

"CITIZENS MONITORING PRECIPITATION IN THEIR BACKYARDSFILLING IN THE GAPS"

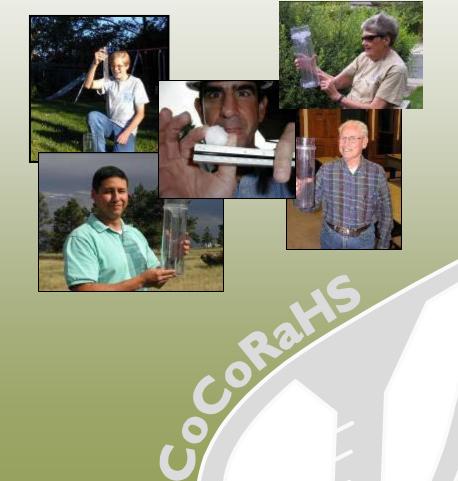




WHAT IS COCORAHS??

"CoCoRaHS is a grassroots, non-profit, community-based, high-density precipitation network made up of volunteers of all backgrounds and ages . . .





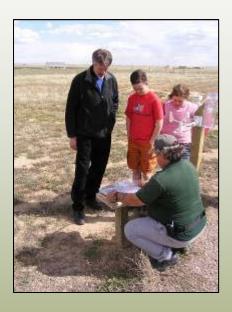
... who take daily measurements of precipitation right in their own backyards"











c.oRa

Just Precipitation!





s how

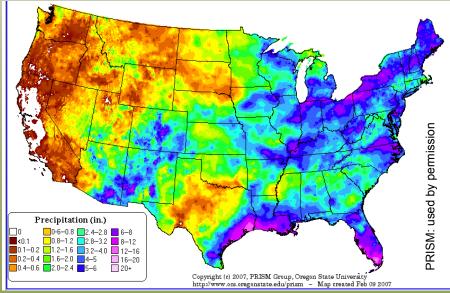
WHY COCORAHS ??



1) Precipitation is important and highly variable



2) Data sources are few and rain gauges are far apart



3) Measurements from many sources are not always accurate (especially snow)

4) There is almost no quantitative data being collected about hail

5) Storm reports can save lives



Our volunteers collect data by using low-cost measurement tools:





Aluminum foil-wrapped Styrofoam hail pads

4-inch diameter high capacity rain gauges

All volunteers are trained

This helps CoCoRaHS to provide accurate and high quality data.

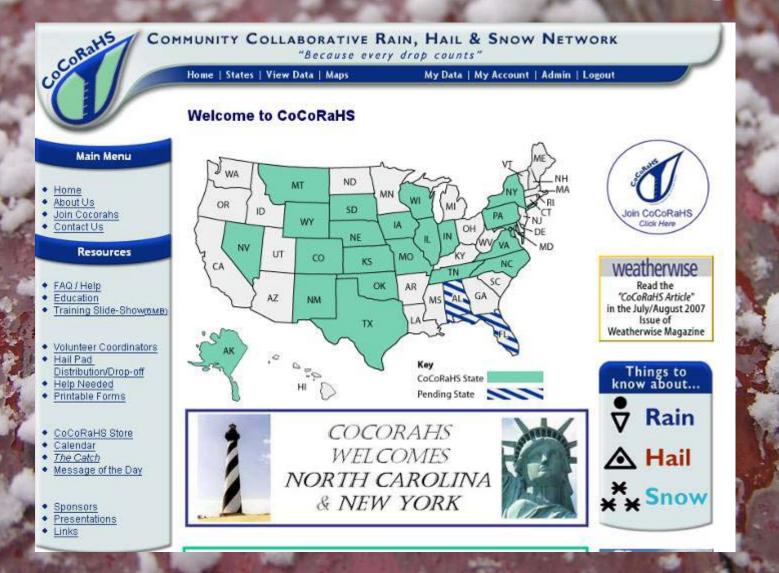






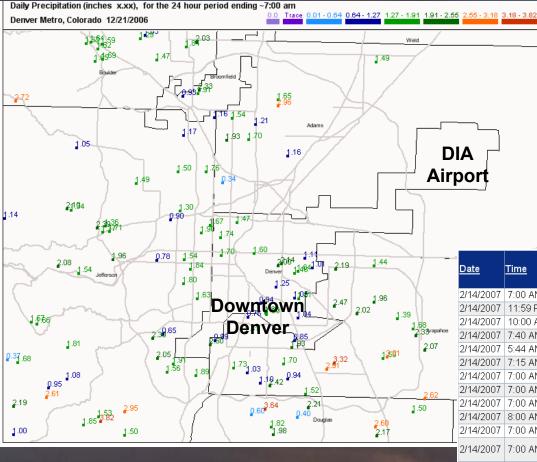
Training may take place at local training sessions, by CD or via the Web

Volunteers report their daily observations on our interactive Web site: www.cocorahs.org



Observations are immediately available in map and table form for the public to view.

