INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

2nd Quarter 2002 | The IMPROVE Newsletter | Volume 11 / Number 2

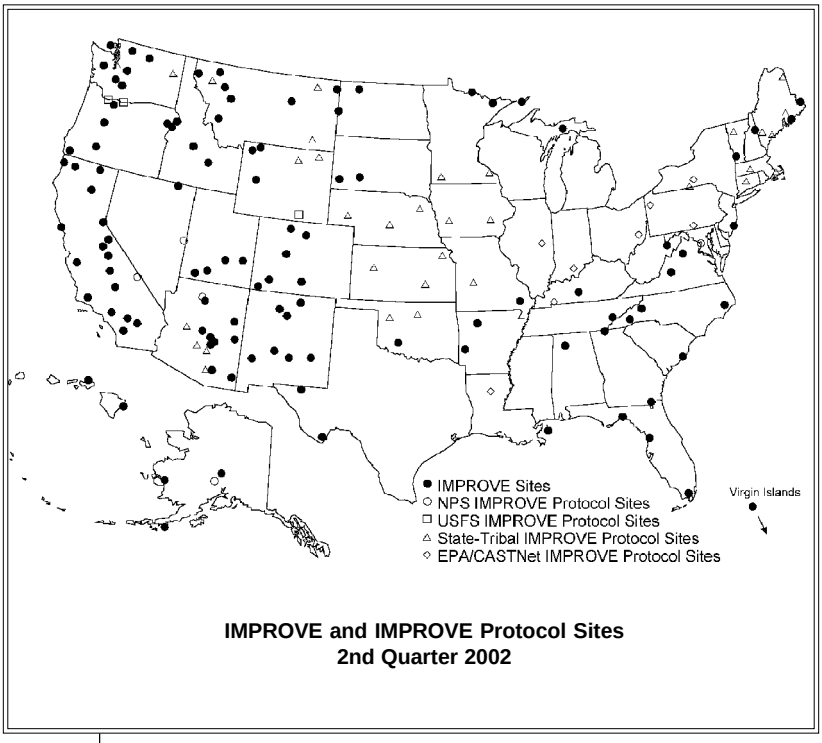
Monitoring update

Network operation status

The IMPROVE Program monitoring network consists of 110 aerosol samplers, 17 transmissometers, 8 nephelometers, and 5 camera systems during 2nd Quarter 2002 (April, May, and June). Preliminary data collection statistics for the quarter are:

- Aerosol (channel A only) 94% collection
- Aerosol (all modules) 91% completeness
- Optical (transmissometer) 95% collection
- Optical (nephelometer) 98% collection
- Scene (photographic) 78% collection

During 2nd quarter, 18 new Midwest sites received aerosol samplers and became part of the IMPROVE Protocol network. One additional site, which was scheduled to be installed in Nebraska, will be relocated to central Texas. The total number of IMPROVE and IMPROVE Protocol sites is 163.



IMPROVE and IMPROVE Protocol Sites
2nd Quarter 2002

Data availability status

Data are available on the IMPROVE Web site, at *http://vista.cira.colostate.edu/improve/Data/data.htm.* Aerosol data are available through November 2001. Aerosol data through February 2002 are expected to be available in Mid-August. Transmissometer data are available through November 2000 and nephelometer data are available through March 2002.

Photographic slides and digital images are archived but are not routinely analyzed or reported. Complete photographic archives and slide spectrums (if completed) are available at Air Resource Specialists, Inc. Slide spectrums are now also available on the IMPROVE Web site, under *Data*.

The IMPROVE Steering Committee has drafted a policy for the review and dissemination of aerosol data. The policy allows states, tribes, federal land managers, or any other organization with an interest in and specific knowledge of aerosol conditions at any of the IMPROVE or IMPROVE Protocol sites an opportunity to review and comment on the accuracy, credibility, and/or representativeness of aerosol speciation data collection. The policy attempts to provide a review opportunity without substantially delaying the appropriate uses of the IMPROVE aerosol data. The policy can be read at *http://vista.cira.colostate.edu/improve/data/IMPROVE/data_review_policy.htm*. All data posted on the IMPROVE Web site has been subject to extensive data validation procedures and are thought to be of sufficient quality for use in support of federal visibility rules.

Contractors collecting data for the IMPROVE Program are making efforts to decrease the lag time of having data available to data users. Intermediate goals were set and are expected to be improved upon in the longer term.

