2006 Calendar

Reaching Out to Those with an Interest in Atmospheric Processes

IMPROVE

Interagency Monitoring of Protected Visual Environments

CIRA

Cooperative Institute for Research in the Atmosphere

Colorado State University

Knowledge to Go Places

IMPROVE
Interagency Monitoring of Protected Visual Environments

The IMPROVE Program

The Interagency Monitoring of Protected Visual Environments (IMPROVE) program is a cooperative air quality monitoring effort between federal land managers; regional, state, and tribal air agencies; and the Environmental Protection Agency. The IMPROVE monitoring program was established in 1985 to aid in the implementation of the 1977 Clean Air Act goal of preventing future and remedying existing visibility impairment in 156 Class I areas (national parks, wilderness areas, and wildlife refuges). The network began operating in 1988 and currently consists of 175 monitoring sites. The data collected are critical for the implementation of our national goal to reduce regional haze in Class I areas by establishing the current visibility conditions, tracking the progress toward attaining the goal, and identifying the chemical species and emission sources responsible for existing visibility impairment.

Because the pollutants that lead to regional haze can originate from sources located across broad geographic areas, EPA has encouraged the states and tribes across the U.S. to address visibility impairment from a regional perspective. Today, EPA funds five regional planning organizations (RPOs) to address regional haze and related issues. The RPOs evaluate how state and tribal emissions impact Class I areas across the nation and pursue the development of regional strategies to reduce emissions of particulate matter and other pollutants leading to regional haze.

Western Regional Air Partnership (WRAP) - http://www.wrapair.org/. WRAP is the successor organization to the Grand Canyon Visibility Transport Commission, which was formed in 1991 to study regional haze impacting 16 Class I areas on the Colorado Plateau. Nine WRAP states are now implementing many of the Commission's recommendations within the framework of the national Regional Haze Rule.

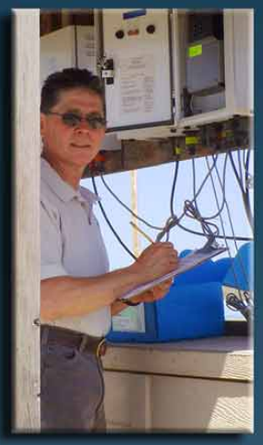
Central Regional Air Planning Association (CENRAP) - http://www.cenrap.org/. Affiliated with the Central States Air Resource Agencies (CenSARA).

Midwest Regional Planning Organization (MRPO) - http://www.ladco.org/about.html. Affiliated with the Lake Michigan Air Directors Consortium (LADCO).

Mid-Atlantic/Northeast Visibility Union (MANE-VU) - http://www.manevu.org/. The Northeast States for Coordinated Air Use Management (NESCAUM) and Mid-Atlantic Regional Air Management Association (MARAMA) are working in cooperation on regional haze issues.

The Visibility Improvement State and Tribal Association of the Southeast (VISTAS) - http://www.vistas-sesarm.org/. VISTAS was established to initiate and coordinate activities associated with the management of regional haze and visibility in the southeastern United States.

Bitterlake National Wildlife Refuge (Salt Creek), New Mexico



In addition to being the IMPROVE operator at the Salt Creek Wilderness site, Richard Gonzalez maintains all buildings and facilities at Bitter Lake NWR, including trails, overlooks, boundary fences, gates, as well as vehicles, tools, and equipment. Richard says there are so many different projects going on, there is no such a thing as the same old routine; he learns something new everyday. In his estimation, the most important part of his job at Bitter Lake is the conservation and preservation of this refuge for future generations. The opportunity to meet and talk with people from all over the world is also a great benefit.

After graduating from Roswell High School in 1970, Richard joined the U.S. Army, serving three years, including an 18-month assignment in Okinawa, Japan. He returned to civil service, working as an aircraft firefighter at Holloman Air Force Base for three years, then joined the City of Roswell Fire Department. Richard retired from the fire department in Jan. 1998 with 21 years of service as a company officer. Unable to stay retired, he jumped into a new job as a maintenance worker for the Fish & Wildlife Service in Feb. 1998!

Richard has been married to high school sweetheart, Lydia, for 31 years. The Gonzalez's have raised two children and are busy with two young grandchildren, Gabrielle, 5, and Xavier Anthony, 3. Both enjoy time with family and friends, are active in church functions, and are always willing to lend a helping hand to those less fortunate. Richard finds time to hunt and fish, go on family vacations, and take long walks with his wife Lydia and short walks with their Chinese pug, Sydney.

Located where the Chihuahua Desert meets the southern plains in southern New Mexico, Bitter Lake National Wildlife Refuge is one of the more biologically significant wetland areas of the Pecos River watershed system. There are sinkholes, natural springs, and an abundance of wildlife. The air is normally very clear and Capitan Mountain, 86 miles to the west, is almost always visible from the monitoring site. Dust storms are common in the spring when high winds stir the soils and pick up fine dust from the numerous dirt roads crossing the empty land.

January

"I shall be telling this with a sigh -- somewhere ages and ages hence; two roads diverged in a wood, and I, I took the one less traveled by, and that has made all the difference."

- Robert Frost, poet

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 *1 Julian day* National Environmental Policy Act, 1969 New Year's Day	**2** *2* IMPROVE particle sampling day	**3** *3* Change IMPROVE particle cartridges.	**4** *4*	**5** *5* IMPROVE particle sampling day	**6** *6*	**7** *7*
8 *8* IMPROVE particle sampling day	**9** *9*	**10** *10* Change IMPROVE particle cartridges.	**11** *11* IMPROVE particle sampling day	**12** *12*	**13** *13*	**14** *14* IMPROVE particle sampling day
15 *15*	**16** *16* Martin Luther King, Jr.	**17** *17* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**18** *18*	**19** *19*	**20** *20* IMPROVE particle sampling day	**21** *21*
22 *22*	**23** *23* IMPROVE particle sampling day	**24** *24* Change IMPROVE particle cartridges.	**25** *25*	**26** *26* IMPROVE particle sampling day	**27** *27*	**28** *28*
29 *29* IMPROVE particle sampling day	**30** *30*	**31** *31* Change IMPROVE particle cartridges.				

Dec 2005

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Feb 2006

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UC-Davis: *Sampler*:
General Lab
(530) 752-1123

ARS: *Optical*:
Carter Blandford or
Karen Rosener
Photography:
Karen Fischer
(970) 484-7941

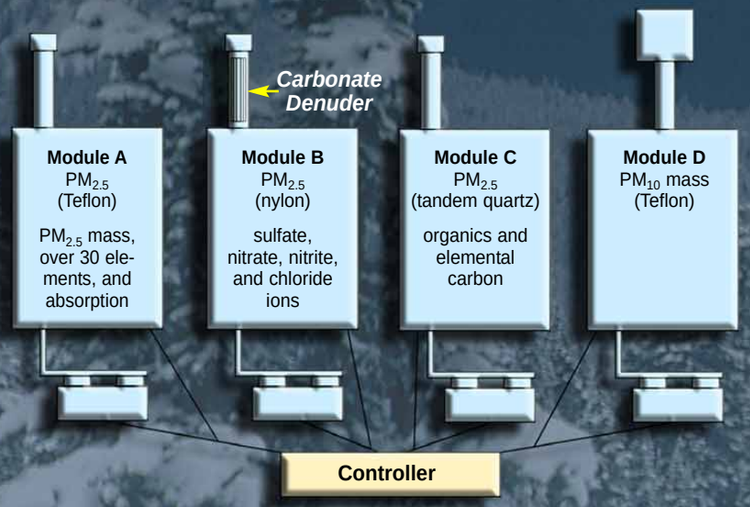
"Operator Involvement -- The Key to Network Success"

IMPROVE
Interagency Monitoring of Protected Visual Environments

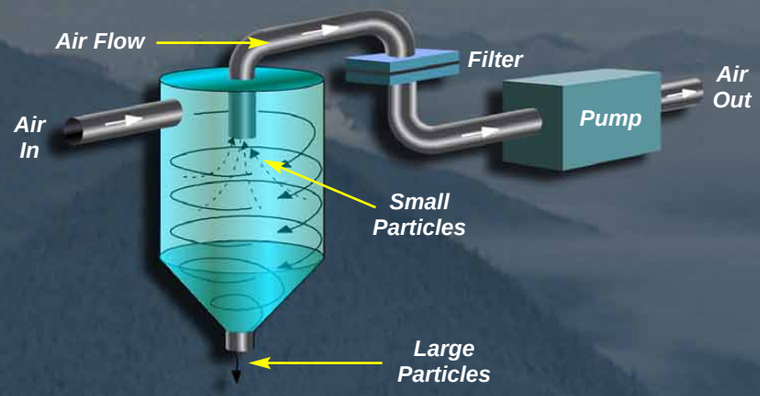
The Aerosol Sampler

Aerosol Monitoring

All IMPROVE program sites conduct aerosol monitoring. Aerosol samples give information about the type of particles that affect visibility. Through sample analysis, particle size, chemical composition and concentration are characterized. Particle measurements, in conjunction with optical measurements, allow estimation of the sources of visibility-reducing aerosols and causes of impairment.



The standard IMPROVE particulate sampler has four sampling modules. Modules A, B, and C collect fine particles (2.5 microns and smaller ($PM_{2.5}$)), while Module D collects larger particles. Fine particles have the greatest impact on visibility, can adversely affect human health, and are often the result of human activities. Module D collects particles 10 microns and smaller (PM_{10}). The coarse mass (particles larger than 2.5 microns) is primarily composed of soil and carbonaceous material and is often of natural origins. IMPROVE aerosol data are used for assessing the contribution of various sources to haze. In addition, these data are the basis for tracking progress related to the Regional Haze Regulations.



The IMPROVE fine particle modules employ a cyclone at the air inlet which spins the air within a chamber. Fine particles are lifted into the air stream where they will be siphoned off and collected on a filter substrate for later analysis. The large particles impact on the sides of the chamber and fall into a collection cup at the bottom.

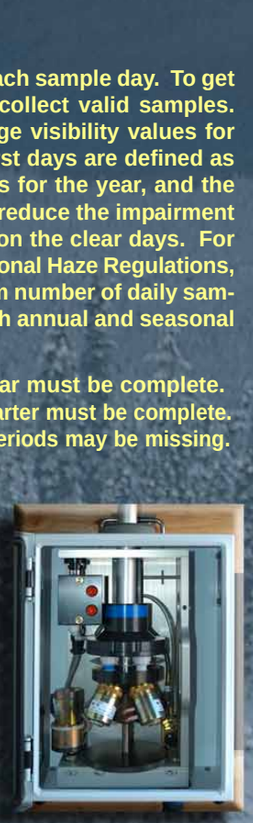
VALID MEASUREMENTS

A visibility impairment value is calculated for each sample day. To get a valid measurement, all four modules must collect valid samples. The Regional Haze Regulations use the average visibility values for the clearest days and the worst days. The worst days are defined as those with the upper 20% of impairment values for the year, and the clearest days as the lower 20%. The goal is to reduce the impairment of the worst days and to maintain or reduce it on the clear days. For your site's data to be considered under the Regional Haze Regulations, criteria have been set to determine the minimum number of daily samples needed to have a valid year. There are both annual and seasonal criteria. The criteria are:

- 75% of the possible samples for the year must be complete.
- 50% of the possible samples for each quarter must be complete.
- No more than 10 consecutive sampling periods may be missing.

The IMPROVE network operates on the one-day-in-three protocol. Sample change is always on Tuesday. (Arrangement of ambient filters varies each week; pattern repeats every third week.)

For two of the three weeks, the sampler will not be operating on the sample-changing day. The operator records final readings, replaces old cartridges, and records the initial readings. There will be initial or final readings for the filter in position 3 for two of the three weeks. The log sheet and display indicate when values for position 3 are recorded.



Every 3rd week, the sampler will be operating when the operator arrives. When sample change is initiated the controller will:

- Suspend sampling.
- Read flow rates on all filters and record information.
- Transfer the cassette in position 3 from the old cartridge to the new one. (New cartridges have no cassette in position 3. The position 3 cassette has a black O-ring attaching it -- the only one that can be removed without a special tool.)
- Transfer the cassette and install a new cartridge. After the initial readings are taken, the sampler will resume collection on the filters in position 3.

The field blanks in position 4 are transparent to the operator and sampler controller. Flow rate measurements are not taken for these.

If for any reason you or your backup cannot make a change on a particular Tuesday or the "blue box" is late, or for any problem or question, immediately call UCD's General Lab at (530) 752-1123. Discussing a problem first will avoid confusion, and a proper diagnosis is more likely to be made. NO problem is too small; it could be a sign of bigger problems, such as unusual readings.

The "blue box" has three dates listed on it. These are the dates (all Tuesdays) on which the filters must be installed. Each blue box contains:

1 flash memory card
3 labeled Ziploc© bags
1 bag/week labeled with install date and 4 color-coded cartridges, one for each module.

