Putting Citizen Science To Practice

Noah Newman

CoCoRaHS (Community Collaborative Rain, Hail and Snow) Network
20+ Years of Citizen Science Precipitation Measurements
A short 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 (8 km)

A = 14.5 inches (368 mm)
B = 2.0 inches (50.8 mm)
1998

A few dozen volunteers in Northern Colorado

Today

20,000+ volunteers in all 50 states, Canada and Puerto Rico
Two Main Goals:

*High Quality Precipitation Data*

*and*

*Educational Resources and Outreach*
What do we measure?

RAIN
HAIL
SNOW
Rainfall Data

CoCoRaHS has quickly become the largest source of daily precipitation measurements in the United States
Local Precipitation Variability

Precipitation from one storm can vary from neighborhood to neighborhood, farm to farm.

“What falls at the airport may not be what falls in your yard.”

Heavy Rain
A great example of one observation making a difference

7.12” (180.8 mm) May 6, 2008, New Braunfels, Texas

“All but .02” fell between 3:30 and 5:30 pm.”

Station TX-CML-17
Hail Data

CoCoRaHS has become one of the largest repositories of hail data in the United States.
CoCoRaHS Volunteers measure both snowfall depth (new and accumulated) as well as the water content of the snow (SWE)
Reference Evapotranspiration

Monitoring water supply and demand

Measure what comes down with a rain gauge

Measure what goes back up with an ETgage

Water balance charts
CoCoRaHS’ Formula for Good Data

A good gauge + Good training + Standard protocol for observations + Good data management & display + Many motivated participants
equals Good data for making good decisions
The 4” (10.2 cm) diameter, high capacity plastic rain gauge

Selected a gauge that met National Weather Service requirements so that data could be compared.


20 year side by side measurements show 98% correlation with standard NWS 8” diameter gauge.

Gauge measures to the hundredth of an inch (0.2 mm). Holds 11.30” (287 mm) of precipitation.
Good Training

Each observer is trained either over the web or in person.

Everyone knows what they are doing and why they are doing it.
Standard Protocols

Relative standard time of Observations

Siting of the gauge

Same gauge used by all

“Comparing apples to apples”
**Good Data Management**

**Reporting forms**

QC is built into the reporting function, as well as by the eyes of 250+ State/Regional Coordinators and CoCoRaHS Headquarters. As a result the data are of high quality.

**Rigorous Quality Control**

**Exportable Data**

CoCoRaHS data are free and exportable to outside users. This lets the end-user customize it for making decisions.

50+ million records easily available with a few clicks of a mouse!!
Good Data Display

Easy to see data in spatial presentation

Observers get to immediately see how their measurement compares to those around

Users and observers get to track precipitation patterns together

Ft. Collins, CO
Good Data Display

Sortable tables

Water Balance Graphs

Year-End Water Summaries
Many Volunteer Observers

20,000+ observers in 50 states, Canada and Puerto Rico

Variety of locations, both rural and urban
Many observers = many data points

Having many observers means having a large amount of data points across a large area. CoCoRaHS is able to provide large, but easy accessed and understood data sets.
Good Data for Making Good Decisions

Zero, 45 days in a row!!

6.15” in 24 hours!

Just shoveled 17”
Some examples of how the data are used
Drought Detection

CoCoRaHS data/maps used weekly to see if drought conditions have worsened or improved over an area.
Improved Drought Awareness

“Making citizens aware of how the lack of precipitation can impact their daily lives”

**Drought Impact Report**

- **Station Number:** TX-BND-5
- **Station Name:** Bandera 3.9 E
- **Start Date:** 12/10/2010
- **End Date:**
- **Submitted:** 12/10/2010 7:31 AM

**Description:**

Have curtailed outside burning. Native plants are suffering, large and small wildlife are attracted to any available water source, smaller ponds and creeks are drying up, level of Medina river (about 1/2 mile from property) is noticeably dropping. Local roads are deep in dust.