Intermediate goals for posting of aerosol data are 6 months after collection of the filters. (Much of the lag time is due to the filters being shipped to and from three laboratories for analysis). Intermediate goals for posting of optical data are 90 days after the period of record. It should be noted, however, that transmissometer data cannot be finalized until an annual instrument calibration has been performed.

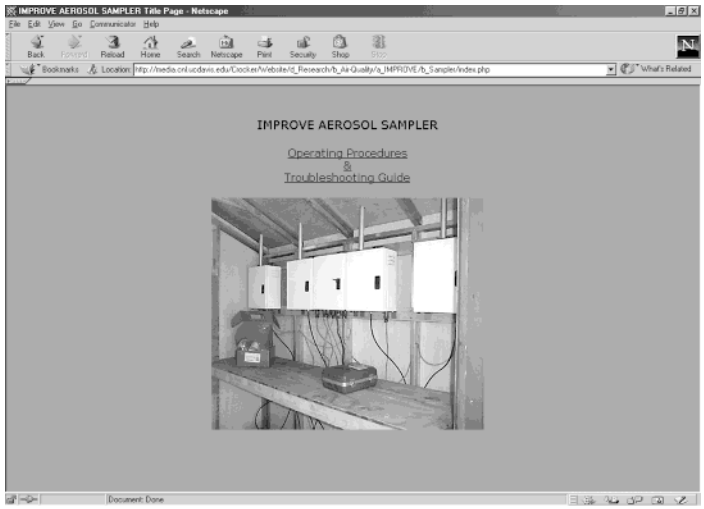
Visibility news

New Web site available for aerosol operators

A Web site is now available for IMPROVE aerosol monitoring site operators, to aid in servicing and troubleshooting site operations. This Web site was created by the University of California - Davis, aerosol contractor for the IMPROVE Program, and will be updated periodically with new information, according to monitoring operator needs.

Detailed photographs and step-by-step instructions are provided on the Web site, which currently includes:

- Normal operations (how to perform IMPROVE sampler filter changes)
- Sampler repairs (how to conduct a site audit, calibrate the modules, and replace components)
- Sampler manuals
- Contact information for further assistance
- Troubleshooting guide (coming soon)



The Web page with information for IMPROVE aerosol monitoring site operators is located at http://media.cnl.ucdavis.edu/Crocker/Website/d_Research/b_Air-Quality/A_IMPROVE/b_Sampler/index.php

The Web site was developed to further improve data completeness for the aerosol network.

IMPROVE and UCD recognizes that site operators are the key to obtaining valid data. To be valid, filters from all four sampler modules must be collected. In addition, three criteria have been set to determine the minimum number of daily samples needed to have a valid year. These criteria are:

1) 75% of the possible samples for the calendar year must be complete.
2) 50% of the possible samples for each calendar quarter must be complete.
3) No more than 10 consecutive sampling periods may be missing.

For more information contact Bob Eldred at UCD. Telephone: 530/752-1124. Fax: 530/752-4107. E-mail: eldred@crocker.ucdavis.edu.

California air board passes stronger particulate matter standards

The California Air Resources Board (CARB) in June passed new, stricter standards for particulate matter, both PM_{10} and $PM_{2.5}$. The new standards are expected to go into effect later this year, after the state completes its review process for new regulations.

The new standards result from review of California's current standards, as required by the 1999 Children's Environmental Health Protection Act. The Act requires the CARB to "review all existing health-based ambient air quality standards to determine whether, based on public health, scientific literature, and exposure pattern data, these standards adequately protect the health of the public, including infants and children, with an adequate margin of safety."

California's new standards for particulate matter are:

- 20 micrograms per cubic meter ($\mu g/m^3$) annual average for PM_{10}, not to be exceeded. This is lowered from 30 $\mu g/m^3$.
- 12 $\mu g/m^3$ annual average for $PM_{2.5}$, not to be exceeded.
- 50 $\mu g/m^3$ shall be retained as the 24-hour average standard for PM_{10}.
- 24 $\mu g/m^3$ shall be retained as the 24-hour average standard for sulfates.

The ARB is a department of the California Environmental Protection Agency. It oversees all air pollution control efforts in California to attain and maintain health based air quality standards.

For more information contact Jerry Martin at the ARB. Telephone: 916/322-2990, or Richard Varenchik. Telephone: 626/575-6730. Or, check the ARB Web site at http://www.arb.ca.gov.

Operators of distinction

Data collection begins with those who operate, service, and maintain monitoring instrumentation. Thank you, site operators, for your efforts in operating the IMPROVE and IMPROVE Protocol networks.

