Veriground™ vs. CMORPH Precipitation Data in Cocoa Growing Regions: Comparisons, Contrasts, and Conclusions

Executive Summary

This study looks at daily rainfall information from two different weather sources in selected cocoa-growing areas, covering the period from January 2020 to December 2025. The two sources gather rainfall information in very different ways.

The first source, Veriground, collects rainfall measurements directly from small weather stations placed in specific locations. These stations record rainfall and regularly send information to online data systems throughout the day.

The second source, called CMORPH, consists of satellite precipitation estimates that have been bias corrected and reprocessed using the Climate Prediction Center (CPC) Morphing Technique (MORPH) to form a global, high resolution precipitation analysis. It does not measure rainfall directly at the ground level. Instead, data is reprocessed on a global grid with 8km-by-8km spatial resolution. Temporal resolution is 30 minutes over a 20-year period of record (January 1998–present).

The study focused on two main questions. First, it examined how closely the two sources agree when reporting rainfall in the same locations at the same time. Second, it explored whether information from both sources could be combined in a way to provide faster and more accurate rainfall information for cocoa-growing regions.

To answer these questions, the researchers compared the data using summary statistics, how rainfall amounts were distributed, and statistical tests that measure how closely the two data sets are related.

The results showed that the two sources have some similarities in describing rainfall for the same regions and time periods. In spite of these similarities, the study found no reliable way to combine the two data sources to improve rainfall estimates.

Veriground Precipitation Data[1]

Veriground is a network of weather stations built by Commodities Risk Analysis (CRA), a company that helps the chocolate and confectionery industry understand global cocoa markets. CRA wanted better weather information from cocoa-growing areas but discovered a major problem: in many of these regions, reliable local weather data simply did not exist.

For decades, weather stations around the world were placed mainly to serve aviation. As a result, large parts of the world—especially outside North America, Europe, and other developed regions—had very few stations. In many cases, weather reports were created by estimating conditions across huge distances between airports. These estimates were often inaccurate and slow. In some countries, weather records were still kept on paper and shared internationally

[1] Summarized from information found at https://www.veriground.io/, accessed March 16, 2026.

months later, sometimes with errors. This was especially problematic in tropical farming areas near the equator, where weather can vary significantly over just a few kilometers.

CRA realized that modern mobile phone networks and small, low-cost electronics made a better approach possible. The result was the Veriground station—designed to be installed wherever there is mobile coverage, need little ongoing maintenance, and collect data directly from the places where crops are actually grown.

Each station measures weather conditions every hour and sends reports every two hours during the day. They track rainfall, temperature, humidity, sunlight, and air pressure. Rainfall is measured using a dedicated rain gauge that is carefully cleaned during routine maintenance to ensure accuracy. Stations include backup sensors, and CRA closely monitors and checks all measurements on an ongoing basis.

The data is sent through mobile networks to secure cloud servers. Built-in checks make sure the information arrives correctly, and if anything is missing or unclear, the system automatically requests a resend. From even the most remote locations, new data is usually available within a few hours.

This steady flow of accurate, local rainfall data feeds into modern weather forecasting systems, improving predictions for each station's exact location. As newer AI-based forecasting models continue to improve, the growing Veriground data set is helping build a clearer picture of weather in regions that have long been poorly measured—and helping farmers, traders, and companies make better-informed decisions.

CMORPH Precipitation Data[2]

CMORPH (Climate Prediction Center Morphing Technique) is a global precipitation estimation product developed by NOAA's Climate Prediction Center (CPC). It generates high-resolution precipitation analyses by combining two key inputs: precipitation estimates derived from passive microwave (PMW) satellite sensors and motion vectors from geostationary infrared (IR) imagery. Rather than using IR data directly for rain rates, IR is used to "morph"—spatially propagate and interpolate—the more accurate microwave-based estimates across time gaps when microwave coverage is unavailable. CMORPH data are available at roughly 8 km spatial resolution and 30-minute temporal resolution, with global coverage spanning roughly 60°S to 60°N latitude. Longer-term reanalysis versions extend back to 1998, making it useful for climatological studies.

CMORPH is widely used in hydrology, climate research, and weather forecasting because it offers near-real-time precipitation estimates over both land and ocean—areas where ground-based radar and rain gauge networks are sparse or nonexistent. It performs particularly well in tropical and subtropical regions where convective rainfall dominates.

