Oscar M. Lopez Center

Science for Climate Resilient Communities

# STATE OF THE 2022 PHILIPPINE CLIMATE

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2024/AUGUST

INTERACTIVE

**STATE OF THE 2022 PHILIPPINE CLIMATE**
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# STATE OF THE 2022 PHILIPPINE CLIMATE


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# ABOUT THE PUBLICATION

**THE STATE OF THE PHILIPPINE CLIMATE (SPC) IS AN ANNUAL REPORT THAT PROVIDES A SUMMARY OF OBSERVATIONS OF THE COUNTRY'S ESSENTIAL CLIMATE VARIABLES, AS WELL AS NOTABLE CLIMATIC AND WEATHER EVENTS**

This publication is based on data provided by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), National Disaster Risk Reduction and Management Council (NDRRMC), and other national and international institutions. The primary goal of this annual climate report is to efficiently disseminate necessary climate information that can aid policy makers, local government units, and other stakeholders in their decision making processes toward science-based climate change adaptation and disaster risk management.

Effective communication of climate information to relevant stakeholders and the general public is one key step toward building a climate-resilient society. Such information allows the authorities to better visualize the implications and make informed decisions that could help the general public adapt to a changing climate.

This 2022 SPC report gives a brief but comprehensive overview of climate indicators (e.g. temperature, rainfall, El Niño Southern Oscillation (ENSO), tropical cyclones) and the patterns, changes, and trends representing the country's climate in 2022. Several climatological records that have been broken or equaled, as well as climate anomalies and significant extreme events and their impacts are also presented.

## ABOUT THE COVER

A digital illustration of Typhoon Agaton based on an image from a news article.

The 8 bars with equal widths clipping the digital illustration represents SPC 2022 as the eighth edition. Bars are arranged from lowest to highest (left to right) to depict the increasing number of climate-related risks.

## ACKNOWLEDGEMENTS

**PHILIPPINE ATMOSPHERIC, GEOPHYSICAL, AND ASTRONOMICAL SERVICES ADMINISTRATION (PAGASA)**

**OSCAR M. LOPEZ CENTER FOR CLIMATE CHANGE ADAPTATION AND DISASTER RISK MANAGEMENT FOUNDATION, INC. (OML CENTER)**

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**NATIONAL DISASTER RISK REDUCTION AND MANAGEMENT COUNCIL (NDRRMC)**

Deniece Krizia B. Manding

Katherine A. Hernandez

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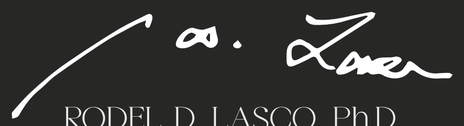
# MESSAGE FROM OML CENTER

As our country continues to navigate the aftermath of the global COVID-19 pandemic, the relentless onslaught of disasters exacerbated by a changing climate remains an ever-present challenge. With 2022 ranking as the sixth warmest year on record, the specter of global heating looms large, while hydrometeorological hazards continue to wreak havoc on the lives of millions of Filipinos each year.

In this edition of the State of the Philippine Climate, we look back on the climate-related and weather events that unfolded in 2022. The emergence of a three consecutive year cool ENSO phase, otherwise known as “triple-dip” La Niña, did not only cause a moderation of temperatures, but also ushered a significant increase in rainfall across the country. The effects were particularly severe in Leyte, where Tropical Storm Agaton (Megi) triggered extensive flooding and landslides due to the over 900 mm of rainfall, resulting in the loss of 214 lives. Moreover, the latter part of the year witnessed the devastating blow of Severe Tropical Storm Paeng, causing a staggering PHP 13 billion in damages to our agricultural lands and vital infrastructure. These events remind us of the urgent need for proactive measures.

We at the Oscar M. Lopez Center, alongside our esteemed partners from PAGASA, NDRRMC, and other institutions, stand unwavering at the forefront of climate change adaptation efforts. We extend our deepest gratitude for the collaborative spirit and invaluable datasets shared in the creation of this report.

Our utmost desire is for this report to resonate with its readers on a personal level, and empower national and local stakeholders to take decisions rooted on both data and compassion. Together, let’s work towards solutions that reduce the impacts of climate-related hazards, particularly on our most vulnerable communities, as we strive to build a more resilient and sustainable future for all Filipinos.



RODEL D. LASCO, Ph.D.
**EXECUTIVE DIRECTOR**

# MESSAGE FROM PAGASA

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NATHANIEL T. SERVANDO, Ph.D
**ADMINISTRATOR**

# CLIMATE TYPES

**THE PHILIPPINE CLIMATE IS CHARACTERIZED BY RELATIVELY HIGH TEMPERATURES, SMALL TEMPERATURE RANGES, AND ABUNDANT RAINFALL.**

Due to its geographic location and archipelagic nature, the country receives an uneven distribution of rainfall throughout the year. As of writing, the country has four major climate types based on rainfall distribution as shown in Figure 1.

This report utilizes climate information obtained from 55 operational PAGASA synoptic weather stations across the Philippines, as shown in Figure 1. These stations serve as a reference for the maps and figures in the subsequent sections of this report.

**TYPE I:** Two pronounced seasons— dry from November to April and wet during the rest of the year. Maximum rain period is from June to September.

**TYPE II:** No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Minimum monthly rainfall occurs during the period from December to February or from March to May.

**TYPE III:** No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

**TYPE IV:** Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

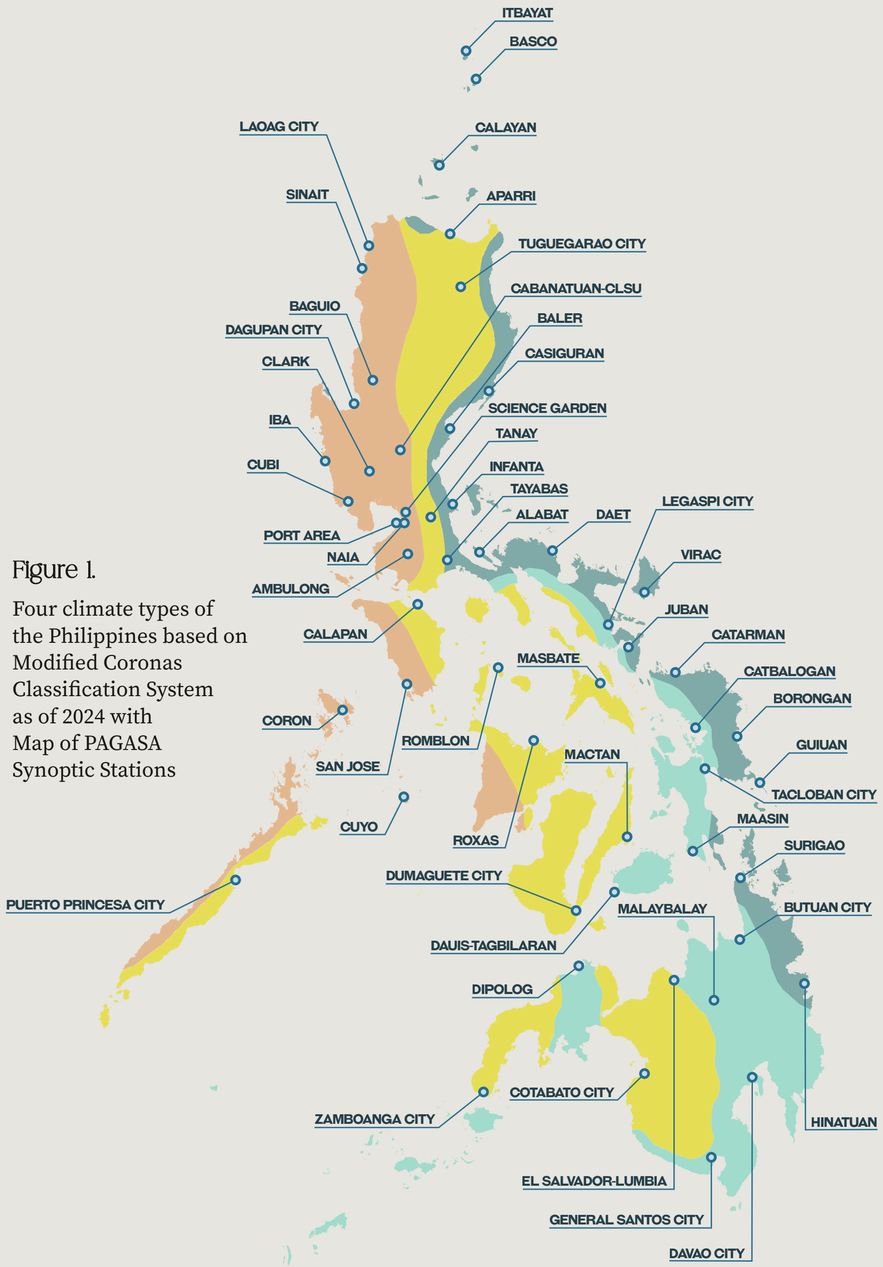


Figure 1.
Four climate types of the Philippines based on Modified Coronas Classification System as of 2024 with Map of PAGASA Synoptic Stations

# KEY FINDINGS

## What happened in 2022?

### TEMPERATURE

The country experienced cooler- than-normal conditions for most of 2022. The mean temperature was 27.5 °C, which is 0.1 °C colder than the 1991-2020 baseline temperature, hereon referred to as “normal”.

Daytime temperatures were colder than normal by -0.3 °C and nighttime temperatures have slightly warmed by 0.1 °C.

### TROPICAL CYCLONE

Eighteen (18) tropical cyclones entered the Philippine Area of Responsibility (PAR). This is slightly below the annual average of 19-20. Five of them made landfall and three reached super typhoon category.

STS Paeng affected about 6 million people and incurred the highest cost of damage to agriculture and infrastructure amounting to PHP 13 billion. Meanwhile, STY Karding was the strongest tropical cyclone that made landfall.

### RAINFALL

The year 2022 was marked as the seventh wettest since 1991, with annual mean rainfall of 2,966.5 mm. Generally, below-normal to above-normal rainfall conditions were observed.

Rain-bearing weather systems, such as monsoon surges, shear line, LPAs, and tropical cyclones contributed to the above-normal rainfall conditions.

### ENSO

The rare occurrence of the three-year cool ENSO phase, otherwise known as “triple-dip” La Niña, moderated temperatures and caused above-normal rainfall across the country.