Aerosol sites that achieved 100% data collection for 2nd Qtr 2002 are:

Arendtsville
Mount Baldy
Bandelier
Blis

Bondville
Casco Bay
Cabinet Mountains
Dolly Sods

Everglades
Gates of the Mountains
Gila
Great Basin

Great Gulf
Haleakala
Grand Canyon
Hawaii Volcanoes

Hells Canyon
Hercules-Glades
Hoover
Isle Royale

Kalmiopsis
Lava Beds
Lassen Volcanic
Livonia

Mammoth Cave
MK Goddard
Mount Hood
Moosehorn

North Absaroka
North Cascades
Petrified Forest
Pinnacles

Presque Isle
Puget Sound
Quabbin Reservoir
Queens Valley

Cape Romain
Rocky Mountain
Salt Creek
Saguaro

St. Marks
Seney
Simeonof
Snoqualmie Pass

Starkey
Sula
Sycamore Canyon
Three Sisters

Upper Buffalo
Voyageurs
Washington DC
White Mountain

Wind Cave
Wichita Mountains
Yellowstone
Zion

This 100% data collection statistic reflects the number of samples received from monitoring sites divided by the number of possible filters. Operators at many other aerosol, optical, and scene monitoring sites also achieved excellent data collection over 95%.

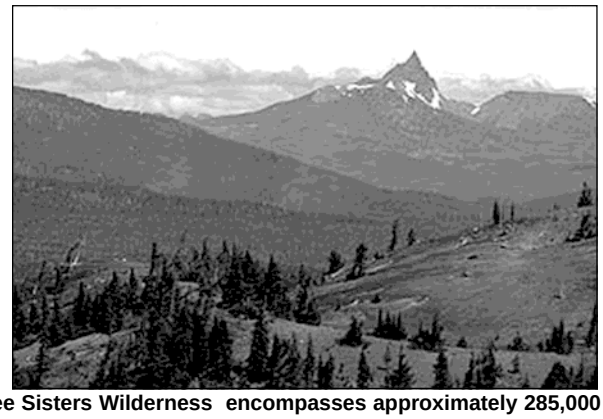
One site that consistently achieves excellent data collection is Three Sisters Wilderness, Oregon. Mike Cobb has serviced the IMPROVE aerosol sampler at Three Sisters Wilderness for several years. Although servicing the sampler constitutes only a small part of his job responsibilities, he has achieved 100% data collection for 2nd Qtr 2002.

Most of Mike's responsibilities at the wilderness are with water resources. Mike is a hydrotech, and assists soil scientists and hydrologists with water quality projects and research. He performs reservoir surveys and monitors turbidity and temperature of the wilderness' waterways to determine their quality and ability to support healthy fish and aquatic life. He also works closely with Forest Service fisheries personnel. One project being instituted this summer is the fabrication of cooling towers, which will help keep water temperatures appropriate to sustain the wilderness salmon population.

Mike joined Three Sisters Wilderness in 1982 as a temporary fire crew member. He was hired on full-time in 1988 and shifted to water quality duties in 1994. He attended a small college in Oregon and now lives with his wife (a nurse), and daughter, who works part-time with the Forest Service. In his free time, Mike likes to hunt and fish with his black Labrador retriever, maintain a garden, and spend time with his family.

As in most of the Western U.S., Oregon is having its share of wildland fires this summer. "Eleven fires are currently burning in the state. Because of some fires, the Oregon transportation people are now closing a state highway; a major east-west route over the Cascade Mountains that connects Eugene and Bend," said Mike. Although it is hot and dry in the Three Sisters Wilderness, no fires have erupted yet this season.

"This has got to affect regional air quality," said Mike. "I've changed the [IMPROVE] aerosol filters a couple of times recently and they look pretty bad." An IMPROVE aerosol sampler has operated in the wilderness since 1993.



Three Sisters Wilderness encompasses approximately 285,000 acres and is managed by the U.S. Forest Service. This Class I area is located in the Deschutes and Willamette National Forests in Oregon.

Visibility news continued on page 6....

Feature article

Spatial and temporal sulfate trends for 10-year period examined across United States

Introduction

Sulfur dioxide (SO_2) emissions into the atmosphere create fine particulate sulfate through various physio-chemical processes. Large concentrations of these sulfates may impair visibility and be detrimental to the health of both humans and the environment. Legislative and regulatory mandates and other pressures have assisted in the reduction of SO_2 emissions in the United States during the 1990s.