Four filter cartridges:
Red for Module A
Yellow for Module B
Green for Module C
Blue for Module D

Module A filter pack.

Caney Creek Wilderness Area, Arkansas

Dale Powell has been operating the Caney Creek IMPROVE site since it was installed in 2000. The site is scenically situated on top of Eagle Mountain in the Ouachita Mountains of western Arkansas. In spite of the rugged mountain terrain, Powell says he rarely has problems servicing the site. Occasionally in the winter months, ice and snow can make the road impassable but one can always get there on foot. For this 54-year-old operator and avid runner this is not much of an obstacle. He's run the Pikes Peak Marathon near Colorado Springs seven times, completed the 26-mile Rim to Rim hike across the Grand Canyon three times, competed in the 50-mile Palo Duro trail run in northern Texas, and finished a 100-mile run and numerous marathons along the way. Originally transplants from California, Powell and wife Joyce (now married 30 years) have three grown children and three grandchildren. When IMPROVE measurements are done, Powell settles down to work in his own graphic design and advertising business. He is also building a marketing business, helping others become more financially self-reliant as an independent marketing director of Team National with National Companies. When there is free time, it's to pick up rod and reel as this avid fisherman takes every opportunity to enjoy bass tournament fishing in the local area.

The Caney Creek region consists of rugged mountains and narrow valleys which form the headwaters of the Little Missouri River. Mountain ridges are populated with a variety of hardwoods and bushes that provide excellent fall colors. The Caney Creek site was one of seven sites added to expand monitoring in the Heartland Network area, which encompasses most of the central United States. Ten percent of the time visibility is 75-80 miles, but on really bad days it drops to just 20 miles. About 70% of the haze can be attributed to sulfates, and high relative humidity makes the problem worse.

February

"Everybody needs beauty as well as bread, places to play and pray in, where nature may heal and cheer and give strength to body and soul alike."
- John Muir

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Jan 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		Mar 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	**1** *32 Julian day* IMPROVE particle sampling day	**2** *33* Groundhog Day	**3** *34*	**4** *35* IMPROVE particle sampling day
5 *36*	**6** *37*	**7** *38* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**8** *39*	**9** *40*	**10** *41* IMPROVE particle sampling day	**11** *42*
12 *43* Lincoln's Birthday	**13** *44* IMPROVE particle sampling day	**14** *45* Valentine's Day Change IMPROVE particle cartridges.	**15** *46*	**16** *47* IMPROVE particle sampling day	**17** *48*	**18** *49*
19 *50* IMPROVE particle sampling day	**20** *51* President's Day	**21** *52* Change IMPROVE particle cartridges.	**22** *53* Washington's Birthday IMPROVE particle sampling day	**23** *54*	**24** *55*	**25** *56* IMPROVE particle sampling day
26 *57* Grand Canyon National Park established, 1919	**27** *58*	**28** *59* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.				

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Filters

Filters cycle through several processes before they reach the monitoring site and after they return to the University of California-Davis.

Pre-Shipping...

1. Clean A and D module filters are pre-weighed on a balance before shipping the blue box. Clean B and C module filters are simply placed in a cassette without being weighed. This process is called uploading.

2. The uploader weighs the A and D filters. Each filter has an ID according to the site it will be sent to and the date that the filter will be used. Each A and D filter's weight is automatically recorded in a database.

3. After the box has been uploaded, the work is double-checked. This is the final process before the box is shipped out.

After Return From the Field...

4. After the log sheets and flashcards are removed from the box, the data in the flash card is read and automatically placed into a database.

5. After the flash card is read into the database, its data is compared to the data written on the log sheets. Any problems a box might have are dealt with at this point.

6. The B and C filters are placed in a petri dish with the corresponding identification sticker.

7. The B and C petri dishes are placed in trays in a particular order generated by the database.

8. After the B and C filters are downloaded, the box moves on to the post-weighing station where the sampled A and D filters are weighed.

9. After post-weighing, the filter is stored in a pre-labeled slide mount for later analysis.

10. After downloading the B and C filters and post-weighing the A and D filters, the box is placed back at the uploading station to start the process again.

The first step in correctly diagnosing and solving any problem is to call UCD's General Lab at (530) 752-1123. No problem is too small, and a correct diagnosis is more likely to be made.

Has a filter or cartridge been dropped?

The cartridges are well protected and unless the operator is physically forcing air through the media there should be no immediate problem. Pay careful attention to any fluctuation in the normal readings on that particular set of filters. As with any significant event, note it on the log sheet and detail what occurred. Notify UCD about any questions or concerns.

What if the filter gets wet?

Although this can significantly affect the sample, UCD may or may not be able to send a replacement. Call the lab so that UCD can deal with it properly and note it on the log sheet.

Missed changing filters on the regular Tuesday?

Immediately call UCD to get instructions before proceeding with the sample change. Experienced operators should still call UCD to advise of any deviation in the sample changing schedule.

* If there are remaining sampling days in the week: **Remove the exposed filters as would normally be done, and put in the clean filters that were to have been installed on the last change day. Make a note on the log sheet.**

* If the week is completely missed: **Remove the exposed filters as would normally be done but do not put in the filters for the missed change day. Keep these in the shipping box and send them back to UCD when both weeks in that box have passed. Install the appropriate filters for the current week. Make a note on the log sheet of the filters that were not installed.**

Trouble with the "red button"-controlled motors:

Sometimes when the weather turns cold, the electric motor that raises and lowers the solenoids works very slowly. If this occurs, or if the red buttons fail to work for any reason, follow these steps:

Modules A-C:
The motor is located in the top right area.

1. Disengage motor by gently pushing down on the top of the motor.

2. "Lockout" the motor by rotating it toward the solenoids.

3. Raise and lower the solenoids by turning the handwheel at the top of the module.

Module D:
The motor is located in the bottom left area.

1. Disengage motor by gently pushing up on the bottom of the motor.

2. "Lockout" the motor by rotating it toward the solenoids.

3. Raise and lower the solenoids by turning the handwheel at the bottom of the module.

For questions or problems with:

Filter boxes and sample changes: **contact Sujan Bhattarai or Alexis Bidou at (530) 752-1123.**

Flash cards, equipment malfunctions, sampler maintenance, or flow adjustments: **contact Jose Mojica at (530) 752-9044, Joseph Carle at (530) 752-4286, Sara Djoundourian at (530) 754-8770, or Alexis Bidou at (530) 752-1123.**

Sampler audits: **Steven Ixquiac (530) 752-4108.**

You may e-mail any of the above using the format last-name@crocker.ucdavis.edu.

Craters of the Moon National Monument & Preserve, Idaho

Michael Munts wears many hats at Craters of the Moon NM&P; first and foremost he is a bioscience technician in the Natural Resources Department. With a background in wildlife biology, Mike performs duties which generally involve wildlife management activities with a wide range of work in biological and physical resources. He participated in a study to count and track various snake species, putting in considerable time and effort constructing and checking traps in addition to discovering a communal rattlesnake den! Mike is also an avid birder, lending his expertise to guided bird walks around the crater, pointing out a variety feathered residents including the beautiful Mountain Bluebird, Idaho's state bird. He also hosts an afternoon slide show about the birds of the crater. In spite of all these activities, Mike still finds time to service the air quality monitoring equipment at Craters. He has been involved with the acid deposition monitoring program for 7 years and has taken care of the IMPROVE site since it started in 2000. "Well," Mike says, "variety is one the greatest parts of this job!" Recreational activities often include hiking, camping, and a lot of nature photography.

Craters of the Moon NM&P was established to preserve parts of the Great Rift, a 13-mile-long area of volcanic cones and lava vents. Although visibility is superior here, it has declined in the last 15-20 years. On a good day, you can see mountain features 150 miles away in Montana, Wyoming, and Idaho, but about 20% of the time visibility is only 50 miles. Like many sites in the northern portions of the country, winter provides some interesting challenges for monitoring. With average snowfall over 80 inches and 50 to 70 mph winds occurring during winter storms, the shed needs to be sealed each fall to prevent drifting inside the structure. Blizzards can close the highway for multiple days during these storms.

March

"Unless someone like you cares a whole lot, nothing is going to get better. It's not."
- From Dr. Seuss' *The Lorax*

Feb 2006

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Apr 2006

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1 *60 Julian day* Yellowstone Natl. Park established, 1872	**2** *61*	**3** *62* IMPROVE particle sampling day	**4** *63*
5 *64*	**6** *65* IMPROVE particle sampling day	**7** *66* Change IMPROVE particle cartridges.	**8** *67*	**9** *68* IMPROVE particle sampling day	**10** *69*	**11** *70*
12 *71* IMPROVE particle sampling day	**13** *72*	**14** *73* Change IMPROVE particle cartridges.	**15** *74* IMPROVE particle sampling day	**16** *75*	**17** *76* St. Patrick's Day	**18** *77* IMPROVE particle sampling day
19 *78*	**20** *79* Spring begins	**21** *80* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**22** *81*	**23** *82*	**24** *83* IMPROVE particle sampling day	**25** *84*
26 *85*	**27** *86* IMPROVE particle sampling day	**28** *87* Change IMPROVE particle cartridges.	**29** *88*	**30** *89* IMPROVE particle sampling day	**31** *90*	**UC-Davis**: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941

"Operator Involvement -- The Key to Network Success"

CloudSat

CloudSat and Calipso in the "A" Train formation

CloudSat transmissions to ground stations

Data streams from ground stations

United State Air Force RTD&E Support Center

Colorado State University's Cooperative Institute for Research in the Atmosphere's Data Processing Center

Science and engineering data

Product array Web site for the science community

Product review

Product approval

Atmospheric Science / CIRA Research Center (ACRC)

CloudSat - The first vertical cloud profiling radar from space will provide new observations for weather forecasts and advance our understanding of key climatic processes. CloudSat products are built using data from both the CloudSat and Calipso satellites.

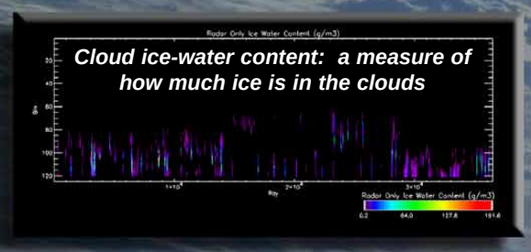
The CloudSat satellite will collect atmospheric data to:

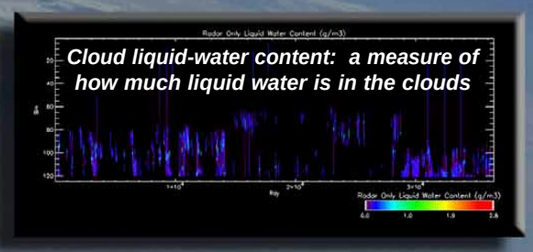
- **Discover how clouds and cloud processes are represented in global atmospheric models.**
- **Determine how the vertical distribution of cloud liquid water and ice relate to radiative heating by clouds.**
- **Improve and validate cloud and aerosol information.**
- **Improve the understanding of the effects of aerosols on clouds.**

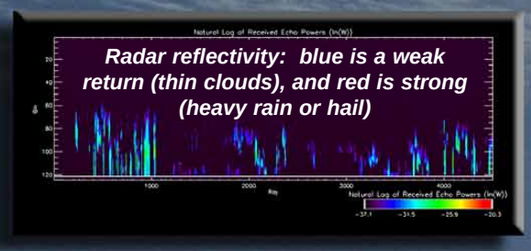
Mission Partners:

Data Processing Science Team:

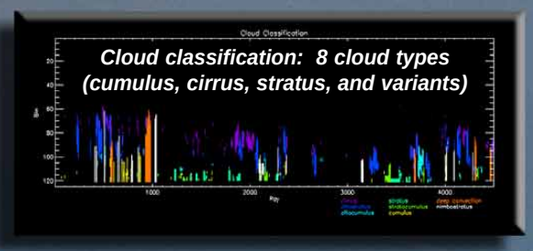
- **Colorado State University - Atmospheric Science**
- **University of Utah**
- **University of Wyoming**
- **University of Alaska**
- **University of Lille, France**
- **NASA JPL**



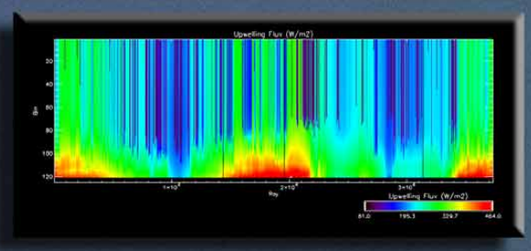


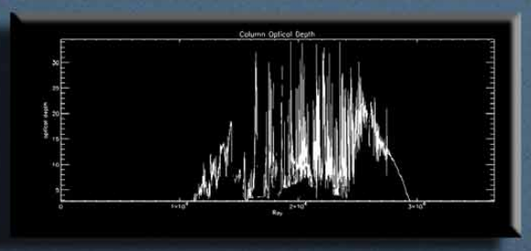


Science community



Fluxes and heating rates: a measure of how fast the tops and bottoms of each detected cloud layer are warming or cooling





Optical depth: a measure of the opaqueness or visible thickness of the clouds

Everglades National Park
Florida

April

"May all your trails be crooked, winding, lonesome, dangerous, leading to the most amazing view, where something strange and more beautiful and more full of wonder than your deepest dreams waits for you."
- Edward Abbey

Fabian Kahn is a native of south Florida and is well adjusted to the weather in the Everglades. As a hydrological technician in Everglades National Park spending much of the work day outdoors, he needs to be! Everglades is consistently listed as one of the most threatened parks in North America. Hydrological developments have disrupted water flow with serious ecological consequences. Kahn's primary duties include helping with a large-scale, long-term water monitoring project aimed at optimizing the quantity, distribution, and timing of water flow needed for the health of native flora and fauna. A network of over 100 monitoring stations throughout the park provides a comprehensive view of the hydrology in the marsh and marine environments.