| - | | | Station | | | | Total | | _ | |
|----|-------------|-----------|----------|----------------------------|------------|------------|------------|-------|--------------------|----------|
| | <u>Date</u> | lime | Number | Station Name | | | | State | County | View |
| | | | | | <u>.in</u> | <u>.in</u> | <u>.in</u> | | - | |
| oe | | 7:00 AM | MD-GR-1 | Mc Henry 4.0 SSE | 2.85 | 6.7 | 12.5 | MD | Garrett | 2 |
| | 2/14/2007 | 11:59 PM | MD-MG-8 | Gaithersburg 2 WNW | 2.80 | 4.2 | 4.0 | MD | Montgomery | |
| | 2/14/2007 | | MD-CR-7 | Westminster 1.0 W | 2.10 | 5.5 | 5.5 | MD | Carroll | 2 |
| | | 7:40 AM | MD-MG-1 | Montgomery Village 1.3 SSW | | 4.1 | 3.0 | MD | Montgomery | |
| | 2/14/2007 | 5:44 AM | MD-WH-1 | Williamsport 2.8 ENE | 1.92 | 2.6 | 5.0 | MD | Washington | ۵, |
| | 2/14/2007 | 7:15 AM | MD-CR-3 | Mount Airy 0.2 SE | 1.90 | 5.1 | 5.0 | MD | Carroll | A |
| | 2/14/2007 | 7:00 AM | MD-CR-6 | Taneytown 3.2 NE | 1.83 | 5.0 | NA | MD | Carroll | A |
| | 2/14/2007 | 7:00 AM | MD-HW-2 | Sykesville 1.7 SSE | 1.78 | 5.0 | 5.0 | MD | Howard | ۵, |
| | 2/14/2007 | 7:00 AM | MD-HW-12 | Sykesville 2.6 SE | 1.61 | 0.0 | NA | MD | Howard | 2 |
| | 2/14/2007 | 8:00 AM | MD-MG-3 | Potomac 0.9 NNW | 1.54 | 3.2 | NA | MD | Montgomery | ۵, |
| | 2/14/2007 | 7:00 AM | MD-MG-2 | Redland 0.8 NNE | 1.52 | 4.5 | 4.5 | MD | Montgomery | (🔍 |
| | 2/14/2007 | 7:00 AM | MD-PG-37 | Brandywine 6.7 ESE | 1.49 | т | т | MD | Prince George's | 3 |
| | 2/14/2007 | 7:00 AM | MD-PG-1 | Bowie 0.5 E | 1.47 | 1.0 | 1.5 | MD | Prince George's | 4 |
| | 2/14/2007 | 7:00 AM | MD-SM-3 | Leonardtown 0.6 NE | 1.42 | 0.0 | NA | MD | St. Mary's | 2 |
| | 2/14/2007 | 7:00 AM | MD-CH-7 | Waldorf 3.2 SW | 1.40 | 0.8 | 0.7 | MD | Charles | 2 |
| | 2/14/2007 | 7:00 AM | MD-HW-11 | Columbia 1.7 W | 1.40 | 3.2 | 3.5 | MD | Howard | 4 |
| | 2/14/2007 | 7:00 AM | MD-PG-7 | Camp Springs 1.6 NNW | 1.38 | 1.8 | NA | MD | Prince George's | 24 |
| | 2/14/2007 | 4:00 PM | MD-BL-7 | White Hall 3.5 NE | 1.38 | NA | NA | MD | Baltimore | ۵, |
| | 2/14/2007 | 7:00 AM | MD-CV-1 | Marlton 6.0 E | 1.37 | 0.3 | 0.0 | MD | Calvert | 2 |
| | 2/14/2007 | 7:00 AM | MD-SM-4 | Charlotte Hall 3.6 ENE | 1.37 | 0.3 | Т | MD | St. Mary's | ۵, |
| | 2/14/2007 | 7:00 AM | MD-MG-24 | White Oak 1.2 N | 1.35 | 2.5 | 2.0 | MD | Montgomery | (🔍 |
| | 2/14/2007 | 7:00 AM | MD-PG-35 | Brandywine 2.5 NNW | 1.35 | 1.0 | 1.4 | MD | Prince George's | 2 |
| | 2/14/2007 | 7:00 AM | MD-WC-1 | Vienna 11.3 SSW | 1.35 | 0.0 | NA | MD | Wicomico | ۵. |
| | 2/14/2007 | 7:00 AM | MD-PG-6 | Friendly 1.0 N | 1.32 | 2.4 | 1.8 | MD | Prince George's | 3 |
| | 214 4/2007 | 7.00 4.84 | | | 1 24 | 24 | 25 | | | |



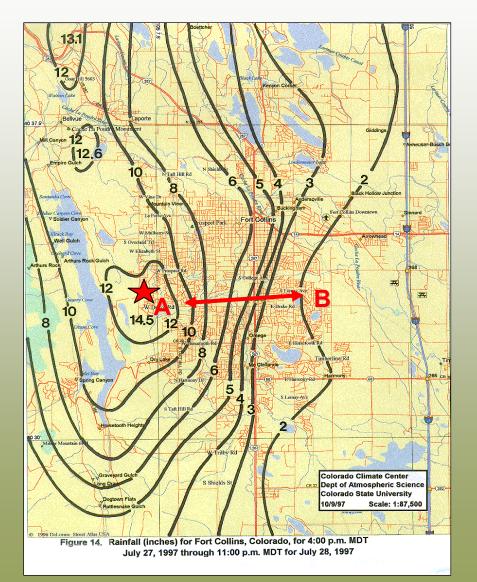
A Brief History of CoCoRaHS



CoCoRaHS was born in response to the 1997 Fort Collins, Colorado Flood



The flood pointed out:



1. the extreme local variations in rainfall possible from convective storms.