# CLIMATE TRENDS

**THE LA NIÑA CONDITIONS IN 2022 INDUCED NOTABLE CHANGES IN TEMPERATURE AND RAINFALL PATTERNS.**

While temperatures exhibited a cooler than normal values, the accumulated rainfal showed a significant increase. A 0.1 °C decrease in the mean temperature was observed, and daytime (maximum) temperatures got colder by 0.3 °C. Moreover, the country received an annual rainfall greater by 1,635 mm than the 1991-2020 baseline period.

Eighteen (18) tropical cyclones were formed in 2022. While this is higher than 2021, this is still below the average yearly count.

January remained the coldest month despite experiencing 0.5 °C increase, while May remained the warmest with a 0.3 °C decrease.

Table 1. Comparison of 2022 Climate Variables to baseline (1991-2020) and 2021.

| CLIMATE VARIABLES | 1991-2020 | 2021 | 2022 |
|---|---|---|---|
| Annual Average Mean Temperature | 27.6 °C | 27.8 °C | 27.5 °C |
| Annual Average Minimum Temperature | 23.8 °C | 24.2 °C | 23.9 °C |
| Annual Average Maximum Temperature | 31.4 °C | 31.4 °C | 31.1 °C |
| Annual Average Rainfall | 948-4,762 mm | 980-6,865 mm | 1,604 - 6,397 mm |
| Annual Average number of TCs | 19-20 | 15 | 18 |
| Monthly Average Temperature | 25.7 °C (January, coldest) | 26.0 °C (January, coldest) | 26.2 °C (January, coldest) |
| | 28.6 °C (May, warmest) | 28.9 °C (May, warmest) | 28.3 °C (May, warmest) |

**DATA SOURCE:** PAGASA

# TEMPERATURE

**2022 WAS THE WORLD'S SIXTH WARMEST YEAR, A RECORD PREVIOUSLY HELD BY 2021 (NOAA, 2023).**

Various global temperature datasets are in agreement that the global mean surface temperature increased at a mean rate of 0.08 to 0.09 °C per decade since 1880 (NOAA, 2023). However, this mean rate doubles to 0.19 °C to 0.20 °C per decade when referred to the 1980 baseline (NOAA, 2023).

Compared to the global average, the Philippines' annual mean temperature anomaly for 2022 drastically decreased from 0.2 °C to -0.1 °C. A temperature anomaly is a measure of how much hotter or colder it is compared to what's considered normal for the time of the year.

Despite the country's mean temperature showing interannual variability, an increasing trend of 0.1 °C is apparent.

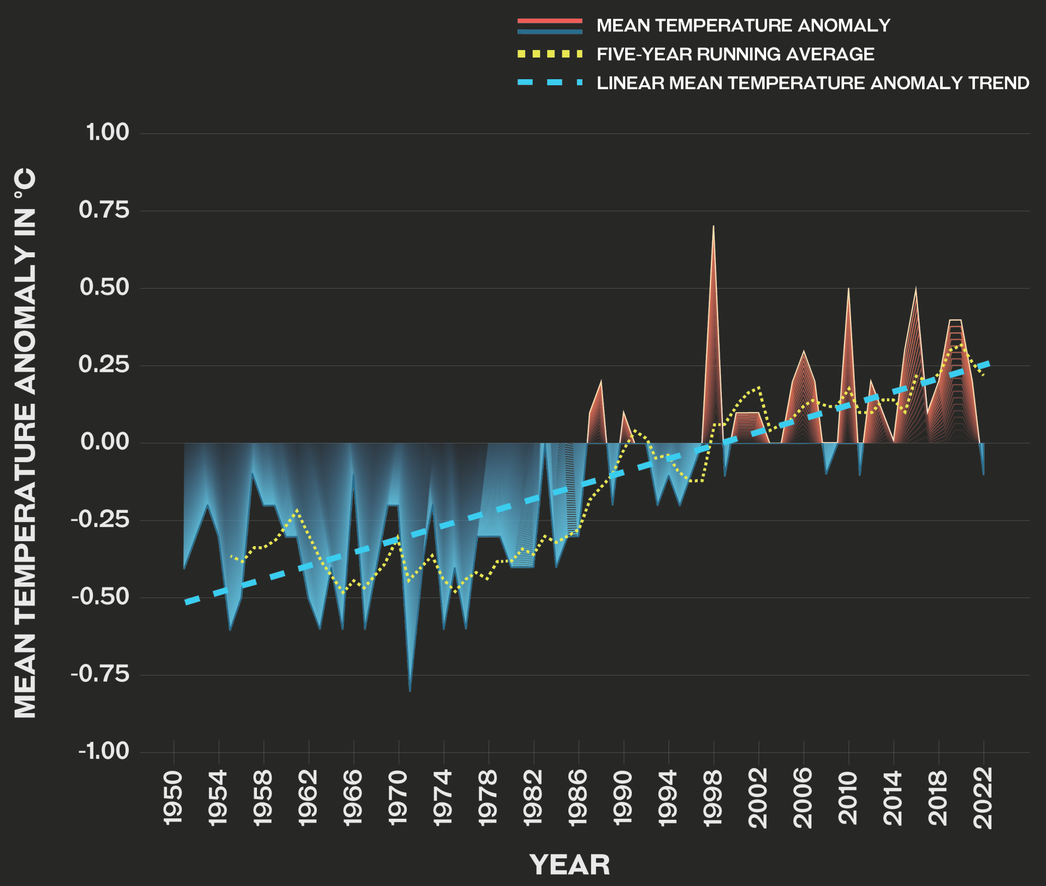


Figure 2. National annual average mean Temperature Anomalies from 1951 to 2022 (relative to 1991-2020 baseline).

DATA SOURCE: PAGASA

# Maximum and Minimum Temperature Anomalies

Interannual variability is also evident for both nighttime (minimum) and daytime (maximum) temperature anomalies.

While the nighttime temperature drastically decreased compared to the previous year, it was still hotter than normal by 0.1 °C. Overall, an increasing trend (blue dashed line) is observed.

Meanwhile, the daytime temperature was colder than both 2021 and normal by -0.3 °C. An increasing trend (red dashed line) is also apparent.

As of 2022, the year 1998 still holds the record for the highest nighttime and daytime temperature anomalies of 0.8 °C and 0.5 °C, respectively.

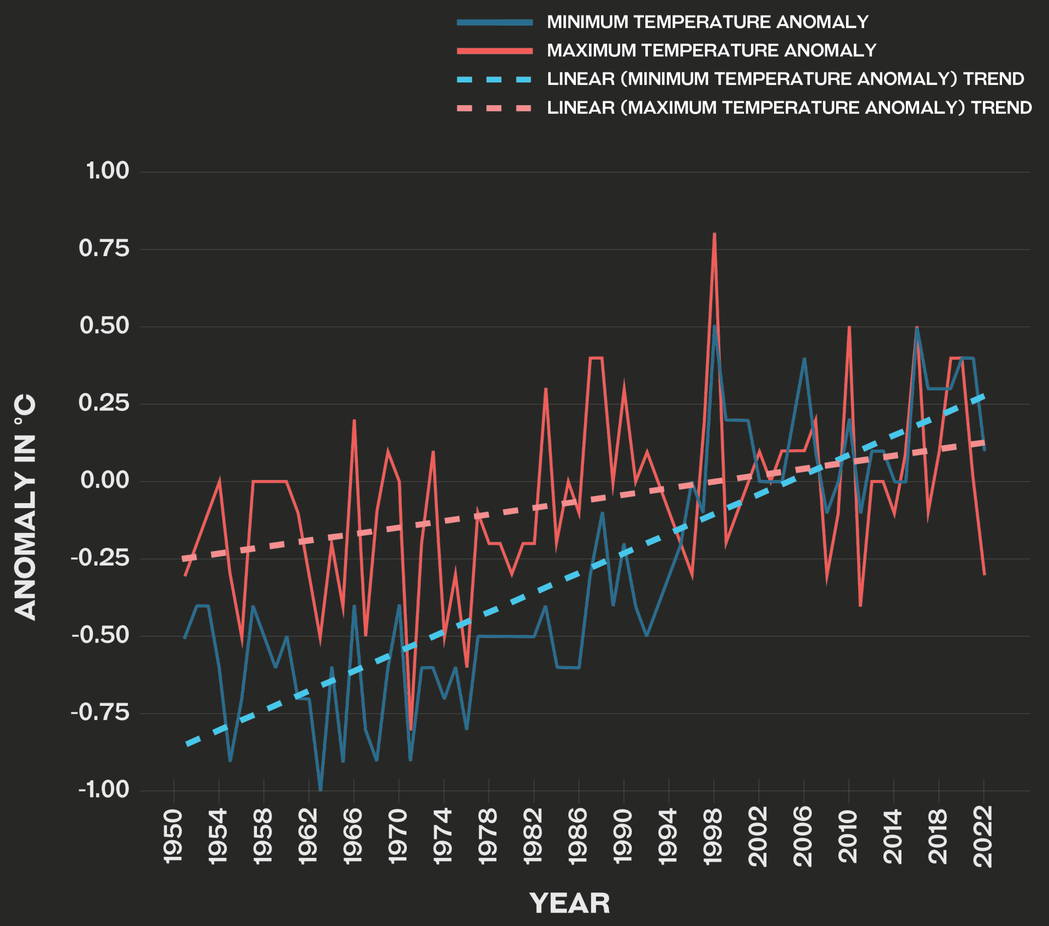


Figure 3. National annual Minimum and Maximum Temperature Anomalies from 1951 to 2022 (relative to 1991-2020 baseline).

DATA SOURCE: PAGASA

A total of 19 PAGASA Synoptic Stations recorded hotter-than-normal daytime temperatures, while 20 stations noted cooler daytime temperatures than normal (Figure 4). Three stations reported daytime temperatures of at least 1 °C higher than normal, with Clark (Pampanga) experiencing the highest temperature anomaly at 1.3 °C. Similarly, both Dipolog (Zamboanga del Norte) and Guiuan (Eastern Samar) exhibited an increase of 1.0 °C.

On the other hand, four stations recorded a decrease in daytime temperature of at least 1.0 °C. Coron (Palawan) observed the largest decrease, which is 1.3 °C lower than normal.

