NEW MEXICO
Climate

A service of NMSU's Climate Center | 2007 Vol. 5 (1)
Office of the State Climatologist | Department of Plant and Environmental Sciences
College of Agriculture and Home Economics | Agricultural Experiment Station

New Mexico Climate

Spring 2007
Vol. 5 (1)

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Cover Photo:
Big snow storm that hit Albuquerque in December 2006.
Photo by: CoCoRaHS Station NM-BR-6

If you have a photo or slide that you would like considered for the cover of New Mexico Climate, please call us for instructions (number below). Enclose a note describing the contents and circumstances including location and date it was taken. Digital photographs can also be considered. Submit digital imagery via attached files to email at the right. Unless otherwise arranged in advance, photos cannot be returned.

About NMSU's Climate Center

NMSU's Climate Center is home to the state climatologist who helps New Mexicans understand the impact of climate changes on the environment, human health, and agricultural production.

The state climatologist is responsible for archiving weather data and distributing climate information to the public. Unlike meteorologists, climatologists do not provide weather forecasting or up-to-the-minute bulletins. Instead, they use a computerized data collection system to provide statewide weather reports for previous days, as well as for historical information.

The state climatologist puts climate data into a form people can use to make decisions about their lives. During fire season, people use climate data to assess potential fire hazards and to evaluate fire-fighting conditions. Engineers use information about rainfall and flooding to design bridges, culverts, storm sewers, and sanitary sewers. Business owners use climate data to evaluate new business or relocation sites. Farmers use it to anticipate outbreaks of insect pests or crop diseases. People also use climate data when making their recreation and travel plans.

For more information:
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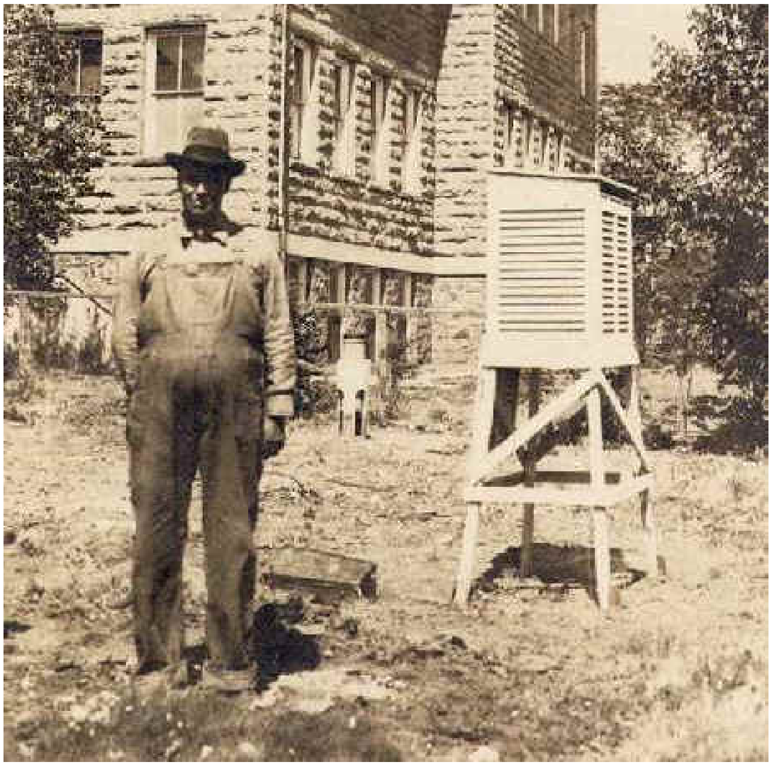
Internet: http://weather.nmsu.edu

The office of the state climatologist and its head, the state climatologist, are described in New Mexico Statue 75-4-1 through 75-4-4