With his busy schedule Kahn still finds time to take care of the IMPROVE monitoring site. He describes challenges to station maintenance that are perhaps unique to the Everglades. During the hot and sunny wet season, swarms of mosquitoes use the IMPROVE shelter to seek shade from the sun. "If you don't wear a mosquito-proof jacket, you'll be wearing a suit made of blood-thirsty mosquitoes," he explains. Fabian also remarks on the challenge involved with avoiding the contamination of the filters with mosquito carcasses. "It's a tough job," he says, "but somebody has to do it!"

IMPROVE began monitoring air quality in the Everglades in 1988. The current site is located on the southern tip of the Florida peninsula. Because of this region's flat topography and exposure to oceanic air currents, the Everglades, and south Florida in general, enjoy skies of relatively clean air. IMPROVE data indicates improving visibility on both the cleanest and haziest days. In 2003 visibility reached 73 miles on the clearest days and dropped to 27 miles on the haziest days.

Everglades fire episode, May 11-13, 1986

Mar 2006

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May 2006

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21	22	23	24	25	26	27
28	29	30	31			

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 *91 Julian day*
2 *92* Daylight Saving Time Begins IMPROVE particle sampling day	**3** *93*	**4** *94* Change IMPROVE particle cartridges.	**5** *95* IMPROVE particle sampling day	**6** *96*	**7** *97*	**8** *98* IMPROVE particle sampling day
9 *99*	**10** *100*	**11** *101* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**12** *102*	**13** *103*	**14** *104* IMPROVE particle sampling day	**15** *105*
16 *106*	**17** *107* IMPROVE particle sampling day	**18** *108* Change IMPROVE particle cartridges.	**19** *109*	**20** *110* IMPROVE particle sampling day	**21** *111*	**22** *112* Earth Day
23 *113* IMPROVE particle sampling day	**24** *114*	**25** *115* Change IMPROVE particle cartridges.	**26** *116* IMPROVE particle sampling day	**27** *117*	**28** *118*	**29** *119* IMPROVE particle sampling day
30 *120* Arbor Day						

UC-Davis: *Sampler*:
General Lab
(530) 752-1123

ARS: *Optical*:
Carter Blandford or
Karen Rosener
Photography:
Karen Fischer
(970) 484-7941

"Operator Involvement -- The Key to Network Success"

The Afternoon Constellation of Satellites (A-Train)

CENTRE NATIONAL D'ÉTUDES SPATIALES

PARASOL

USA, France

INSTRUMENTS:

- Cloud-Aerosols Lidar with Orthogonal Polarization
- Infrared Radiometer
- Wide-Field Camera: develops aerosol and cloud profiles, measures impact of clouds and aerosols on the radiation budget

CALIPSO

USA, France

INSTRUMENTS:

- Cloud-Aerosols Lidar with Orthogonal Polarization
- Infrared Radiometer
- Wide-Field Camera: develops aerosol and cloud profiles, measures impact of clouds and aerosols on the radiation budget

CLOUDSAT

USA, Canada

CSU - Atmospheric Science (Science Team)
CSU-CIRA (Data Collection Products)
See April 2006 for CloudSat details.

INSTRUMENTS:

- 94 GHz Cloud Profiling Radar: 3-D study of clouds

Colorado State University
CIRA

AQUA

USA, Japan, Brazil

INSTRUMENTS:

- Atmospheric Infrared Sounder: measures temperature, ozone, greenhouse gases, cloud properties, water vapor, and carbon dioxide in 3-D
- Advance Microwave Sounding Unit: measures temperature profiles, water vapor, and precipitation
- Humidity Sounder: measures cloud liquid water and precipitation
- Advanced Microwave Scanning Radiometer: measures precipitation, water vapor, sea surface temperature, near-surface wind speed, sea ice, snow cover, and soil moisture
- Clouds and Earth-Radiant Energy System: measures incoming and outgoing energy on a global scale
- Moderate Resolution Imaging Spectroradiometer: measures the visible and infrared portions of the EM spectrum

AURA

USA, Netherlands

INSTRUMENTS:

- High Resolution Dynamics Limb Sounder: measures trace gases and aerosols
- Microwave Limb Sounder: measures carbon monoxide, gas radicals, chlorine, and greenhouse gases
- Ozone Monitoring Instrument: measures ozone, surface ultraviolet radiation, tropospheric pollutants, and aerosols
- Tropospheric Emission Spectrometer: measures trace gases, ozone, and water vapor

OCO

USA

INSTRUMENTS

- Three High Resolution Grating Spectrometers: measure global carbon dioxide concentrations

Six satellites flying in formation to gather data on the health of planet Earth.

By analyzing the instrument data from the six satellites, the "A" TRAIN provides benefits for understanding and improving the health of planet Earth.

- Improved climate change models, predictions, and discussions
- Better forecasting of high UV index days for public health
- Better understanding of the nature of air quality
- Improved weather forecasting
- Improved understanding of the health of the planet.

Quaker City, Ohio

May

"Nature uses only the longest threads to weave her patterns, so each small piece of her fabric reveals the organization of the entire tapestry."
- Richard P. Feynman - Theoretical Physicist 1918-1988

Jim and Mary Lou Trainer generously host and maintain the Quaker City IMPROVE site. The site sits on a portion of their farm in rural southeastern Ohio. The Trainers don't operate the farm but they do allow a neighbor to cultivate hay in exchange for keeping things looking nice. The couple has been making air quality measurements for about 11 years, since air quality monitoring equipment was first installed as part of the Clean Air Status and Trends Network. Operating the site has made them more aware of environmental problems. They pay more attention to EPA reports of air quality in the area, and they're more cognizant of local air quality and environmental issues. Several steel plants, an aluminum plant, and a toxic waste disposal company are located on the Ohio River 75 miles from the farm. They tune in to news reports more often now, and remember the DuPont chemical accident that burned employees in August 2005, and an accidental chemical spill into the Ohio River.

In addition to taking care of the air quality measurements, the Trainers also operate a small business making high-end containers and birdhouses for flower shops. They enjoy traveling to some extent, but their business keeps them close to home most of the time. Spending time with their two children and three grandchildren is a high priority. The newest addition to their family is Susie, a 4-year-old golden lab. Susie was a pound puppy and spent her young life in a cage. The photo above right shows her first visit to the site.

In spite of all this activity, data recovery from the Quaker City site is always 95-100%! This site is instrumental in understanding how Ohio River Valley sources contribute to fine particle concentrations and visibility impairment in rural areas in the Midwestern and Eastern U.S. Visibility on clear days reaches 50 miles, but on hazy days is limited to about 13 miles.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
UC-Davis: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941	**1** *121 Julian day*	**2** *122* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**3** *123*	**4** *124*	**5** *125* IMPROVE particle sampling day	**6** *126*
7 *127*	**8** *128* IMPROVE particle sampling day	**9** *129* Change IMPROVE particle cartridges.	**10** *130*	**11** *131* IMPROVE particle sampling day	**12** *132*	**13** *133*
14 *134* Mother's Day IMPROVE particle sampling day	**15** *135*	**16** *136* Change IMPROVE particle cartridges.	**17** *137* IMPROVE particle sampling day	**18** *138*	**19** *139*	**20** *140* Armed Forces Day IMPROVE particle sampling day
21 *141*	**22** *142*	**23** *143* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**24** *144*	**25** *145*	**26** *146* IMPROVE particle sampling day	**27** *147*
28 *148*	**29** *149* Memorial Day (Observed) IMPROVE particle sampling day	**30** *150* Change IMPROVE particle cartridges.	**31** *151*			

Apr 2006

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Jun 2006

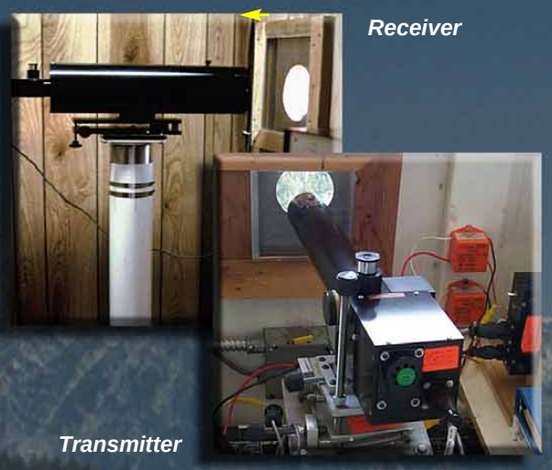
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

"Operator Involvement -- The Key to Network Success"

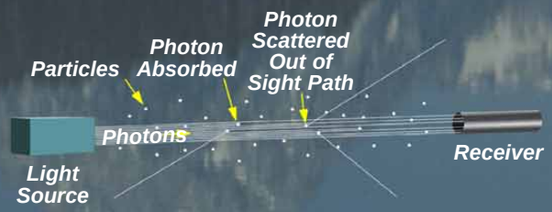
IMPROVE
Interagency Monitoring of Protected Visual Environments

Optical Monitors

Transmissometers



The Optec, Inc. LPV-2 long path transmissometer has been used by IMPROVE since 1986. Transmissometers provide the most direct measure of the extinction properties of the atmosphere. Extinction is a measure of the number of photons both scattered and absorbed over a known distance through the atmosphere. Extinction data is useful for relating visibility directly to particle concentrations.



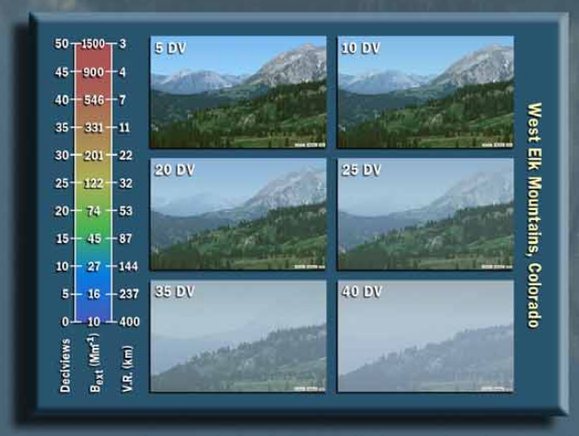
The system consists of an incandescent light source (or transmitter) and a computer-controlled photometer receiver. The transmitter emits a uniform light beam precisely aimed at a receiver located from 1 to 10 kilometers away. The transmissometer receiver measures only the photons that successfully pass through the atmosphere. The receiver isolates transmitter light from ambient light and records the transmission of the intervening atmosphere. Visibility results are calculated and reported as visual range or extinction.

Troubleshooting - The majority of transmissometer problems are caused by:

1. **Misalignment**
2. **Incorrect system timing**
3. **Dirty windows** - Clean window glass once a week. Use canned air or alcohol.
4. **Inadequate power** - Check all surge protector indicator lights. If any are red, contact Karen Rosener at ARS at (970) 484-7941. Clean and inspect the solar panels, and fill the lead-acid batteries as needed with distilled water.

Things to Avoid:

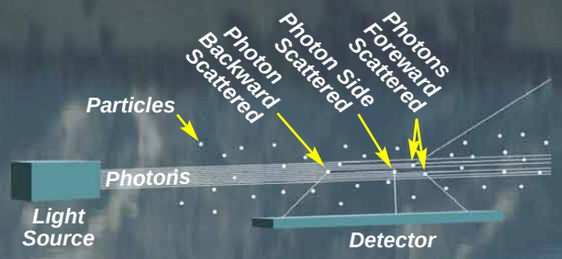
1. **Lamp Changes** - Remove lamp by pulling it straight out of the transmitter body. Don't loosen screws on the lamp alignment plate/system or it will need recalibration.
2. **Transmitter Focus** - Do not change the focus of the transmitter telescope or the system will need recalibration.
3. **Radio Transmission** - Do not transmit with hand-held radios within 10 feet of either transmissometer component or the timing may need to be reset.
4. **Computer Resets** - Avoid unnecessary computer resets or the OFF/ON timing may be disrupted.