2. the important role individuals can play in measuring, mapping and reporting precipitation.

Distance between A and B = 5 miles

A = 14.5 inches B = 2.0 inches









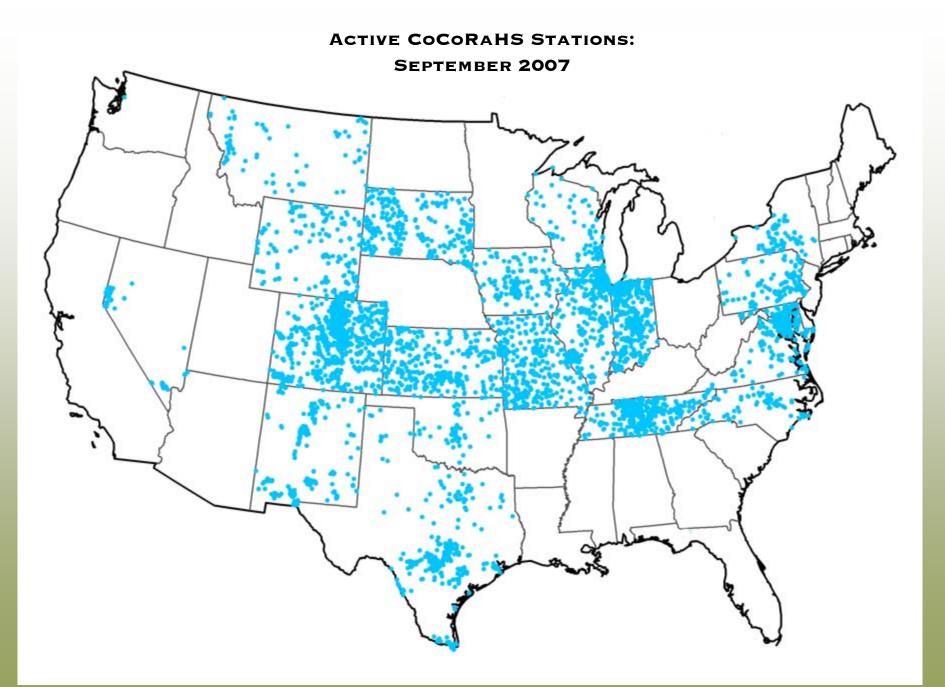


A few dozen volunteers in Northern Colorado

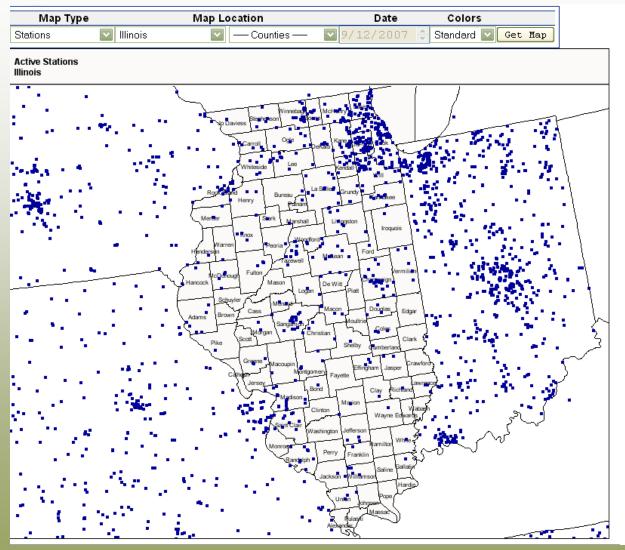


Today

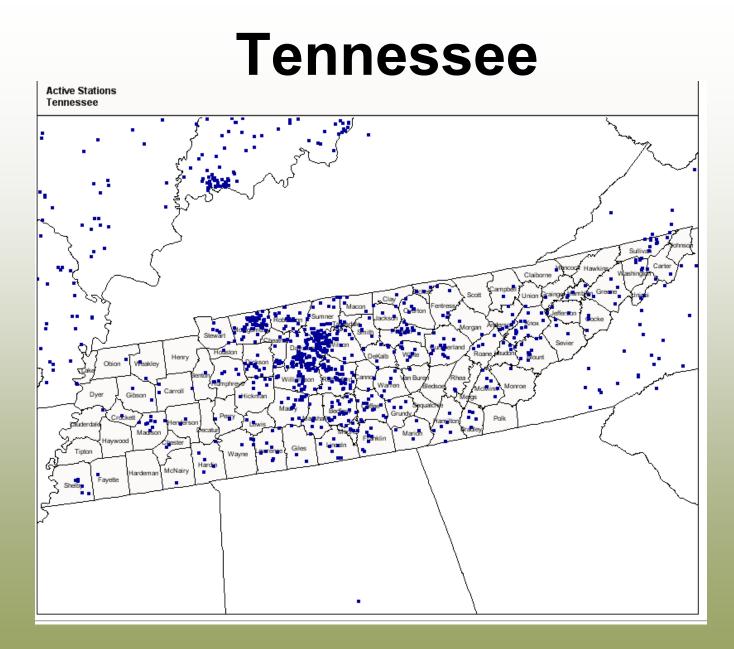
5,500+ volunteers in 22 states



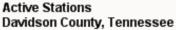
Illinois for example

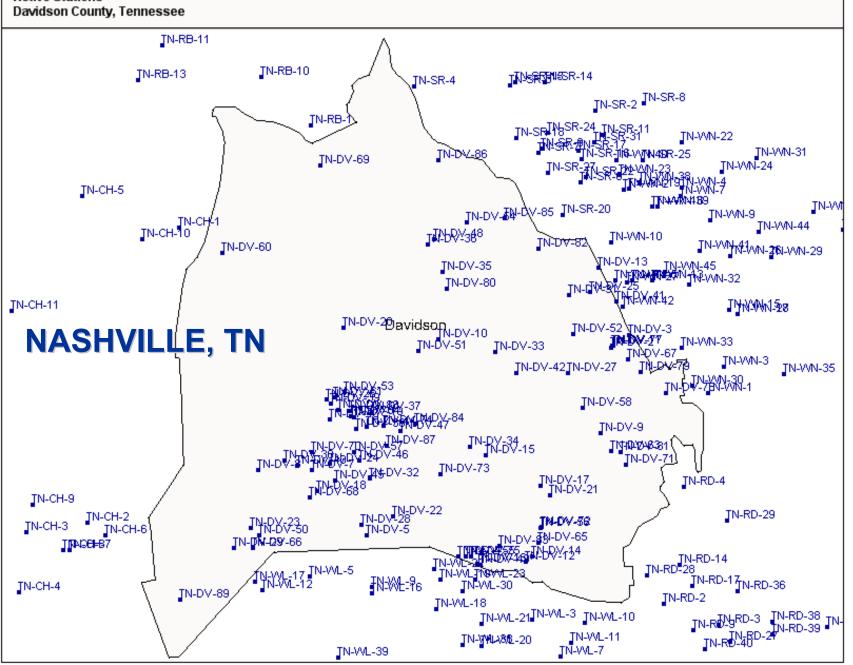