**Drought Impact Categories:**

- **Fire:** $0.00
- **Plants and Wildlife:** $0.00

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**DRINKING WATER TASTE DUSTY?**

**CoCoRaHS Drought Impacts**

Report how drought is impacting your community with a “Drought Impact Report”.

**Water Supply and Water Quality**

The effects of drought have significant impacts on our **water supply and water quality**.

Examples of drought-induced water supply and quality impacts include: dry wells, water restrictions, changes in water rates, easing of water restrictions, increase in requests for new well permits, changes in water use in water use due to water restrictions, greater water demand, decrease...
NOHRSC - (National Operational Hydrologic Remote Sensing Center)

Over 50% of their snow observation reports came from CoCoRaHS observers.

SNOW WATER EQUIVALENT (SWE) FOR SNOWPACK MONITORING

2011 – Souris River, Minot, ND
NOAA’s River Forecast Centers

"Your data has filled in the holes in our NWS/USGS gage network. It also is used to improve the bias used in our Multisensor Precipitation Estimates. The more ground truth - the more accurate our river forecasts are."

Patricia Wnek – Middle Atlantic River Forecast Center
Data used by Coastal Fisheries

Precipitation data used to determine when to close shellfish beds
Agricultural interests

“When is the right time to plant . . . How wet is the soil? Time to irrigate? How much rain has fallen this week?”
Recreational interests

“How much snow fell at the ski slopes . . . Should we go? . . . Heavy rainfall up river last night, rafting today??”
"Water ponding from recent rains? . . . Time to spray for West Nile?" . . . Mosquito control uses our data for decision making.
"We use the CoCoRaHS data in our post-storm summary to describe the overall impacts of a tropical cyclone event."

Dan Brown - National Hurricane Center

Total accumulated rainfall from Tropical System Harvey (August, 2017).

Note the 62-inch final maximum total near Beaumont/Port Arthur!
RADAR & CoCoRaHS

GROUND TRUTH RADAR

Used to “tweak the algorithm” ... Z-R estimates based on reflectivity adjusted based on precipitation readings on the ground.
Severe Weather Decisions

CoCoRaHS instantly provides the NWS with data for Severe Weather Warning decisions

CoCoRaHS “Real-Time” Reports
Challenges

Encouraging Data Collection

Lessons Learned
Recruiting Challenges
Recruiting Drive – March Madness

Total and Active Signups - Water Year 2014

- Signed Up
- Made First Report
How do we encourage our volunteers to collect data?

- **Low cost to participate**, simple tools, not burdensome (five minutes a day), open to everyone.

- Make the process **easy and fun**, feedback on their observations (map), easy and informative website.

- **Part of something bigger** than themselves - for the common good of the nation. Observes identify with network.  
  
  "I'm CoCoRaHS observer CO-LR-610"

- The data are **really used**, not just sitting in a book on a shelf – tell the observers who uses it. Their observation can make a difference.

- **Feedback and encouragement** from headquarters and those in the field
CoCoRaHS has been a place for many organizations to collaborate over the years. It is a lowest common denominator that continues connections to scientists at universities, federal agencies and citizen-science networks all across the country.

Photo – Cheryl Albritton
Climate Literacy Resources for Schools

- Lesson Plans and Activities
- Educational Animation Series
- State Climate Series
- Master Gardeners Resources
- WxTalk Webinars
- Training Videos, Slide Shows
- Ask an expert / Contact a Scientist
- Data, Data, Data!
State and National Standards

• Science
• Math
• Geography
• More!
NGSS and Common Core

Kindergarten:
Next. Gen. Science:
K-ESS2-1
K-ESS3-2

Common Core:
Literacy: W.K.7
Math: MP.2

Third Grade:
Next. Gen. Science:
3-ESS2-1

Common Core:
Literacy: W.3.7
Math: MP.2

Middle School & High School
MS-ESS2-5
HS-LS4-5

http://scistarter.com/blog/2014/01/citizen-science-classroom-series-cocorahs/#sthash.xHJg3znt.dpbo