A comparison of deciviews, light extinction, and visual range, with samples of various haze levels

Nephelometers

The Optec NGN-2 ambient nephelometer has been used by IMPROVE since 1993. Nephelometers measure the amount of light (photons) scattered by particles and gases in the atmosphere. This measurement combined with estimates of the absorption coefficient (from aerosol monitoring filters) can be used to determine the average total light extinction.



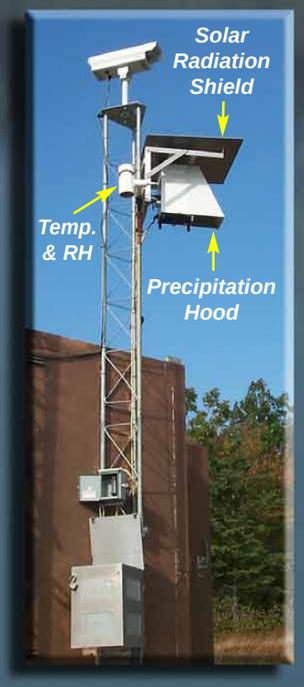
The nephelometer draws ambient air into a chamber where light of known intensity is emitted over a path parallel to a photodiode detector. With this configuration only the photons that are scattered will be detected. The instrument is designed in such a way that the sampling chamber and light source are confined to a small volume so the instrument makes a "point" or localized measurement of scattering. A direct estimate of atmospheric scattering is made by measuring the light scattered from the front, back, and sides of the optical chamber. Because the scattered light is integrated over a large range of scattering angles, the instrument is referred to as an INTEGRATING nephelometer.

Troubleshooting Front Panel Error Codes:

1. **Error Code -400 (4), door closed, no readings:** The lamp is out. Replace lamp, reset neph, and check lamp counts (>2000).
2. **Error Code -500 (5), door closed, no readings:** Rain event. No operator intervention is required. Readings will return when the sensor is dry.
3. **Error Code -600 (6), door closed, no readings:** Incorrect chopper frequency. Reset nephelometer.
4. **Error Code -900 (.920), door closed, locked-up analog readings:** Possible lamp out and/or serial interface malfunction. Reset Blue Earth and neph. If code changes to -400, replace lamp and check lamp counts.
5. **Error Code -900 (.920), door open, analog readings only:** Serial data interface failure. Reset Blue Earth serial data buffer and neph and check for serial reading following POST (Power On Self Test).

*Note: When power outages or surges occur, the data logger may lose its program. Reset on the site.

Standard nephelometer stations are mounted near the top of a 14-foot tower on the north face. A solar radiation and precipitation shield are installed to protect the instrument from severe precipitation (rain, hail, snow) and keep direct sunlight off the monitor. This allows the instrument to be maintained at close to ambient temperatures. Temperature and relative humidity sensors are often installed as part of the standard nephelometer configuration.



Redwoods National Park, California

June

"The care of the Earth is our most ancient and most worthy, and after all our most pleasing responsibility. To cherish what remains of it and to foster its renewal is our only hope."

- Wendell Berry

Lucy Perez, on the right in the photo, is a clerical assistant in the maintenance division and the primary operator of Redwood National Park's IMPROVE station in northern California. Perez is the payroll timekeeper and the maintenance division's General Services Administration fleet manager and is responsible for data input and purchasing for the facilities management department. Perez makes getting good IMPROVE measurements a priority. Frequent power failures, especially during the winter months, are a real challenge, but a great supervisor and supportive staff make the job enjoyable.

Perez considers Redwood National Park an ideal place to work-- it's never too hot or too cold and the beaches and magnificent redwoods provide a beautiful work environment. She thoroughly enjoys coastal living, spending spare time on the beach hunting for 'treasures' like agates and sea glass and hiking the redwood trails. Perhaps this explains why she has been working at the park for over 15 years! Vacations away from the park often lead to the warm waters of Maui to swim and snorkel or visiting a 9-year-old grandchild in Klamath Falls, OR.

Candy Gibson, on the left, has been working at Redwood National Park for over 12 years as a motor vehicle operator. She worked for the Northern California Indian Development Council in partnership with Redwood National Park then was hired as a full-time park employee. Recruited as a back-up operator for the IMPROVE station last year, Gibson adds those duties to a multitude of others including trail construction and maintenance, supervising Youth Conservation Corp (YCC) and Student Conservation Association (SCA) volunteers, constructing and installing trail signs, and driving the park's 10-yard dump truck. Born and raised in Klamath, California, Gibson lives with best friend, Rob. She has 4 children and 3 grandchildren. Seeing Mother Nature through all seasons, and the physical demands of hiking and working make the job enjoyable. Interacting with volunteers from other parts of the U.S., Germany, and France and working with the YCC and SCA students is proving both educational and enjoyable.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		Jul 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		1 *152 Julian day* IMPROVE particle sampling day	2 *153*	3 *154*
4 *155* IMPROVE particle sampling day	5 *156* National Trails Day	6 *157* Change IMPROVE particle cartridges.	7 *158* IMPROVE particle sampling day	8 *159*	9 *160*	10 *161* IMPROVE particle sampling day
11 *162*	12 *163*	13 *164* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	14 *165* Flag Day	15 *166*	16 *167* IMPROVE particle sampling day	17 *168*
18 *169* Father's Day	19 *170* IMPROVE particle sampling day	20 *171* Change IMPROVE particle cartridges.	21 *172* Summer begins	22 *173* IMPROVE particle sampling day	23 *174*	24 *175*
25 *176* IMPROVE particle sampling day	26 *177*	27 *178* Change IMPROVE particle cartridges.	28 *179* IMPROVE particle sampling day	29 *180*	30 *181*	**UC-Davis**: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941

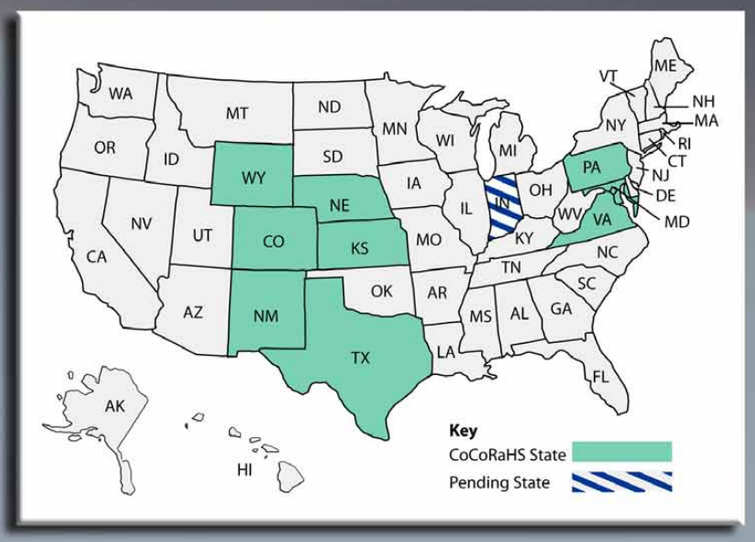
"Operator Involvement -- The Key to Network Success"

CoCoRaHS

Community Collaborative Rain, Hail and Snow Network

Because every drop counts!

Precipitation is essential for life. It varies greatly with topography, storm type and season. CoCoRaHS helps track this precious resource.



The CoCoRaHS Network currently engages over 2,000 volunteer observers in communities across nine states.

The CoCoRaHS Network is a non-profit community-based group of volunteers who collect data on rain, hail, and snow using simple low-cost rain gauges and hail pads.

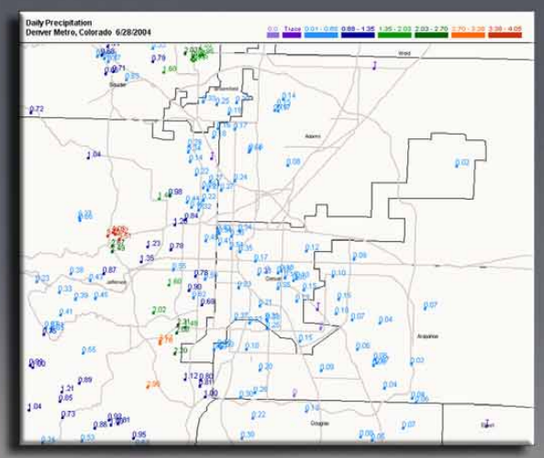
Four-inch diameter high capacity rain gauge holds up to eleven inches of precipitation.

A hail pad is simply a piece of aluminum foil covering a 1-foot-square styrofoam pad.

Volunteers making hail pads

Volunteers of all ages help gather precipitation measurements in a variety of locations ranging from their own backyards, to farms out on the plains, to 11,796 ft. above sea level in Rocky Mountain National Park.

CoCoRaHS volunteers will be cooperating with Rocky Mtn. Natl. Park, the NPS Air Resources Division, and state and local air quality agencies to assess origins and impacts of Front Range and regional air pollution on sensitive natural resources along the Rocky Mtn. Front Range and in Rocky Mtn. Natl. Park. The study, set to begin in early 2006, will have volunteers making daily measurements of airborne particles, precipitation, and ozone in over 30 locations.



Data collected from the Network are available on the network's Web site at: www.cocorahs.org in map and table form. Data are used daily by many federal, state and community organizations. At left is a map of observations from a recent Denver storm.

Colorado State University
Knowledge to Go Places

CoCoRaHS is currently supported by the National Science Foundation and other sponsors. Additional collaborators are welcome to help improve and expand the network.

NSF

Three Sisters Wilderness Area, Oregon

July

"In the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught."
- Baba Dioum

Mike Cobb works on the McKenzie River Ranger District of the Willamette National Forest, on the west slope of the Cascade Range, in west-central Oregon. In 1982 he started as a temporary employee on the fire crew, then worked in the fringe guard in recreation. In 1989 he became a permanent employee in timber stand improvement in silviculture. During the reduction in force in 1994, that job was eliminated, but a position as a hydro-technician in watershed opened up and Mike jumped in. Today his duties include water quality monitoring in reservoirs and wilderness lakes (including hook & line surveys); annual deployment of around 70 thermo sensors in general forest and wilderness streams; erosion abatement (such as road obliteration and land slide restoration), and occasional work with the fisheries shop, monitoring bull trout populations. Cobb has operated the IMPROVE site for 11 years with impressive data collection results. Trend data shows the wilderness air shed is very clean. Average visibility is about 100 miles and on really clear days you can see almost 200 miles. Utilities downwind near the Eugene/Springfield metro area contribute to hazy days, as does smoke from wildfire and prescribed burning operations.

Mike was born in eastern Oregon, in high desert country, and he often returns to bask in the remote isolation. He lives in McKenzie Bridge on six acres with a woodshed and garden. Mike and his wife, a registered nurse, have been married 28 years and raised a 19 year old daughter, now a sophomore in college. The family's 9-year-old black lab named Basil could very well be the best dog on the planet! Mike likes to hunt and fish from the coast to the high lakes. He's interested in rocks, growing things (or watching things grow), plants, and animals. He enjoys the outdoors and an environment uncluttered by folks. He cherishes solitude, yet enjoys good company.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Jun 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			Aug 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			**1** *182 Julian day* IMPROVE particle sampling day
2 *183*	**3** *184*	**4** *185* Independence Day IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**5** *186*	**6** *187*	**7** *188* IMPROVE particle sampling day	**8** *189*
9 *190*	**10** *191* IMPROVE particle sampling day	**11** *192* Change IMPROVE particle cartridges.	**12** *193*	**13** *194* IMPROVE particle sampling day	**14** *195*	**15** *196*
16 *197* National Parks Day IMPROVE particle sampling day	**17** *198*	**18** *199* Change IMPROVE particle cartridges.	**19** *200* IMPROVE particle sampling day	**20** *201*	**21** *202*	**22** *203* IMPROVE particle sampling day
23 *204*	**24** *205*	**25** *206* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**26** *207*	**27** *208*	**28** *209* IMPROVE particle sampling day	**29** *210*
30 *211*	**31** *212* IMPROVE particle sampling day					

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ARS: *Optical*:
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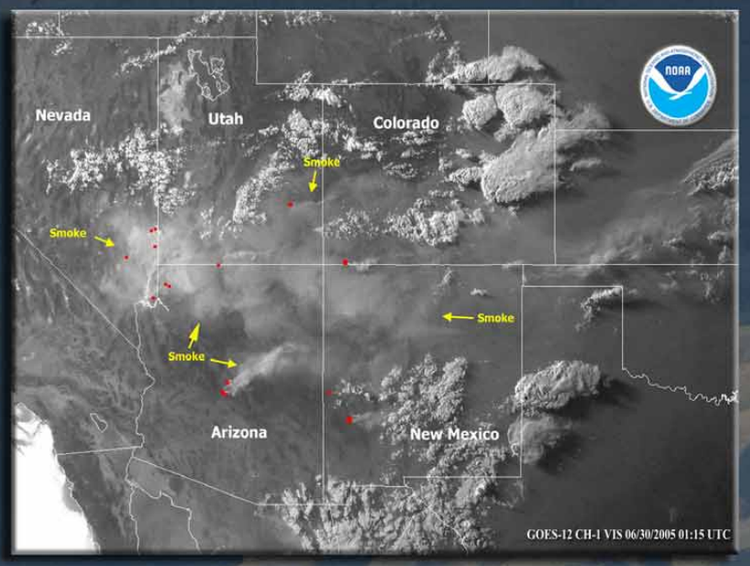
Karen Rosener
Photography:
Karen Fischer
(970) 484-7941

"Operator Involvement -- The Key to Network Success"

Grand Canyon Smoke

Two thousand five was a record year for wildfires across Arizona and much of the southwestern U.S. Drier than normal conditions during the late spring and summer created a perfect environment for the numerous wildfires. At the end of June, fires produced thick smoke that reached from Nevada eastward to Kansas.