Since December 1st: 576 Observers



Since April 1st: 713 Observers

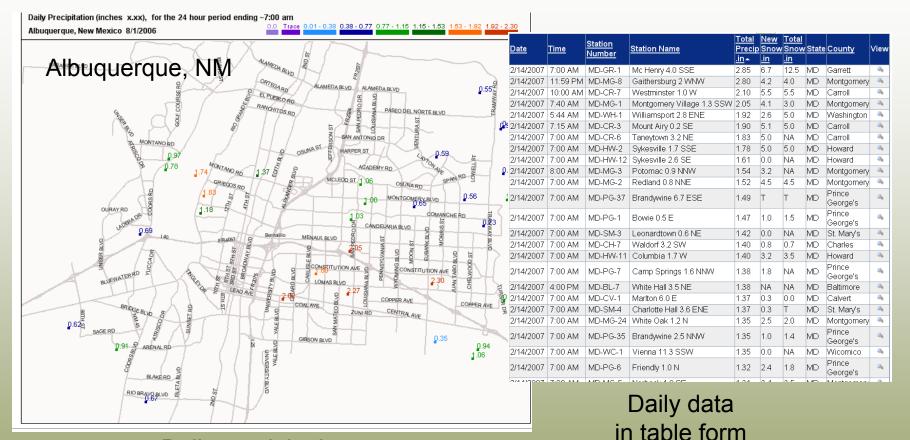






CoCoRaHS's main focus is to provide:

precipitation data . . .



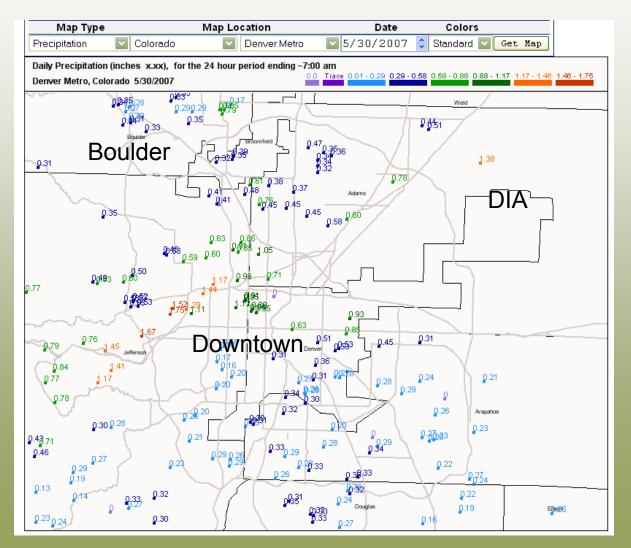
Daily precipitation maps: Rainfall, Hail and Snowfall

This data allows CoCoRaHS to supplement existing networks and provide many useful results to scientists, resource managers, decision makers and other end users on a timely basis.