A number of scientific studies have investigated the temporal relationships involving SO_2 emissions. This article summarizes an examination of data performed by National Park Service and Colorado State University researchers regarding spatial and temporal trends of sulfate across the U.S. These researchers used sulfate data from IMPROVE and CASTNet (Clean Air Status and Trends Network) program monitoring sites. Data were combined into two time periods, 1990-1994 and 1995-1999, to determine: 1) spatial trends, 2) temporal trends, and 3) comparison of trends in SO_2 emissions and sulfate concentrations.

Spatial trends

Spatial trends of summer and winter 90th percentile sulfate mass concentrations were examined for the periods 1990-1994 and 1995-1999. The 90th percentile concentrations were selected because the highest sulfate mass concentrations, which occur in the eastern U.S., correspond to the highest fine mass loadings, hence the potential of greatest health impact, reduced visibility, and climate forcing.

The examination showed that summer sulfate concentrations are highest along the Ohio River Valley and in central Tennessee where SO_2 emissions are highest. Figure 1 below shows the summer sulfate concentrations for the 1995-1999 period. Concentrations in this area are twice that of concentrations in the Northeast, northern Michigan, and coastal areas of the Southeast, and 15 times greater than the Central Western U.S.

Summer concentrations for the two periods are about 2 1/2 to 3 times higher than winter concentrations in the eastern U.S. and about 1 1/2 times higher than winter concentrations in the western U.S. When the two summer periods are compared, a southern shift in the region of the highest sulfate concentrations is apparent. During winter, concentrations along the higher elevations in the Appalachian Mountain region are lower than surrounding lower elevations.