Regional Smoke Event



NOAA satellite image, June 30, 2005. Active fires are shown in red.

IMPROVE Web camera photos showing the view from Yavapai Point. The left photo, taken on June 10, 2005, shows a visibility of 90 miles. The photo on the right shows the view on June 30, 2005, when smoke had filled the canyon from fires in southern Nevada. Visibility is 15 miles.

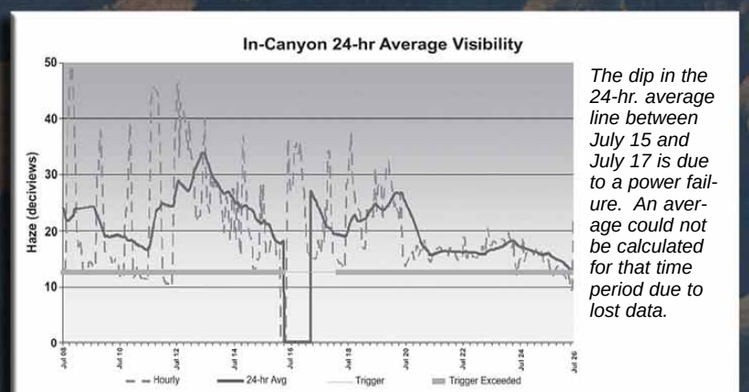
The above image of the fires (in red outlines) was captured by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite on July 13, 2005. The Mudersbach fire on the southern rim of the canyon is visible only as a plume of smoke billowing from beneath a patch of clouds.

Local Fires Impact the Grand Canyon

After July 1, local fires became the primary source of smoke impacts in Grand Canyon National Park. Triggered by lightning, wildfires burned on both the North and South rims. Four miles north of the Grand Canyon North Rim Lodge, the Dragon Complex fires burned in woodland forests, while the Mudersbach fire burned to the south in the Kaibab National Forest. Weather conditions remained fairly constant through mid-July, and air quality patterns fell into a daily routine. Rapid cooling at night encouraged heavy smoke to settle into the canyon overnight. Light winds during the day increased the ventilation, resulting in clearer visibility in the afternoons.

Photos of the canyon's inner gorge from the north rim housing area

Dragon fire plumes looking north and east from Powell point on the South Rim of Grand Canyon on July 8, 2005



The dip in the 24-hr. average line between July 15 and July 17 is due to a power failure. An average could not be calculated for that time period due to lost data.

The "deciview" is a logarithmic scale that mimics the human eye's response to haze levels.(much like decibels measure sound levels.) A change of one deciview is apparent to most viewers under most conditions.

Carl Bowman, air quality specialist at Grand Canyon NP, prepared daily reports over the duration of the smoke event. Light winds and thermal ventilation beginning July 13 facilitated slight visibility improvements. It took the arrival of monsoon rains around July 20th to begin putting out the fires, and visibility improved to "acceptable" levels on July 26. Real-time photographs, hourly visibility levels, and weather conditions in the canyon are updated every 15 minutes and made available through http://www2.nature.nps.gov/air/webcams/parks/grcacam/grcacam.cfm.

High smoke levels pushed average fine particle concentrations into the range EPA identifies as Very Unhealthy for the general public, prompting park personnel to warn visitors and park staff of potentially harmful air quality levels in the park for the first time in recent memory. North Rim and inner canyon visitors, hikers, backpackers, and staff were urged to limit their exposure by reducing the duration or intensity of physical exertion or waiting until smoke levels dropped below unhealthy levels.

Pinnacles National Monument, California

Valerie Nuttman has been the primary air quality station operator at Pinnacles National Monument since 2001. In addition to operating and maintaining the IMPROVE sampler, she collects wet deposition data for the National Atmospheric Deposition Program, dry deposition data for the Clean Air Status and Trends Network, and makes various meteorological measurements. For the past two years the national monument staff has also been working with the USDA Forest Service on passive sampling of ozone, ammonia, and nitric acid.
Nuttman's other duties revolve around attacking the non-native exotic plants invading the monument, including the invasive yellow star thistle, summer mustard, horehound, Italian thistle, poison hemlock, and milk thistle. She enjoys being able to get out in the field, and the flexibility of her part-time position allows her to be home with her two small children. In her spare time, she enjoys hiking, painting, and trying to get plants to grow near her home.

Pinnacles NM is located near California's rapidly growing Salinas Valley, on the border of San Benito and Monterey counties. Census data shows a 71% growth rate between 1990 and 2000 in San Benito County alone. Although visibility in the monument is superior to that in many parts of the country (100 miles on clear days), views are often limited by haze. Ten percent of the time visibility is 40 miles or less. Organics and nitrogen oxides from automobiles and fine particles from agricultural activities, burning, and road dust are the biggest culprits. With more than ten years of measurements in the monument, it is encouraging to see that visibility is improving on both the clearest and haziest days.

Ozone concentrations in the monument also cause concern. On a number of occasions ozone concentrations have exceeded the 8-hr ambient air quality ozone standard; in addition to these high peak concentrations, ozone cumulative doses are sufficient to induce vegetation injury.

August

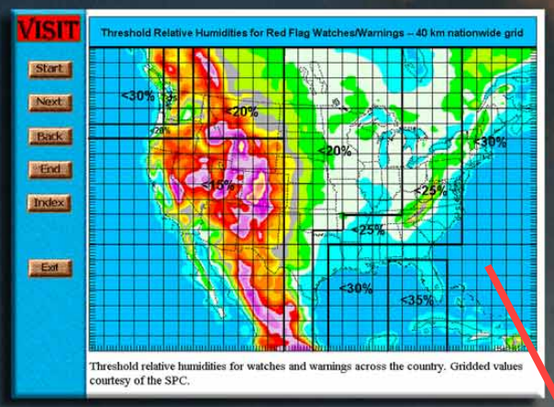
"Study nature, love nature, stay close to nature. It will never fail you."
- Frank Lloyd Wright

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Jul 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		1 *213 Julian day* Change IMPROVE particle cartridges.	2 *214*	3 *215* IMPROVE particle sampling day	4 *216*	5 *217*
6 *218* IMPROVE particle sampling day	7 *219*	8 *220* Change IMPROVE particle cartridges.	9 *221* IMPROVE particle sampling day	10 *222*	11 *223*	12 *224* IMPROVE particle sampling day
13 *225*	14 *226*	15 *227* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	16 *228*	17 *229*	18 *230* IMPROVE particle sampling day	19 *231*
20 *232*	21 *233* IMPROVE particle sampling day	22 *234* Change IMPROVE particle cartridges.	23 *235*	24 *236* IMPROVE particle sampling day	25 *237*	26 *238*
27 *239* IMPROVE particle sampling day	28 *240*	29 *241* Change IMPROVE particle cartridges.	30 *242* IMPROVE particle sampling day	31 *243*	Sep 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	

"Operator Involvement -- The Key to Network Success"

VISIT Virtual Institute for Satellite Integration Training

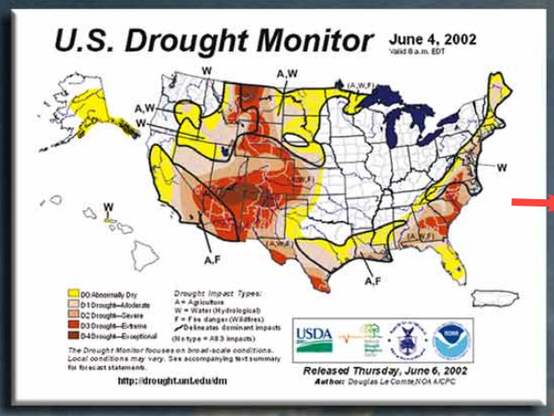
The Virtual Institute for Satellite Integration Training (VISIT) distance learning program was created to train participants in the use of satellite data and products as part of the National Weather Service (NWS) forecasting and warning training program. The primary mission of VISIT is to accelerate the transfer of research results based on atmospheric remote sensing data to National Weather Service operations using distance education techniques that allow users to simultaneously view and manipulate the images, animation, graphics, and text. The VISIT program is administered by staff from the Cooperative Institute for Research in the Atmosphere (CIRA), and their counterparts at the Cooperative Institute for Meteorological Satellite Studies (CIMSS), in conjunction with their cooperators at the National Weather Service (NWS) training division, and the National Environmental Satellite, Data, and Information Service (NESDIS). Teletraining sessions are offered monthly and 60 courses have been developed as of August 2005. The VISIT Web site at http://rammb.cira.colostate.edu/visit contains standalone versions of most sessions, many of which are audio recorded and some of which contain embedded instructor notes and can be viewed at any time through a standard Web browser.



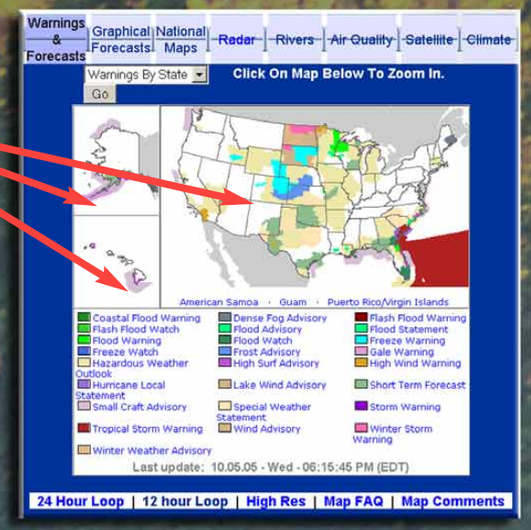
Threshold relative humidities for watches and warnings across the country. Gridded values courtesy of the SPC.

Tools to assist in determing "red flag" warning conditions

Threshold relative humidity for the U.S.



"Red Flag Warnings" for Wildland Fire Detection issued for critical weather conditions conducive to extensive wildfire occurrences



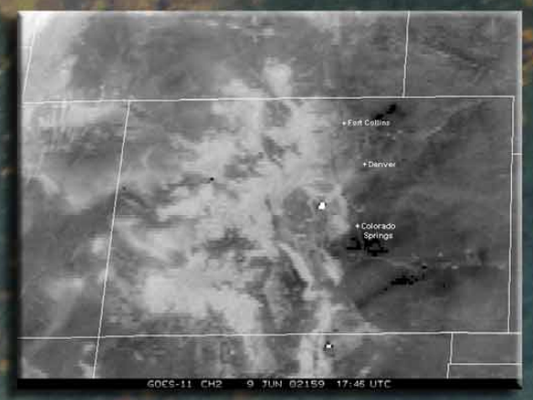
National Weather Service national and regional centers

Since most of the VISIT training is related to weather and forecasting, most of the participants are from the National Weather Service, but there have also been participants from the Air Force, NAVE, and Environment Canada. The VISIT training tool has become very popular in the international weather community through connections with the satellite training efforts of the World Meteorological Organization.

VISIT Courses through teletraining

"Wildland Fire Detection Using Satellite Imagery" course objectives:

- To review the fire weather forecast
- To learn new techniques for wildland fire detection
- To work through case studies of wildland fire detection using GOES satellite imagery



Real-time satellite imagery to detect "hot spots" and resulting smoke plumes

Infrared detection of fire hot spots

GOES-11 detection of smoke plume

Photo of Hayman fire by Sherri Zufall

Voyageurs National Park, Minnesota

Jen Fox has been tramping around Voyageurs National Park in northern Minnesota since she was a graduate student at Michigan Technological University. In 1998 she conducted a wolf ecology study while working on her M.S. in wildlife biology. Fox has worked on numerous research and monitoring projects with various universities and federal and state agencies over the past 15 years. She also spent 2-1/2 years in central Africa working on freshwater fisheries projects as a Peace Corps volunteer. In March 2004, Fox accepted a position as a biological science technician at Voyageurs National Park and coincidently became the primary site operator of the park's air quality station. Currently, she is conducting a 3-year common loon nesting research project on the park's large network of lakes, and continues to track wolves and lynx in the winter months. Fox has a long-running interest in environmental issues, particularly the impact of human activities on wildlife populations. While not at work, she enjoys hiking, biking, camping, and kayaking.

