large globe showing CO2 distribution and transport. Below the globe are "Maps in Motion" tabs for "Water Vapor", "Carbon Monoxide", and "Temperature". A large map shows "AIRS: 2008.06.01" with "AIRS daily water vapor at 500 mb - (18,000 ft / 5.5 km altitude)".
- Right Side:** A "HEADLINES" section with three news items, each with a small thumbnail image. Below this is a "Satellite Feed" section with a "Satellite Feed" link and a "Larger Map" link.
- Bottom:** A footer with the "USA.GOV" logo, navigation links for "DATA USERS NEWS", "OUTREACH", "FOR PRESS", "PRIVACY", and "CONTACT", and contact information for the Site Manager (Sharon Ray) and Webmaster (Ying Mei Chen).



Jet Propulsion Laboratory
California Institute of Technology

The New AIRS Web Site



News, data, animations, information — The Atmospheric Infrared Sounder on NASA's Aqua satellite is making a difference in the science of Earth's weather and climate

“The AIRS instrument has provided the most significant increase in forecast improvement in this time range of any other single instrument.”

- Vice Admiral Conrad C. Lautenbacher, US Navy (Ret.), NOAA Administrator

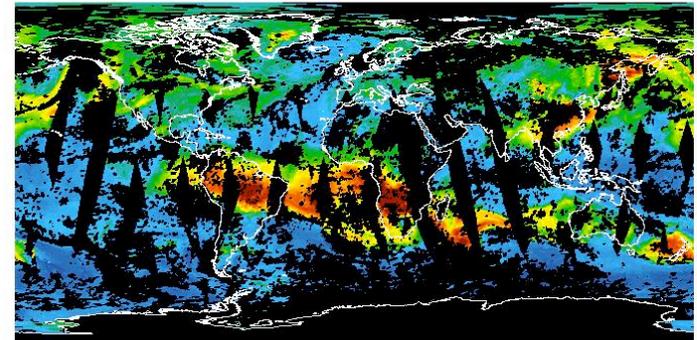
“The [weather] forecast improvement accomplishment alone makes the AIRS project well worth the American taxpayers investment”

- Dr. Mary Cleave, associate administrator of NASA's Science Mission Directorate

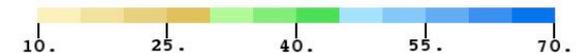
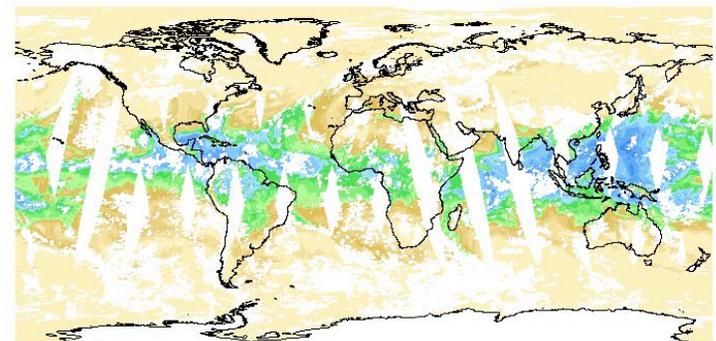
The New AIRS Web Site

- Serving the Public & the Science Communities
 - Overviews, Stories, Maps, Rapid Reponse, Multimedia
 - Major Findings, Papers, Extensive Data Information, AskAIRS, FAQ
- New Organization
 - Easy access
 - Get imagery the way you want it. Organized by: geophysical data product, natural hazard, visualizations, animations, video
- New Look
 - Lots of visuals with links to NASA databases
- New Features
 - **Maps In Motion:** archive of the “pretty version” of 10 data products from the beginning of the mission
 - **Maps from Satellite Feed coming soon:** daily images of 6 data products. Image is zeroed out at night, builds up during the day as granules come in
 - Science News
 - FAQ
 - Publications Database
- Efficient Image Archive Strategy
- Fast updates
 - iWeb development environment

AIRS CO AT 505mb (ppbv) 20081010



AIRS TOTAL PRECIPITABLE WATER VAPOR (millimeters) 20081010



The New AIRS Web Site

More content please

- Papers
 - Publications Database
 - possible web feature (home page headline)
- Feature stories
 - Home page headline
 - Could feed to the Global Climate Change web site
- Science News
 - informal, to highlight an image, field campaign, anything
 - latest papers
- Video
 - build up our scientist interviews gallery
- Multimedia Gallery
 - add your image/movie/plot

Teasing out Carbon Dioxide From Earth's Atmosphere: An interview with Cyril Crevoisier

Cyril Crevoisier of France's National Center for Scientific Research talks about the challenges of retrieving atmospheric CO2 and his effort to find its sources and sinks

My name is Cyril Crevoisier. I was formerly a Ph.D. student in Paris at the [Laboratoire de Météorologie Dynamique](#), working with Alan Chedin, and we were working on CO2 retrievals from AIRS observations. Since October 2004 I've been doing a post-doc at Princeton University, estimating carbon sources and sinks at Earth's surface.