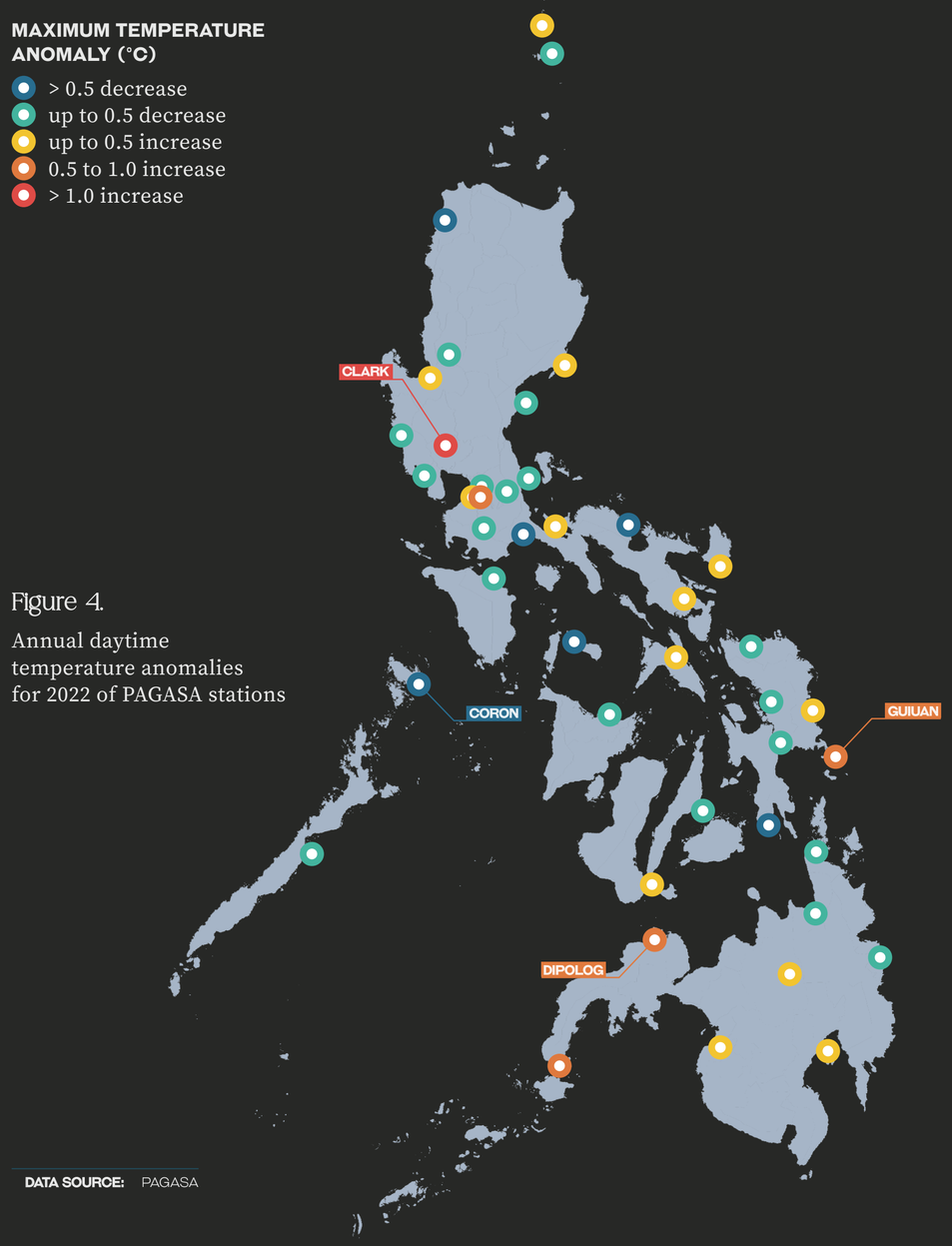


Figure 4.
Annual daytime temperature anomalies for 2022 of PAGASA stations

Thirty-four stations recorded hotter-than-normal nighttime temperatures while eight stations noted cooler temperatures (Figure 5). Similarly with daytime temperature, Clark (Pampanga) had the highest nighttime temperature anomaly with a 1.6 °C increase. Tuguegarao (Cagayan), Alabat (Quezon), Dipolog (Zamboanga del Norte), Dagupan (Pangasinan), and Iba (Zambales) recorded at least 1.0 °C increase in nighttime temperatures.

Guiuan station (Eastern Samar) noted the largest decrease in nighttime temperature with 1.0 °C lower than normal.

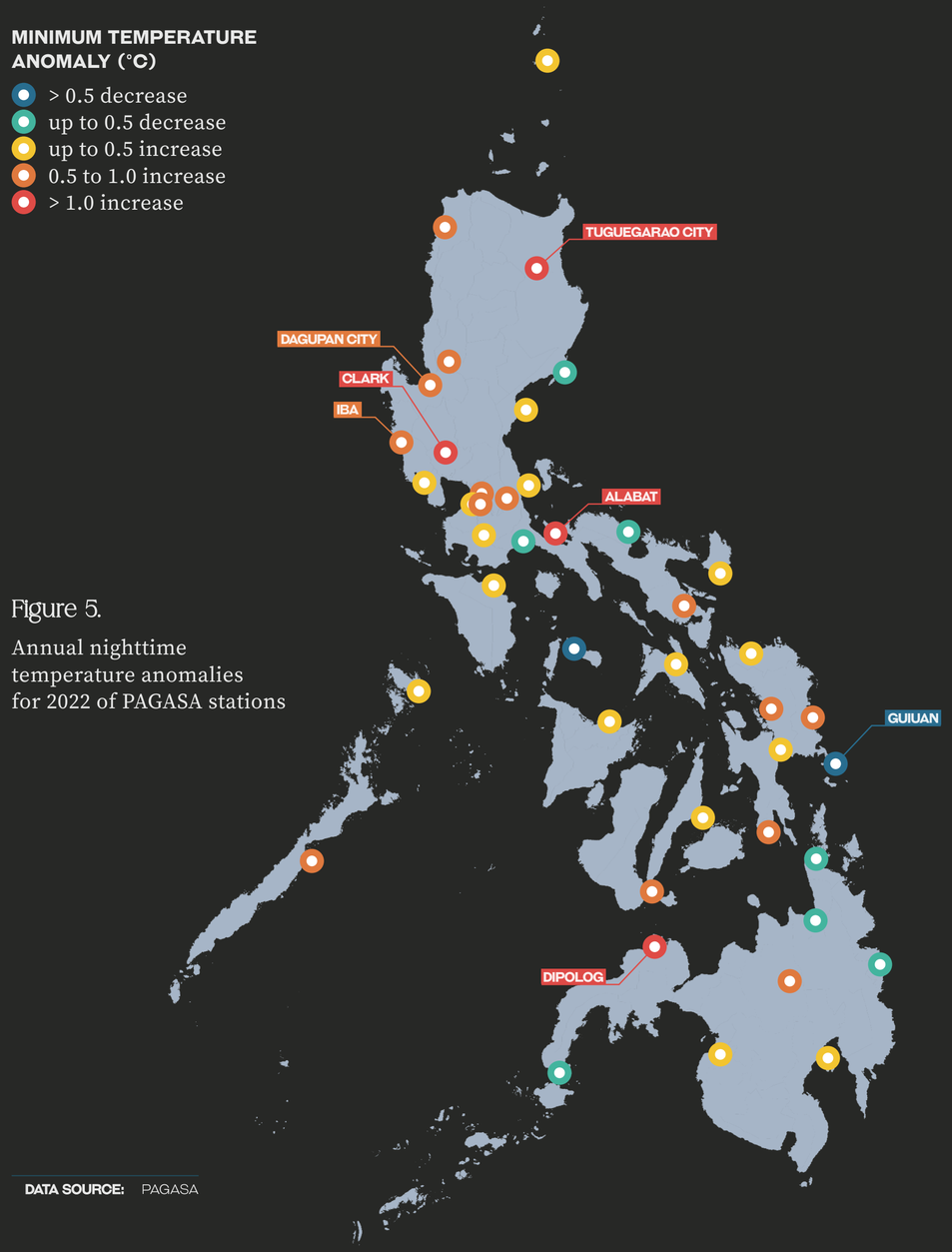


Figure 5.

Annual nighttime temperature anomalies for 2022 of PAGASA stations

# Monthly Average Temperature

Hotter-than-normal conditions in 2021 persisted broadly in 2022. The average temperature in the first and last quarters of 2022 was higher than both the baseline and 2021.

While May had the highest mean temperature at 28.3 °C, March recorded the largest increase in mean temperature with an increase of 0.7 °C compared to the average temperature.

January was the coolest month with a mean temperature of 26.2 °C, which is still 0.5 °C higher than its normal. April, May, and August were cooler by 0.1 to 0.5 °C.

Moreover, the mean temperature in June equaled with the baseline.

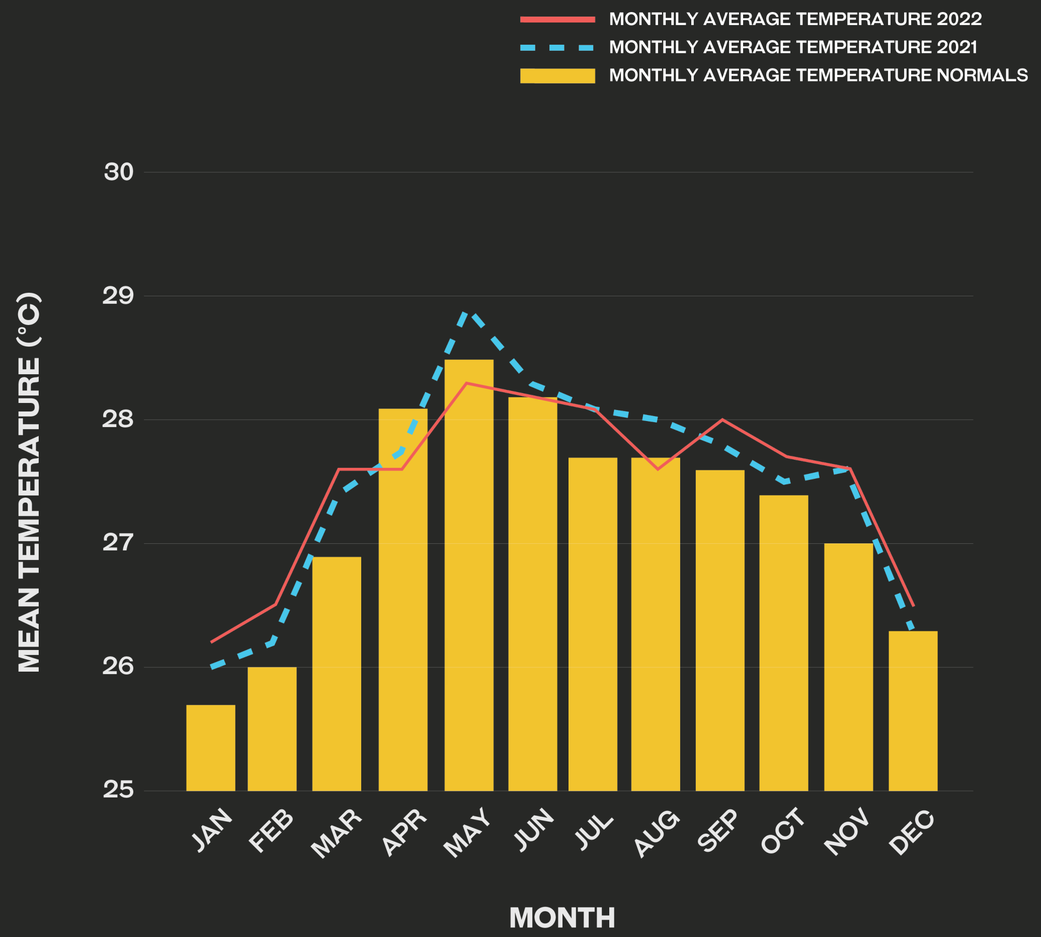


Figure 6. Monthly average temperature in 2022 and 2021 (relative to 1991–2020 baseline).