Modernizing the Cooperative Observer Network of climate station

By Dr. Ted Sammis *

The Cooperative Observer Network (coop) of climate stations operated by the federal government was established by the Organic Act of 1890 concurrent with the launch of the U. S. Weather Bureau. Some particularly valuable stations within the coop have been operating continuously since the early 1800s. The climate station in Las Cruces NM was started in 1895. The network now consists of about 10,900 observing sites in the United States and about 203 sites in New Mexico not all currently active. The COOP climate data of maximum and minimum temperature, rainfall and snowfall are measured by volunteers and is entered into a database from data recorded on paper and then transferred to electronic format. The data is stored at NCDC and other internet sites. The long term data are the basis for global warming studies, hydrology studies of rainfall runoff relationships, long term drought conditions studies and heating or cooling degree days for calculating insect development and heat and cooling loads on buildings. As volunteers retire it is becoming harder to find people that will continue to measure the climate parameters 7 days a week 52 weeks a year. The federal government is considering automating the network with automated climate stations. However, the modernization program has stalled in congress and the American Association of State Climatologists organization has volunteered to work with NOAA and Congress to make the modernization of the coop successful if Congress will allocate the needed fund to accomplish the task. In addition to the coop network the federal government runs RAWS, Snowtel, ASOS, and AWAS automated climate networks that need to be integrated with the coop updated network. Each state, including New Mexico also runs automated climate stations that again need to be integrated into the national modernized network to provide real time climate data on the internet at no cost to the public.



Many private climate stations are being installed and these data are available on the internet. As these automated climate networks involve, quality control on all them becomes an issue of importance. The coop network has excellent rainfall data compared to the automated networks because of the difficulty and cost of measuring rainfall with an automated rain gage. New technology needs to be developed to improve on low cost automated rain gages. As electronic technology decreases in price, the ability to measure rainfall accurate and cheaply increase.

The future of understanding global warming, extreme weather conditions, drought conditions and the impact of climate change on the New Mexico and U. S. economy depends on accurate climate information, the backbone of which is the coop network. Consequently, a modern automated coop station integrated with the other automated stations and the disseminated information over the internet will result in better quality of live for people in New Mexico and the United States.

* *Department of Plant and Environmental Science, NMSU*

How much CO_2 have humans added to the atmosphere, and how does this compare with natural variations?

By Dr. Vince Gutschick*

Two relevant patterns are apparent when we examine carbon dioxide in the atmosphere (CO_2). First, CO_2 levels have varied over time. They have risen markedly in the past century, especially in the last half-century. We see this in detailed measurements of the air, out in the middle of the ocean, where it is well mixed from all over the earth and far from local industrial sources of CO_2 (Fig. 1). Second, humans have been releasing CO_2 into the air at high rates, since the Industrial Revolution began in the early 1800's. We can quantify the rate of CO_2 release readily. Our use of fossil fuel is closely tracked by records of oil, coal, and gas production (Fig. 2). We also are deforesting the globe, releasing CO_2 as the tree biomass burns. Deforestation is occurring at high rates that can be measured, particularly in the last decades using satellite imagery. Are these two patterns related, the second causing the first? Is it possible that a substantial part of the rise in CO_2 comes from natural variations in the chemistry of the globe? We do see large variations in CO_2 over the last 400,000 years, when we examine air trapped in ice cores (Fig. 3).

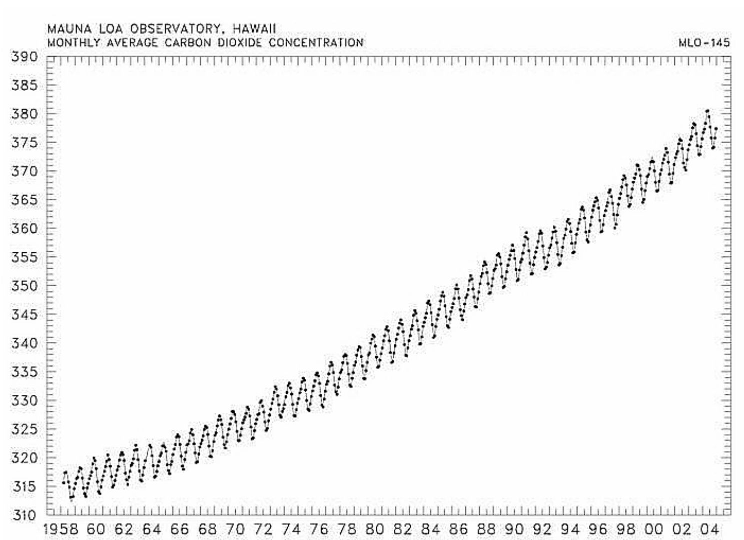


Fig. 1. Carbon dioxide concentrations measured at Mauna Loa peak in Hawaii by Charles Keeling and coworkers.

