

Managing and Utilizing Precipitation Observations from Volunteer Networks

11th Annual Meeting of the WERA 1012 Technical Committee

Virtual Meeting

May 19-20, 2020

Estes Park, CO

Executive Summary

The 13th meeting of the WERA 1012 Committee convened virtually this year due to travel restrictions resulting from the Covid-19 virus pandemic. The Co-Chairs were Russ Schumacher and Nancy Selover. This year's meeting was divided into two half-day meetings with sessions on Headquarters Updates, Partners Updates, Equipment/Measurement Updates, and Field Updates. The Co-Chairs gave a brief welcome and explained the format of the meeting as brief 10-minute "lightning round" presentations for each session followed by a discussion period. Since four time zones were represented the meetings lasted from around 11:15 am EDT to 3:30 or 4pm EDT with a 30-minute "lunch" break. The virtual meeting provided an opportunity to engage a larger group since travel funding was not a limiting factor, and many coordinators attended the sessions. While our Estes Park meetings typically have 20-25 attendees, the attendance at this virtual conference had 69, 73, 62 and 55 attendees for the HQ, Partners, Equipment, and Field sessions, respectively.

Headquarters Updates:

Steve Hilberg reported that the QC database has finally been moved from a Midwest Regional Climate Center server to a CoCoRaHS server. This will make it easier to upgrade the database and user interface, and integrate it with the primary CoCoRaHS. QC tickets decreased by more than 20% from the previous 12 months though efforts continue to improve snow reports which account for about half the QC tickets in December through March. The software migration to Azure is progressing. The new software improves mapping, mail chimp, QC, cloud storage, and every web app can now run in Azure. A little more testing is left with a plan to go live in June. The new mapping system performance, ease of use, and interactivity is much improved on mobile devices, and offers better scaling of data with zooming, and allows more options for color schemes and aggregating data for user selected intervals. Henry Reges and Nolan Doesken reported the approximate expenses for FY2020 are \$420K with about 56% covering HQ staff including observer support, web development, database management, education, and the help desk. CSU overhead costs are about 16% website hosting, maintenance, data services and webinars are about 20%. The remaining 8% covers materials, equipment, and travel. The revenue comes from users of the data (52%), donations (33%) and the National Mesonet Program (15%). The Year-End fundraiser exceeded the goal by \$20K. This year there is an anticipated shortfall of \$20K (~5%), though some of this will be mitigated by reduced travel and other expenses owing to the pandemic. Sources of additional funding include data users outside Colorado and pursuing more grant funding. Noah Newman has been focusing education efforts on libraries, with a "Spotty Rain" program, and a "Water in the Four Corners" program. Matt Spies, Connecticut State Coordinator reported on recruiting and retention. The number of daily reports have grown 39.7% in the past 10 years and 4.5% in 2019, which is a steady increase in reports. The number of observers has also grown

37.2% over the last 10 years, but the 2019 increase was less than 1%. This is due to a balancing act of replacing observers who drop out with new observers. It should be much easier to retain observers than to find new ones so we have to find a way to get those first reports and create a habit of observing. The number of observers who make the first report after joining has decreased from about 75% in 2010 to about 63% in 2019.