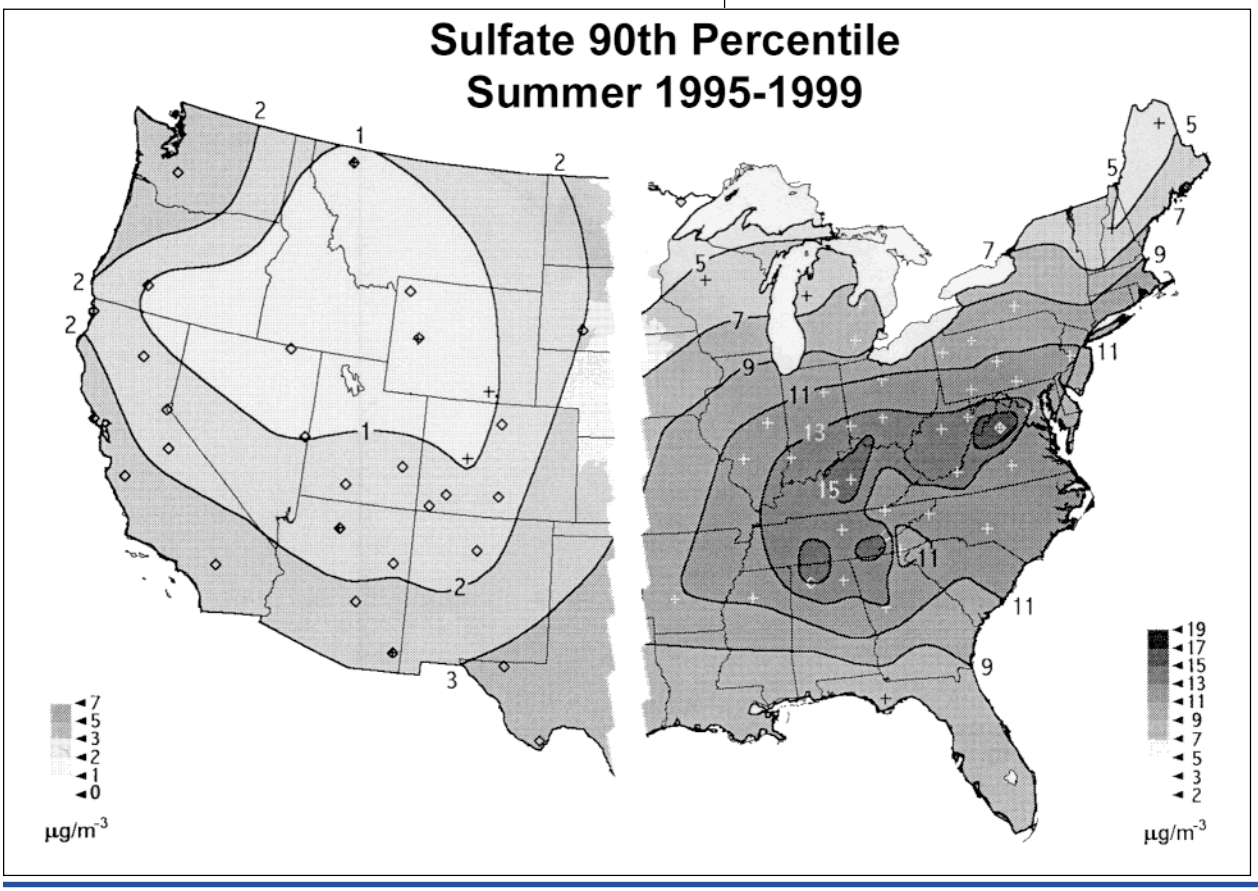


Figure 1. Summary of spatial trends of the 90th percentile sulfate ion concentrations (3*S for the IMPROVE Program) for the average 1995-1999 summer season (June, July, August).

Temporal trends

Temporal trends in the annual 80th percentile sulfate mass concentration for an 11-year period (1988 through 1998) show that in general, most monitoring sites show a decrease in sulfate concentration. The largest decreases in the East occurred north of the Ohio River Valley. The patterns of the 20th percentile are similar to those of the 80th percentile.

Comparison of trends in SO_2 emissions and sulfate concentrations

Since sulfate concentrations are a primary result of SO_2 emissions, the SO_2 emission trends were examined and compared to sulfate concentrations. Trends were examined for each state from 1990-1999 using annual SO_2 emission rates from the EPA's National Emission Trends (NET) database.

In the northern half of the eastern U.S., SO_2 emissions have decreased from 10% to 60% per state and about 30% over the entire region. States along the Ohio River Valley (Ohio, Indiana, Illinois, Kentucky, and West Virginia), which have the highest SO_2 emissions in the country, had statistically significant decreases over the 10-year period. In the southern half of the eastern U.S., however, emissions have increased. Increases are also apparent in the Central states, with Wyoming, North Dakota, and Minnesota having the highest SO_2 emission rates in the Northern Central region. Emissions throughout most of the western U.S. have decreased.

Finally, trends in SO_2 emission rates from 1990-1999 and ambient annual 80th percentile sulfate concentrations were compared over broad geographic regions (Northeastern, Southeastern, South-central, and Western U.S.). As can be seen in Figure 2 below, the Northeastern region has the largest SO_2 emission rates. This region showed decline in both SO_2 emissions and sulfate concentrations during the early 1990's and a sharp 20% drop between 1994 and 1995. This decline coincides with the 1995 reduction of emissions from utilities participating in the Phase I implementation of the Acid Rain Program. The Southeastern region showed annual SO_2 emissions and sulfate concentrations not changing much over the 10-year time period. The South-Central region showed a 15% increase in both annual SO_2 emission rates and sulfate concentrations, and the Western region showed a similar 15% decrease in both annual SO_2 emission rates and sulfate concentrations.

The research presented in this examination was briefly discussed at the AWMA conference in Baltimore, Maryland in June 2002. The examination is fully detailed in a January 2002 paper submitted for publication, titled "A ten-year spatial and temporal trend of sulfate across the United States."

For more information contact Rodger Ames at Colorado State University. Telephone: 970/491-3700. Fax: 970/491-8598. E-mail: rames@cira.colostate.edu.