[2] Summarized from information found at https://www.drought.gov/data-maps-tools/cmorph-daily-precipitation, accessed June 15, 2026.

Data Preparation

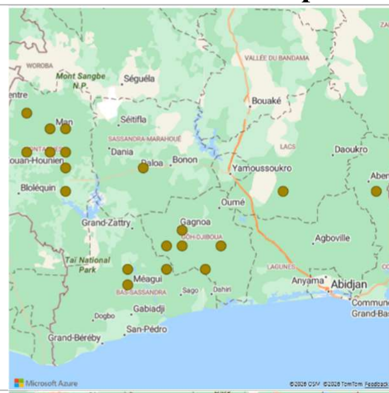
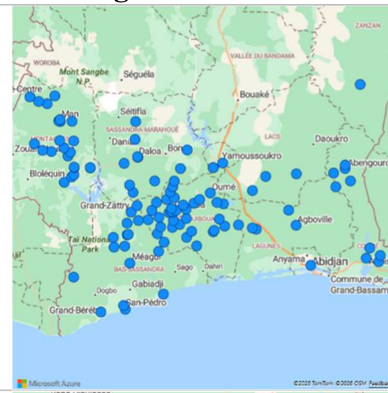
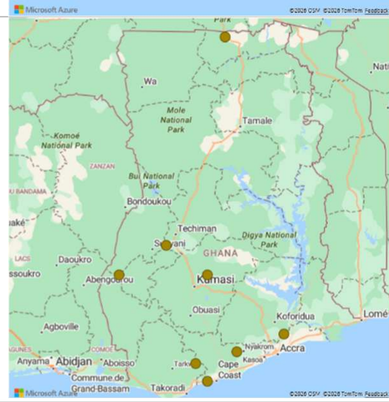
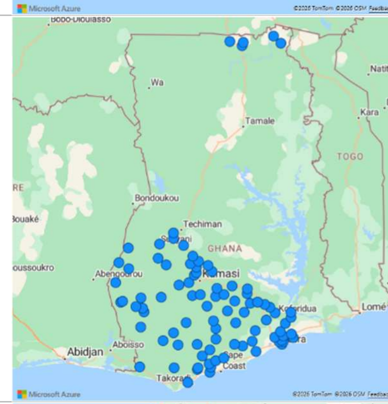
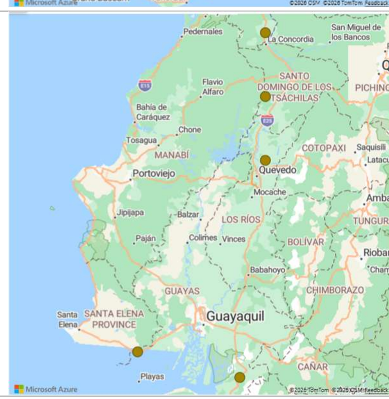
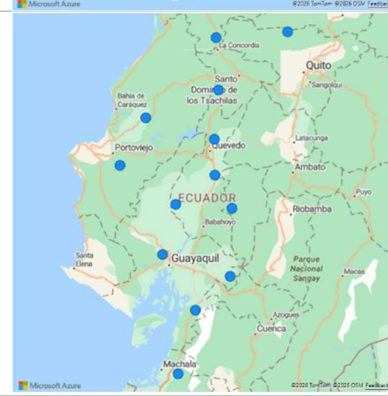
To make a meaningful comparison between the two weather data sources (CMORPH and Veriground), the data needed to refer to the same places and the same days. To do this, each CMORPH grid area was represented by its center point. Each Veriground weather station was then linked to the nearest CMORPH grid mid-point by rounding its latitude and longitude to one decimal place. This allowed each Veriground station to be paired with the most comparable CMORPH location.

Appendices A through C show how CMORPH grids and Veriground stations were matched for Côte d'Ivoire, Ghana, and Ecuador (see also the maps in Figure 1). These appendices also list how many daily reports were available from each data source between January 2020 and December 2025, as well as the distance between each Veriground station and its matching CMORPH grid center.

Next, the two datasets were combined into a single table so that rainfall values from both sources could be compared day by day at the same locations. In a small number of cases, two or three Veriground stations were linked to the same CMORPH grid. When this happened, the rainfall readings from those Veriground stations were averaged for each day.

CMORPH provides rainfall estimates for every day, but Veriground stations occasionally have missing data due to maintenance or when faulty readings are removed. When Veriground data was missing for a given day and location, the corresponding CMORPH data was removed as well. As a result, the final dataset contains only days and locations where both sources reported data, making the comparison fully consistent. All data preparation and analysis were carried out primarily using Power BI.