WERA Partners

Amanda Farris of the Carolina integrated Science & Assessment program reported on the Condition Monitoring program which allows CoCoRaHS observers to report early signs of drought, changes to drought conditions, signs of improvement, weekly changes and lingering impacts. The program recognizes consistent observers with certificates and has guidance on what to look for in each region. The Condition reports are used in State Climate and Regional Climate summaries, as well as ground truth for storm events. Amy Fritz, the NOAA COP Program Manager, provided an update on the COOP network. She has identified 682 unofficial COOP sites, the best of which (~100) will transition to official COOP sites. NOAA is working on some equipment changes prioritizing stations, using our CoCoRaHS Spatial Importance Factor calculation for both USHCN and COOP sites. They are also examining equipment including Cotton Region Shelters and Fisher Porter gauges along with climatology, station age, performance and other measures to prioritize stations. They are also restocking with 4" plastic rain gauges, albeit with a different mounting arrangement that makes it easier to remove the gauge for measuring amounts over 1.00", and they are looking to separate hail from snow reports with software and training. NIDIS is tapping into citizen science projects, like CoCoRaHS, to address drought issues such as public health, wildfire, impacts and triggers and indicators. They are also involved in soil moisture monitoring which CoCoRaHS has slowly begun to implement. NCEI uses CoCoRaHS to fill in gaps in spatial coverage and improve spatial QC by comparing neighboring sites. Our data also helps verify extreme values in the GHCN network, allowing near real-time investigation of extreme values. They are included in NCEI's 1-day/2-day/3-day snowfall extremes table, and CoCoRaHS data are considered for data record by the State Climate Extremes Committee. The NWS River Forecast Centers rely on CoCoRaHS data for flood forecasting due to the high density and quality of the CoCoRaHS data. Our data both fill gaps in other networks and provide QC comparisons for nearby gauges, as the human observations tend to be more accurate in heavy rain events than automated gauges. PRISM is a major supporter of CoCoRaHS as our data are critical to the US precipitation mapping and the USDA crop insurance program. Our network is high density in clusters (nearer cities) and combines with other networks to improve spatial coverage of the US and increase spatial density in highly populated areas. It is critical that CoCoRaHS observers report when it rains, but reporting zeros is significant in reporting completeness for monthly, annual and cumulative products.

Equipment/Measurements Updates:

Lucy Plahmer with WeatherYourWay.com, our main supplier of gauges and parts has some new payment options, more inventory and a new webpage. David St. John of WeatherFlow said they are looking for some field testers for their Tempest All-in-One weather station and Tempest and Nimbus rain gauges. The Nimbus 4" manual rain gauge is easier to mount re-assemble for rain events above 1.00 inches, and is slightly less expensive than the current CoCoRaHS Stratus gauge. Chad Gimmestad

from NWS Boulder explained how NWS uses the CoCoRaHS Significant Weather Reports. The reports are screened for thresholds of severe hail or rain or intensity and sent directly to the appropriate NWS office where they can be set to alarm forecasters of severe weather events that require warnings. Filtering is dependent on the local topography and climatology. Not all NWS Offices are aware of or use CoCoRaHS Significant Weather Reports. We are working to spread the word. The ET gauges have a new wafer that is slightly thinner. The ET and Water Balance maps are available at <https://mrcc.illinois.edu/cliwatch/drought/drought.jsp#evap>. Jay Shafer from Vermont discussed ongoing research into ice accretion as a major factor in power outages during winter storms. They found our observers responded best to e-mails around storms to measure, categorize or photograph ice accretion. Observers then categorized ice thickness they observed using a table for Vermont impacts of ice thickness.

In the Field Updates:

Michelle Margraf from Minneapolis NWS explained how COOP and CoCoRaHS observations impact the NWS. The daily reports provide situational awareness in the community that the forecasters use for decision support in preparing watches and warnings. The daily maps and summaries are used for river models and forecasts as well as flood outlooks, and to ground truth radar estimates and verify automated gauge values. They also provide a primary source of snowfall data as automated snow measurements are not as accurate, though snow is critical for SWE and water resource modeling and forecasting. Sam Childs reported that the US has the densest most complete database of hail in the world, and CoCoRaHS is adding to that database especially with the vast number of reports of sub-severe hail. While the sub-severe hail does not tend to contribute to deaths or major infrastructure damage it has a significant negative impact on agriculture. CoCoRaHS observers are more likely to measure hail than reference size by objects (golf ball, quarter, etc.), and CoCoRaHS hail reports have less population bias based on our distribution. Bill Runyon, a Texas Coordinator has had a lot of success recruiting Master Naturalists across Texas as observers. This is a widespread program (48 active chapters) across Texas with listserv and meetings of the members. They are enthusiastic and careful observers. In Canada the CoCoRaHS data and maps are reaching the agricultural community. Canada Climate Citizen program is being launched and will provide information on citizen science and the importance of volunteer data collection. Chris Fuhrmann reported on the CoCoRaHS data from San Salvador in the Bahamas, where there are 7 active stations around the coastline. Three new gauges were added on the eastern coast, but not much populations, so they ask for visitors to make observations when they pass the gauges. Seems to be an almost 2:1 gradient of rainfall from the north of the island to the south, approximately 60"/year in the north and 25"/year 12 miles to the south.