I'm now working with Alan Chedin and Noelle Scott of the [Laboratoire de Météorologie Dynamique](#). They have been involved in using satellite observations for about 20 or 30 years now and so have very good knowledge of all these instruments. They began looking at TOVS [data for] observations of CO2. The TOVS instruments were first launched in 1972 and are still operating now, but they have very small spectral resolution which means we cannot really extract all the information about different species – CO2, methane, etc. Whereas with AIRS, the spectral resolution has really increased so we have a lot more information about CO2.



Dr. Cyril Crevoisier

Cyril Corvouisier
 Andrew Dessler
 Larrabee Strow
 Mitch Goldberg
 Walter Wolff

David Neilan
 Chris Barnett
 Mous Chahine
 Andrew Gettleman
 Laura Pan

Global Climate Change Web Site

Launched June 15, 2008

- 1.2 million hits/99,000 page views in first two weeks
- Already a top 10 Google search result for 'Global Climate Change'
- Earth Vital Signs Widget: Number 9 out of over 3,700 widgets on Apple.com
- Solid following on Twitter

A Focus on Visual Elements

News...key climate change indicators...interactives...
 videos...NASA's role in climate science research

GLOBAL CLIMATE CHANGE
 NASA's Eyes on the Earth

EVIDENCE
 Global change: How do we know?

For 650,000 years, atmospheric CO₂ has never been above this line... until now.

2007 current level

1950

CO₂ parts per million

YEARS before today (0 = 1980)

Source: Vostok ice core data

The Earth's climate has changed throughout history. Just in the last 650,000 years, there have been

GLOBAL CLIMATE CHANGE
 NASA's Eyes on the Earth

UNCERTAINTIES
 Unresolved questions about Earth's climate

Extreme Ultraviolet Imaging Telescope (EIT) image of a large solar filament eruption in 1997. While there is no evidence of a change trend in total solar output over the past half century, long-term changes in solar output are not well understood.

This website presents a data-rich view of climate and a discussion of how that data fits together into the scientific "current picture" of our changing climate. But there is a small detail that we don't know.

GLOBAL CLIMATE CHANGE
 NASA's Eyes on the Earth

EFFECTS
 The current and future consequences of global change

Global climate change has already had observable effects on the environment. Glaciers have shrunk, ice on rivers and lakes is breaking up earlier, plant and animal ranges have shifted and trees are flowering sooner.

Effects that scientists had predicted in the past would result from global climate change are now occurring: loss of sea ice, accelerated sea level rise and longer, more intense heat waves.

Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by humans. The Intergovernmental Panel on Climate Change (IPCC), which includes more than

"Taken as a whole, the range of published evidence indicates that this

So, the Earth's average temperature has increased about 1 degree Fahrenheit during the 20th century. What's the big deal?

One degree may sound like a small amount, but it's an

SEA LEVEL VIEWER

Large El Niño
 November 1997

Large El Niño
 November 1997

The extra-large El Niño of 1997 and 1998 was the most intense in over a century. It played havoc with normal climate patterns, triggering forest fires, floods, and disruption to fisheries and agriculture.

OVERVIEW | MISSIONS

GLOBAL CLIMATE CHANGE
 NASA's Eyes on the Earth

KEY INDICATORS

Sea Level Last updated 05/16/08

HISTORICAL DATA: 1880-1990
 RATE OF CHANGE: +2 mm per year (estimated)

LATEST DATA: 1993-PRESENT
 RATE OF CHANGE: +3.4 mm per year (estimated)

Current sea level data furnished by Jason-1

The chart on the left shows historical sea level data derived from 23 tide-gauge measurements. The chart on the right shows the average sea level since 1993 derived from global satellite measurements, updated here monthly. Sea level rise is associated with the thermal expansion of

GLOBAL CLIMATE CHANGE
 NASA's Eyes on the Earth

CAUSES
 The greenhouse effect

Light and heat travel from the sun to the Earth. Much of it reflects off of the surface of the planet and back into outer space.

Some of the heat is absorbed by gases in the atmosphere, like carbon dioxide. This warms the surface of the Earth.

Most scientists agree the main cause of the current global warming trend is human expansion of the "greenhouse effect" - warming that results when the atmosphere traps heat radiating from Earth.