DATA SOURCE: PAGASA

# RAINFALL

**THE PHILIPPINES EXPERIENCED AN ANNUAL MEAN RAINFALL OF 2,966.5 MM, WHICH IS 0.6 MM HIGHER THAN THE AVERAGE FOR THE 1991-2020 BASELINE PERIOD (PAGASA, 2022). THIS RANKS 2022 AS THE 7TH WETTEST YEAR SINCE 1991.**

## Total Annual Rainfall

Among the 55 stations, Borongan (Eastern Samar) recorded the highest accumulated rainfall of 6,397 mm for 2022. This is approximately 400 mm lower than 2021, where Borongan also ranked 1st with over 6,800 mm of rainfall.

Overall, the eastern portion of the country received more rainfall than the western side. Other than Borongan, the Hinatuan (Surigao del Sur) and Juban (Sorsogon) synoptic stations also recorded accumulated rainfall of at least 5,000 mm throughout the year.

Meanwhile, Central Luzon State University (CLSU) station (Nueva Ecija) holds the least amount of 1,604 mm.

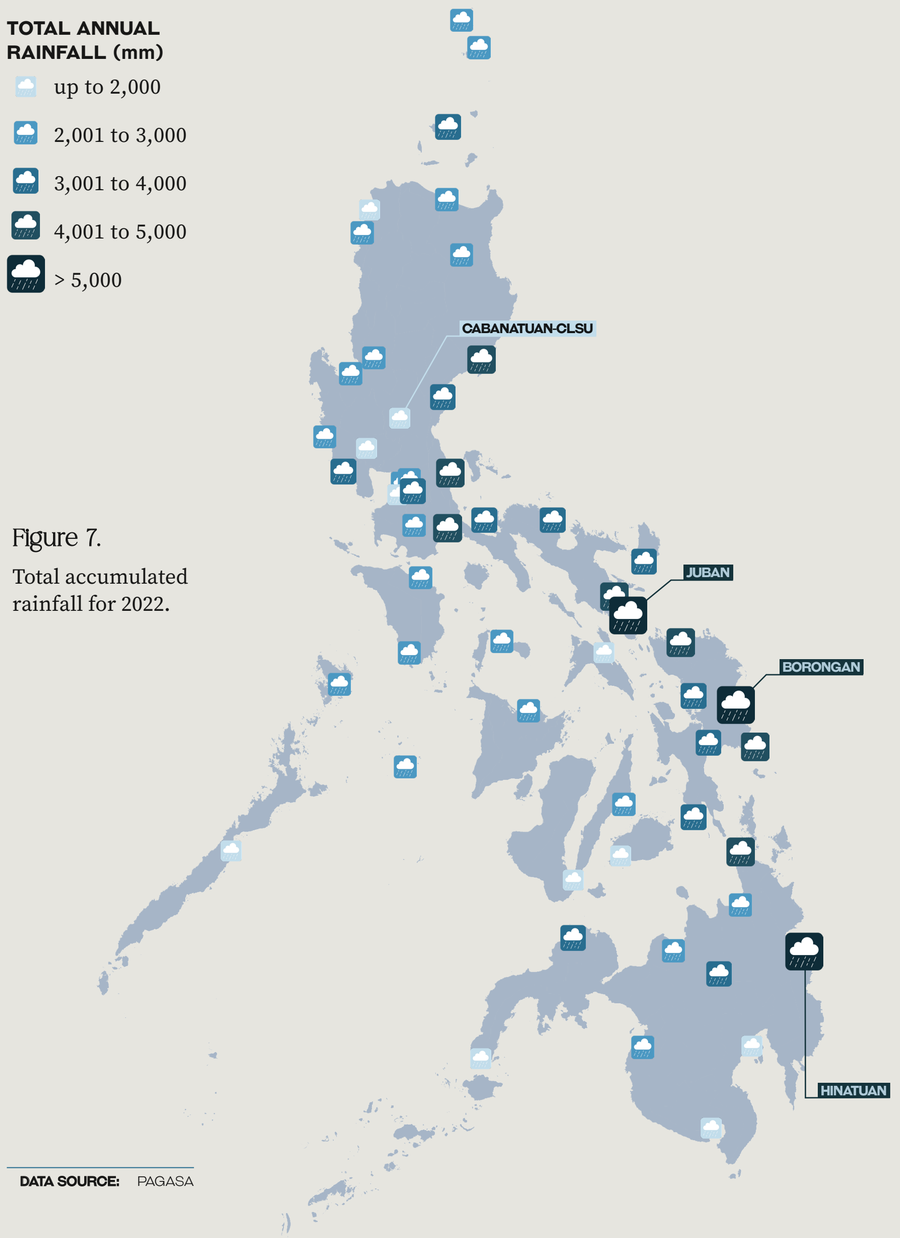


Figure 7.
Total accumulated rainfall for 2022.

DATA SOURCE: PAGASA

# Maximum 1-Day Rainfall

The highest 1-day maximum rainfall was 323.8 mm and recorded in Aparri, Cagayan (323.8 mm) on October 15, 2022, while Tropical Depression (TD) Neneng was located in nearby coastal waters. This amount is 42.9 mm greater than the Aparri station's average monthly rainfall from 1991 to 2020.

Although the TD did not make landfall, the outer rainbands of clouds extending to the area induced moderate to heavy rains as early as morning, resulting in widespread flooding and landslides.

Table 2. Top 10 PAGASA synoptic stations with highest 1-day maximum rainfall

| STATION | DATE OF OCCURENCE | 1-DAY MAXIMUM RAINFALL (mm) | MONTHLY NORMAL RAINFALL (mm) |
|---|---|---|---|
| Aparri, Cagayan | October 15 | 323.8 | 280.9 |
| Borongan, Eastern Samar | December 23 | 313.6 | 336.9 |
| Tayabas, Quezon | October 29 | 257.7 | 452.0 |
| Cubi Point, Zambales | September 25 | 255.8 | 680.2 |
| Infanta, Quezon | October 25 | 251.8 | 498.6 |
| Roxas City, Capiz | October 28 | 241 | 305.1 |
| Hinatuan, Surigao del Sur | December 27 | 234.7 | 626.5 |
| Calayan, Cagayan | October 15 | 228.8 | 259.8 |
| Tanay, Rizal | October 29 | 217.6 | 283.3 |
| Juban, Sorsogon | October 28 | 208 | No record |

DATA SOURCE: PAGASA


Figure 8.
Distribution of the maximum 1-day rainfall observed across the country in 2022.

DATA SOURCE: PAGASA

# Rainfall Anomaly

Four stations in Eastern Visayas – Borongan (Eastern Samar), Tacloban (Leyte), Surigao (Surigao del Norte), and Maasin (Southern Leyte) – recorded more than 1,500 mm increase in rainfall.

In Western Luzon, Sinait (Ilocos Sur), Baguio (Benguet), Iba (Zambales), and Clark (Pampanga), experienced drier than normal conditions with a deficit of more than 1,000 mm.

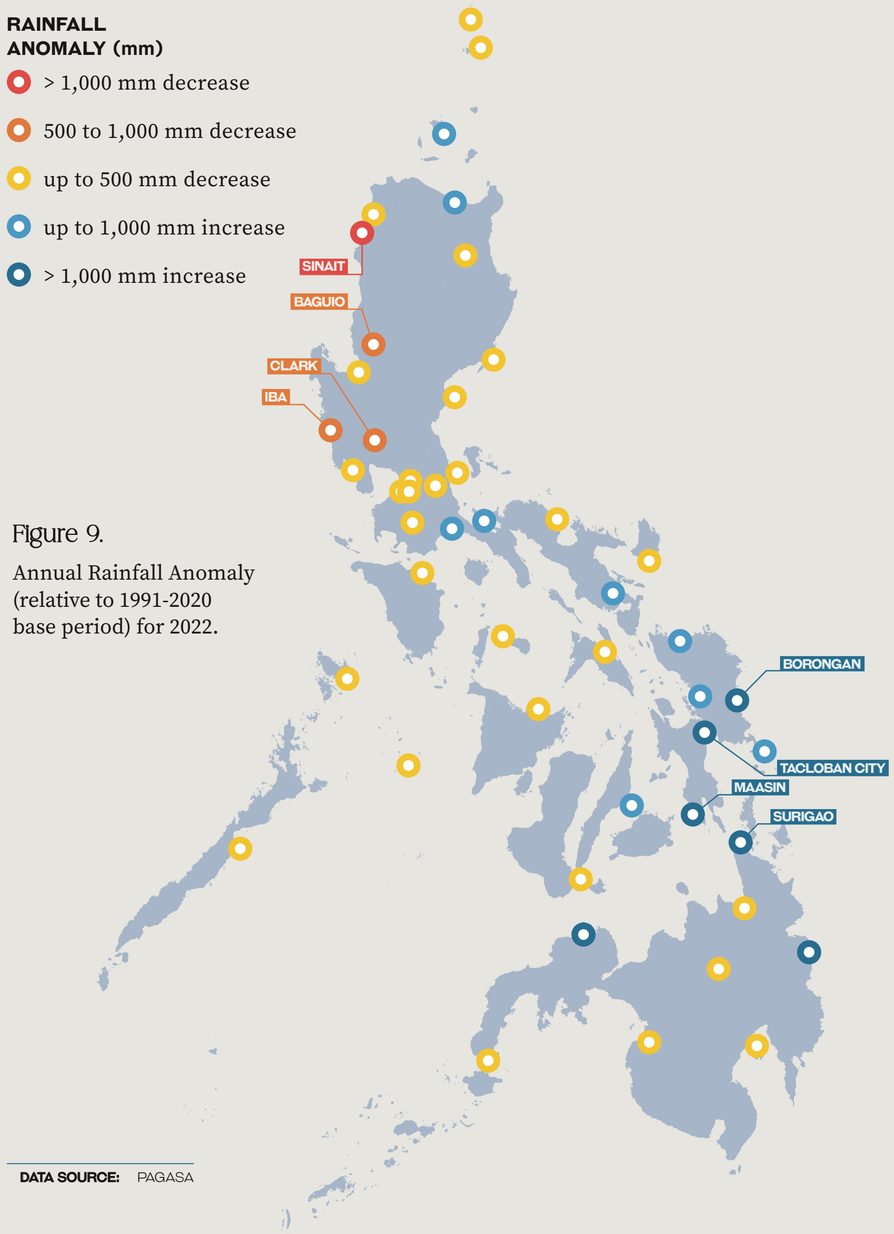


Figure 9.