Finally, a note about dew: Dew forms when surfaces cool and water condenses, while precipitation refers to water that falls from the atmosphere, such as rain. Standard weather stations do not count dew as precipitation, and Veriground follows this same practice by removing very small measurements that are likely caused by dew. It is not clear how the CMORPH model accounts for dew formation in its estimates.

Figure 1. Maps		
	CMORPH Grid Midpoints	**Veriground Locations**
Côte d'Ivoire		
Ghana		
Ecuador		

Precipitation Comparison Methodology

This study compares two sources of rainfall data using three steps.

1. **Basic summaries of the data.**
   First, we look at general features of each data set—such as typical values and overall ranges—to see how similar or different the two sources are.

2. **How the data is distributed.**
   Rainfall data behaves differently from many other types of data. In this step, we examine

whether the two data sources show similar or different patterns in how rainfall amounts are distributed.

3. **Relationship between the two sources.**
   Finally, we use regression analysis to see whether there is a clear and meaningful relationship between the rainfall measurements from the two sources.

Together, these steps help answer key questions about how the two datasets compare and provide a foundation for future research.

Analysis Results

Descriptive statistics.

Table 1 provides a side-by-side summary of the main features of the two rainfall data sets. The most important differences are briefly explained here and explored in more detail later.

Table 1. Summary Statistics

Statistic	CMORPH	Veriground
No. of Observations	32,870	32,870
Minimum Value	0.00	0.00
Maximum Value	152.90	173.80
Average Value	3.29	2.79
Median Value	0.00	0.00
Standard Deviation	9.32	8.04
Fisher-Pearson skewness coefficient	5.25	5.76
No. Obs. Equal to 0.00 mms	18,382	22,599
Pct. of Obs. Equal to 0.00 mms	55.9%	68.8%
Average Rain Days Per Week	3.1	2.2

On the surface the 32,870 observations from the CMORPH and Veriground data appear to have some similarities. The skewness coefficients are similar. Although Veriground has a maximum observation that is only 13 percent larger than the largest CMORPH observation, the CMORPH average is 18 percent greater than the Veriground average. The variability of CMORPH data, as measured by the Standard Deviation, is 16 percent greater than Veriground data.

The two data sets differ noticeably in how often they report no rain at all. Veriground shows zero rainfall on nearly 69 percent of days, while CMORPH reports zero rainfall on fewer than 56 percent of days. On average, this means that one can expect rain 2.2 days per week, according to Veriground data, compared to 3.1 days per week according to CMORPH data. Anticdotal experience of rainfall, especially in West Africa, lines up closer with the Veriground results than with CMORPH.

Distribution of the data

Because the data are heavily uneven, we closely reviewed the largest and most unusual rainfall values in both data sets. Tables 2 and 3 list the 20 highest rainfall measurements from CMORPH and Veriground, respectively. Each table compares measurements from both data sources for the same dates and locations, allowing the largest values in each data set to be examined side by side.

Table 2. CMORPH – Top 20 Observations with Most Rainfall								
Rank	**CMORPH Rain**	**Date**	**CMORPH ID**	**Country**	**CMORPH Latitude**	**CMORPH Longitude**	**VG ID**	**VG Rain**
1	152.9	10-Feb-21	847197	Ecuador	-2.6	-79.6	9000102	5.9
2	139.7	23-Jun-21	843371	Côte d'Ivoire	5.4	-6.6	9000022	34.8
3	138.2	29-Oct-21	843371	Côte d'Ivoire	5.4	-6.6	9000022	7.0
4	132.2	27-Aug-24	833612	Côte d'Ivoire	7.1	-7.4	9000141	39.9
5	130.5	27-Aug-24	836588	Côte d'Ivoire	7.4	-7.4	9000159	0.0
6	129.7	14-Mar-21	834651	Côte d'Ivoire	5.6	-6.6	9000064	52.5
7	129.7	27-Aug-22	832214	Côte d'Ivoire	6.6	-7.4	9000129	17.6
8	124.0	1-Aug-21	834651	Côte d'Ivoire	5.6	-6.6	9000064	24.7
9	120.7	6-Apr-23	838275	Ecuador	-0.9	-79.4	9000055	39.9
10	120.0	8-Apr-20	847524	Côte d'Ivoire	6.1	-5.9	9000083	0.5
11	114.6	27-Aug-22	833612	Côte d'Ivoire	7.1	-7.4	9000141	43.9
12*	112.9	28-Sep-25	848704	Côte d'Ivoire	7.4	-7.6	9000374	119.9
13	110.4	4-Jun-23	838275	Ecuador	-0.9	-79.4	9000055	1.2
14	109.9	5-Feb-24	838275	Ecuador	-0.9	-79.4	9000055	69.3
15	108.5	17-Sep-21	847524	Côte d'Ivoire	6.1	-5.9	9000083	57.7
16	108.3	24-Feb-20	838275	Ecuador	-0.9	-79.4	9000055	0.3
17	108.3	28-Sep-25	833612	Côte d'Ivoire	7.1	-7.4	9000141	35.2
18	107.6	5-Mar-25	838275	Ecuador	-0.9	-79.4	9000055	0.0
19	106.2	11-Aug-21	834656	Côte d'Ivoire	6.9	-6.4	9000071	12.6
20	105.5	27-Aug-22	854965	Côte d'Ivoire	7.1	-7.6	9000133	0.0