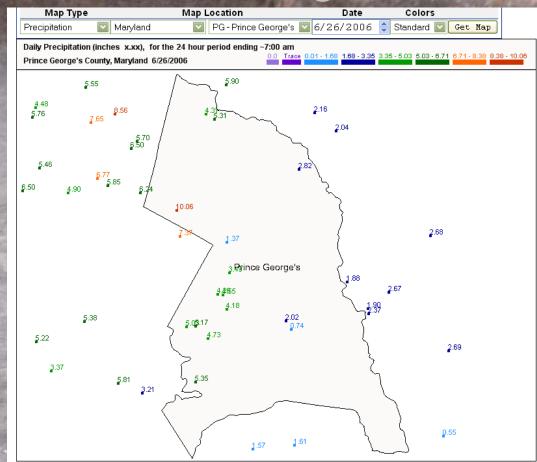
Rainfall Measurement



Our maps provide the ability to pick-up local variability in rainfall from convective events



CoCoRaHS helps with flood monitoring as well!



June 2006 flooding in the Maryland/Virginia/DC area A great example of Citizen Scientists in Action!

CoCoRaHS instantly provides the NWS with data for possible Severe Weather Warnings



Actual CoCoRaHS Intense Rain Report received at NWSFO

NZUS45 BKOU 051425 CCRAHS Intense rain report from CoCoRAHS spotter: County: Robertson TN Cross Plains 3.7 W (number TN-RB-2) Latitude: 36.550248 Longitude: -86.747602 05/05/2007 09:15 AM local time -2.00 inches so far, with 2.77 inches in the past 222 mins Flooding: Minor Comments: Majority of rain fell 30-45 minutes before 09:15. Received NWS Boulder Sat May 5 08:25:50 2007 MDT

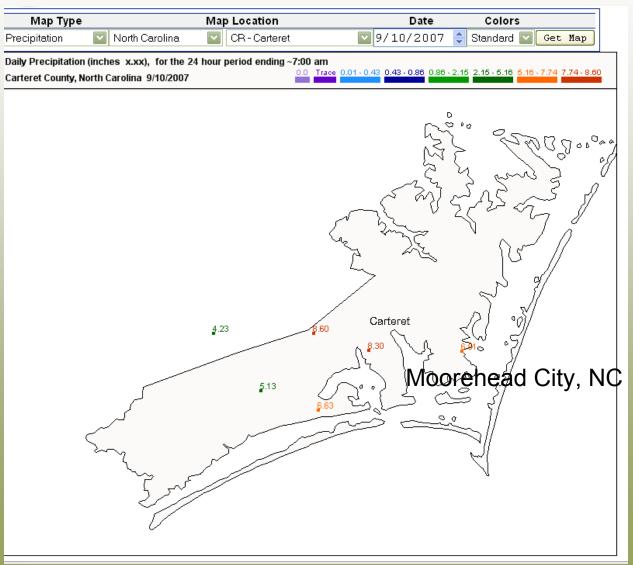
All of today's CoCoRAHS observations are in WRKCCR (WFO Boulder only) Or at http://www.cocorahs.org (click on reports)

Actual CoCoRaHS Detailed Hail Report received at NWSFO

NZUS45 KBOU 120128 CCRAHS Detailed hail report from CoCoRAHS spotter: County: Coffee TN Wartrace 6/3 ENE (number TN-CF-4) Latitude: 35.564987 Longitude: -86.230624 05/11/2007 03:30 PM local time Largest hail: 0.625 average: NA Damage: minor leaf damage Duration: 30 depth: Comments:

Received NWS Boulder Fri May 11 19:28:43 2007 MDT All of today's CoCoRAHS observations are in WRKCCR (WFO Boulder only) Or at http://www.cocorahs.org (click on reports)

Recent Tropical Storm Gabrielle in North Carolina



Snow Data



In many cases radar doesn't measure snow well, while satellite-based products have many limitations.

With our local volunteers CoCoRaHS is providing additional "winter weather" measurement capabilities in many states across the country.

In some Colorado cities, there is approximately one CoCoRaHS observer per sq. mile.