Annual Rainfall Anomaly (relative to 1991-2020 base period) for 2022.

# Percent of Normal Rainfall

**IN 2022, THE PHILIPPINES GENERALLY EXPERIENCED BELOW- TO ABOVE-NORMAL RAINFALL CONDITIONS.**

At the start of the year, most parts of Visayas and Mindanao experienced below-normal rainfall, while most of Luzon received near-normal (81–120%) to above-normal rainfall. As the first quarter progressed, some parts of the country, particularly those with previously noted below-normal rainfall, experienced above-normal rainfall. This increase can be attributed to weather systems such as the shear line, northeast monsoon (NEM) or amihan, LPA, and thunderstorms.

During the second quarter, the rainfall conditions reversed from what was observed in the first quarter. In April, most parts of the country received above-normal rainfall which was attributed to thunderstorms, shear line, intertropical convergence zone (ITCZ), LPAs, southwest monsoon (SWM) or habagat, and the passage of Tropical Storm Agaton. However, from May to June, western parts of the country transitioned from above-normal to below-normal rainfall.

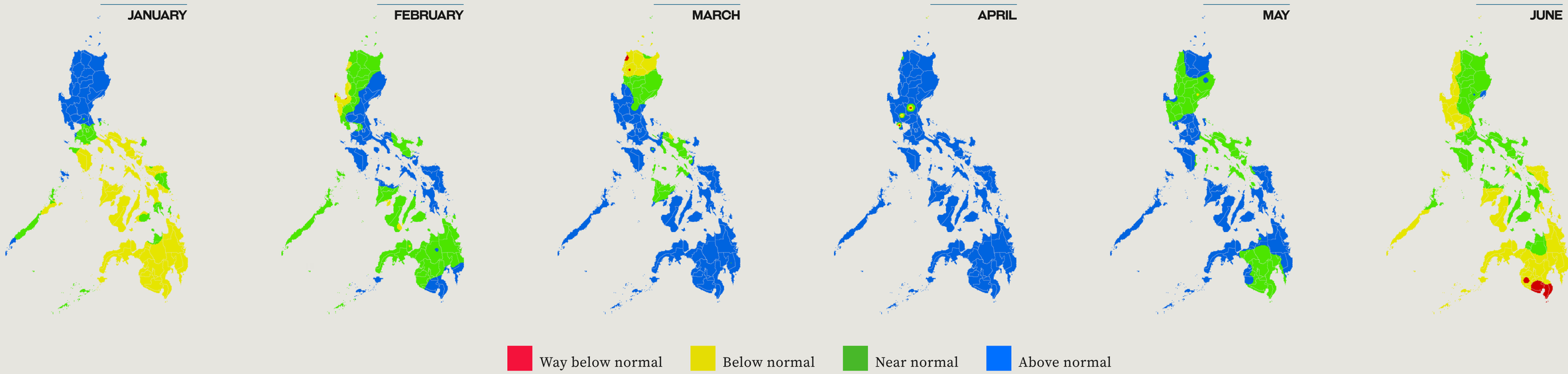


Figure 10a. Percentage of observed total monthly rainfall relative to 1991–2020 reference period in 2022. Blue colors represent areas with above normal (>120%) rainfall conditions, while green colors depict near normal (81–120%) conditions. Areas with below normal (41-80%) conditions are in yellow, while areas under way below normal (≤40%) rainfall conditions are in red.

Below-normal to near-normal rainfall conditions occurred across the country in the third quarter. The weather systems that induced rains during this period were SWM, LPAs and tropical cyclones.

In the remaining months, October experienced above-normal rainfall conditions, mainly contributed to by enhanced moisture convergence along the shear line for the eastern sections, further induced by consecutive tropical cyclones, and the enhanced southwest monsoon. It is also important to note that some areas in northwestern Luzon experienced significantly below-normal rainfall in November and December.

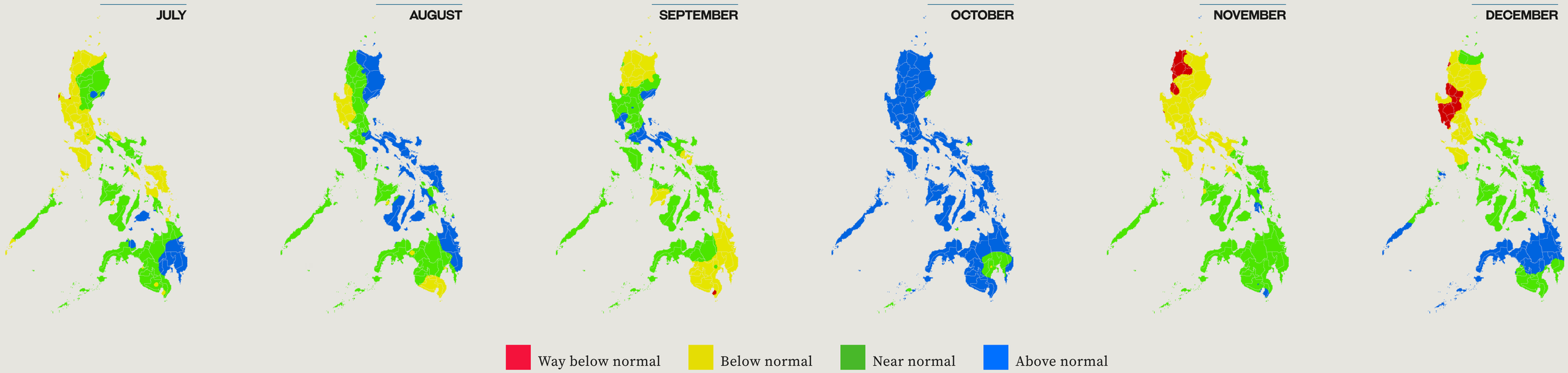


Figure 10b. Percentage of observed total monthly rainfall relative to 1991–2020 reference period in 2022. Blue colors represent areas with above normal (>120%) rainfall conditions, while green colors depict near normal (81–120%) conditions. Areas with below normal (41-80%) conditions are in yellow, while areas under way below normal (≤40%) rainfall conditions are in red.

# CLIMATOLOGICAL EXTREMES

**MULTIPLE PREVIOUS RECORDS SINCE 1980 ACROSS STATIONS WERE BROKEN.**

Out of 55 stations, 22 surpassed or equaled temperature and rainfall records in 2022. Ten (10) of the stations recorded all-time highest daily temperature records, while 14 recorded new highest amount of rainfall in a single day.

Clark (Pampanga) and Zamboanga (Zamboanga del Sur) had the most number of highest daily temperature records broken for a single station. Records were surpassed for the months of January, September, October, and November.

Only San Jose (Occidental Mindoro) recorded lowest daily temperatures. Four new records in the station were broken since 1980s for the months of May, July, and September.

Roxas station broke two greatest 1-day rainfall records for a single station, exceeding records in April and October.

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Highest Daily Temperature
Lowest Daily Temperature
Greatest Daily Rainfall

Figure 11-13.
PAGASA Synoptic Stations with new Highest Daily Temperature, new Lowest Daily Temperature, & new Greatest Daily Rainfall Records

**DATA SOURCE:** PAGASA

Table 3. Climatological extremes exceeded or equaled in 2022.

| WEATHER STATION | RECORDS EXCEEDED/ EQUALLED | HIGHEST TEMP. (°C) | DATE | LOWEST TEMP. (°C) | DATE | GREATEST DAILY RAINFALL (mm) | DATE |
|---|---|---|---|---|---|---|---|
| Butuan | Previous | 36.4 | 09-20-1991 | | | 107.4 | 10-24-2003 |
| | New | 36.5 | 09-17-2022 | | | 133.8 | 10-24-2022 |
| Catbalogan | Previous | 35.8 | 10-23-1987 | | | | |
| | New | 35.9 | 10-31-2022 | | | | |
| | Previous | 34.8 | 12-04-1998 | | | | |
| | New | 35.0 | 12-15-2022 | | | | |
| Clark | Previous | 35.4 | 09-26-2021 | | | 37.0 | 03-14-2013 |
| | New | 36.4 | 09-08-2022 | | | 55.6 | 03-15-2022 |
| | Previous | 34.2 | 10-30-2022 | | | | |
| | New | 35.6 | 10-09-2022 | | | | |
| | Previous | 34.5 | 11-07-2021 | | | | |
| | New | 34.6 | 11-30-2022 | | | | |
| Dagupan | Previous | | | | | 83.0 | 01-22-2021 |
| | New | | | | | 103.4 | 01-30-2022 |

Table 3. (Continuation) Climatological extremes exceeded or equaled in 2022.

| WEATHER STATION | RECORDS EXCEEDED/ EQUALLED | HIGHEST TEMP. (°C) | DATE | LOWEST TEMP. (°C) | DATE | GREATEST DAILY RAINFALL (mm) | DATE |
|---|---|---|---|---|---|---|---|
| Guiuan | Previous | | | | | 136.3 | 04-13-2014 |
| | New | | | | | 207.8 | 04-09-2022 |
| Hinatuan | Previous | | | | | 130.2 | 05-10-2010 |
| | New | | | | | 171.2 | 05-01-2022 |
| Iba | Previous | | | | | 72.2 | 04-18-1998 |
| | New | | | | | 77.8 | 04-08-2022 |
| Infanta | Previous | 34.1 | 01-18-1998 | | | | |
| | New | 34.6 | 01-30-2022 | | | | |
| Itbayat | Previous | 32.0 | 03-28-2020 | | | | |
| | New | 32.5 | 03-22-2022 | | | | |
| Legazpi | Previous | 32.7 | 01-24-1912 | | | | |
| | New | 32.7 | 01-30-2022 | | | | |
| Lumbia El Salvador (Laguindingan) | Previous | | | | | 84.2 | 03-19-1982 |
| | New | | | | | 87.6 | 03-06-2022 |

Table 3. (Continuation) Climatological extremes exceeded or equaled in 2022.

| WEATHER STATION | RECORDS EXCEEDED/ EQUALLED | HIGHEST TEMP. (°C) | DATE | LOWEST TEMP. (°C) | DATE | GREATEST DAILY RAINFALL (mm) | DATE |
|---|---|---|---|---|---|---|---|
| Maasin | Previous | | | | | 138.4 | 04-04-1994 |
| | New | | | | | 148.8 | 04-09-2022 |
| Mactan | Previous | | | | | 96.6 | 08-17-1982 |
| | New | | | | | 107.0 | 08-03-2022 |
| Malaybalay | Previous | 34.0 | 01-23-1988 | | | | |
| | New | 34.0 | 01-08-2022 | | | | |
| Masbate | Previous | 34.2 | 12-16-1997 | | | | |
| | New | 34.5 | 12-17-2022 | | | | |
| NAIA | Previous | | | | | 36.0 | 03-07-2011 |
| | New | | | | | 63.5 | 03-14-2022 |
| Puerto Princesa | Previous | | | | | 120.4 | 01-03-2013 |
| | | | | | | 147.9 | 01-26-2022 |
| Roxas | Previous | | | | | 148.0 | 04-09-1996 |
| | New | | | | | 172.0 | 04-11-2022 |

Table 3. (Continuation) Climatological extremes exceeded or equaled in 2022.