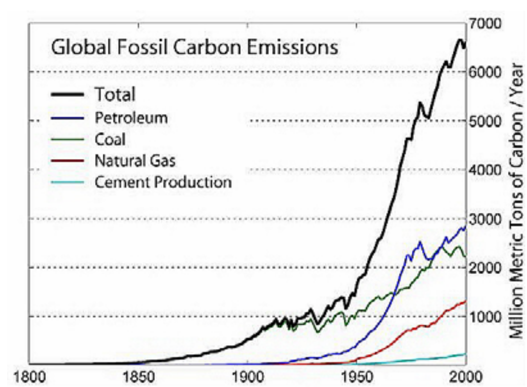


Fig. 2. Use of major fossil fuels that contribute CO2 to the air (Wikipedia).

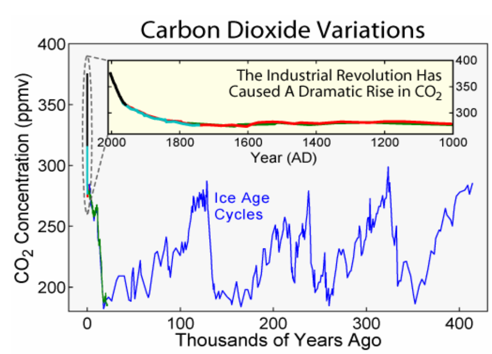
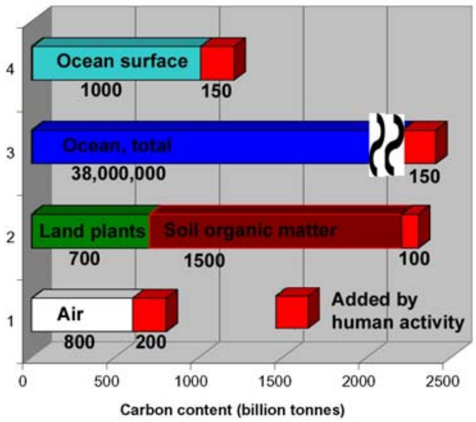


Fig. 3. Atmospheric concentrations of CO_2 derived from air trapped in ice cores.

There are many pieces of evidence that humans have caused the rise. First, the atmosphere has gained about 200 Pg (petagrams; trillion metric tons) of carbon since the Industrial Revolution. This is about 40% of the carbon we put into the air from using fuels and deforesting large areas, totaling about 500 Pg. The ocean is absorbing about 40% of our addition, and extra growth of land plants at high CO_2 absorbs around another 20%. Second, the CO_2 from fossil fuels has a distinct chemical signature, in what is termed its stable isotope composition. Carbon is mostly carbon-12, having 6 neutrons in the nucleus of each atom along with the 6 protons. A small fraction of carbon is the heavier carbon-13 (^{13}C). We can measure the fraction of ^{13}C with great accuracy in the atmospheric CO_2 as well as in fuels and plants. The rate of change of the ^{13}C fraction in CO_2 in the air is well matched to the amount of fuel use and the rate of deforestation.

Are there, nonetheless, natural sources of CO_2 that might have changed enough in the last two centuries to explain a major part of the rise of CO_2 in the air? Certainly, volcanoes inject CO_2; although the amount is uncertain, it appears to be less that one-hundredth the rate of the sources attributed to humans. The activity of plants might also vary. Their photosynthesis takes CO_2 out of the air and releases oxygen. At the same time, dead matter in soil decomposes, releasing CO_2. Overall, we expect these two processes to be in balance. Can they get far out of balance for a century or more at a time? Figure 4 shows the human additions to the atmosphere, land biomass, and oceans. The gain in the air is about 200 Pg, from human activities. Are we sure? If the atmosphere had to gain 200 Pg by decomposition outstripping photosynthesis, instead, it would have to be accompanied by great losses in biomass around the world that would certainly be noticed, but which has not been seen. We can again turn to stable isotopes in old plant samples to affirm that this has not been a significant change. In summary, we did it, not nature.