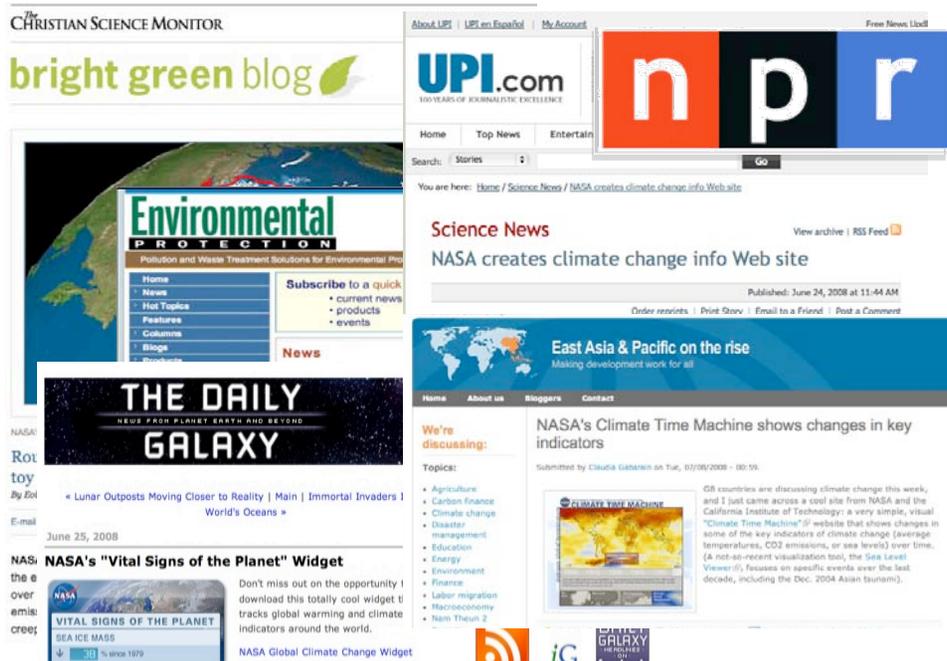
We live in a greenhouse.



Strong Reviews from Media, Web Pundits, and Users

Dozens of articles; 300+ blog postings

Reaching into the Web 2.0 World



I plan to have it a classroom staple.
–J.R.Waring, Earth science teacher

The "Climate Time Machine".... will knock your socks off.
–Greg Laden, Science and Engineers for America

Target Outlets

- The Web
 - AIRS, Global Climate Change, JPL Home, Earth Observatory, NASA Home, NASA Earth
 - Discovery EarthLive, Google Earth
 - Wikipedia
- Print
 - Weatherwise
- Radio
- Broadcast
 - Event-driven visualizations for News outlets
 - CO visualization on KNBC
 - AIRS hurricane image on Fox News





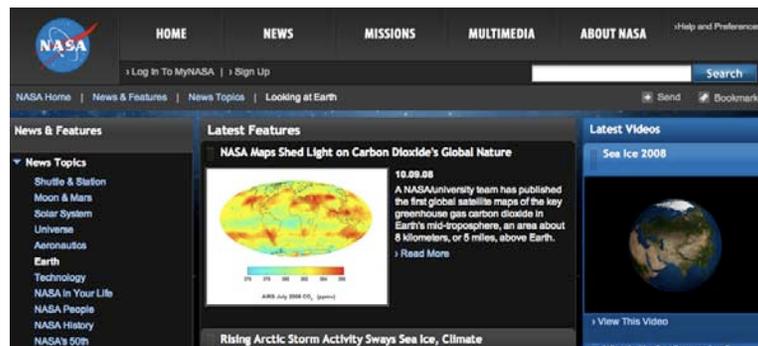
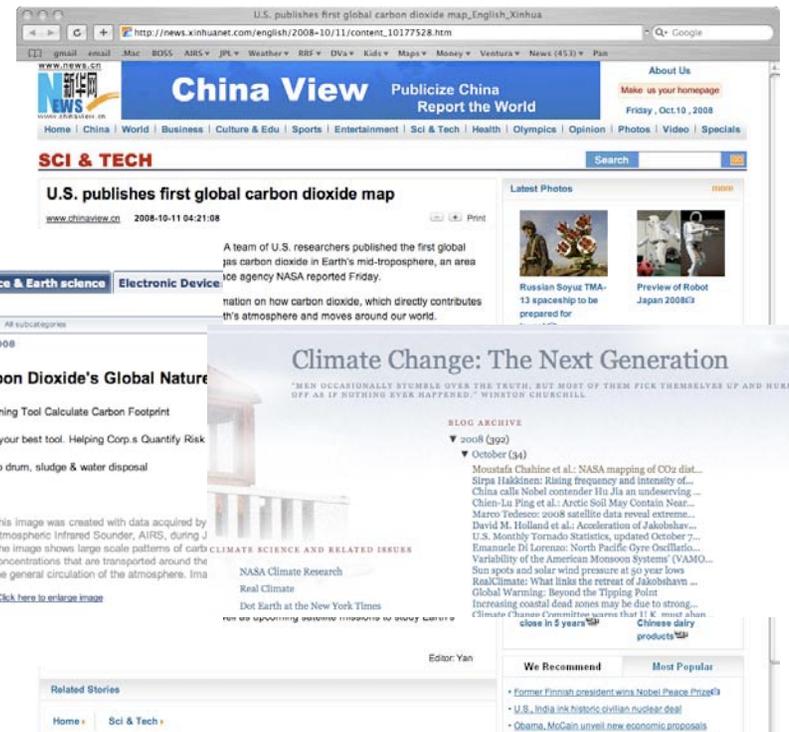
News Release: NASA Maps Shed Insights Into Its Global Nature

• Issued October 9

Chahine, M. T., L. Chen, P. Dimotakis, X. Jiang, Q. Li, E. T. Olsen, T. Pagano, J. Randerson, and Y. L. Yung (2008), **Satellite remote sounding of mid-tropospheric CO₂**, Geophys. Res. Lett., 35, L17807, <http://dx.doi.org/10.1029/2008GL035022> 9 September 2008

October 09, 2008 PASADENA, Calif.