The park lies in the southern part of the Canadian Shield, on the northern edge of Minnesota's border with Ontario. There are no roads in Voyageurs, so site access is mostly over water, and in the winter months that means over ice and mainly by snowshoe. Keeping equipment operational in severe subzero temperatures and heavy snow and ice conditions is a real challenge. Air quality is an important issue in northern Minnesota, where iron/taconite mines and coal-burning power plants dot the landscape and local paper mills operate in proximity to the park. Aerosol sampling began in 1988 providing data to track long-range transport of regional haze from the Midwest and the Ohio River Valley. The park service is particularly concerned about the effects of airborne toxics, especially mercury, at Voyageurs. Research and monitoring in area show elevated levels of contaminants and documented effects in ambient air, soil, surface waters, fish, crayfish, loons, eagles, and other birds.

Lake Kabetogama

September

"Life is a daring adventure or nothing."
- Alabamian Helen Keller

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
UC-Davis: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941 Aug 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 Oct 2006 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31					1 244 Julian day	2 245 IMPROVE particle sampling day
3 246	4 247 Labor Day	5 248 IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	6 249	7 250	8 251 IMPROVE particle sampling day	9 252
10 253	11 254 IMPROVE particle sampling day	12 255 Change IMPROVE particle cartridges.	13 256	14 257 IMPROVE particle sampling day	15 258	16 259
17 260 IMPROVE particle sampling day	18 261 National Public Lands Day Pollution Prevention Week	19 262 Change IMPROVE particle cartridges.	20 263 IMPROVE particle sampling day	21 264	22 265	23 266 Autumn begins IMPROVE particle sampling day
24 267	25 268	26 269 IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	27 270	28 271	29 272 IMPROVE particle sampling day	30 273

"Operator Involvement -- The Key to Network Success"

GLOBE

Global Learning and Observations to Benefit the Environment

The GLOBE Program was established in 1994 with goals to increase environmental awareness of countries throughout the world, contribute to a better understanding of the earth, and help all students reach higher levels of achievement in science and mathematics.

CIRA has been a key contributor throughout the history of the GLOBE Program, starting in 1995 when a team of nine CIRA researchers composed of meteorologists, computer scientists, and teachers, began working on the GLOBE Program Web site. The primary responsibilities of the CIRA team are the development and maintainance of the Web site and database, acquisition of the student data in real time, and presentation of the data as maps and graphs.

Science

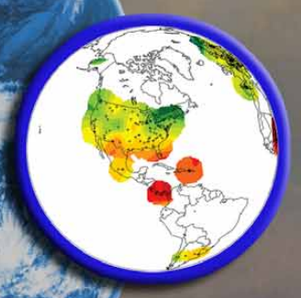
GLOBE scientists design protocols for measuring atmospheric, soil, land cover, biological, and hydrological data.

Under the supervision of GLOBE teachers, K-12 students using these protocols collect environmental data.

The findings from this environmental data are entered on the Internet.

Outreach

The GLOBE Program has been conducted in over 16,000 schools located in 109 partner countries, with more than 13 million student measurements reported to the GLOBE database.



The GLOBE Program

http://www.globe.gov

These maps and graphs are shared with other K-12 students worldwide.

These data are collected in real-time and converted into data maps and graphs.

Education

K-12 students learn about the environment with hands-on experience. Students can discuss the results of their data collections with on-line GLOBE scientists.

Landcover: plant species groundcover

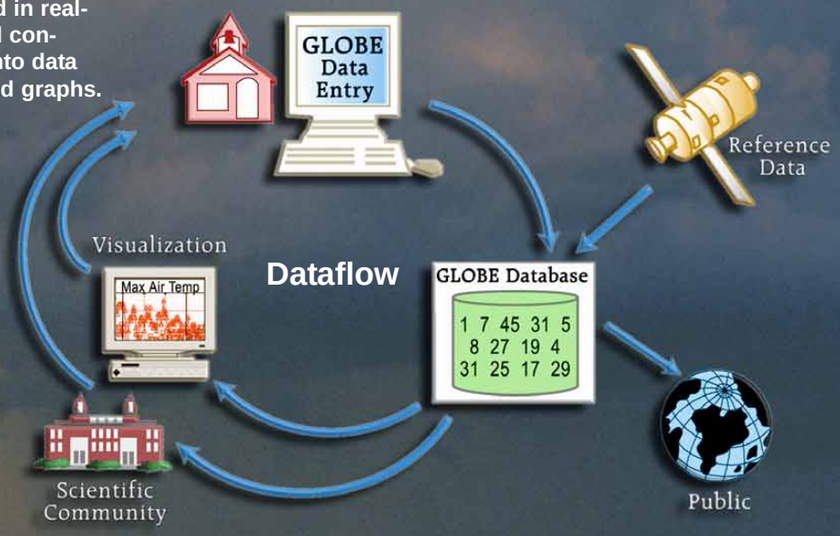
Atmospheric Instrument Shelter

Student Data: air temperature plot

Soil: moisture, pH, and characterization

Hydrology: water temperature, salinity, pH, nitrates, etc.

Years of student data collection have resulted in a significant contribution to science. In August 2005, GLOBE members and educators journeyed into the mountains of the Blue Ridge and the Great Smoky Mountains National Park to evaluate the damage that surface ozone has caused to the scenic vistas and vegetation. They learned how students across the country could measure atmospheric conditions using simple scientific instruments and ozone-sensitive plants from their own ozone garden. This is a great example of partners in environmental research and education creating an awareness of environmental problems and planting the seeds of understanding that can make a difference in solving future environmental problems!



GLOBE is a cooperative educational effort led by the United States in partnership with government and non-government organizations, colleges, and universities, state and local school systems, and non-profit organizations.

UCAR NASA

Colorado State University
Knowledge to Go Places

CIRA

The GLOBE Program is managed by UCAR and CSU under a cooperative agreement with NASA.

Weminuche Wilderness Area, Colorado

October

"Life is a daring adventure or nothing."
- Alabamian Helen Keller

Brian Parker has been involved in air quality sampling since the late '70s. While working in the silviculture shop in the supervisor's office of the San Juan National Forest, he helped install the first air quality monitoring equipment and occasionally served as a back-up operator. In the mid '80s he moved into a recreation position in the Animas district, becoming the primary air quality technician responsible for the National Atmospheric Deposition (NADP) and IMPROVE monitoring sites throughout the district. His current position has evolved to combine activities in the Columbine district with duties for the wildlife and hydrology functions in the Public Lands Center, as well as oil and gas monitoring for the Bureau of Land Management. The Public Lands Center combines the supervisor's office of the San Juan NF and the San Juan Resource Area of the BLM.

Parker says he enjoys the air quality duties which take him to the NADP site at Molas Pass (10,900'), the IMPROVE site at Engineer Mountain (9100') with its collocated NO_X, NO_2, and O_3 monitors, and to the IMPROVE site at Beaver Meadows (7800'). Located within 45 miles of Durango, CO, operations entail weekly field visits through all kinds of weather and across all seasons. When added to the mix of other monitoring in the physical, biological, and social sciences, it serves to keep him out in the landscape that he's called home and office for the past 31 years!

The Weminuche site is part of the USDA Forest Service effort to assess pollution impacts in the wilderness areas of the central Rockies. Visibility, lake chemistry, and lichens are the most pollution sensitive resources in the region. Compared to other parts of the nation, visibility in the Weminuche is very clear. You can often see 160 miles from Indian Trail Ridge with average visibility ranging 90-100 miles. Rocky Mountain pollutants originate from "mobile sources" such as vehicles and railroads; "point sources" such as power plants and oil and gas processing facilities; and "area sources" such as feedlots, quarries, and coal mines. Haze can also come from wildfires and prescribed fires.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 *274 Julian day*	**2** *275* IMPROVE particle sampling day	**3** *276* Change IMPROVE particle cartridges.	**4** *277*	**5** *278* IMPROVE particle sampling day	**6** *279*	**7** *280*
8 *281* IMPROVE particle sampling day	**9** *282* Columbus Day (Observed)	**10** *283* Change IMPROVE particle cartridges.	**11** *284* IMPROVE particle sampling day	**12** *285*	**13** *286*	**14** *287* IMPROVE particle sampling day
15 *288*	**16** *289*	**17** *290* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**18** *291*	**19** *292*	**20** *293* IMPROVE particle sampling day	**21** *294*
22 *295*	**23** *296* IMPROVE particle sampling day	**24** *297* Change IMPROVE particle cartridges.	**25** *298*	**26** *299* IMPROVE particle sampling day	**27** *300*	**28** *301*
29 *302* Daylight Saving Time Ends IMPROVE particle sampling day	**30** *303*	**31** *304* Halloween Change IMPROVE particle cartridges.				

Sep 2006

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Nov 2006

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

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ARS: *Optical*:
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Photography:
Karen Fischer
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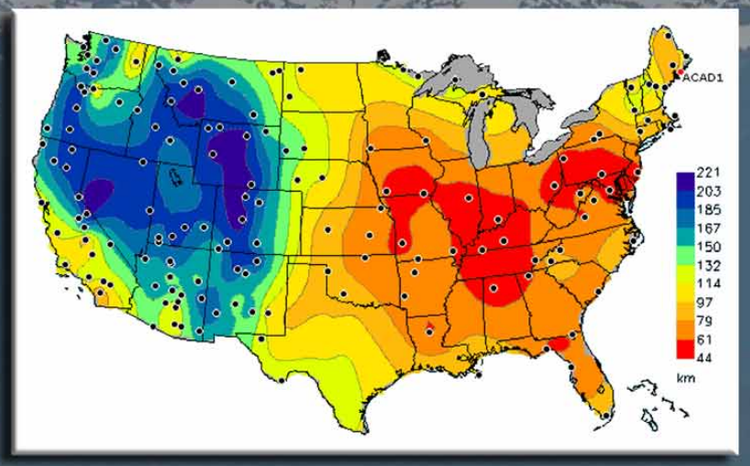
"Operator Involvement -- The Key to Network Success"

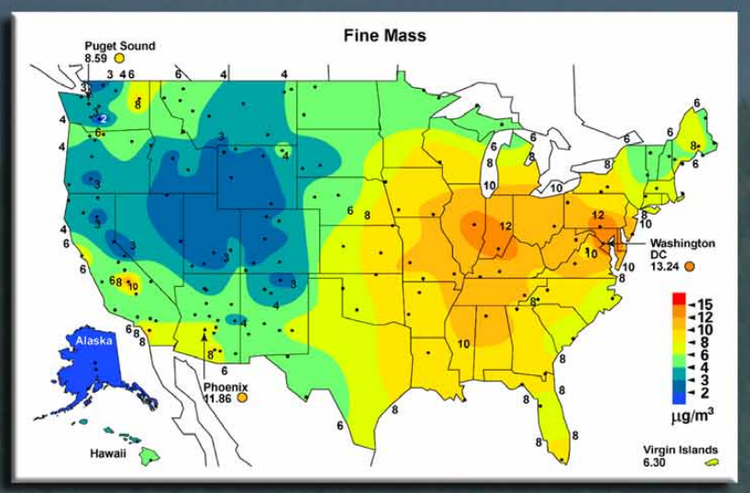
IMPROVE
Interagency Monitoring of Protected Visual Environments

Data Summaries

The best visibility in the continental United States occurs in the Great Basin, central Rocky Mountains, and nonurban Southwest. By comparison, the lowest visibilities are recorded in the eastern half of the United States. Visibility impairment is also significant near the Los Angeles and San Francisco metropolitan areas of California and to a lesser degree in the Pacific Northwest. In 2003, mean visual range for the worst days in the East was about 30 km (18 miles) compared to 100 km (62 miles) for the best visibility. In the West, mean visual range for the worst days was about 120 km (75 miles) while the mean visual range for the best days was about 294 km (183 miles).