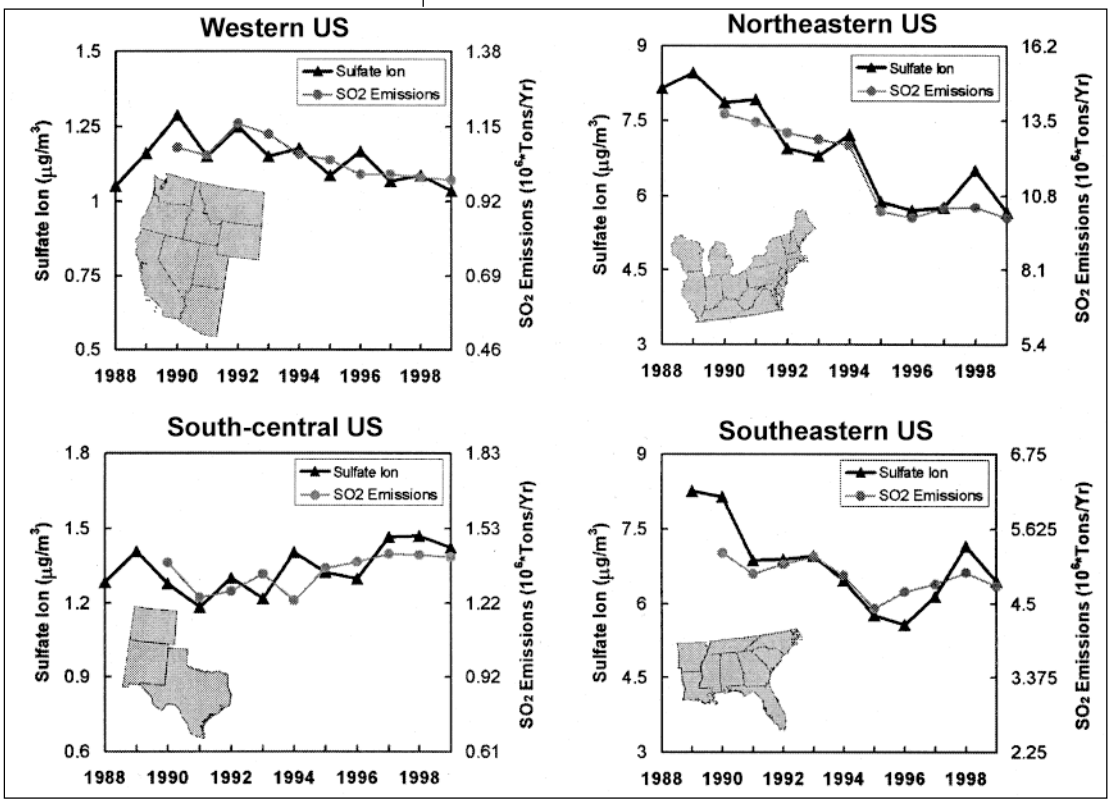


Figure 2. Comparison of the ambient sulfate 80th percentile sulfate concentrations (3*S for IMPROVE Program) and NET SO_2 emissions aggregated over Northeastern, Southeastern, South-central, and Western U.S. regions. In each plot, the sulfate and SO_2 emission scales have a factor of 3 change between the low and high values.

Visibility news

continued from page 3 ....

Grand Canyon, Joshua Tree, Mammoth Cave National Parks join Web cam network

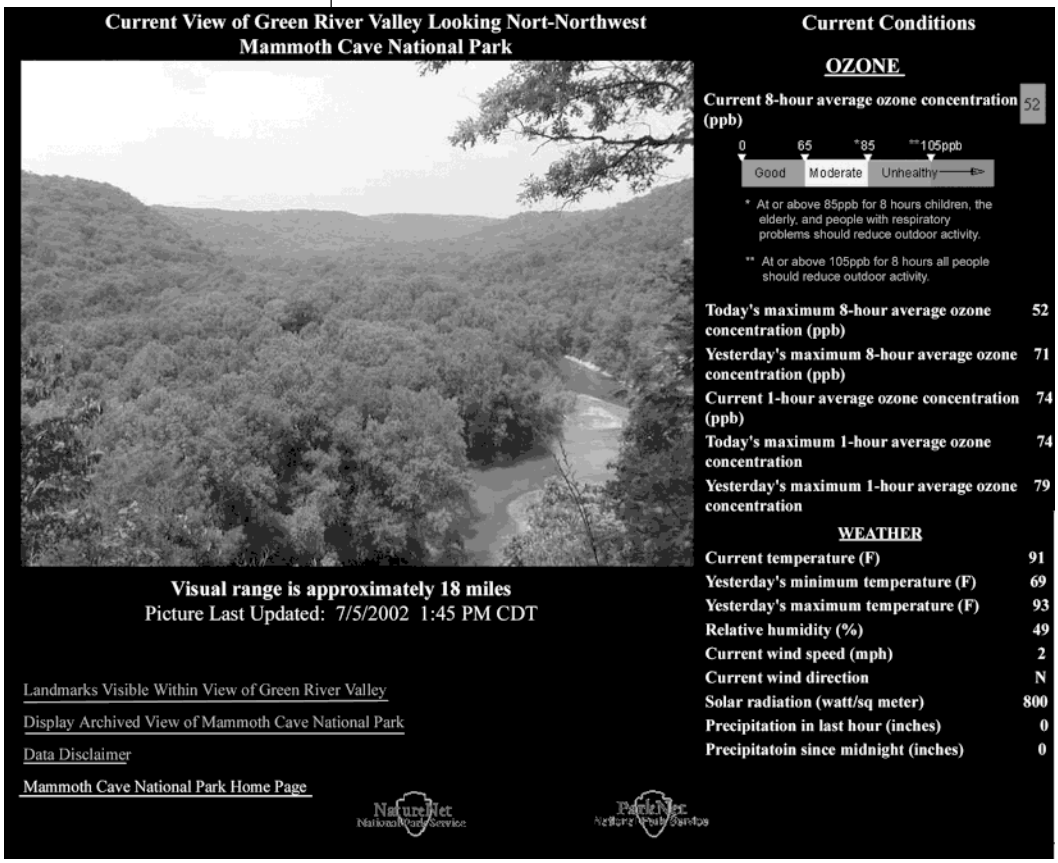
The National Park Service expanded its network of Web cameras with the additions of Grand Canyon, Joshua Tree, and Mammoth Cave National Parks. These parks join Acadia, Big Bend, and Great Smoky Mountains National Parks in displaying visibility and air quality information on the Internet. Several other agencies also provide images of park scenes using Web cameras. Later this year, National Capital, Sequoia and Kings Canyon National Parks, and Theodore Roosevelt National Park will also go online with Web cameras.