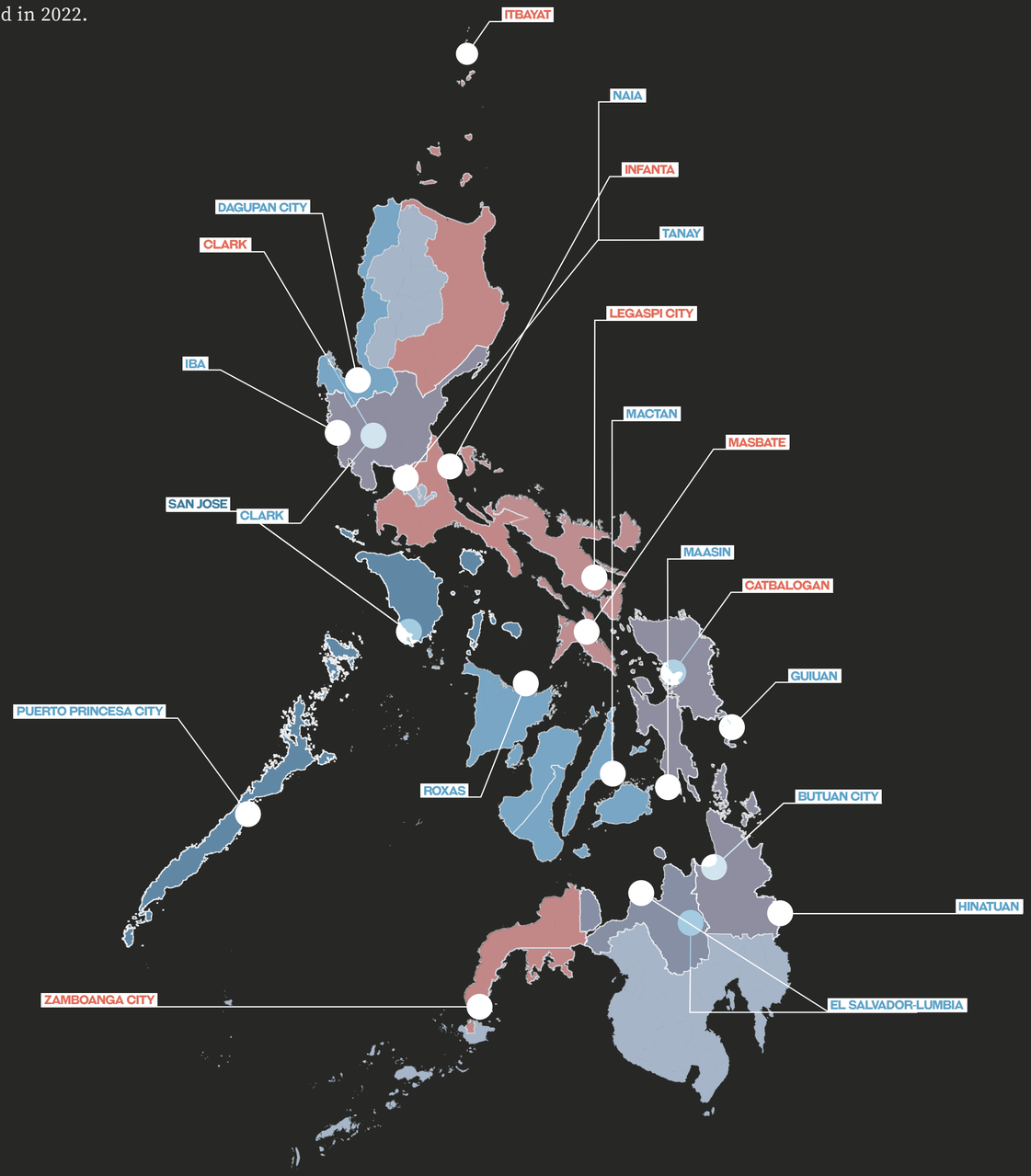
| WEATHER STATION | RECORDS EXCEEDED/ EQUALLED | HIGHEST TEMP. (°C) | DATE | LOWEST TEMP. (°C) | DATE | GREATEST DAILY RAINFALL (mm) | DATE |
|---|---|---|---|---|---|---|---|
| Roxas | Previous | | | | | 231.4 | 10-07-2004 |
| | New | | | | | 241.0 | 10-28-2022 |
| San Jose | Previous | 36.5 | 02-09-2019 | 20.5 | 05-27-1986 | | |
| | New | 36.7 | 02-27-2022 | 17.5 | 05-02-2022 | | |
| | Previous | | | 20.0 | 07-30-1980 | | |
| | New | | | 19.5 | 07-12-2022 | | |
| | New | | | 19.5 | 07-31-2022 | | |
| | Previous | | | 19.0 | 09-17-1980 | | |
| | New | | | 19.0 | 09-20-2022 | | |
| Tagbilaran | Previous | | | | | 64.8 | 04-21-2015 |
| | (Science Garden) | | | | | 68.2 | 04-05-2022 |
| Tanay | Previous | | | | | 204.6 | 10-28-2000 |
| | New | | | | | 217.6 | 10-29-2022 |

Table 3. (Continuation) Climatological extremes exceeded or equaled in 2022.

| WEATHER STATION | RECORDS EXCEEDED/ EQUALLED | HIGHEST TEMP. (°C) | DATE | LOWEST TEMP. (°C) | DATE | GREATEST DAILY RAINFALL (mm) | DATE |
|---|---|---|---|---|---|---|---|
| Zamboanga | Previous | 35.8 | 01-29-2016 | | | | |
| | New | 36.0 | 01-03-2022 | | | | |
| | Previous | 35.8 | 09-02-2004 | | | | |
| | New | 36.1 | 09-02-2022 | | | | |
| | Previous | 36.0 | 11-15-2020 | | | | |
| | Previous | 36.0 | 11-21-2020 | | | | |
| | Previous | 36.0 | 11-23-2020 | | | | |
| | New | 36.4 | 11-13-2022 | | | | |

Figure 14-16. Climatological extremes exceeded or equaled in 2022.

Highest Daily Temperature
Lowest Daily Temperature
Greatest Daily Rainfall



# EL NIÑO SOUTHERN OSCILLATION

**LA NIÑA CONDITIONS PREVAILED THE ENTIRE YEAR.**

The La Niña conditions, which began in late 2020 and took a break in August 2021, persisted in 2022 until January 2023. The year-round La Niña episode contributed to the above-normal rainfall experienced by the country in March, April, September and October. The three-year cool ENSO phase was unusual because a typical cycle last for 9 to 12 months. The event was dubbed as a "Triple-dip" La Niña. Aside from lasting for three consecutive years, there were also noticeable dips of Oceanic Nino Index (ONI) values in charts (NOAA, 2023).

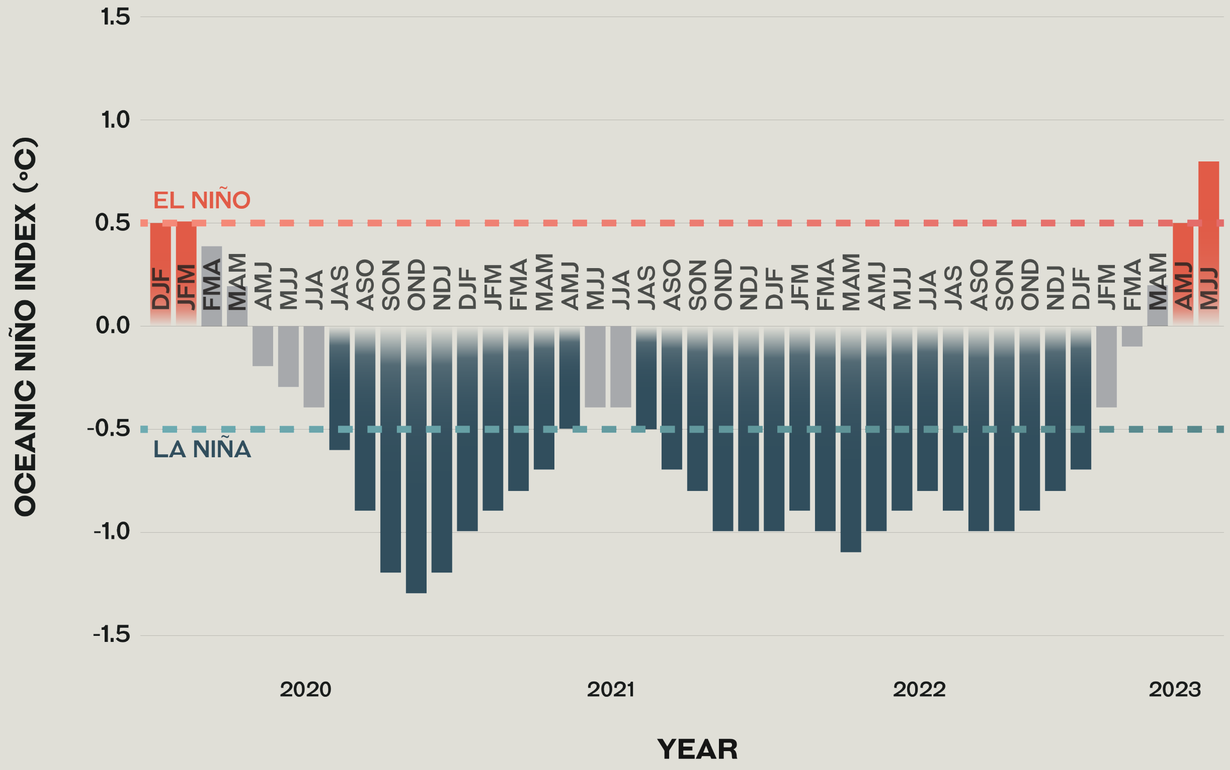



Figure 17. Seasonal Oceanic Niño Index showing warm and "triple-dip" cold phases in 2022.