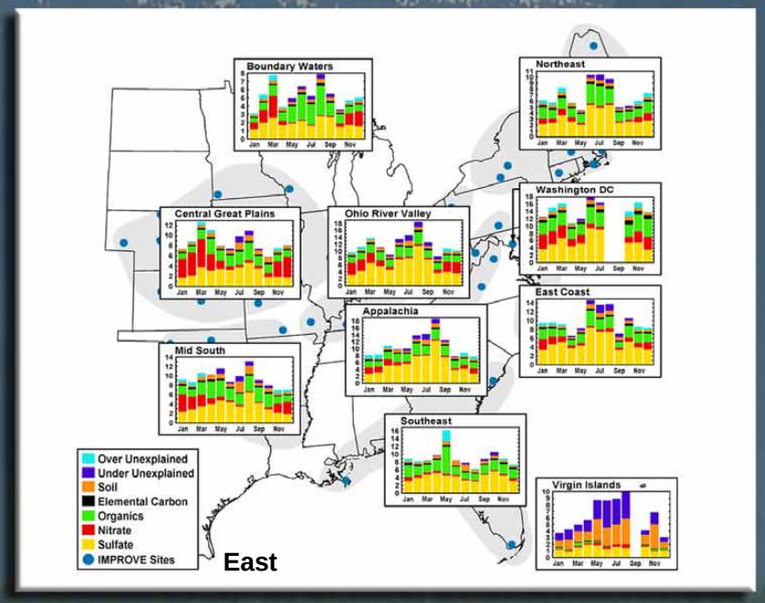


Average visibility expressed in kilometers calculated from 2003 IMPROVE data

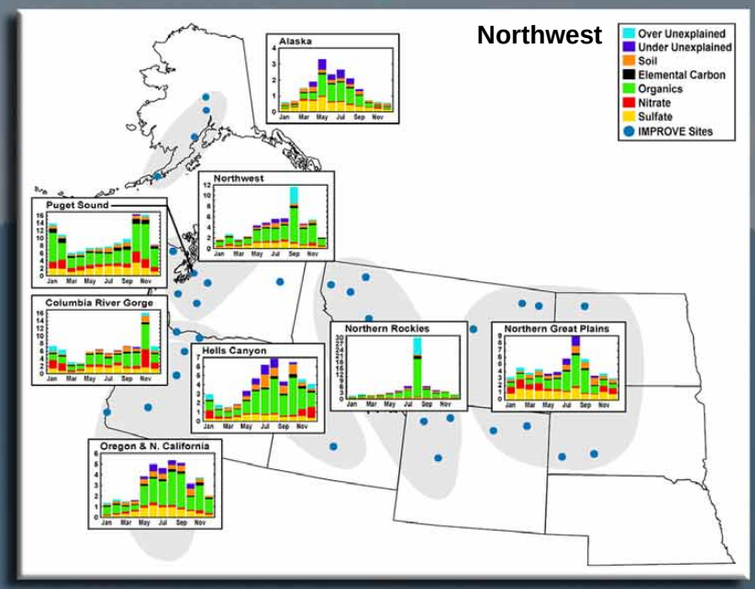


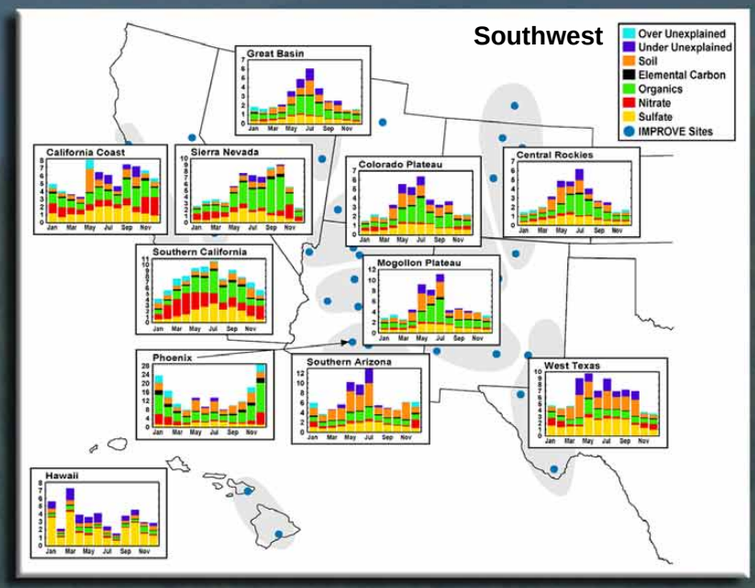
The fine mass contribution to total light extinction expressed in µg/m3 calculated from 2003 IMPROVE data

Fine particle concentration ($PM_{2.5}$) describes particulate matter that is less than 2.5 µm in diameter - 1/30th the diameter of a human hair. The chemical composition of particles depends on location, time of year, and weather. Fine particles are the major source of visibility-reducing haze in the United States. Concentrations of fine particles in the Midwest and Ohio River Valley are typically higher in the third calendar quarter (July-September) when sulfates are more readily formed from sulfur dioxide emissions from power plants. Fine particle concentrations tend to be higher in the fourth calendar quarter (October-December) in most areas of the West, in part because fine particles nitrates form more readily in cool weather, and woodstove and fireplace use is higher.



Generally speaking, sulfate concentrations tend to be higher during the summer months (June, July, and August) in almost all areas of the United States. Sulfates contribute 60-80% of the haze in the eastern United States and 20-40% of the haze in the western United States. Annual average nitrate concentrations are highest during the winter months, contributing 40-50% of the wintertime haze in the Midwest, southern California, California coastal, Sierra Nevada, Hells Canyon, and Columbia River Gorge regions. The highest annual average organic mass concentrations are found in the southeastern United States. High concentrations can occur in the late summer and early fall in the Northwest and Sierra Nevada mountain range regions, when forest fire and prescribed burning activity is high. Fine soil concentrations are highest in the desert Southwest with abrupt increases in concentrations in most of the western United States in the month of April. At least a portion of the measured fine dust during these events is associated with large-scale transport mechanisms of regional dust events rather than local sources of wind-blown crustal material.





Maps of stacked bar charts showing monthly distributions of fine aerosol species calculated from 2003 IMPROVE data

Badlands National Park, South Dakota

November

"The national park is the best idea America ever had."
- James Bryce, British Ambassador to the U.S., 1912

Pat Sampson claims to be just passing through South Dakota on her way to Texas. In private, she smilingly admits to being a thirty-one-year resident of Badlands and is currently in her 18th year monitoring air quality in Badlands National Park. Sampson's plans took a drastic turn when she met husband Jerry, married him, and started a family in 1975. Today, the Sampson's own and operate a ranch along the White River of western South Dakota, within sight of the Badlands Wall. They have raised three children, two of whom now own their own ranches. Riding horses, hiking the Badlands, and traveling to watch her son perform on the professional rodeo circuit are some of her many passions. She enjoys sharing the culture of western South Dakota, and many park employees have gotten their first taste of ranch life at the annual Sampson calf branding.

Sampson was born in Missouri and trained as a medical technician, with minors in biology and chemistry. She has been continuously involved with air quality monitoring in the park since 1987 and continues as a contractor for both the IMPROVE site and a South Dakota state air quality site also located at Badlands.

Badlands air quality monitoring has gained importance in recent years because of increased efforts to develop coal and natural gas resources in Wyoming, and population growth in the Black Hills, particularly Rapid City. Other concerns include the proposed train route through South Dakota transporting coal from Wyoming to eastern power plants, proposed generating plants in Wyoming, and industrial development in the Black Hills. The Badlands Wilderness Area and Badlands National Park are downwind from these potential pollution sources. Sampson's deep-rooted interest and commitment to the air quality monitoring program have ensured a solid long-term database to aid managers in making informed decisions about possible impacts on resources, as well as allowing air quality managers to track changes in air quality levels over time.

Oct 2006

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
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22	23	24	25	26	27	28
29	30	31				

Dec 2006

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1 *305 Julian day* IMPROVE particle sampling day	**2** *306*	**3** *307*	**4** *308* IMPROVE particle sampling day
5 *309*	**6** *310*	**7** *311* Election Day IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**8** *312*	**9** *313*	**10** *314* IMPROVE particle sampling day	**11** *315* Veterans Day
12 *316*	**13** *317* IMPROVE particle sampling day	**14** *318* Change IMPROVE particle cartridges.	**15** *319* America Recycles Day	**16** *320* National Park Service established, 1916 IMPROVE particle sampling day	**17** *321*	**18** *322*
19 *323* IMPROVE particle sampling day	**20** *324*	**21** *325* Change IMPROVE particle cartridges.	**22** *326* IMPROVE particle sampling day	**23** *327* Thanksgiving	**24** *328*	**25** *329* IMPROVE particle sampling day
26 *330*	**27** *331*	**28** *332* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**29** *333*	**30** *334*		

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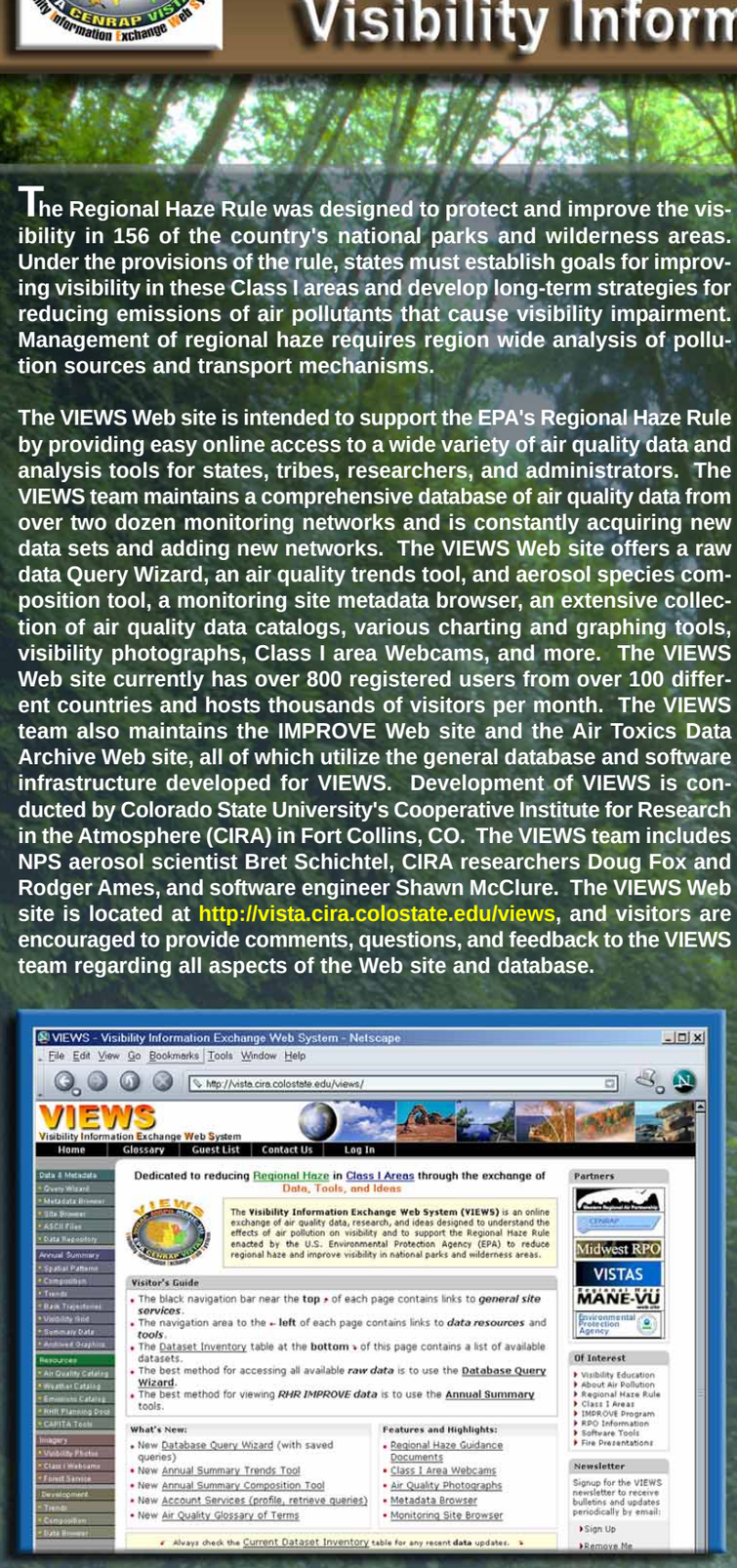
VIEWS

Visibility Information Exchange Web System

The Regional Haze Rule was designed to protect and improve the visibility in 156 of the country's national parks and wilderness areas. Under the provisions of the rule, states must establish goals for improving visibility in these Class I areas and develop long-term strategies for reducing emissions of air pollutants that cause visibility impairment. Management of regional haze requires region wide analysis of pollution sources and transport mechanisms.

The VIEWS Web site is intended to support the EPA's Regional Haze Rule by providing easy online access to a wide variety of air quality data and analysis tools for states, tribes, researchers, and administrators. The VIEWS team maintains a comprehensive database of air quality data from over two dozen monitoring networks and is constantly acquiring new data sets and adding new networks. The VIEWS Web site offers a raw data Query Wizard, an air quality trends tool, and aerosol species composition tool, a monitoring site metadata browser, an extensive collection of air quality data catalogs, various charting and graphing tools, visibility photographs, Class I area Webcams, and more. The VIEWS Web site currently has over 800 registered users from over 100 different countries and hosts thousands of visitors per month. The VIEWS team also maintains the IMPROVE Web site and the Air Toxics Data Archive Web site, all of which utilize the general database and software infrastructure developed for VIEWS. Development of VIEWS is conducted by Colorado State University's Cooperative Institute for Research in the Atmosphere (CIRA) in Fort Collins, CO. The VIEWS team includes NPS aerosol scientist Bret Schichtel, CIRA researchers Doug Fox and Rodger Ames, and software engineer Shawn McClure. The VIEWS Web site is located at http://vista.cira.colostate.edu/views, and visitors are encouraged to provide comments, questions, and feedback to the VIEWS team regarding all aspects of the Web site and database.