This network of Web cameras and Web sites is one way the National Park Service (NPS) communicates information and understanding to various audiences, including park personnel, NPS managers, park visitors, regulatory agencies, the general public, and others. Visibility and air quality data collected in each park by various programs, including the IMPROVE Program, are provided on the Web sites for use by audiences, as well as scientists and researchers.

The Web sites have a similar appearance; they display near real-time digital camera images in conjunction with optical data provided by the IMPROVE Program, and air quality and meteorological data provided by the National Park Service. Each monitoring location is equipped with a high-resolution digital camera system, and ozone, temperature, relative humidity, wind speed, wind direction, and precipitation sensors. Grand Canyon and Mammoth Cave are also equipped with a transmissometer or nephelometer, which are used to estimate the visual range that corresponds with the near real-time image.

The Internet connectivity configuration varies at each site, but acquiring the data and uploading to the Internet are similar. A computer instructs the digital camera to take a digital image of a selected vista every 15 minutes. The computer also polls on-site and off-site dataloggers every hour to collect ozone, meteorological, and visibility data. The computer then uploads that data and image to the National Park Service Web server. The Web sites were developed by the NPS Air Resources Division in cooperation with park staff.

Installing Web camera systems and data collection equipment is different for every site, and is based on each site's unique characteristics. Site logistics need to take into account acceptable views to monitor, general location, availability of electrical power and telephone service, and data collection needs. All of the National Park Service Web cam sites make use of existing NPS and/or IMPROVE monitoring stations in a cooperative effort.



Example Webcam display from Mammoth Cave National Park, Kentucky. The page displays a near real-time photographic image, corresponding visual range value, ozone conditions, and weather parameters.

The Web camera at Grand Canyon National Park, Arizona, became operational last fall. The camera is located at Yavapai Point and views west across the Canyon. At this site, the personal computer polls two dataloggers; the local datalogger is for the transmissometer and the remote one is for ozone and meteorology data. That same personal computer will also control the digital display on the newly rebuilt outdoor exhibit.

Construction on the exhibit is now underway. The camera at Joshua Tree National Park, California, also became operational last fall. It is located on Belle Mountain overlooking the park. The view can document significant quantities of pollutants from the Los Angeles urban area affecting the park. The camera at Mammoth Cave National Park, Kentucky, became operational late last year. It is located near a lookout on the Green River Bluffs Trail. The site provides an excellent view looking generally northward of the Green River Valley and several ridgelines at various distances from the site. The Mammoth Cave camera location is remote, with no electrical power available. The camera equipment is connected to computer, power, and telephone service through a 1,200-foot buried conduit containing low voltage power and signal cable.

The network of Web cameras is part of NPS' dedicated effort to facilitate exchange of air quality related information. Internet addresses of these, and other Web cameras funded by the NPS are available on the IMPROVE Web page at *http://vista.cira.colostate.edu/IMPROVE/data/other/webcam/webcam.htm* or specific NPS Web address. Web camera technology has become popular and widespread, as can be seen by browsing the Internet.

For more information about the Web camera systems contact Scott Cismoski at Air Resource Specialists, Inc. Telephone: 970/484-7941. Fax: 970/484-3423. E-mail: scismoski@air-resource.com. For more information about the Web pages contact Dave Joseph at the National Park Service. Telephone: 303/969-2816. E-mail: david_joseph@nps.gov.