- A NASA/university team has published the first global satellite maps of the key greenhouse gas carbon dioxide in Earth's mid-troposphere, an area about 8 kilometers, or 5 miles, above Earth. The team's study reveals new information on how carbon dioxide, which directly contributes to climate change, is distributed in Earth's atmosphere and moves around our world.



New Details on Carbon Dioxide's Global Nature

PASADENA, Calif. - A NASA team has published the first global satellite maps of the key greenhouse gas carbon dioxide in Earth's mid-troposphere, an area about 8 kilometers, or 5 miles, above Earth. The team's study reveals new information on how carbon dioxide,...

[READ FULL ARTICLE](#)

Quotes

...track," he said. **"No place on Earth is immune from its influence. It will take many independent measurements, including AIRS, to coax this culprit out of hiding and track its progress from creation to storage."**The new maps reveal...

...atmosphere. **"These data capture global variations in the distribution of carbon dioxide over time"**Chahine said...

...Chahine said. **"These variations are not represented in the four chemistry-transport models used to determine where carbon dioxide is created and stored."**Chahine said the AIRS...



Jet Propulsion Laboratory
California Institute of Technology

Web Stats

September 2008

3,644 visits came from 105 countries/territories

Detail Level: [City](#) | [Country/Territory](#) | [Sub-Continent Region](#) | [Continent](#) Dimension: [None](#)

Site Usage		Goal Conversion	
Visits	3,644	Pages/Visit	3.20
% of Site Total:	100.00%	Site Avg:	3.20 (0.00%)
Avg. Time on Site	00:00:00	Site Avg	

Detail Level: Country/Territory	
1. United States	3,644 Visits
2. United Kingdom	2,975 Absolute Unique Visitors
3. Japan	11,668 Pageviews
4. Canada	3.20 Average Pageviews
5. India	00:02:22 Time on Site
6. Germany	52.09% Bounce Rate
7. Australia	78.13% New Visits
8. France	
9. China	
10. Mexico	

Page	Visits
1. /	3,644
2. /Data/	
3. /Data/DailyMaps/	
4. /News/Events/	
5. /Products/	
6. /WeatherSnapshots/HurricaneGustav/	
7. /Data/GetAIRSdata/	
8. /Science/	
9. /Products/CarbonDioxide/	
10. /Mission/	

Source/Medium	Pages
1. google / organic	3.20
2. (direct) / (none)	
3. yahoo / organic	
4. search.nasa.gov / referral	
5. climate.jpl.nasa.gov / referral	
6. search.jpl.nasa.gov:8080 / referral	
7. photojournal.jpl.nasa.gov / referral	
8. jpl.nasa.gov / referral	
9. images.google.com / referral	
10. nasa.gov / referral	

October 1-12, 2008

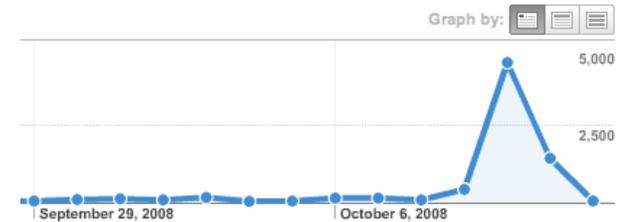
Visits
7,672
% of Site Total: 100.00%

Detail Level: Country/Territory	
1. Italy	
2. United States	
3. United Kingdom	
4. Germany	
5. France	
6. Canada	
7. Switzerland	
8. Spain	
9. Japan	
10. Netherlands	

Page	Visits
1. /story_archive/Measuring_CO2_from_Space/	
2. /	
3. /meetings/science-team-greenbelt/	
4. /maps/maps_in_motion/	
5. /overview/overview/	
6. /science/news/	
7. /multimedia/geophysical_products_multimedia/carbon_dioxide/	
8. /data_products/data_product_descriptions/	
9. /story_archive/Measuring_CO2_from_Space/Measurement_to_Science/	
10. /multimedia/geophysical_products_multimedia/	