CoCoRaHS Volunteers measure both snowfall depth (new and accumulated) as well as the water content of the snow

April 11, Spring 8 Colorado, 0)()/-Izzaro-

Daily Snow (inches x.x), for the 24 hour period ending ~7:00 am 0.0 Trace 0.0 - 4.3 4.3 - 8.7 8.7 - 13.0 13.0 - 17.3 17.3 - 21.7 21.7 - 26.0 Denver Metro, Colorado 4/11/2005 813^o 7.0 87487,8 91080 Weld 9.8 5.2 87 7.8 Baide irooni 10.0 Boulder - 93 80.2 16,5 10.0 12.0 Adams 6.0 11.0 0 15.8 10.3 50 50 S DIA 12.5 71 9.48 11.0 12690 13.5 12.1 1285 15.3 21.0) 13.5 14.0 9 10705 8.0 8.0 9 8.0 13.0 6.2 19.0 Derver 26.0 10.0 10.5 10.91.6 9.5 15.0 13.5 9.8 13.97.2 Downtown efferson 93 12.5 15.5 17.0 12.5 11.3 11.2 15.5 8.0 14.5 130 17.0 7.0 11.5 5 8.5 11.5 Arapahoe 1185 17.5 16.7 139 18.2 19.0 17.0 25 16.0 18.0 15.95.4 13.7 12.8

10.0 101 25.0 135 16.7 8.0 11.010.84 1198 Douglas 15.0 17.0 17.0 7.5 14.9

8.5

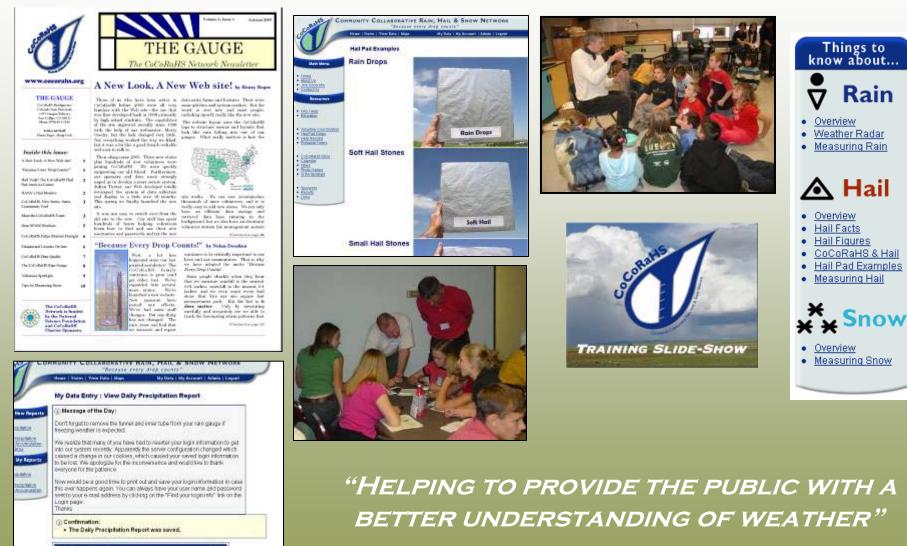
9.0 11.0

17.0

14.5

E15.5

Our other main focus is educational opportunities



Date Prescription Report Edit of training Standard Control (1997) Control (1997)

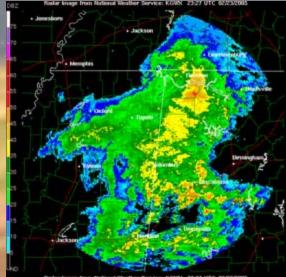
CoCoRaHS also hosts fun <u>outreach events</u> where scientists and observers can interact face to face



COCORAHS DATA IS USED BY MANY

- National Weather Service
- Other Meteorologists
- Hydrologists
- Emergency Managers
- City Utilities
 - -Water supply
 - -Water conservation
 - -Storm water
- Insurance adjusters
- USDA—Crop production
- Engineers
- Scientists studying storms
- Mosquito control
- Farm Service Agency
- Ranchers and Farmers
- Outdoor & Recreation

- Teachers and Students
 - Geoscience education tool
 - Taking measurements
 - Analyzing data
 - Organizing results
 - Conducting research
 - Helping the community





Benefits for Climate Applications

- identify local precipitation patterns
- high spatial detail improves data quality
- depth/area/duration extreme precipitation analysis
- engineering applications (road, bridges, culverts—design and construction)
- Scales and typical patterns of storms for various weather patterns
- Radar/rainfall relationships
- Drought (improving local perspective)
- Hail characteristics
- Snow applications—roof loads, water supplies, melting and settling rates
- Insects
- agricultural production and agricultural management

BENEFITS TO THE NATIONAL WEATHER SERVICE



* Hydrologic Services

* Climate Services

*Local Research

* Warning Operations

*Outreach and Partner Collaborations

*Environmental and Science Education

* CoCoRaHS is able to <u>supplement</u> and <u>enhance</u> the Co-op network by providing a group of highly interested observers. This proves to be a benefit when a forecast office is looking for a new cooperative observer, as there will be a group who is already dedicated enough to participate in the CoCoRaHS network. Drawing from this pool can provide candidates for new co-op observers.