WERA 1012 is a Multistate Research Coordinating Committee and Information Exchange Group formed under the auspices of the Western Associations of Agricultural Experiment Station Directors (WAAESD). The committee includes participation from 15 Land Grant states and five non-land grant institutions. Anyone with an interest in volunteer precipitation networks is welcome to participate in the annual meeting.

The next annual meeting will be held May 18-20, 2021 at the YMCA of the Rockies in Estes Park, CO.

Managing and Utilizing Precipitation Observations from Volunteer Networks

14th Annual Meeting of the WERA 1012 Technical Committee

May 18-19, 2021

Virtual Zoom Meeting

Executive Summary

The 14th meeting of the WERA 1012 Committee convened virtually again this year due to travel restrictions resulting from the Covid-19 virus pandemic. The Co-Chairs were Russ Schumacher and Nancy Selover. The two half-day meetings included sessions on Headquarters Updates, Partners Updates, Community Engagement Updates, and Field Updates. The lightning-round format that worked so well last year (brief 10-minute updates) was repeated. The short talks focused on the critical information and the discussion period at the end of each session allowed in-depth analyses of how the updates could improve the network. Again, this year, attendance was higher than the typical 20-25 attendees we usually get in person at Estes Park. We had 126 and 98 attendees for the two days, respectively, though much is lost by not meeting in person. Many ideas for recruitment, QC and training come to light during the personal interactions of the group at breaks. Hopefully we will be able to meet in person next year, but will still incorporate the virtual platform so we can also capture the broader audience.

Headquarters Updates:

Steve Hilberg reported that the number of QC tickets for this past year are about the same as the previous year, with winter snow errors accounting for about half. Since most of the errors are reporting errors, largely decimal and false zeros, they can be reduced by providing more training when contacting the observer. Improving the mobile apps will help when observers can see their data after entering the value, particularly decimal and zero errors. The software migration to Azure is complete and the QC ticketing is now integrated to the main database. The new software improves mapping, Mail Chimp, QC, cloud storage, and every web app. Expenses for FY2021 are \$499K with about 58% for equipment and staff, 23% for web hosting, 0% for travel this year, 4% for materials and supplies, 14% for CSU overhead. The revenues were \$498K, with 47% from users of the data, including PRISM, 36% from donations. The Year-End fundraiser, \$10 for CoCoRaHS, raised \$175,342 from 3,346 donors. We lost some municipal funding this year. Would like to see if states could get some state and regional funding for the program and share with headquarters. Covid disrupted some of the educational outreach this year, limiting it to virtual interaction. We still have the ongoing "Spotty Rain" and "Water in the Four Corners" NSF funded programs. There is a CoCoRaHS room in the virtual museum and you can explore CoCoRaHS maps and the website. There is a Zapper App, where you scan a code in the "Make it Rain" game. <http://www.spottyrain.org/make-it-rain-app.html> Next year will have more school visits and there will be recognition certificates for the schools with the most observations. Matt Spies, Connecticut State Coordinator reported on recruiting and retention. The number of daily reports have grown with Covid. Now 24,249 active stations. Maricopa County AZ has 182 active observers, second only to Larimer County, CO. About 3000 observers stop reporting each year, so we need well over 3000 new recruits each year to grow. Also during Covid a number of observers started reporting

again after having stopped previously. We added 1724 stations in the past 12 months. 63% of the new observers filed their first report, which is consistent with last year's new observers.