• News Release Issued October 9

Sep 1, 2008 - Oct 12, 2008



7,672 Visits

7,122 Absolute Unique Visitors

14,067 Pageviews

1.83 Average Pageviews

00:01:11 Time on Site

72.73% Bounce Rate

90.92% New Visits

Sources

corriere.it (referral)
(direct) ((none))
google (organic)
climate.jpl.nasa.gov (referral)
nasa.gov (referral)



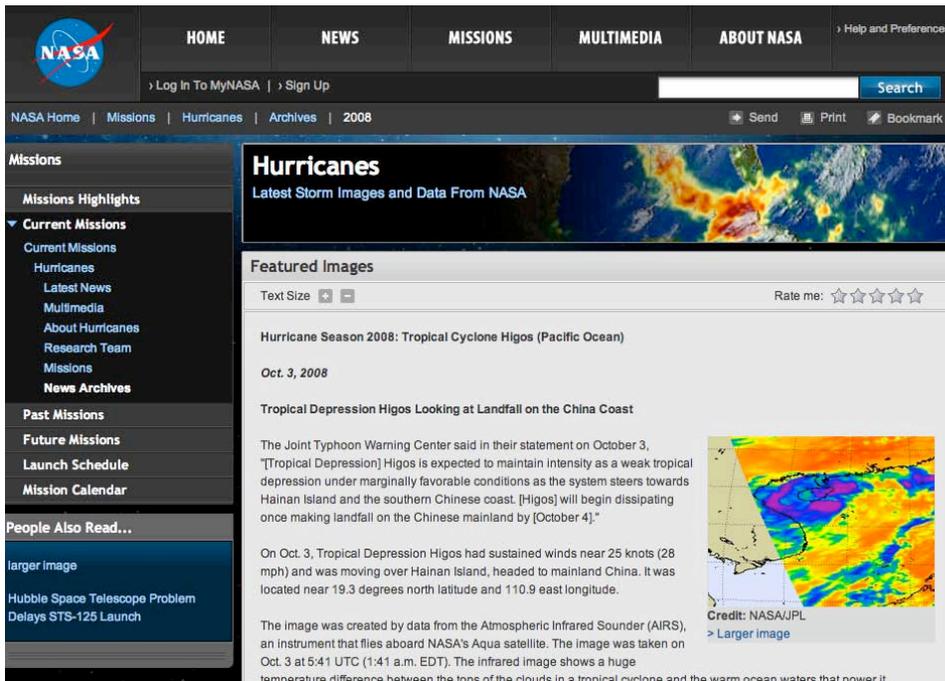
Web Stats

As of October 12

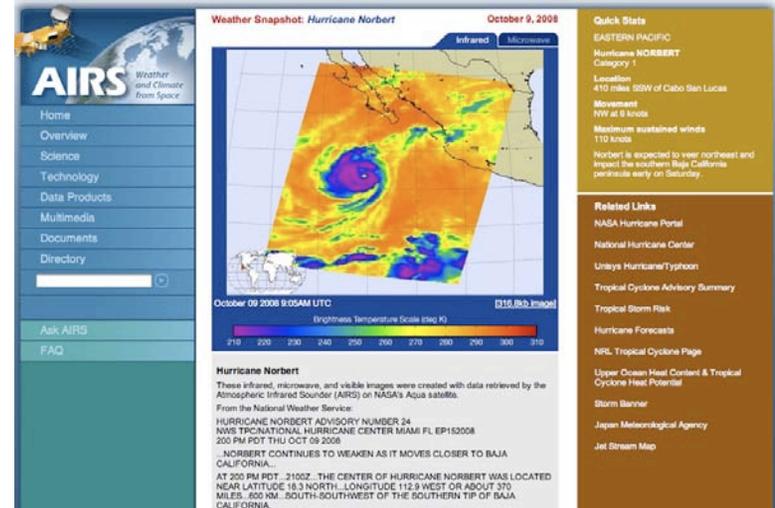
- Google Search Terms
 - carbon dioxide: 19th
 - carbon dioxide map: 4th; 3 of the first 10
 - carbon dioxide map - images: 7th, 9th of 449k results
- Yahoo Search Terms
 - carbon dioxide: -
 - carbon dioxide map: 3rd, 4th of 16.5 million results
 - carbon dioxide map - images: 24th of 504 results
- Cited on 184 blogs

Hurricane Rapid Response

- AIRS supplied 41 of the 60 images used by the NASA Hurricane portal so far during the 2008 Hurricane Season
- NASA Hurricane Page - almost half a million visitors in September
 - The NASA Hurricane page pulled in 495,979 hits in the month of September (per Rob Garner, NASA Goddard web master)