Table 3. Veriground – Top 20 Observations with Most Rainfall								
Rank	**VG Rain**	**Date**	**VG ID**	**Country**	**CMORPH Latitude**	**CMORPH Longitude**	**CMORPH ID**	**CMORPH Rain**
1	173.8	28-Sep-25	9000134	Côte d'Ivoire	7.1	-7.9	840802	77.3
2	155.7	9-Aug-23	9000219	Ghana	10.9	-1.1	841793	47.1
3	127.9	19-Feb-24	9000055	Ecuador	-0.9	-79.4	838275	62.4
4	125.2	10-Jun-20	9000070	Ghana	5.6	-0.9	841172	91.2
5	121.4	11-Jan-24	9000055	Ecuador	-0.9	-79.4	838275	59.6
6	120.3	18-Apr-24	9000391	Ecuador	0.1	-79.4	850973	3.4
7*	119.9	28-Sep-25	9000374	Côte d'Ivoire	7.4	-7.6	848704	112.9
8	118.3	10-Sep-25	9000134	Côte d'Ivoire	7.1	-7.9	840802	45.5
9	118.2	14-Jun-25	9000104	Ghana	6.9	-2.9	838993	21.4
10	107.6	20-Mar-23	9000070	Ghana	5.6	-0.9	841172	0.0
11	105.1	25-Jun-21	9000022	Côte d'Ivoire	5.4	-6.6	843371	65.5
12	104.3	25-Oct-22	9000070	Ghana	5.6	-0.9	841172	22.4
13	103.9	13-Apr-24	9000391	Ecuador	0.1	-79.4	850973	10.7
14	103.6	9-Jul-22	9000134	Côte d'Ivoire	7.1	-7.9	840802	2.6
15	102.7	16-Jun-22	9000022	Côte d'Ivoire	5.4	-6.6	843371	18.3
16	100.6	27-Jun-25	9000141	Côte d'Ivoire	7.1	-7.4	833612	14.7
17	98.6	3-Aug-23	9000374	Côte d'Ivoire	7.4	-7.6	848704	78.9
18	95.7	1-Oct-25	9000063	Côte d'Ivoire	5.9	-5.4	836783	41.6
19	94.4	22-Oct-23	9000387	Ecuador	-0.4	-79.4	846179	95.4
20	93.6	4-Sep-25	9000374	Côte d'Ivoire	7.4	-7.6	848704	14.4