Biology Department, NMSU

The Community Collaborative Rain, Hail and Snow Network

By Dr. Nolan Doesken* & Dr. Deborah Bathke**

CoCoRaHS - the Community Collaborative Rain, Hail and Snow Network -- is a growing organization of volunteers of all ages and backgrounds who share a common interest in weather. Using simple tools -- a very accurate but low cost plastic rain gauge, rulers for measuring snow, and squares of Styrofoam wrapped with aluminum foil ("hail pads") -- volunteers carefully measure and report the precipitation that lands in their yards, gardens, fields or pastures. With the help of the Internet and a coordinated website for gathering and displaying volunteer reports, precipitation maps are immediately compiled and available to the public. http://www.cocorahs.org.

CoCoRaHS originated in Colorado in the late 1990s after a major flash flood devastated the campus of Colorado State University. Five people near the campus died in the flood waters. Despite modern weather technology, the intensity of the storm was underestimated, and no rainfall reports reached the National Weather Service in a timely manner. Since then, the Colorado Climate Center at Colorado State University has been promoting CoCoRaHS as a great way for citizens and scientists to work together to improve weather prediction, water resources monitoring and climate research.

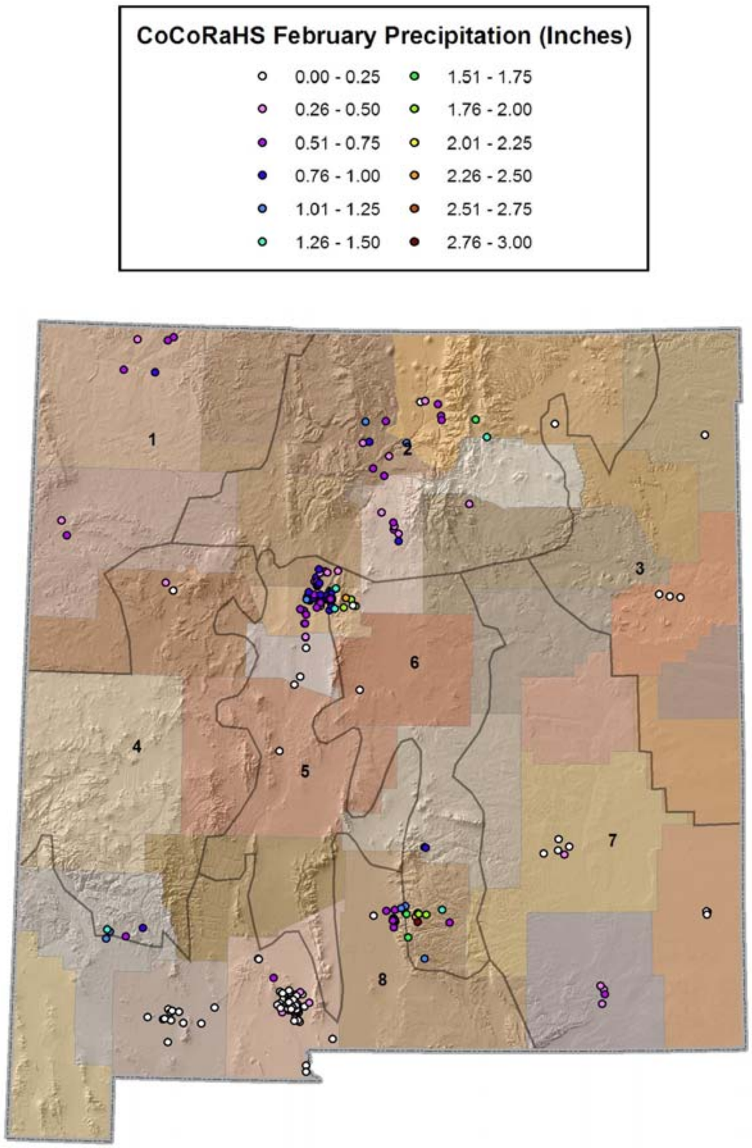
New Mexico CoCoRaHS station in Sandoval County (NM-SN-1).