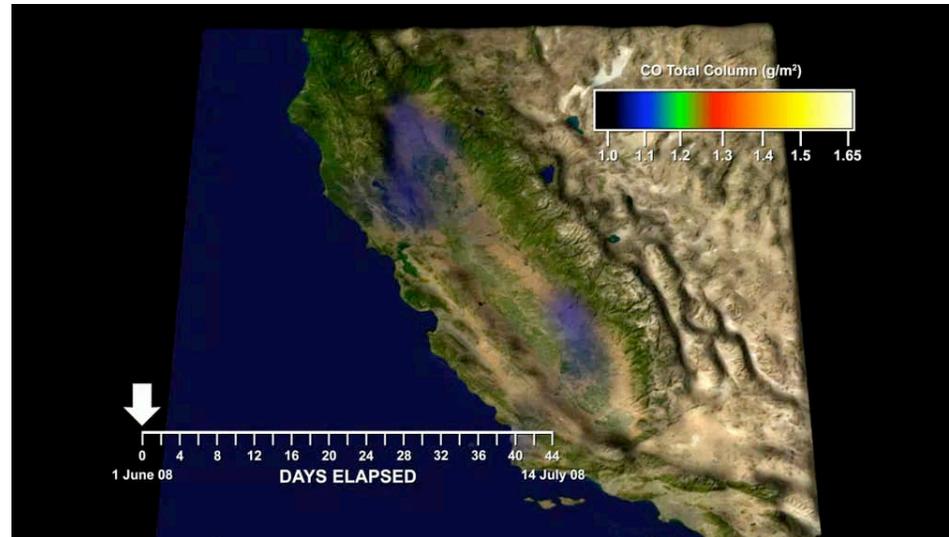
The screenshot shows the NASA Hurricane portal homepage. At the top, there is a navigation bar with links for HOME, NEWS, MISSIONS, MULTIMEDIA, and ABOUT NASA. Below this is a search bar and a secondary navigation bar with links for NASA Home, Missions, Hurricanes, Archives, and 2008. The main content area is titled "Hurricanes" and features a large satellite image of a tropical cyclone. Below the image, there is a "Featured Images" section with a sub-heading "Hurricane Season 2008: Tropical Cyclone Higos (Pacific Ocean)" and a date of "Oct. 3, 2008". The text describes Tropical Depression Higos looking at landfall on the China coast. A smaller satellite image of Higos is shown to the right of the text. The page also includes a sidebar with "Missions" and "Current Missions" sections, and a "People Also Read..." section at the bottom.



The screenshot shows the AIRS Weather Snapshot for Hurricane Norbert on October 9, 2008. The main feature is a satellite image of the hurricane's eye and surrounding cloud structure, with a color scale for brightness temperature ranging from 210 to 310 Kelvin. The image is titled "Weather Snapshot: Hurricane Norbert" and includes a date of "October 9, 2008". To the right of the image, there is a "Quick Stats" section with the following information:

- EASTERN PACIFIC**
- Hurricane NORBERT**
- Category 1
- Location: 410 miles SSW of Cabo San Lucas
- Movement: NW at 8 knots
- Maximum sustained winds: 110 knots
- Norbert is expected to veer northeast and impact the southern Baja California peninsula early on Saturday.

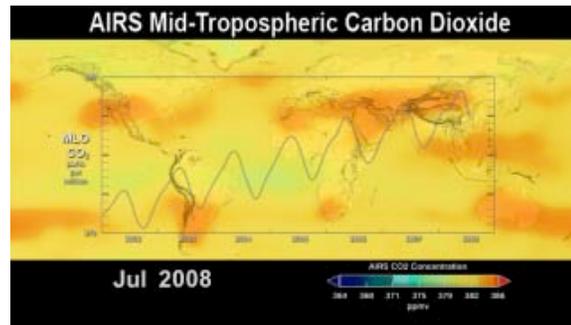
Below the quick stats, there is a "Related Links" section with links to the NASA Hurricane Portal, National Hurricane Center, Unisys Hurricane/Typhoon, Tropical Cyclone Advisory Summary, Tropical Storm Risk, Hurricane Forecasts, and NRL Tropical Cyclone Page. At the bottom, there is a "Storm Banner" and a "Japan Meteorological Agency" link.



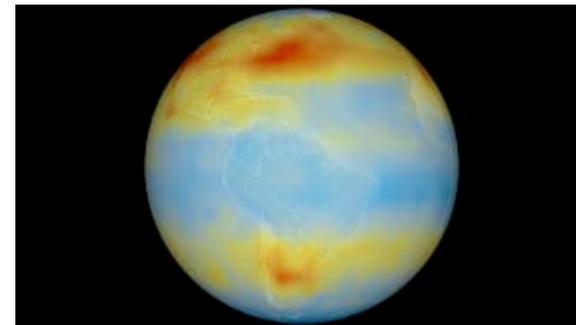
Carbon Monoxide from California's Wildfires

Visualization of the rapid increases in carbon monoxide (CO) emitted by fires burning in California in June and July 2008. Only the largest values of CO detected by AIRS are shown to highlight the impact of the fires. AIRS primarily observes CO in a layer from 2 to 7 kilometers above Earth's surface. Thus, it tends to see where the wind blows the carbon monoxide and not just the smoke directly above the fires. However, many of these intense fires lofted a significant amount of carbon monoxide directly above the fires, making the hotspots also visible to AIRS.