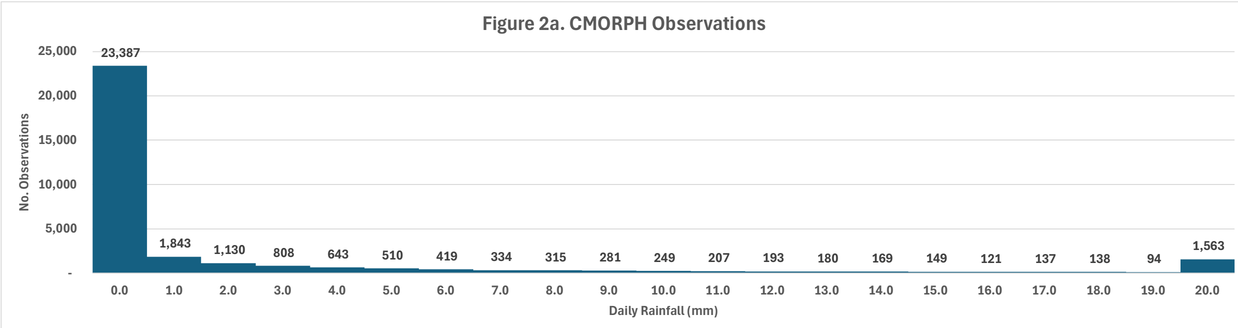
The top 20 CMORPH observations listed in Table 2 are all from Côte d'Ivoire and Ecuador; there are no observations from Ghana. Rainfall amounts in the top 20 CMORPH observations range from 105.5 to 152.9 mms. Significantly, only one of those observations is also listed in Table 3—September 28, 2025 at CMORPH gridpoint 848704 in Côte d'Ivoire. One CMORPH station in Ecuador, #838275, has five observations in the top 20. Another CMORPH station in Côte d'Ivoire, #833612, has three observations in the top 20.

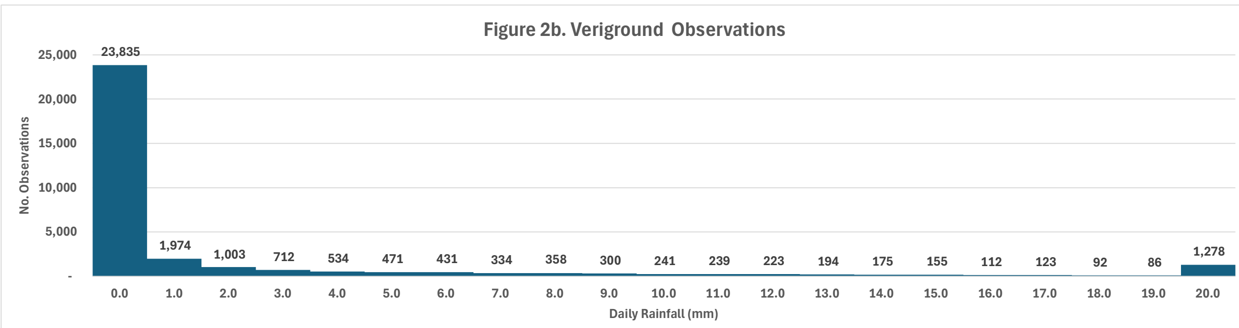
Table 3, showing the top 20 Veriground observations, is a mix of all three countries in the study. Rainfall amounts in the top 20 Veriground observations range from 93.6 to 173.8 mms—a broader range of values than CMORPH. Three Veriground stations, #9000070, #9000134, and #9000374, each have three observations in the top 20.

To make this analysis more practical, rainfall amounts were grouped into ranges of 1 millimeter. All values from 0 to 1 millimeter were placed in the first group, values from 1 to 2 millimeters in the second group, and so on. Very large rainfall amounts—anything over 20 millimeters—were grouped together into a single category. The results of this grouping are shown in Table 4, and the corresponding charts for CMORPH and Veriground are shown in Figures 2a and 2b.

Table 4. Distribution of Rainfall Observations

Daily Rainfall Range (mm)	ERA5 Observations	Veriground Observations
0.0 <= 1.0	23,387	23,835
1.0 <= 2.0	1,843	1,974
2.0 <= 3.0	1,130	1,003
3.0 <= 4.0	808	712
4.0 <= 5.0	643	534
5.0 <= 6.0	510	471
6.0 <= 7.0	419	431
7.0 <= 8.0	334	334
8.0 <= 9.0	315	358
9.0 <= 10.0	281	300
10.0 <= 11.0	249	241
11.0 <= 12.0	207	239
12.0 <= 13.0	193	223
13.0 <= 14.0	180	194
14.0 <= 15.0	169	175
15.0 <= 16.0	149	155
16.0 <= 17.0	121	112
17.0 <= 18.0	137	123
18.0 <= 19.0	138	92
19.0 <= 20.0	94	86
greater than 20.0	1,563	1,278
Total Observations	**32,870**	**32,870**
Obs. exactly equal to 0.0 mms	**18,382**	**22,599**
Percentage equal to 0.0 mms	**55.9%**	**68.8%**





When we compare the two charts, clear similarities appear. In both data sets, most measurements fall into the very lowest category of rainfall (0 to 1 mm). In fact, nearly three-quarters of all observations from both data sets are in this range. If we look only at days with no rain at all, CMORPH reports no rain on 55.9 percent of all observations, compared with 68.8 percent for Veriground. Put another way, CMORPH suggests that it rains on average 3.1 days per week, compared with 2.2 days per week for Veriground. Everyday experience of rainfall, especially in West Africa, lines up slightly more closely with the Veriground results than with CMORPH, in terms of frequency of rain days.