Partners Updates

Nolan, along with Jessica Spaccio and Art DeGaetano, published a study on the effect of Covid on observations. (<https://journals.ametsoc.org/view/journals/bams/aop/BAMS-D-20-0170.1/BAMS-D-20-0170.1.xml>). In the northeast and southeast, there was a significant decrease on missing observations during the lockdowns. People were at home during the observation time and stayed home so perhaps they were entered the data sooner since they were working from home. The weekly cycle also disappeared as people were home all 7 days of the week. The change was not so great in the west where lockdowns were not so prevalent. We also saw a rise in the number of observations in general during the stay at home times. In 2021, the weekly cycle reappeared as the lockdowns and stay-at-home orders disappeared. There was a more consistent reporting of traces since people were home to notice a few drops of rain. Amy Fritz, the NOAA COOP Program Manager, provided an update on the COOP network. They are removing 682 unofficial COOP sites, making 111 of them official COOP stations, and 373 will be moved to other programs. 240 of them went to Hydrology/Drought monitoring, 48 went to the paid snow network, and 78 were converted to CoCoRaHS or Weather Spotters. There are still 42 yet to be moved to other programs. The COOP Plan has 4 priorities; new instrumentation, new software system, workforce to better support the program, and volunteer support improvement. They are restocking equipment and supplies, ordering 700 more gauges. The 4" gauges have a different mounting ring. No stations were visited during the pandemic, though maintenance did not seem to suffer from the lack of visits. The wireless MMTS has not been successful yet. They are considering cellular communication instead of wireless for USHCN station that are remote or can't find a volunteer. This is in the prototype testing phase. They will add 5 minute temperatures and 15 minute precipitation. Molly Woloszyn gave the NIDIS update. The Drought Early Warning System (DEWS) is a program for early prediction of drought that can provide affected people with information to reduce or prevent their vulnerability by taking actions before the emergence of drought. The DEWS program has regional coordinators and they have re-designed their drought.gov website so you can drill down to county or zip code level. They are also increasing their tribal engagement to get more observers on tribal lands and provide more drought information to the tribes. NIDIS is planning to expand the soil moisture monitoring network and partnering with the Forest Service to add monitoring. Also they are working with the University of Nebraska Medical Center on Drought and Human Health, and partnering with WRCC and DRI on Drought & Wildfires in the areas of planning, fire behavior and post wildfire response. NE Rain is CoCoRaHS, but is run from Nebraska, though the data all go directly to CoCoRaHS. There are 22 regional coordinators, but only one person in the office. Doing training virtually was a challenge, particularly snow measurements. They have distributed some free gauges. Goal is to get one evaporation gauge in each county or basin. They use the atmometer, not the evaporation pan. Amanda Farris of the Carolina integrated Science & Assessment program reported on the Condition Monitoring program. The program has been successful due to leveraging partnerships and existing networks, evaluating all

program components, updating and improving resources and supporting volunteers and users with training early on and continuously communicating and reaching out to them. The reports can be used for monitoring wet and flooding conditions and documenting the impacts of severe events, so an expansion of the reporting. Conditions are not limited to drought. The range goes from severely dry to severely wet. Triangles point down for severely dry and point up for severely wet. The guidance documents are regional so they have more relevance to each region. They provide certificates for consistent observers. They use a simple comparison table for demonstrating what the various conditions or report might show – what to submit when and how. Now have story maps of condition monitoring. Bryant Korzeniewski (contractor for NCEI) has completed the data matching from GHCN and CoCoRaHS daily data and NWS submitted data. Handle multi-day reports from CoCoRaHS to QC. GHCN reports, compared to WxCODERIII data. Single day data from one network are compared to multi-day reports from the other. Now almost finished with time of observation for CoCoRaHS within the GHCN daily system. The time of observation will be in a separate data column. CoCoRaHS data are available by station or by year and ftp access. CoCoRaHS stations are available with prefix of US1 at the station of the station number. Ensuring CoCoRaHS extreme values are flagged in the GHCN database. Helps determine QC. Are documenting change points in CoCoRaHS stations for historical metadata provenance; i.e. station name changes, closings, openings etc. CoCoRaHS data are very useful to GHCN to complete data gaps, and QC data in GHCN, and helped real-time investigations into records. CoCoRaHS data are considered as data records by State Climate Extremes Committee.

