GEORGIA COCORAHS: THE FIRST DECADE

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Abstract. The Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) was started in Colorado in 1998. Georgia joined CoCoRaHS in 2008; since then, more than 1000 stations across the state have submitted observations. Numerous significant precipitation events have been documented, including Hurricane Matthew (2016) and Tropical Storm Fay (2008), and the September 2009 extreme rain event in the metropolitan Atlanta area. CoCoRaHS observations more than doubled the number of manual precipitation observations available for these events. CoCoRaHS data are available via the CoCoRaHS website (www.cocorahs.org), as well as in the Global Historical Climatology Network archived data set maintained by the National Centers for Environmental Information. The National Weather Service's Southeast River Forecast Center uses CoCoRaHS data to perform quality control on gridded multisensor precipitation estimates which are key forcings to the river forecast model.

INTRODUCTION AND BACKGROUND

The Community Collaborative Rain, Hail and Snow Network (CoCoRaHS), a grassroots organization of volunteer precipitation observers, was started in Colorado in 1998, and gradually spread across the U.S. Georgia joined CoCoRaHS in 2008. Since then, more than 1000 stations across the state have submitted observations, with over 100 stations remaining active for at least 10 years. More than 500 stations are currently active in Georgia (Figure 1). Over 950,000 daily observations have been submitted in Georgia to date. CoCoRaHS observers make manual daily readings of rain and snow using a standard 4-inch diameter rain gauge. Observers can also submit special observations of heavy precipitation at any time.

While there are numerous automated rain gauges of various types across Georgia, the National Weather Service's (NWS) Cooperative Observer (Co-op) program is the only other source of manual precipitation data. Both CoCoRaHS data and NWS Co-op data are archived in the Global Historical Climatology Network (GHCN) data set maintained by the National Centers for Environmental Information. (Community Collaborative Rain, Hail and Snow Network, 2019). CoCoRaHS' goal is to establish a very high-density network of precipitation observers; the NWS Co-op network is much sparser by design (Bonner et al., 1998).

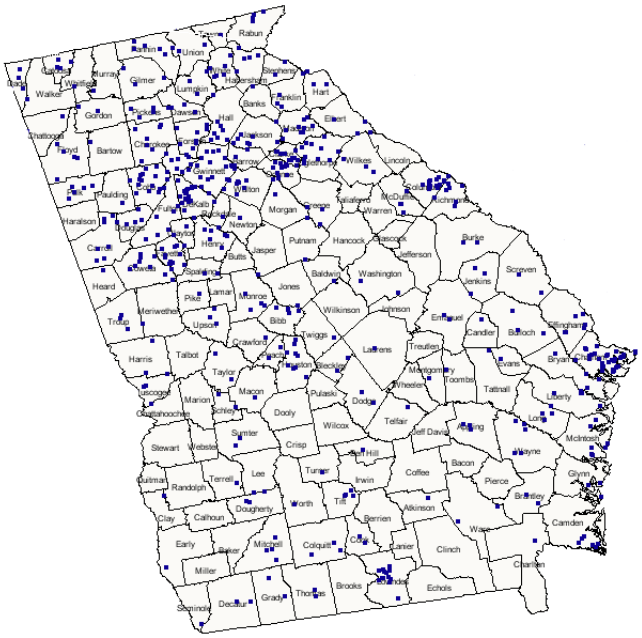

Figure 1. The Georgia CoCoRaHS Network, April 2019.

During the past decade, CoCoRaHS observations have added significantly to the amount of manual precipitation data available for Georgia. These data are used for immediate operational applications of the NWS, such as flash flood warnings and river forecasts, as well as other public and private endeavors such as climate and drought assessment, engineering and insurance industry analyses (Community Collaborative Rain, Hail and Snow Network, 2019.) Higher-density rain gauge data can improve the overall accuracy of multisensor precipitation estimates.