Both data sets show overall patterns that match what scientists often see in tropical rainfall[3]. Statisticians recognize these patterns as approximating gamma frequency distributions.

[3] For instance:
Malaysia. Ab Malek et al. (2021). Modelling the Distribution of Rainfall Amount, Mathematical Sciences and Informatics Journal Vol. 2, No. 2, Nov. 2021, pp. 26-34

Bangladesh. Sanjib Ghosh et al. (2016). Determination of the Best Fit Probability Distribution for Monthly Rainfall Data in Bangladesh, American Journal of Mathematics and Statistics 2016, 6(4): 170-174.

India. Mohita Anand Sharma and Jai Bhagwan Singh (2010). Use of Probability Distribution in Rainfall Analysis. New York Science Journal 2010;3(9)

India. Deka S., and Borah M., (2009). Distribution of Annual Maximum Rainfall Series of Northeast India, European Water Publications 27/28: 3-14.

However, Veriground includes more zero and small rainfall amounts—amounts less than one mm.

Regression Analysis

We used regression analysis to see whether the two data sets show a consistent relationship under different conditions, and to explore whether information from one data source could help improve the other. To do this, we started with a basic statistical comparison that measures how changes in one data set relate to changes in the other.

$$y_i = a + bx_i$$

Where:

y_i = *Veriground observation for date/location combination i.*

a = *y intercept*

b = *slope; expected change in y for a one mm change in x*

x_i = *CMORPH observation for date/location combination i.*

The full data set, which includes about 32,870 observations, was sorted into smaller groups to make comparisons easier. These groups were created based on different time periods and locations. Specifically, the data were organized into eight categories:

1. All observations together
2. Broken down by year, combining all countries
3. Broken down by country, combining all years
4. Rainy-season months, by country
5. Dry-season months, by country
6. Months influenced by El Niño, by country
7. Months influenced by La Niña, by country
8. Months with neutral ENSO conditions, by country

Using these groups, we ran a total of 28 separate comparisons to see how the two data sources relate to each other under different conditions. The results of these comparisons are summarized in Table 5.

Table 5. Regression Runs									
Run Number	Area Specification	Month Specifications	n	CMORPH Avg.	VG Avg.	a	b	r2 (%)	SE
1	All areas	All	32,870	3.29	2.79	1.37	0.43	25.18%	6.95
2	All areas	2020 only	1,312	3.40	1.78	0.95	0.25	15.94%	5.63
3	All areas	2021 only	5,397	4.12	3.29	1.61	0.41	28.24%	6.95
4	All areas	2022 only	5,917	3.18	2.55	1.34	0.38	19.64%	6.95
5	All areas	2023 only	6,536	3.18	3.13	1.40	0.54	30.95%	7.35
6	All areas	2024 only	6,310	2.87	2.33	1.09	0.43	27.03%	6.38
7	All areas	2025 only	7,396	3.19	2.90	1.50	0.44	23.25%	7.11
8	Côte d'Ivoire only	All	22,599	3.38	2.78	1.41	0.41	25.95%	6.55
9	Ghana only	All	6,523	2.11	2.57	1.17	0.66	29.00%	6.65
10	Ecuador only	All	3,748	4.77	3.25	1.21	0.43	22.69%	9.18
11	Côte d'Ivoire only	Rainy season[1]	9,879	3.75	3.37	1.74	0.43	25.63%	7.08
12	Ghana only	Rainy season	2,766	2.90	3.48	1.61	0.65	27.34%	7.84
13	Ecuador only	Rainy season	1,896	8.17	5.55	2.29	0.40	18.76%	12.21
14	Côte d'Ivoire only	Dry season[2]	12,720	3.09	2.32	1.15	0.38	26.35%	6.07
15	Ghana only	Dry season	3,757	1.53	1.90	0.87	0.67	30.07%	5.59
16	Ecuador only	Dry season	1,852	1.30	0.89	0.34	0.42	25.33%	4.03
17	All areas	El Niño impact[3]	3,051	2.50	2.45	1.06	0.55	28.57%	7.32
18	Côte d'Ivoire only	El Niño impact	2,039	2.11	1.53	0.91	0.29	18.15%	4.29
19	Ghana only	El Niño impact	568	0.85	1.47	0.87	0.71	22.08%	4.48
20	Ecuador only	El Niño impact	444	6.44	7.97	2.96	0.78	36.54%	14.77
21	All areas	La Niña impact[4]	14,689	3.24	2.70	1.38	0.41	23.22%	6.73
22	Côte d'Ivoire only	La Niña impact	10,752	3.53	2.83	1.41	0.40	25.55%	6.60
23	Ghana only	La Niña impact	2,978	2.00	2.48	1.15	0.66	25.50%	6.60
24	Ecuador only	La Niña impact	959	3.88	1.90	0.98	0.24	9.55%	7.59
25	All areas	ENSO-Neutral[5]	15,130	3.48	2.95	1.43	0.44	26.42%	7.07
26	Côte d'Ivoire only	ENSO-Neutral	9,808	3.47	2.99	1.52	0.42	26.93%	6.84
27	Ghana only	ENSO-Neutral	2,977	2.47	2.87	1.25	0.66	32.00%	7.03
28	Ecuador only	ENSO-Neutral	2,345	4.83	2.91	1.10	0.38	23.81%	7.72