PRISM is working on the 1991-2020 normals. Volunteer networks contribute to the normal. Started doing normals in the 1990s. (1961-1990). Inclusion in the eastern US requires more than 10 years period of record, and more than 5 years in the period of record for the west (west of 104.5 degree longitude). 18022 stations used in summer and 10650 stations used in winter. 89% of stations are in volunteer network (COOP has 11,600 stations), CoCoRaHS has 3305-3429 stations for new normals. There has been more change (an increase in rain) in the east of new normal, but a little drier in the west. Because the stations themselves are changing, the changes between normals may not be due to climate changes, if you look at a smaller scale. At larger scale, the changes are probably due to changes in climate. Have to reach backward for older stations in the new maps as many great sites disappeared. Henry will send out Julian's' project list and everyone should think about priorities and what might be added to the list if it's needed and not addressed.

Community Engagement Updates:

CoCoRaHS data are used to help verify State Records from the COOP network, and high quality CoCoRaHS observations can also set records for precipitation. The past data has been reviewed and some new record precipitation amounts have been found in the CoCoRaHS data. The State Extremes Committee which includes NCEI, local NWS office, regional NWS HQ, Regional Climate Center and the State Climatologist verify the data when considering new records. The type of records include 24-hour precipitation, 24-hour snowfall, monthly snowfall, and seasonal snowfall. The committee reviews the observer's record, the siting, equipment condition and the metadata record.

CoCoRaHS is also engaging with other citizen science programs including CitSci.org, citizenscience.gov, and SciStarter. Projects include the National Phenology Network's Nature's Notebook, Condition Monitoring, the Community Snow Observations, and aerosol sampling. Mike Crimmins from the University of Arizona Extension has been working for several years on a precipitation monitoring project with ranchers in Arizona. They monitor rainfall on remote rangeland using accumulating gauges that are read infrequently and reported with smartphones to a database, similar to CoCoRaHS. The ranchers can share their data with other ranchers or keep it private. The reference climatology comes from the PRISM network, which relies heavily on the CoCoRaHS network. The seasonal reference data helps the ranchers evaluate the precipitation through the season, since the forage available is highly dependent on the precipitation, including the timing. Melissa Griffin uses CoCoRaHS for community engagement in South Carolina to educate the population and keep them interested. Outreach efforts tend to be one-time events and only one side is benefitting. Engagement activities involve two way communication and learning and both parties benefit. They also develop relationships and long-term involvement. Alaska started CoCoRaHS in 2007, but about half the original stations are closed. Also, most of the observers are around Anchorage. They are planning to expand the network and focus on snow measurement training. Snotel sites are key in Alaska, as most precipitation is snow, and they need observers to report any time there is a new snow event, in addition to the daily observations. They are reaching out to schools, libraries, organizations and tribes to make contacts in the summer when they can travel to in person training and meetings.

Field Updates:

CoCoRaHS data was used to ground-truth the Quantitative Precipitation Estimates (QPE) from the NWS radar for Hurricanes Harvey and Florence. The research was done by the National Severe Storms Laboratory (NSSL), and published. They used a web interface to compare and analyze the data and create error matrices. This work will be used in the future to develop QPF (Quantitative Precipitation Forecast) models.

Nature's Notebook is a community science network in Phenology. There are about 20 thousand observers at 16 thousand sites nationwide. They make repeated observations of vegetation, animals or insects weekly throughout the year to track how things are changing over time. The data are used in research and can be correlated to CoCoRaHS precipitation data as well. They forecast emergence of insect and invasive vegetation species as well as green-up of various plant communities.