Significant rain events affecting Georgia

Georgia CoCoRaHS observers increased the amount of manual precipitation data available for several significant rain events that affected the state. Two such storms, Tropical Storm Fay (2008) and Hurricane Matthew (2016), are among the top ten wettest tropical systems that have affected Georgia (Wikipedia, 2019.) CoCoRaHS observations more than doubled the number of manual precipitation readings in Georgia for these events. For the extreme rain event in the Atlanta area in September 2009, 55 of the 64 manual rain observation sites were part of Georgia CoCoRaHS.

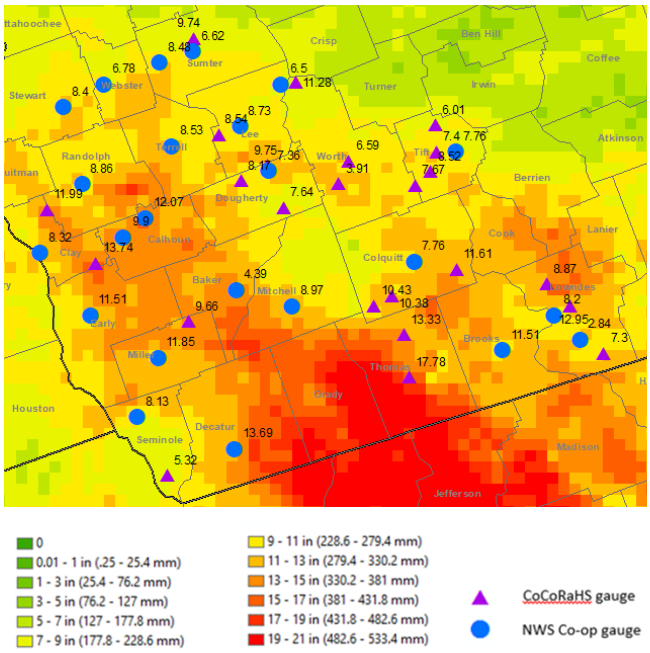

Figure 2. Quantitative Precipitation Estimates for August 21-27, 2008 (Tropical Storm Fay) in southwest Georgia, with gauge totals in inches.

Tropical Storm Fay

TS Fay made its final landfall near Carrabelle, Florida early on August 23rd, 2008. The center of the storm meandered over south central Mississippi before turning northeast, and was ultimately declared extratropical early on the 27th when the center was near Chattanooga, Tennessee (Stewart and Beven, 2009.) Twenty-three NWS Co-op stations were active across the most-affected portion of southwest Georgia at the time, with 12 in northwest Georgia. CoCoRaHS sites added 24 and 16 data points to these areas respectively, more than doubling the available number of observations. While the highest Georgia CoCoRaHS rain total for this event (17.78 in/451.6 mm) was in Thomas County (Figure 2), just north of the Florida border, the second highest came from Habersham County in the far northeast portion of the state. Moisture streamed northeast well ahead of the center, and, aided by orographic lifting in the southern Appalachians, dropped more than 15 inches (127 mm) of rain on portions of Habersham County between August 24th and 28th (Figure 3.)

Hurricane Matthew

While the center of Hurricane Matthew stayed off the Georgia coast, the storm still brought significant rain to coastal Georgia on October 7-8, 2016. The National Hurricane Center's (NHC) Tropical Cyclone Report on Hurricane Matthew listed totals from 21 NWS Co-op gauges and 22 CoCoRaHS gauges in Georgia (Stewart, 2017.) Thirteen Georgia CoCoRaHS sites reported event totals over 10 inches (254 mm); the highest total was 13.86 inches (352.04 mm) in Chatham County.