ONI is used to identify El Niño and La Niña episodes in the central and eastern tropical Pacific region. The index is based on the running three-month mean sea surface temperature (SST) anomaly for the Niño 3.4 region (shown in Figure 13).

El Niño episodes happen when the ONI is at or above the +0.5 °C threshold for five consecutive overlapping three-month periods. La Niña episodes occur when ONI is at or below the -0.5 °C threshold for the same amount of time.

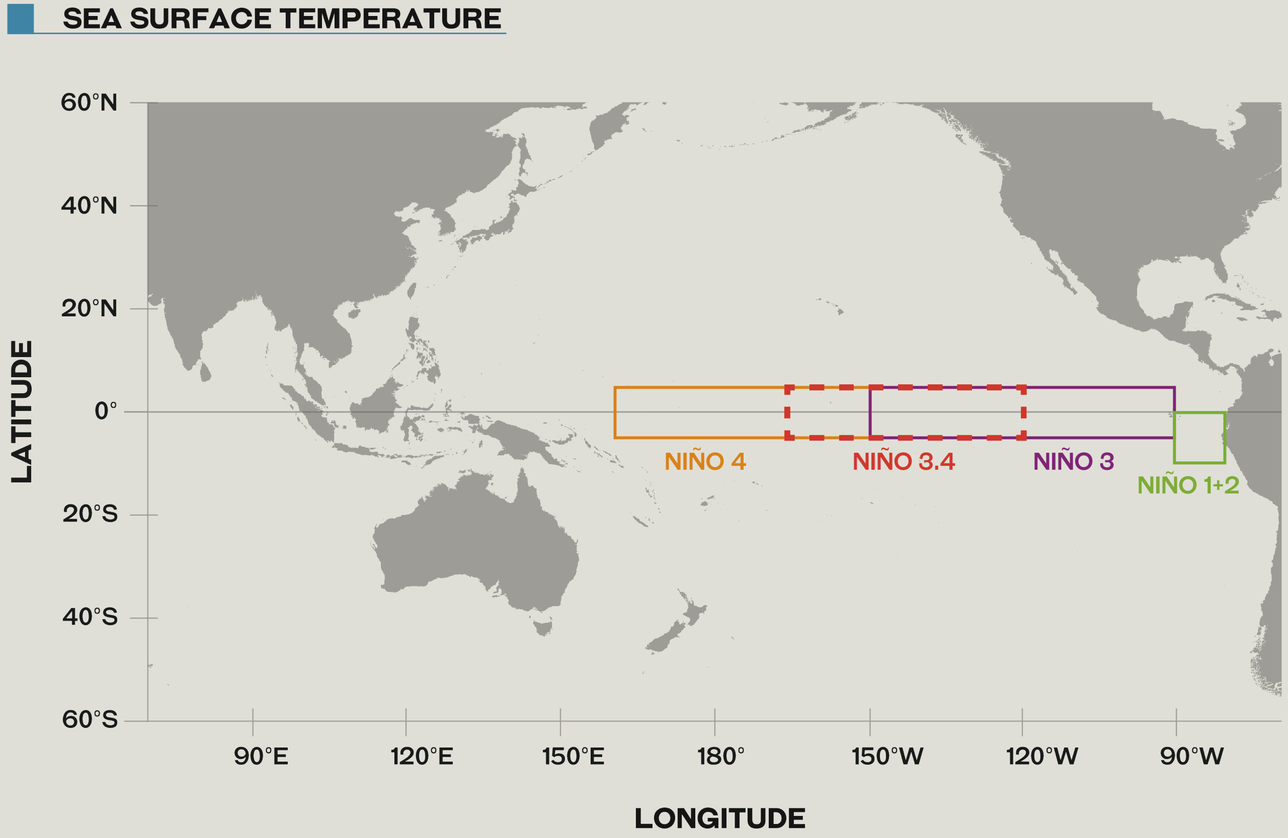


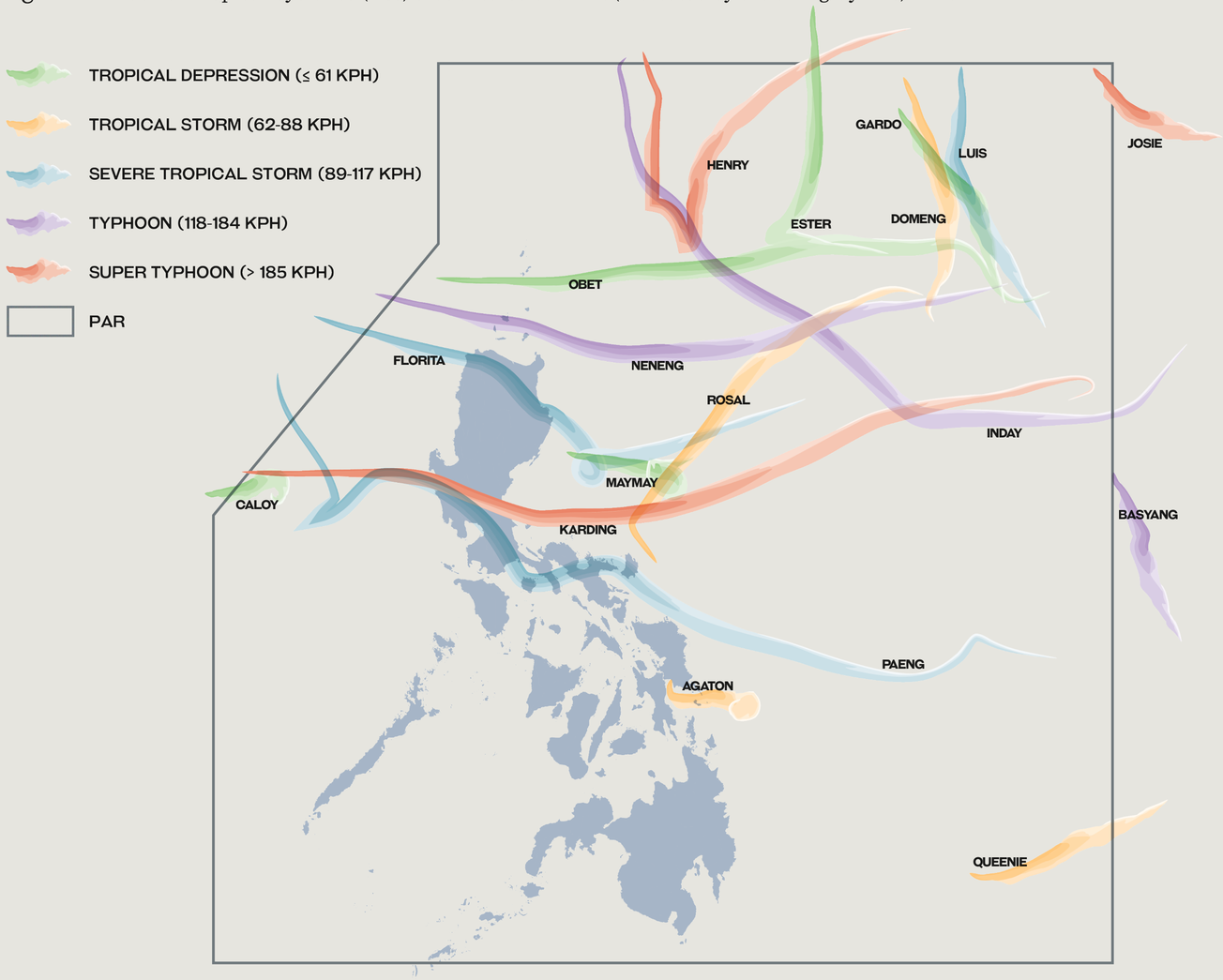

Figure 18. Location of the parts of the tropical Pacific used for monitoring sea surface temperature. The sea surface temperature in the Niño3.4 region, spanning from 120˚W to 170˚W longitude, when averaged over a 3-month period, forms NOAA's official Oceanic Niño Index (the ONI). NOAA Climate.gov image by Fiona Martin.

# TROPICAL CYCLONES

A total of 18 TCs entered the Philippine Area of Responsibility (PAR) in 2022, which was slightly lower than the long-term average of 19–20 TCs count per year. Out of these, five made landfall in the country. Three TCs reached Typhoon (TY) Category, while three developed into a Super Typhoon (STY).

In March 2022, PAGASA adjusted the threshold intensities (maximum wind speed) for tropical cyclone categories to align with the accepted standards and best practices observed by other meteorological centers in the Northwest Pacific region.

Figure 19. Track of Tropical Cyclones (TCs) that entered the PAR (indicated by the thin gray line) in 2022.




DATA SOURCE: PAGASA

Table 4. Revised Maximum Wind Speed thresholds in 2022

| TC CATEGORY | MAX. WIND SPEED | |
|---|---|---|
| | OLD | STARTING MARCH 2022 |
| Tropical Depression (TD)  | ≤ 61 kph | ≤ 61 kph |
| Tropical Storm (TS)  | 62-88 kph | 62-88 kph |
| Severe Tropical Storm (STS)  | 89-117 kph | 89-117 kph |
| Typhoon (TY)  | 118-220 kph | 118-184 kph |
| Super Typhoon (STY)  | > 220 kph | > 185 kph |

**DATA SOURCE:** PAGASA

Table 5. List of TCs that entered the Philippine Area of Responsibility (PAR) in 2022.

| TC # | TC TYPE | LOCAL NAME | INTL. NAME | DATE | MAX. SUSTAINED WINDS/ GUSTS (kph) | LOWEST MEAN SEA LEVEL PRESSURE OVER LAND (hPa) | HIGHEST RECORDED PEAK GUST OVER LAND | | | MAXIMUM RAINFALL ACCUMULATION DURING THE TC DURATION INSIDE OVER LAND | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | GUST (m/s) | STATION | DATE, TIME | RF (mm) | STATION |
| 1 | TS | Agaton | Megi | Apr 9-12 | 75/105 | 995.4 | 30 | Guiuan, Eastern Samar | Apr 10, 8:00 AM | 996.8 | Baybay City |
| 2 | TY | Basyang | Malakas | Apr 12 | 130/160 | — | None | | | 107.8 | Borongan City |
| 3 | TD | Caloy | Chaba | Jun 28-29 | 55/70 | — | None | | | 182.3 | Baler |
| 4 | TS | Domeng | Aere | Jun 30-Jul 2 | 85/105 | — | None | | | 174.6 | Iba |
| 5 | TD | Ester | Trases | Jul 29-31 | 45/55 | — | None | | | 198.6 | Subic |
| 6 | STS | Florita | Ma-on | Aug 21-24 | 110/185 | 989.1 | 27 | Basco, Batanes | Aug 23, 8:00 PM | 284.8 | Batac |
| 7 | TD | Gardo | — | Aug 30-Sep 1 | 55/70 | — | None | | | 120.0 | Basco |
| 8 | STY | Henry | Hinnamnor | Aug 31-Sep 4 | 195/240 | — | None | | | 322.0 | Iba |

**NOTE:**

"—" means no data or no record.