The Midwestern Regional Climate Center has a Vegetation Impact Program that keeps track of frost and freeze dates, chill hours and weather conditions that affect vegetation. Users can enter data if they are registered in the network, or simply view and use the data.

Canada uses their CoCoRaHS data for mapping and climate bulleting and to supplement the Environment Canada weather network and for quality control. They also verify storm warnings and use it for drought monitoring across the agricultural areas of southern Canada. The National Operational Hydrologic Remote Sensing Center (NOHRSC) uses the Canadian CoCoRaHS data for their SWE forecasts and other products.

In the northeast the NWS makes snow and precipitation maps with CoCoRaHS data to verify winter storm warnings and advisories, and in summer they use it for major summer storm events. The maps

are GIS and go out in the public information statements. They first QC the data then map it., and the entire process is automated. Their automated program is called GAZPACHO.

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The next annual meeting will be held May 17-19, 2021 at the YMCA of the Rockies in Estes Park, CO.

Managing and Utilizing Precipitation Observations from Volunteer Networks

15th Annual Meeting of the WERA 1012 Technical Committee

May 17-21, 2022

Hybrid In-Person/Virtual Meeting

Executive Summary

Meeting Chairs:

Jon Meyer: Climatologist – Utah State University

Peter Goble: Climatologist – Colorado State University

Executive Summary

After two years of completely virtual WERA 1012 meetings due to pandemic-related uncertainties, the meeting made its triumphant return to the YMCA of the Rockies in Estes Park. The meeting had 29 registrants: 14 in-person and 15 virtual (not including CoCoRaHS staff). It is worth considering keeping the fully virtual format in the future if for no other reason than it yielded to the largest attendance numbers. That said, the hybrid in-person/virtual format was executed successfully as in-person discussions were lively, and virtual attendees had minimal complaints about sound. A microphone would be a worthwhile addition as softer-spoken in-person participants were not easily picked up by the “owl,” a 360 sound and video capturing device.

The main topics of this meeting were similar to previous years: it featured updates from those who run and use precipitation data from volunteer rain gauge networks. Focal points of discussion were how to grow, adapt to technical and societal changes, and keep the data we collect both valuable and relevant to key data user groups.

Session 1 Summary (Partner Updates): The first session was opened with a keynote speech from Amy Fritz, the head of NOAA’s Cooperative Observer Network. It was followed by a presentation from Brian Walawender on how NOAA’s Central Region is experimenting with more automated observations using the Cellular Cooperative Observer Program. Technological advancements to the COOP Network are an integral part of its future vision as COOP equipment, and its observer base, are aging.

The next portion of session one featured updates from volunteer rain gauge network data users. These updates came from the National Centers for Environmental Information, NOAA High Plains Regional Climate Center, National Integrated Drought Information System, PRISM Climate Group, and US Drought Monitor. Presentations featured numerous creative and innovative usage of volunteer rain gauge data, and expressions of gratitude to organizations like COOP and CoCoRaHS for collecting such data. Chris Daly, from PRISM, gave a standout

presentation exploring how the temporal completeness of PRISM's dataset, and the changing spatial patterns of organizations like CoCoRaHS can be used in combination to produce more accurate climate normals.

Session 2 Summary (CoCoRaHS Support and Operations): CoCoRaHS is supported by a mix of data user funding and volunteer support. This funding varies somewhat unpredictably from year-to-year, but the most recent funding campaign was the most successful in the organization's history.

CoCoRaHS' challenges and goals are varied and numerous. Data quality control is an ongoing issue, and will always need attention given the organizations volunteer nature. That said, the CoCoRaHS error rate is low, about one tenth of a percent of reports are obvious errors. The most prevalent quality control issue is date-shifted observations, particularly those entered retroactively, where observers mixed up the date on which the storm should be reported. To help correct this, CoCoRaHS staff is providing extra notifications to coordinators when repeated errors from a single station go uncorrected in their area of responsibility.