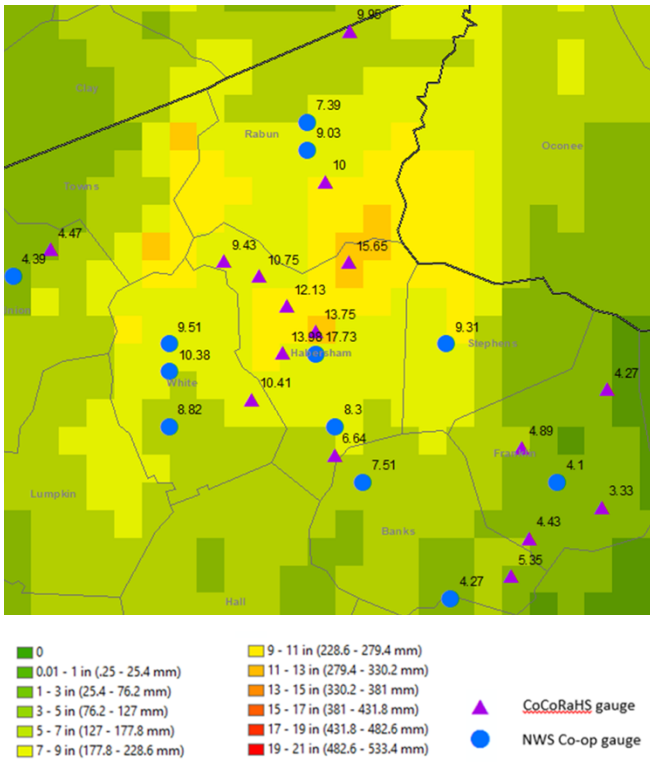

Figure 3. Quantitative Precipitation Estimates for August 24-28, 2008 (Tropical Storm Fay) in northeast Georgia, with gauge totals in inches.

Eight NWS Co-op sites had totals over 10 inches (254 mm), with the highest being 14.81 inches (376.17 mm), also in Chatham County (Figure 4.)

Atlanta-area floods of September 2009

Heavy rain led to record flooding in the Atlanta metropolitan area in mid-September 2009 (McCallum and Gotvald, 2010.) There were nine NWS Co-op stations active across the affected area at that time; some Atlanta-area counties had no Co-op site. Georgia CoCoRaHS observers provided 55 stations' worth of additional observations during that event. Rain amounts for the period September 20-22, 2009, exceeded 10 inches (254 mm) at 26 CoCoRaHS stations; the highest total for the period was 17.05 inches (433.07 mm) at GA-CB-6 (Kennesaw 5.6 SW). Cobb, Douglas and Paulding Counties were the most affected by this event; Cobb and Paulding each had two NWS Cooperative Observer stations active at the time, while Douglas County had none.

Seven CoCoRaHS observers in Cobb County and one in Paulding County greatly increased the density of precipitation data; Douglas County's three CoCoRaHS stations provided the only manual readings there. Douglas County station GA-DS-6 reported the event's highest one-day total, 10.50 inches (266.7 mm) (Figure 5.)

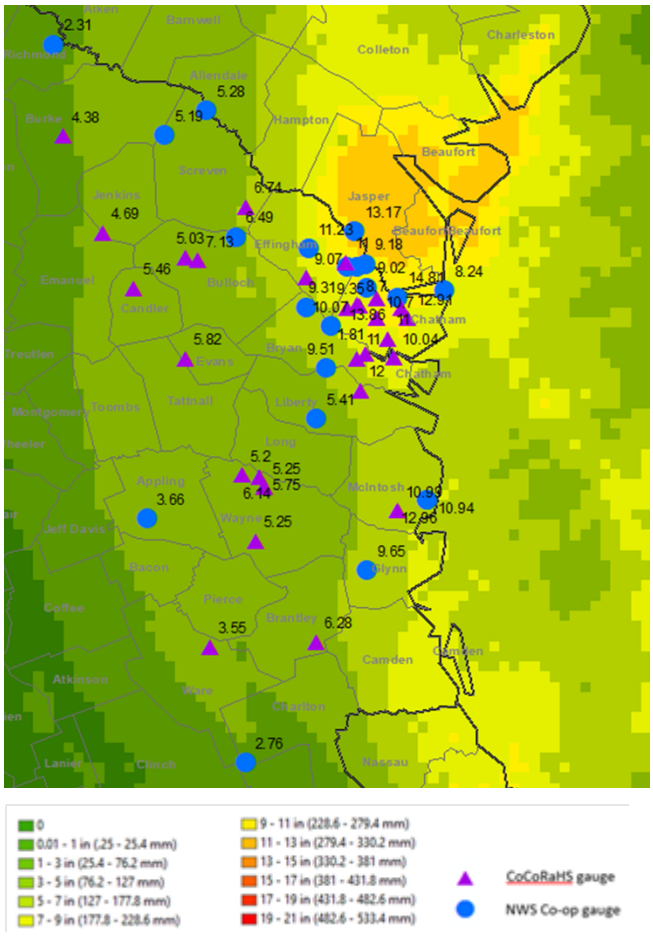

Figure 4. Quantitative Precipitation Estimates for October 10, 2016 (Hurricane Matthew) in coastal Georgia, with gauge totals in inches.