The images above represent a few of the many tools available for browsing, summarizing, and viewing data on the VIEWS site. Sophisticated data analysis and data access tools provide ready access to data from multiple networks, allowing users to extract raw and summary data ASCII files and easily generate customized displays for any location on the fly. Metadata is provided for all networks and monitoring sites, enabling users to make informed decisions on data use, including the ability to merge across data networks and comparison with model outputs.

Some VIEWS facts:

- Over 600 registered users
- Over 200 organizations represented
- Almost 100 countries represented
- 300+ unique hits a day
- Linked to over four dozen sites
- Over 40 million records of air data
- Dozens of monitoring networks
- CSU Research Initiative Award
- Uses the new Manifold GIS
- Monitoring site photographs
- Class I area Webcams
- Visibility photographs
- Visibility gray literature
- Periodic newsletter
- Contour maps trends analysis
- Air mass composition analysis

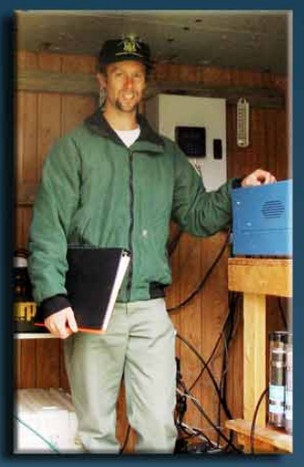
Network	Locations	Parameters
Air Sciences Aerosol	CO (2 sites)	speciated aerosols
AQS $PM_{2.5}$ Mass FRM (daily)	US (~1300 sites)	$PM_{2.5}$ mass
AQS $PM_{2.5}$ Mass FRM (hourly)	US (~370 sites)	$PM_{2.5}$ mass
AQS $PM_{2.5}$ Speciation (daily)	US (~250 sites)	$PM_{2.5}$ mass, speciated aerosol
AQS PM_{10} Mass (daily)	US (~2300 sites)	PM_{10} mass
AQS PM_{10} Mass (hourly)	US (~278 sites)	PM_{10} mass
Back trajectories	US (all IMPROVE sites)	ATAD trajectories
BRAVO	TX	$PM_{2.5}$, speciated aerosol, size, ++
CASTNet Dry Chemistry	US (~108 sites)	speciated aerosol
CASTNet Visibility Chemistry	US (~12 sites)	optical
EPA Supersites	US	aerosol, gaseous, meteorology
GAViM	eastern Canada (5 sites)	$PM_{2.5}$ mass, speciated aerosol
IMPROVE Aerosol (prelim.)	US (~200 sites)	speciated aerosol
IMPROVE Aerosol (raw)	US (~200 sites)	speciated aerosol
IMPROVE Aerosol (RHR)	US (~200 sites)	speciated aerosol
IMPROVE Nephelometer (raw)	US (~60 sites)	optical
IMPROVE Study - MOHAVE	AZ (~44 sites)	speciated aerosol
IMPROVE Study - PREVENT	northwestern US (~30 sites)	speciated aerosol
IMPROVE Study - SEAVS	southeastern US (1 site)	speciated aerosol
NADP/NTN	US (~225 sites)	wet deposition ions
NADP AIRMoN	US (~10 sites)	wet deposition ions
NEPART	northeastern US (~9 sites)	$PM_{2.5}$ mass, speciated aerosol
NPS SFU Aerosol	US (~82 sites)	speciated aerosol
NPS-Gaseous	US	O_3, NO_X, SO_2
REVEAL	Canada	speciated aerosol
SEARCH All Variables	southeastern US (~8 sites)	$PM_{2.5}$ mass, speciated aerosol
SEARCH Best Estimate	southeastern US (~8 sites)	$PM_{2.5}$ mass, speciated aerosol
SEARCH FRM	southeastern US (~8 sites)	$PM_{2.5}$ mass, speciated aerosol
Surface Met	US (~850 sites)	meteorology and visual range

The table above represents a summary of the monitoring networks currently in the VIEWS database. The list of parameters for each network is incomplete and is only intended to provide an overview of the networks contents.

Great Gulf Wilderness Area
New Hampshire

December

For if one link in nature's chain might be lost, another might be lost, until the whole of things will vanish by piecemeal.
- Thomas Jefferson



Matthew Shomburg, a native of New Hampshire, has been responsible for maintaining the Great Gulf IMPROVE site for eight years. The site is located at Camp Dodge near the base of Mount Washington in New Hampshire's White Mountain National Forest. Shomburg says he enjoys this responsibility and appreciates help from supervisor Justin Preisendorfer and summer seasonal employees. Working together ensures the job gets done right.

The station is operated year-round and snowshoes are required during the winter. It's not very far but the weather can be very cold. Shomburg says, "Mount Washington has the reputation of having the world's worst weather." Monitoring equipment is often affected by freezing temperatures and power outages. Snow can melt and refreeze around the samplers, and sometimes the doors can't be opened. Extra time is spent replacing controllers, electronic boxes, and restarting the nephelometer. Over the years three new roofs have been installed over the aerosol samplers.

In addition to maintaining the air quality instrumentation, Shomburg is a wildland firefighter and a backcountry/wilderness crew leader. In the winter he maintains the cross-country ski trails, checks wood duck boxes, and helps in the visitor center. "I feel very lucky to work here," he says. With a B.S. in outdoor recreation and education and a minor in biology from Lyndon State College, VT, Shomburg brings unique skills to the Androscoggin Search and Rescue team, the Randolph Mountain Club Board of Directors, and Milan's volunteer fire department. He enjoys hiking, canoeing, biking, and running trail marathons. He and his dad have partnered up to hike the Appalachian Trail and the Long Trail and to canoe the length of the Connecticut River from New Hampshire to Massachusetts.

The White Mountain National Forest is one of the most heavily used forests in the country with over 7 million visitors annually -- more than Yosemite and Yellowstone combined. On clear days one can see New York's Adirondack Mountains 130 miles away. Average visibility is about 55 miles and on very hazy days mountain features 20 miles away are barely discernable.

Nov 2006

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Jan 2007

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 *335 Julian day* IMPROVE particle sampling day	**2** *336*
3 *337*	**4** *338* IMPROVE particle sampling day	**5** *339* Change IMPROVE particle cartridges.	**6** *340*	**7** *341* IMPROVE particle sampling day	**8** *342*	**9** *343*
10 *344* IMPROVE particle sampling day	**11** *345*	**12** *346* Change IMPROVE particle cartridges.	**13** *347* IMPROVE particle sampling day	**14** *348*	**15** *349*	**16** *350* IMPROVE particle sampling day
17 *351*	**18** *352*	**19** *353* IMPROVE particle sampling day Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge.	**20** *354*	**21** *355*	**22** *356* Winter begins IMPROVE particle sampling day	**23** *357*
24 *358*	**25** *359* Christmas IMPROVE particle sampling day	**26** *360* Change IMPROVE particle cartridges.	**27** *361*	**28** *362* IMPROVE particle sampling day	**29** *363*	**30** *364*
31 *365* New Year's Eve IMPROVE particle sampling day						

UC-Davis: *Sampler*:
General Lab
(530) 752-1123

ARS: *Optical*:
Carter Blandford or
Karen Rosener
Photography:
Karen Fischer
(970) 484-7941

"Operator Involvement -- The Key to Network Success"

Sites With ≥90% Data Completeness in 2004

Site		Completeness (%)
BRID1	Bridger	100%
CACR1	Caney Creek	100%
DOSO1	Dolly Sods	100%
FRES1	Fresno	100%
HEGL1	Hercules-Glades	100%
ISLE1	Isle Royale	100%
KALM1	Kalmiopsis	100%
MOOS1	Moosehorn	100%
PRIS1	Presque Isle	100%
SHMI1	Shamrock Mine	100%
STAR1	Starkey	100%
THSI1	Three Sisters	100%
WICA1	Wind Cave	100%
AREN1	Arendtsville	99%
BADL1	Badlands	99%
BRIG1	Brigantine	99%
CEBL1	Cedar Bluff	99%
HANC1	Grand Canyon	99%
JARI1	James River	99%
MOHO1	Mount Hood	99%
QUCI1	Quaker City	99%
ROMO2	Rocky Mountain	99%
SAWE1	Saguaro West	99%
SAGO1	San Gorgonio	99%
SENE1	Seney	99%
SNPA1	Snoqualamie Pass	99%
SYCA1	Sycamore Canyon	99%
BOAP1	Bosque del Apache	98%
CABA1	Casco Bay	98%
CHER1	Cherokee	98%
CHIC1	Chicago	98%
GRSM1	Great Smoky Mtns	98%
HECA1	Hells Canyon	98%
MKGO1	MK Goddard	98%
MORA1	Mount Rainier	98%
TONT1	Tonto	98%
TRCR1	Trapper Creek-Denali	98%
NEYO1	New York	98%
HOUS1	Houston	98%
CLPE1	Cloud Peak	98%
EVER1	Everglades	98%
GRSA1	Great Sand Dunes	98%
MACA1	Mammoth Cave	98%
MEAD1	Meadview	98%
MOMO1	Mohawk Mountain	98%
QURE1	Quabbin Reservoir	98%
SULA1	Sula	98%
WHRI1	White River	98%
CABI1	Cabinet Mountains	97%
JOSH1	Joshua Tree	97%
LIVO1	Livonia	97%
MELA1	Medicine Lake	97%
MEVE1	Mesa Verde	97%
TUXE1	Tuxedni	97%
ULBE1	UL Bend	97%
WARI1	Walker River Pauite Tribe	97%
WHIT1	White Mountain	97%
FRRE1	Frostburg Reservoir	97%
BAND1	Bandelier	96%
BIBE1	Big Bend	96%
BLMO1	Blue Mounds	96%
CHAS1	Chassahowitzka	96%
CHIR1	Chiracahua	96%
COHU1	Cohutta	96%
DENA1	Denali	96%
DETR1	Detroit	96%
GLAC1	Glacier	96%
IKBA1	Ike's Backbone	96%
LABE1	Lava Beds	96%
LOST1	Lostwood	96%
OKEF1	Okefenokee	96%
OLTO1	Old Town	96%
PUSO1	Puget Sound	96%
UPBU1	Upper Buffalo	96%
VILA1	Viking Lake	96%
PITT1	Pittsburgh	96%
PETE1	Petersburg	96%
BIRM1	Birmingham	96%
ACAD1	Acadia	95%
BOND1	Bondville	95%
BRMA1	Bridgton	95%
CACO1	Cape Cod	95%
COHI1	Connecticut Hill	95%
LIGO1	Linville Gorge	95%
BALD1	Mount Baldy	95%
NOCH1	Northern Cheyenne	95%
PORE1	Point Reyes	95%
SIME1	Simeonof	95%
WASH1	Washington DC	95%
WEMI1	Weminuche	95%
ZICA1	Zion Canyon	95%
DOUG1	Douglas	95%
ROMA1	Cape Romain	95%
OLYM1	Olympic	95%
SACR1	Salt Creek	95%
SWAN1	Swanquarter	95%
WIMO1	Wichita Mountains	95%
ATLA1	Atlanta	95%
BALT1	Baltimore	94%
CORI1	Columbia Gorge East	94%
GRGU1	Great Gulf	94%
HALE1	Haleakala	94%
JARB1	Jarbidge	94%
MONT1	Monture	94%
NOAB1	North Absaroka	94%
ORPI1	Organ Pipe	94%
PASA1	Pasayten	94%
SAGA1	San Gabriel	94%
THRO1	Theodore Roosevelt	94%
CRLA1	Crater Lake	93%
DEVA1	Death Valley	93%
ELDO1	El Dorado Springs	93%
ELLI1	Ellis	93%
GRRI1	Great River Bluffs	93%
LASU1	Lake Sugema	93%
PHOE1	Phoenix	93%
PMRF1	Proctor Research Center	93%
REDW1	Redwood	93%
TALL1	Tallgrass	93%
WHPA1	White Pass	93%
YELL1	Yellowstone	93%
RUBI1	Rubidoux	93%
NOCA1	North Cascades	93%
FLAT1	Flathead	92%
GAMO1	Gates of the Mountains	92%
LAVO1	Lassen Volcanic	92%
TRIN1	Trinity	92%
COGO1	Columbia Gorge West	92%
CRMO1	Craters of the Moon	92%
CRES1	Crescent Lake	92%
NEBR1	Nebraska	92%
SAGU1	Saguaro	92%
RAFA1	San Rafael	92%
SEQU1	Sequoia	92%
VOYA1	Voyageurs	92%
WHPE1	Wheeler Peak	92%
CADI1	Cadiz	91%
GRBA1	Great Basin	91%
SAFO1	Sac and Fox	91%
THBA1	Thunder Basin	91%
CANY1	Canyonlands	90%
HOOV1	Hoover	90%
KAIS1	Kaiser	90%
SHEN1	Shenandoah	90%
SIKE1	Sikes	90%

Cover photo: "Standing Wave Cloud Over the Craggy Mountains", 10 miles NE of Asheville, North Carolina, by Grant Goodge