The CoCoRaHS website is maintained by Julian Turner, who keeps detailed notes on the organizations' priorities, and uses annual meetings to tweak priorities according to the demands of stakeholders. Recent website improvements include a new mapping system, and improved water year reports. Among discussed improvements were additions of photos, mobile app improvements, changing ways to contact observers, and making the CoCoRaHS experience more social and interactive.

Session 3 Summary (CoCoRaHS Outside CONUS): CoCoRaHS is alive and well in areas thousands of miles away from its origin story in Fort Collins, Colorado. In this session we received updates from Doug Wesley, who is a CoCoRaHS coordinator in Alaska, Christina Chanes, who is a coordinator in the Virgin Islands, and Doug Leonard, who coordinates CoCoRaHS operations in Canada. These areas have varied challenges that are sometimes unlike CoCoRaHS in the lower 48. For instance, winter observations in Alaska and Canada are typically taken in the dark, and often with present snow cover or new snowfall. Sometimes this includes a visit from a moose! Christina Chanes of the Virgin Islands has done stellar education and outreach work across the island, and has worked closely with school-aged children collecting precipitation data. She is in charge of a significant effort to improve the US Virgin Island's drought monitoring capabilities with in-situ data both from volunteers and automated stations.

Session 4 Summary (Volunteer Recruiting, Retention, and Engagement): CoCoRaHS grew in 2021. The previous 12 months have seen a record number of reporters (over 25000), and a record number of reports. The average CoCoRaHS observer only lasts a few years in the network, and it takes nearly 5000 new recruits annually just to keep CoCoRaHS reporting numbers stable. The pandemic was a boon to CoCoRaHS participation as more people have looked for home-

based hobbies. CoCoRaHS did come up just shy of the 5000 new observers target, but is still growing. This is in part due to observers who previously quit returning to the fold.

CoCoRaHS' growth is concentrated in the Central Region, particularly in Minnesota and Wisconsin. In most other areas it was steady or shrunk slightly. Michelle Margraff from the National Weather Service in Minnesota shed light on their successful recruiting tactics, but the bottom line is they put time and energy into increasing observations above and beyond what we see other places. Minnesota was the winner of 2022's CoCoRaHS March Recruiting Drive. They did so by beginning their campaigns early (March 1st), reaching out to a multitude of media outlets (from print to cable to online), cultivating a social media presence, and through grassroots/word-of-mouth-style efforts.

Also, Russ hosted a "CoCoRaHS Jeopardy!" game after lunch. Doug Wesley won.

Session 5 Summary (The Rain Gauge): In this session we heard a mix of things, including updates on a couple CoCoRaHS projects: improving CoCoRaHS Condition Monitoring Report numbers in forested areas, and expanding CoCoRaHS' suite of observational capabilities to ice accretion measurements. The ice accretion project includes experimental photo uploads, which have been well-received. Jim Williams from the Nebraska-based "NE Rain" gave an update from their network. This included the addition of some beautiful new web graphics. When observers enter their report number, the website comes up with a picture of what that value should look like in their gauge. This helps cut down on several types of QC issues, and would be an ideal model for other volunteer rain gauge networks to follow. The session was closed with a discussion lead by CoCoRaHS' founder, Nolan Doesken. He discussed the power of reduced cost rain gauges, or rain gauge donations. In many cases, observers who live in areas without many CoCoRaHS reports, and may be part of a marginalized community, are not able to pay the full price of a gauge. It can be worthwhile to retain some wiggle room in a rain gauge organization's budget for accommodating such situations. It is the experience of most participating networks that people who get a gauge completely free do not use it. Just asking for five dollars (for a \$45 gauge) is far more likely to yield a reporting observer. They have "skin in the game."

Session 6 Summary (Next Steps): The final morning of WERA was comprised only of open discussion, which was enriching. This discussion was centered around the vision of the organization, and covered topics such as organization density, future vision, including more types of people in CoCoRaHS, and staying true to the values of our current stakeholders.