CoCoRaHS data in SERFC operations

CoCoRaHS data are used by the National Weather Service's Southeast River Forecast Center (SERFC) to perform quality control on gridded multisensor precipitation estimates. These estimates are key forcings to the river forecast model.

The Multi-Radar/Multi-Sensor (MRMS) system (National Severe Storms Laboratory, 2015) uses a variety of algorithms to produce hourly Quantitative Precipitation Estimation (QPE) grids, including a radar-only field that is the starting point for SERFC's Hydrometeorological Analysis and Support (HAS) forecasters. SERFC bias-corrects the radar-only field by superimposing a substantial number of hourly precipitation measurements and making adjustments as necessary, creating a final quality-controlled product.

Typically, CoCoRaHS observations are made once a day, and so they aren't suitable for use in hourly precipitation grid adjustments. However, they are used by SERFC HAS forecasters as an external check for the daily totals of their quality-controlled gridded estimates (C. Schaffer 2019, personal communication).

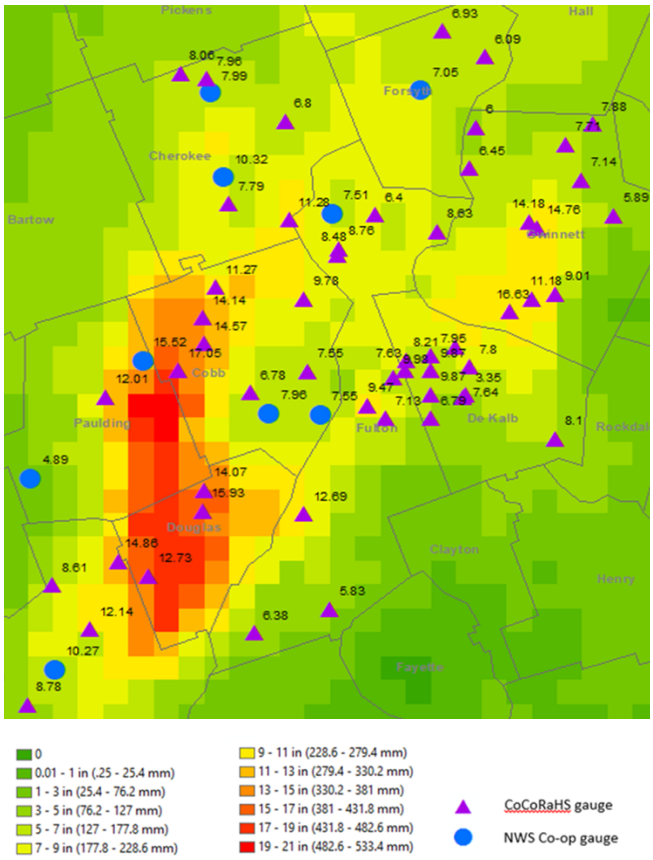

Figure 5. Quantitative Precipitation Estimates for September 20-22, 2009 in the metropolitan Atlanta area, with gauge totals in inches.

QPE data are input to SERFC's operational hydrologic river forecast model along with streamflow data and forecast precipitation to simulate river discharges.

CONCLUSION

Since 2008, CoCoRaHS observers have made a substantial amount of precipitation data available throughout the state of Georgia. These data have significantly increased the density of manual precipitation measurements across the state, since the only other source of such measurements is the NWS Co-op Observer Program.

Past and present data are available to the public at www.cocorahs.org, and are also archived by the National Centers for Environmental Information's Global Historical Climatology Network at www.ncdc.noaa.gov. These data are a valuable resource for both public and private industry.

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