New Mexico joined the CoCoRaHS network in 2005. Since then, over 500 volunteers have signed up to participate in the program. Nationally, 17 states and the District of Columbia now participate in CoCoRaHS. Over 3500 volunteers are currently involved and many others regularly use the CoCoRaHS website to view and access data. More states will soon be joining.

Nolan Doesken, State Climatologist for Colorado, is the founder of the CoCoRaHS network. "Precipitation, especially in the dry western states, is incredibly important," he said. "It is our water supply and our livelihood. Precipitation is so incredibly variable! It may pour on one side of the road and be dry on the other. One month we'll be having severe drought and the next thing we know we're having floods (remember 2006?).

While official weather observing networks exist, the stations are too far apart to accurately document precipitation patterns.

Snow is hard to measure, and hardly any weather stations measure the properties of hail."



Data collected by volunteers can help provide warning for floods and can also provide important information about emerging droughts. "Many don't realize it, but scientists have surprisingly little data to assess current and future water supplies" Doesken pointed out. "Automated instruments for measuring precipitation are expensive and not always accurate. Every single volunteer report of rain, hail and snow is useful. We need more volunteers, not only in rural areas where data are very sparse, but also in urban areas."

In the two years since the New Mexico State Climate Office brought CoCoRaHS to New Mexico, volunteers have already helped track extreme drought conditions, major hail storms, and very heavy snows this past winter. During the summer of 2006, several CoCoRaHS volunteers in the mountains east of Alamogordo received over 25" of rain in less than three months.

Please help us recruit more volunteers for CoCoRaHS. If you know people who might be interested, please point them to the CoCoRaHS website or contact Deborah Bathke, the New Mexico Assistant State Climatologist. (E-mail: djbathke@nmsu.edu, Phone: (505) 646-6327).

***Colorado Climate Center, Colorado State University*

*****Plant and Environmental Sciences, NMSU*

Questions for the New Mexico Climate Center:

Question : Does the greenhouse effect vary with elevation?

Answer by Dr. Vince Gutschick

Carbon dioxide (CO_2) increases the temperature of the earth's surface by trapping a fraction of thermal radiation escaping from the surface. This is the same as windows in a house or a car trapping this radiation escaping from the interior. The amount of heating of the surface locally is directly related to the amount of thermal radiation trapped. Consequently, the heating at a location depends upon the amount of CO_2 above that location. At higher elevations, there is less air above a site. There is also less CO_2, because the proportion of CO_2 in air is very nearly constant across the globe.

Does this mean that higher elevations have less heat trapping and will warm less than low elevations? This is only true for very broad regions of high elevation. Consider a single mountain range oriented transversely (crosswise) to the mean wind direction. In a single day, air moves across the range from distances of perhaps a hundred kilometers, maybe more. The average air temperature will depend very much on the energy transfers far away. Greenhouse warming then depends upon radiation trapping far upwind, more so than the trapping right over the site.

Question: Is there any place I can go to get heat units (55-85) for Deming, Hatch, and Las Cruces? I would like to report them to growers on a weekly basis.

Answer: Yes you can get this information by going to the New Mexico Climate Center. Select Irrigation Management and GDD Climate Data Retrieval System form at:

http://weather.nmsu.edu/cgi-shl/cns/oldformat.pl

Next select the climate station you want and over riding the gdd cutoff settings by entering in 999 for max and -999 for min and then the base temp 55 or 60 or your desired base temperature. Next retrieve the data. The program will compute heat units = max + min/2 - base temperature with no cutoffs. The accumulative is from when you start the calculations based on the starting and ending dates you entered in the program. You can copy and past the data from the screen into a spreadsheet.