[1]Rainy season: For West Africa = May through July and October through November. For Ecuador = December through May.
[2]Dry season: For West Africa = December through April and August through September. For Ecuador = June through November.
[3]El Niño Impact = For the months November 2023 through April 2024.
[4]La Niña Impact = For the months August 2020 through March 2023 and November 2025 through December 2025.
[5]ENSO-Neutral Conditions= For all months remaining after removing El Niño and La Niña impact months.
ENSO Source: Climate Prediction Center, https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.shtml

Summary of key findings:

- Across all the comparisons we made, the relationship between the two data sets was weak, as shown by R-squares less than 37 percent. Measures of how closely they move together were consistently low, meaning the two sources rarely agree in a reliable way. Results were slightly better during El Niño, La Niña, and neutral climate periods, but still weak overall.

- The baseline rainfall levels estimated by the models, as shown by the value of “a”, varied widely. Ecuador showed the largest differences, with generally higher rainfall levels reported by CMORPH than by Veriground in both wet and dry seasons. For example, during the rainy season, CMORPH suggests average daily rainfall almost 50 percent higher than what Veriground reports.

- The amount of uncertainty in the results was large, as shown by the Standard Error. This uncertainty is big enough that none of the comparisons can be trusted to make accurate predictions.

- The strength of the relationship between the two data sets, as shown by the value of “b”, also varied widely, with Ecuador showing the greatest variation in “b” values.

- Taken together—weak relationships, high uncertainty, and wide variability—these results show that data from one source cannot be reliably used to improve or correct information from the other.

Conclusions

This study sets out to answer two basic questions. First, how well do Veriground and CMORPH data describe local rainfall in cocoa-growing areas? Second, can information from the two sources be combined to produce more accurate and timely rainfall insights? To answer these questions, we compared basic statistics, rainfall patterns, and direct relationships between the two data sets.

On the first question, the results show that Veriground and CMORPH differ in various ways. Although both aim to describe rainfall events in the same places and time periods, they tell different stories. Across the full data set, CMORPH generally reports more rainfall than Veriground—on average about 18 percent more. The difference is greater in Ecuador, where CMORPH reports nearly 47 percent more average daily rainfall than Veriground.

The frequency profiles of the two data sets have some noticeable similarities. Both show clear evidence of gamma-type distributions, a characteristic often reported in other tropical rainfall studies. For Veriground, this pattern arises from the actual data readings from reporting stations. For CMORPH, the pattern likely comes from the mathematical algorithms used in the estimation model.

Similarities in overall frequency distributions raise the hope that the two data collection approaches might somehow be reconciled in a way that would allow data from one source to enhance the accuracy of data in the other source. However, similarities in overall frequency patterns do not translate to similarities in individual date/location observations. This is demonstrated first in the listing of the 20 observations from each source that report the greatest daily rainfall amounts. The two sources report lists that are significantly different. Only one date/location observation was common on both lists.

Regression analysis also demonstrates that the two data sources lack meaningful correlations. Across dozens of seasonal or geographic comparisons, the relationship between CMORPH and Veriground observations was consistently weak.