New Visualization



CO2 with Mauna Loa Data Overlaid

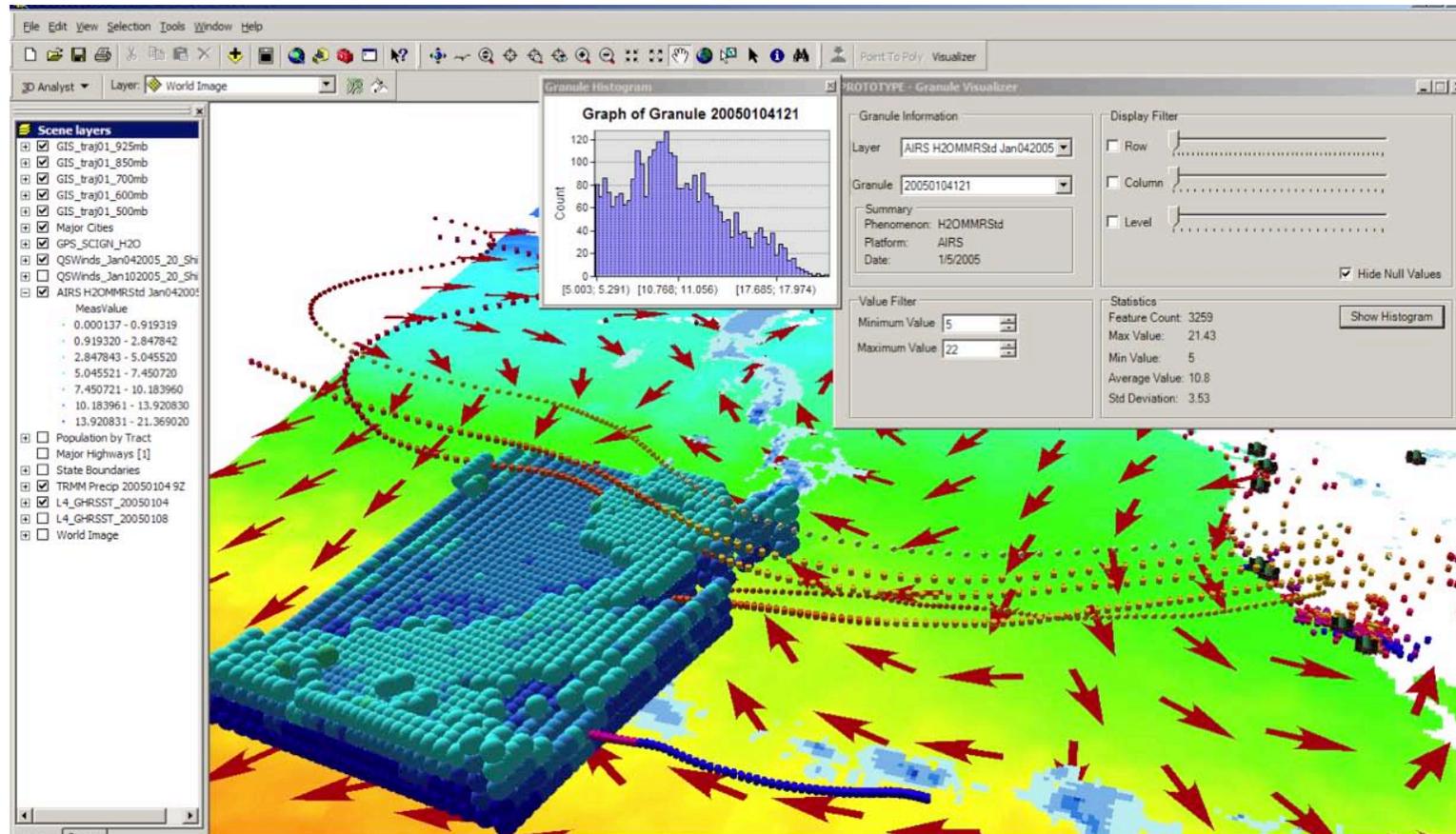


AIRS Sees Belt of CO2 in Southern Hemisphere, July 2003

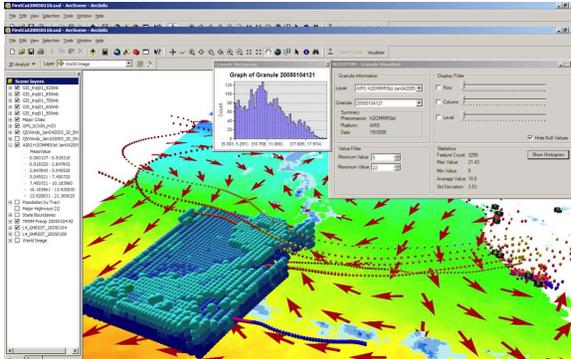
- Created by Lori Perkins, GSFC SVS



New Visualization



Three-Dimensional View Of Water Vapor Transport Along A Pacific Basin Atmospheric River, January 4, 2005



Three-Dimensional View Of Water Vapor Transport Along A Pacific Basin Atmospheric River, January 4, 2005

The development of a plug-in prototype GIS tool had, as a science driver, a case study examining the role of water vapor transport along an atmospheric river across the Pacific Basin in January 2005. During this time period an extreme precipitation event was produced. This event caused significant amounts of rain to fall over much of California, triggering mudslides that resulted in millions of dollars of damage and a dozen deaths.