What's new on the IMPROVE Web site

The IMPROVE Web site continues to add new items. Recent additions to the Web site (*http://vista.cira.colostate.edu/improve*) include:

Quality assurance documents. The IMPROVE aerosol monitoring network Quality Assurance Project Plan and the Quality Management Plan are now available as .PDF documents.

New Links to Web cameras in Class I areas. Click on the WEB CAM link to see a list of Web cameras operating in the national parks.

WHITEX final report. The Winter Haze Tracer Experiment (WHITEX) special study, conducted in 1989, final report is now available.

Standard operating procedures. Procedures for the IMPROVE aerosol monitoring network ion chromatography analysis are available.

Changes and additions to the IMPROVE Web site are highlighted in the "Bulletins" section, located at the bottom of the home page. The above new items can all be reached by clicking on them as listed in the "Bulletins" section.

For more information or questions regarding the IMPROVE Web site, contact Bret Schichtel at CIRA. Telephone: 970/491-8581. Fax: 970/491-8598. E-mail: Schichtel@cira.colostate.edu.

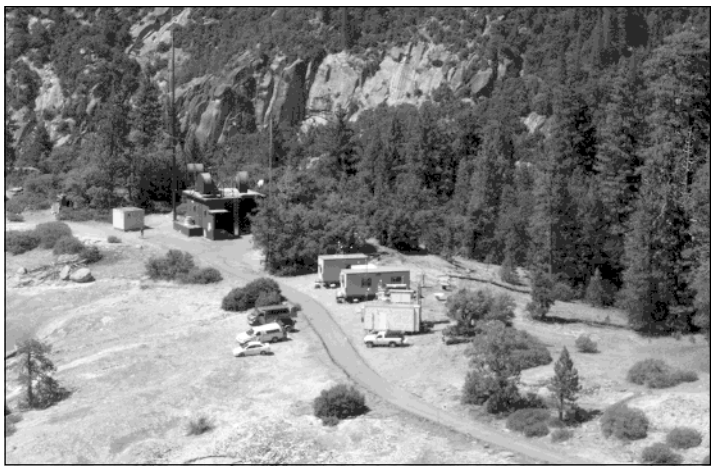
Special studies

Yosemite aerosol characterization study

The National Park Service is sponsoring a wildland fire air quality study this summer at Turtleback Dome in Yosemite National Park, California. It is estimated that 50% or more of organic carbon at remote area monitoring sites is due to fire, and that emissions in the western U.S. from prescribed fire programs are expected to increase by a factor of 10 in the coming years. The 8-week study is being performed to: 1) characterize biomass smoke physical, chemical, and optical properties, and 2) begin to develop unambiguous and routine biomass smoke apportioning methodologies.

Various particle samplers, optical instruments, and meteorology sensors will be used to sample different particle-size distributions and current air quality conditions.

For more information contact Derek Day at the Cooperative Institute for Research in the Atmosphere. Telephone: 970/491-8354. Fax: 970/491-8598. E-mail: day@cira.colostate.edu.



The Yosemite aerosol characterization study is being conducted from mid-July through mid-September at Turtleback Dome. Study trailers visible in the center of the photograph above include an aerosol trailer, chemistry trailer, an IMPROVE aerosol sampler stage, and the IMPROVE study trailer.

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IMPROVE STEERING COMMITTEE

IMPROVE Steering Committee members represent their respective agencies and meet periodically to establish and evaluate program goals and actions. IMPROVE-related questions within agencies should be directed to the agency's Steering Committee representative. Steering Committee representatives are:

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Associate Membership in the IMPROVE Steering Committee is designed to foster additional IMPROVE-comparable visibility monitoring that will aid in understanding Class I area visibility, without upsetting the balance of organizational interests obtained by the steering committee participants. Associate Member representatives are:

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Government organizations interested in becoming Associate Members may contact any Steering Committee member for information.

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The IMPROVE Program was designed in response to the visibility provisions of the Clean Air Act of 1977, which affords visibility protection to 156 federal Class I areas. The program objectives are to provide data needed to: assess the impacts of new emission sources, identify existing human-made visibility impairments, and assess progress toward the national visibility goals as established by Congress.

To submit an article, to receive the IMPROVE Newsletter, or for address corrections, contact:

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IMPROVE Newsletters are also available on the IMPROVE Web site at http://vista.cira.colostate.edu/improve/Publications/publications.htm, and on the National Park Service Web site at: http://www.aqd.nps.gov/ard/impr/index.htm

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