Based on these findings, there is no reliable way to improve one data source by using information from the other. The differences between Veriground and CMORPH are not simply a matter of adjusting scales or fine-tuning assumptions. They reflect two fundamentally different approaches to measuring rainfall: one based on local, ground-level observations, and the other based on satellite models designed to cover the wider areas.

Future research should focus on understanding why these differences are so significant.

--July 2, 2026

Appendix A
Côte d'Ivoire Matching Station Reports

CMORPH				Veriground					
Grid ID	Latitude	Longitude	No. of Reports	Locality ID	Locality Name	Latitude	Longitude	No. of Reports	Distance to CMORPH grid midpoint (km)
848484	5.6	-5.6	2192	9000181	Akridou Laddé	5.6355	-5.6110	1156	4.13
848701	6.6	-3.4	2192	9000128	Appoisso	6.5500	-3.4333	195	6.67
834656	6.9	-6.4	2192	9000071	Daloa	6.8842	-6.4428	1183	5.06
834656	6.9	-6.4	2192	9000372	Daloa CCC	6.8903	-6.4493	1024	5.58
834656	6.9	-6.4	2192	9000017	Daloa Northwest	6.8838	-6.4475	0	5.57
836783	5.9	-5.4	2192	9000063	Divo Konankro	5.8539	-5.3624	1871	6.60
850487	5.6	-6.1	2192	9000174	Dogopié	5.5585	-6.1495	1569	7.17
832034	6.6	-4.6	2192	9000204	Ebimolossou	6.6132	-4.6335	1235	4.00
836588	7.4	-7.4	2192	9000159	Facobly	7.3877	-7.3762	1714	2.97
847524	6.1	-5.9	2192	9000369	Gagnoa CCC	6.1115	-5.9343	998	4.02
834651	5.6	-6.6	2192	9000064	Gblettia Meagui	5.6327	-6.6290	1306	4.85
833612	7.1	-7.4	2192	9000141	Gloplou	7.1115	-7.3523	1712	5.45
851101	5.9	-5.9	2192	9000182	Gnamagnoa	5.9362	-5.8517	1558	6.70
851710	6.9	-7.4	2192	9000130	Guéhiébly	6.9000	-7.4333	372	3.70
854965	7.1	-7.6	2192	9000133	Logoualé	7.1167	-7.5500	1629	5.85
832214	6.6	-7.4	2192	9000129	Lokossou	6.6062	-7.3821	729	2.10
848704	7.4	-7.6	2192	9000374	Man CCC	7.3947	-7.5658	1007	3.84
843371	5.4	-6.6	2192	9000022	Méagui	5.3917	-6.5578	800	4.77
847524	6.1	-5.9	2192	9000083	Mocko	6.1332	-5.9052	1984	3.73
839364	5.9	-6.1	2192	9000394	Sérihio	5.9018	-6.1220	314	2.45
840802	7.1	-7.9	2192	9000134	Zérégbo	7.0725	-7.9097	1675	3.24

Appendix B
Ghana Matching Station Reports

CMORPH				Veriground					
Grid ID	Latitude	Longitude	No. of Reports	Locality ID	Locality Name	Latitude	Longitude	No. of Reports	Distance to CMORPH grid midpoint (km)
841172	5.6	-0.9	2192	9000070	Agona Bobikumah	5.5503	-0.8575	1783	7.26
852289	5.9	-0.1	2192	9000098	Akropong Akuapem	5.9480	-0.1002	1657	5.33
838993	6.9	-2.9	2192	9000104	Kwesifrekrom	6.9087	-2.8762	1685	2.81
841793	10.9	-1.1	2192	9000219	Navrongo	10.8784	-1.0833	1162	3.03
836399	5.4	-1.6	2192	9000234	Wassa Dormama	5.3753	-1.5731	236	4.05

Appendix C
Ecuador Matching Station Reports

CMORPH				Veriground					
Grid ID	Latitude	Longitude	No. of Reports	Locality ID	Locality Name	Latitude	Longitude	No. of Reports	Distance to CMORPH grid midpoint (km)
838275	-0.9	-79.4	2192	9000055	Chollo Farm	-0.9061	-79.4247	1323	2.82
850973	0.1	-79.4	2192	9000391	La Unión	0.1288	-79.4073	690	3.30
847197	-2.6	-79.6	2192	9000102	Naranjal	-2.6491	-79.6179	1025	5.80
846179	-0.4	-79.4	2192	9000387	Puerto Limon	-0.4051	-79.3831	710	1.96