CoCoRaHS benefits to the NWS Offices



1. Warning Operations:

CoCoRaHS offers a form for observers to enter reports of hail or intense rainfall amounts. This includes information on damage or flooding that is occurring at the observer location, as well as time of observation. This information is available in real-time as an AWIPS text product called DENCCRAHS. This product is set up for all WFO's in participating states and is filtered to only alarm for reports from counties within the forecast area. This provides a new source for storm reports that are extremely valuable for warning verification and for the issuing of new warnings. High density of snowfall observations can also provide support for winter weather product verification.

2. Climate Services:

CoCoRaHS enhances the climate record by providing an additional data set of good quality, as the observations are taken by trained observers using officially recognized standard 4-inch rain gauges. The data set of precipitation measurements is of unparalleled density. It serves as a supplement to the already existing co-op network and allows rainfall patterns to be seen with a very high resolution. It can provide quality-control checks for questionable co-op observations. Long term collection of data will allow for a better understanding of regional micro-climates within a forecast area.



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3. Hydrologic Services:

CoCoRaHS provides tremendous benefit to the office hydrologic program as well. The network provides additional data at a very high density. Observations can supplement existing automated rainfall observations within the hydrologic network, as well as serve as quality control checks, and provide verification of automated gauge function. With extremely localized rainfall often providing the impetus for flash flooding and small stream rises, CoCoRaHS provides a tremendous help to the forecasting of such localized flooding events. In addition, the high density data can be ingested by River Forecast Centers for use in precipitation summary products and flood forecasting models. With an enhanced focus on drought, the high density CoCoRaHS network is a powerful tool for drought monitoring and forecasting activities.

4. Local Research:

CoCoRaHS provides a large data set of good quality observations that proves valuable for local research applications. A better understanding of variability in the amounts of rainfall and snowfall across a small area will be gained, as well as a truer picture of hail stone distribution. High density data fosters more effective studies of small scale climatology within a forecast area.



5. Co-op Network:

In addition to the above mentioned benefits of <u>supplementing</u> and <u>enhancing</u> the Co-op network, the CoCoRaHS network provides a group of highly interested observers. This proves to be a benefit when a forecast office is looking for a new cooperative observer, as there will be a group who is already dedicated enough to participate in the CoCoRaHS network. Drawing from this pool can provide candidates for new co-op observers.

6. Outreach and Partner Collaboration:

By its very nature, the CoCoRaHS project is collaboration. It is a partnership between a multitude of organizations, including governmental, academic, agricultural, and private interests. It has already fostered very strong working relationships between the National Weather Service and State Climate Offices, County Agricultural Extension Agencies, television stations, and local universities. The network provides a chance for all interested parties to work together to make a real and substantial contribution to enhancing our nation's climate record and providing high quality data for research applications. The network is also a large outreach source for NWS offices. The format includes training of observers through an interactive training program with methods and practices adhering to standard co-op observation procedures. The network has resulted in good PR for the NWS in print, radio, and television media sources.

CoCoRaHS benefits to the NWS Offices: continued



7. Environmental and Science Education:

CoCoRaHS allows the NWS another outlet to aid in the enhancement of environmental and science education. Observers have included many school aged children, and several schools have adopted the program into their curriculum. The observer training program is built around standard observer training practices and also encourages study of rainfall and snowfall patterns in science education.

Summary

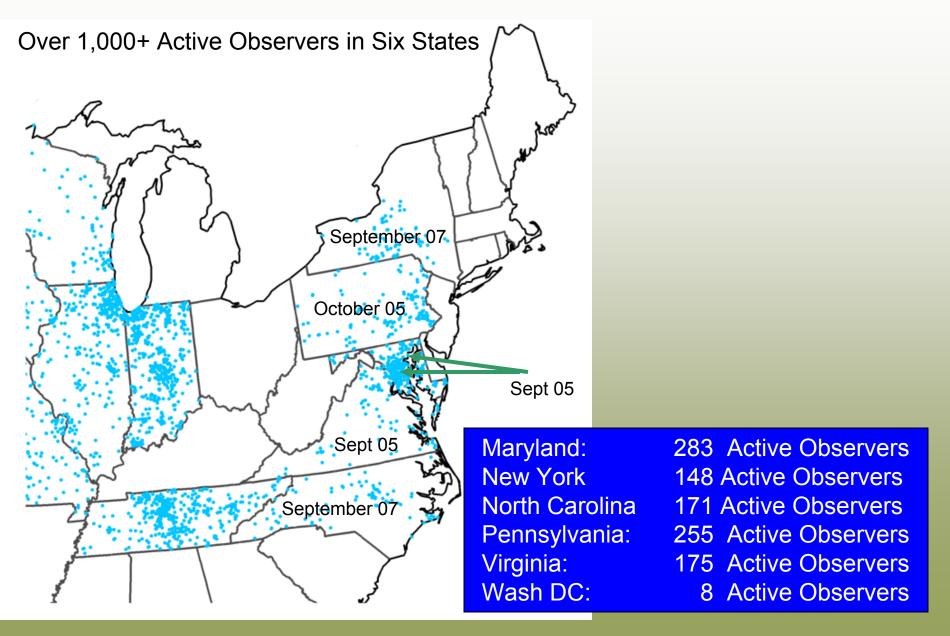
CoCoRaHS is a unique, collaborative based partnership designed to provide a high density data set of good quality measurements of rain, snow, and hail. Observers receiving training in a manner consistent to co-op observer training, and are all equipped with standard 4-inch gauges. The resulting data set has tremendous usage for National Weather Service Offices, and will assist offices in performing several critical mission functions.