The study characterized the three-dimensional distribution of water vapor during the event and related surface winds and height-resolved water vapor to coastal rainfall. Measurements were supplied by a host of spaceborne instruments and one ground-based instruments. These measurements consisted of: water vapor from the AIRS instrument, surface winds from QuikSCAT, precipitation from TRMM, sea surface temperature from GHRSSST, and integrated water vapor from SCIGN ground-based GPS. Back-in-time trajectories were provided by HYSPLIT.

In this figure, a granule of AIRS water vapor data was subsetted to show the points with highest values of water vapor in the northeastern Pacific. These measurements are shown as a point cloud superimposed on a background of GHRSSST sea surface temperatures, TRMM precipitation, and QuikSCAT wind vectors.

To the right of the image, water vapor amounts from the SCIGN GPS network are shown color-coded by absolute magnitude for various stations. Back trajectories from the NOAA HYSPLIT model are shown as dotted lines, indicating the relationship between the atmospheric water vapor over the Pacific and water vapor over land. A histogram of the AIRS data values is also shown in the top center of the image.



Carbon Markets Insights Conference



“Point Carbon is a world-leading provider of independent news, analysis and consulting services for European and global power, gas and carbon markets.”

“...the number one supplier of unrivaled market intelligence of these markets.”

“Our staff includes experts in international and regional climate policy, mathematical and economic modeling, forecasting methodologies, risk management and market reporting.”

- **New Audience**
 - Congressional staffers, venture capitalists, policy makers
- **Objective**
 - Convey that JPL is a leader in the remote sensing of CO₂
 - unbiased, global data that is free
 - introduce existing data (AIRS) and new missions (OCO & Ascends)
- **AIRS & OCO presence, booth**
 - Staffed by Tom Pagano & Sharon Ray (AIRS), Stacey Boland OCO

Book: Atmospheric Science at NASA - A History

- **Chronicles the history of atmospheric science at NASA**

-traces the story from its beginnings in 1958, the International Geophysical Year, through to the present, focusing on NASA's programs and research in meteorology, stratospheric ozone depletion, and planetary climates and global warming. But the story is not only a scientific one.

- NASA's researchers operated within an often politically contentious environment. Although environmental issues garnered strong public and political support in the 1970s, the following decades saw increased opposition to environmentalism as a threat to free market capitalism.

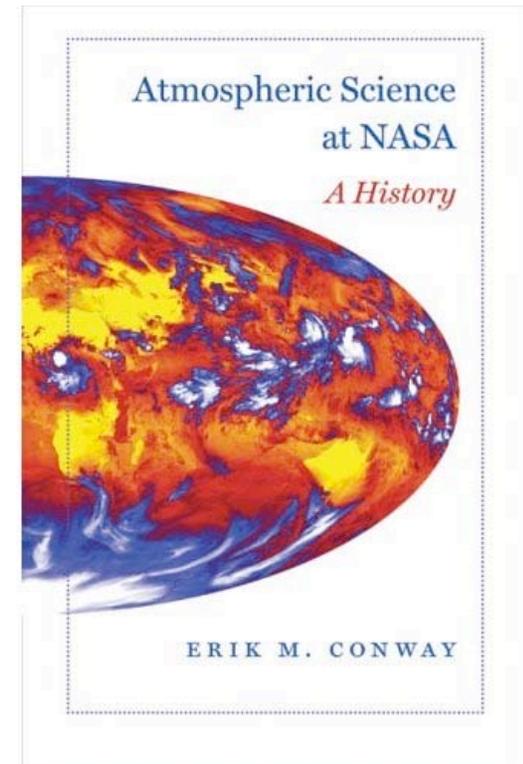
- **Critically examines this politically controversial science**

- Dissects the often convoluted roles, motives, and relationships of the various institutional actors involved -- among them NASA, congressional appropriation committees, government weather and climate bureaus, and the military.

"The author does an excellent job of telling this story -- translating the science into prose, characterizing the various personalities and institutions, organizing the convoluted tale into a narrative, and assessing interactions of multifarious factors. The work... will stand as a significant contribution to the literature. Much of the story has not yet been told, or if it has, certainly not in this detail or scope. It is likely to rank high in the top score or so of books

devoted to the history of space science."

-- *Joseph N. Tatarewicz, University of Maryland, Baltimore County*



Johns Hopkins University Press
http://www.press.jhu.edu/books/title_pages/9567.html