Recipient of the NOAA Office of Education's Environmental Literacy Program Grant



The grant will expand CoCoRaHS into more states and use it as a mechanism for community outreach and education.

NWS Eastern Region Active CoCoRaHS states



Eastern Region NWS Offices currently participating in CoCoRaHS.

Helping with State Regional Coordinators

New York

Binghamton Buffalo Albany Upton Burlington, VT

<u>Virginia</u>

Blacksburg Wakefield Morristown, TN

North Carolina

Raleigh Greer, SC Wilmington Moorehead City Blacksburg, VA Wakefield, VA Morristown, TN <u>Kentucky</u> (Nov 07) Wilmington, OH Charleston, WV

E-mails from citizens interested in participating in Eastern Region States

"Thanks you very much for the quick response, and hopefully in the not too distant future <u>**Rhode Island**</u> and particularly Warren, R.I. will become a part of the group." Jerry

"Are there any plans for the <u>Great State of NH</u> to become involved in this program? Very interested in helping. I'm retired Army and live in Litchfield, NH." Cookie Cisney

"Hi,

I am a trained NWS Spotter in <u>New Jersey</u>. When I went to your website and saw that New Jersey was not including, I was upset. . . . I hope that New Jersey will be added into the network" Sincerely, Charles Ferrer

> "Do you have plans to move into **South Carolina**?? I would like to participate." thank you gerald bailey

"Hello: I want to join your program. I live in <u>Massachusetts</u> on the southwest coast of Buzzards Bay. . . . I noticed Massachusetts was not one of your states yet." Sarah Bishop-Valentine

"The entirety of this region is not yet included in CoCoRaHs! All of New England except parts of <u>Maine</u> would likely provide data point density. The thinly settled parts of Maine need data point representation and would probably provide some. I would like to see where this goes." Thanks, Scott (Eastern Maine)

"I would love for <u>West Virginia</u> to become part of your network. I have two young sons, and would like for them to get hands-on teaching about the weather. What do I need to do to help make this happen?" Jennifer Hamden

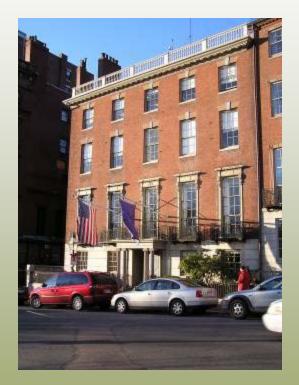
"I found your website through a link on MSNBC weather. It sounded like something that I would like to participate in, but in digging deeper, I found that there was no choice for <u>Ohio</u>. If Ohio ever becomes part of this network, I would love to help." Jeffery A. Primiano Lead Proposal Engineer

CoCoRaHS has the goal of expanding into six to eight new states each year 2008-2009



At least 30 active states by 2009 with a total of 20,000 to 30,000 participants

CoCoRaHS hopes to one day achieve a network of . . .





one observer <u>every square mile</u> in <u>urban</u> areas

one observer <u>every 36 square miles</u> in <u>rural</u> areas

How do I go about getting the ball rolling in my state?

| DC #082007 |
|--|
| What does it take to start CoCoRaHS in my State? |

No matter where you go in the world, precipitation is highly variable and locally important. There are hundreds of thousands of individuals and families in the United States who are fascinated by their local weather conditions and willing to help measure and report precipitation from their own neighborhoods. The Community Collaborative Rain, Hail and Snow network (CoCoRaHS) was conceived to help document the highly variable spatial patterns of precipitation that are often missed in many operational networks. CoCoRaHS provides a structure, framework and tools to engage and educate the citizen volunteers while at the same time collecting valuable high-definition precipitation data to help scientists, educators and resource managers. CoCoRaHS is not intended to replace or become a substitute for existing formal weather and climate observing networks. Rather, it should compliment, supplement and enhance existing networks. CoCoRaHS can provide infrastructure to store and display precipitation data, as well as manage volunteer observers. Because of hands-on training and periodic email that is offered to all observers, the data quality is likely to be very high and suitable for many operational and research applications (check out the "about us" section of the CoCoRaHS web site www.cocorahs.org to find out some of the organizations that use our data). However, CoCoRaHS is first and foremost an informal network and not an official data source.

This document provides guidelines, considerations, and checklists for how to initiate CoCoRoHS in your state. An important first step is identifying organizations that need

Set-up initial CoCoRaHS-State Conference call

Develop an "implementation team" of interested parties: NWS, state climate office, Cooperative Extension, USDA, USGS, etc.

Small amount of time involved for the overall "bang for the buck"

Room for 6 - 8 new states beginning in 2008!