Second Quarter 2022

Third Quarter 2022

Fourth Quarter 2022

Table 4. Revised Maximum Wind Speed thresholds in 2022

| TC CATEGORY | MAX. WIND SPEED | |
|---|---|---|
| | OLD | STARTING MARCH 2022 |
| Tropical Depression (TD)  | ≤ 61 kph | ≤ 61 kph |
| Tropical Storm (TS)  | 62-88 kph | 62-88 kph |
| Severe Tropical Storm (STS)  | 89-117 kph | 89-117 kph |
| Typhoon (TY)  | 118-220 kph | 118-184 kph |
| Super Typhoon (STY)  | > 220 kph | > 185 kph |

DATA SOURCE: PAGASA

Table 5. (Continuation) List of TCs that entered the Philippine Area of Responsibility (PAR) in 2022.

| TC # | TC TYPE | LOCAL NAME | INTL. NAME | DATE | MAX. SUSTAINED WINDS/ GUSTS (kph) | LOWEST MEAN SEA LEVEL PRESSURE OVER LAND (hPa) | HIGHEST RECORDED PEAK GUST OVER LAND | | | MAXIMUM RAINFALL ACCUMULATION DURING THE TC DURATION INSIDE OVER LAND | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | GUST (m/s) | STATION | DATE, TIME | RF (mm) | STATION |
| 9 | TY | Inday | Muifa | Sep 7-13 | 165/205 | — | None | | | 166.9 | Subic |
| 10 | STY | Josie | Nanmadol | Sep 16 | 185/230 | — | None | | | 62.6 | Alabat |
| 11 | STY | Karding | Noru | Sep 22-26 | 195/240 | 993.3 | 25 | Baler, Aurora | Sep 25, 10:00 PM | 345.8 | Subic |
| 12 | STS | Luis | Roke | Sep 27-29 | 100/125 | — | None | | | 110.9 | La Carlota City |
| 13 | TD | Maymay | — | Oct 10-13 | 45/55 | — | None | | | 280.7 | Aparri |
| 14 | TY | Neneng | Nesat | Oct 13-16 | 120/150 | 984.5 | 32 | Basco, Batanes | Oct 16, 4:00 AM | 362.9 | Aparri |
| 15 | TD | Obet | — | Oct 19-22 | 55/70 | 1,008.4 | 20 | Basco, Batanes | Oct 21, 2:00 PM | 256.1 | Aparri |
| 16 | STS | Paeng | Nalgae | Oct 26-31 | 100/140 | 983.5 | 24 | Ambulong, Tanauan City, Batangas | Oct 29, 12:42 PM | 457.0 | Indang |
| 17 | TS | Queenie | Banyan | Oct 31-Nov 1 | 65/80 | — | None | | | 172.2 | Abucay |
| 18 | TS | Rosal | Pakhar | Dec 10-12 | 85/105 | — | None | | | 133.9 | Daet |

**NOTE:**

"—" means no data or no record.

Second Quarter 2022

Third Quarter 2022

Fourth Quarter 2022

# Paeng, Karding, Florita and Agaton, retire in 2022

**ONE THIRD OF THE ANNUAL AVERAGED RAINFALL RECEIVED BY THE COUNTRY IN 2022 WAS CONTRIBUTED BY TROPICAL STORM AGATON.**

In 2022, the Philippines witnessed the retirement of four tropical cyclone names. PAGASA retires TC names when a cyclone results in loss and damage to infrastructure and agriculture surpassing PHP 1 billion or when the death toll reaches 300. This practice is deeply rooted in the desire to mitigate the emotional toll on those affected, sparing them the recurring trauma of these disastrous events.

Among these retired names, **TS Agaton (Megi)**, the first tropical cyclone of the year, brought the highest recorded rainfall and the greatest casualty. A day after it was noted as a low pressure system at the east of eastern Visayas on April 9, it intensified into a Tropical Storm and made landfall in Guiuan, Eastern Samar. The Visayas State University (Leyte) Synoptic Station recorded 996.8 mm of rainfall throughout the duration of Agaton.

TS Agaton's slow movement, torrents of heavy rainfall, and seemingly backing and circling track triggered widespread flooding and landslides across eastern Visayas and Panay Island. By noon of April 12, major landslides occurred in Baybay, and Abuyog, Leyte, resulting to a 113 death toll.

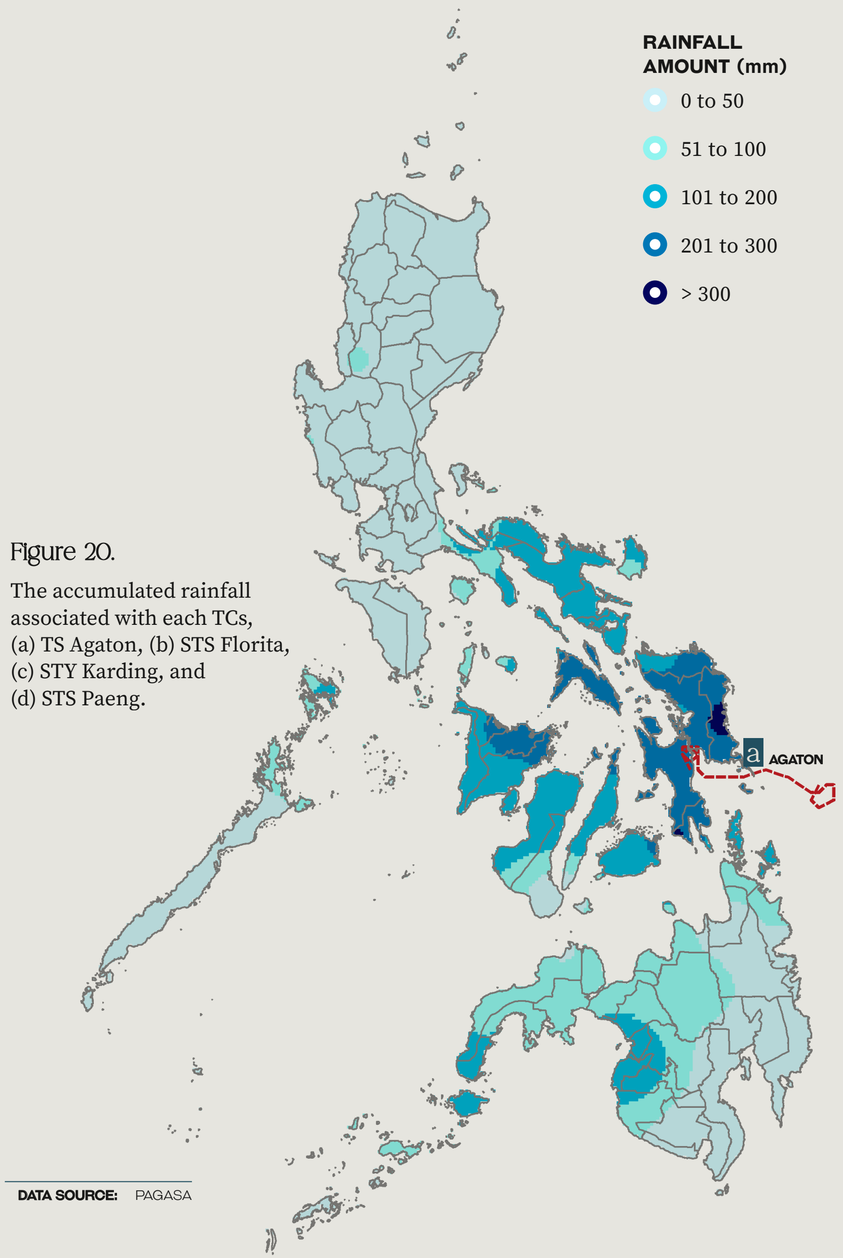



Figure 20.
The accumulated rainfall associated with each TCs, (a) TS Agaton, (b) STS Florita, (c) STY Karding, and (d) STS Paeng.

A total of 214 lives were lost and approximately 600,000 families were affected. Flooding was recorded in 882 areas in the regions of Bicol, Visayas, CARAGA, and BARMM. TS Agaton was estimated to have caused PHP 2.3 billion in agricultural and infrastructural damage.

Initially identified as an LPA along a monsoon trough east of Northern Luzon on August 21, **STS Florita (Ma-on)** developed into a Tropical Depression while moving southwestward. By the next day, it intensified into a Severe Tropical Storm as it moved towards Northern Luzon in a west-northwestward direction, and made landfall in Maconacon, Isabela.

Due to the heavy rainfall associated with the enhanced Southwest Monsoon, class suspensions were declared in 397 cities or municipalities in Northern Luzon, Central Luzon, CALABARZON and Bicol region, despite the in-person class just being reopened after two years since the pandemic struck.

STS Florita affected 131,235 individuals and left with PHP 2.41 billion worth of damage to agriculture and infrastructure.

**STY Karding (Noru)**, the first Super Typhoon to make landfall of the year, was also the strongest tropical cyclone of 2022. It was first spotted as a Tropical Depression in the morning of September 22 and intensified as Tropical Storm in the afternoon of the same day. While traversing southwestward, it underwent rapid intensification and became a Super Typhoon. It made its first landfall in Quezon, followed by a second landfall in Aurora, respectively.

Karding was comparable to 2021's STY Odette (Rai) in terms of strength, and to 2020's TY Ulysses (Vamco) in terms of affected areas. Its passage brought strong winds of up to 195 kph and heavy to intense rains, which resulted in flooding and power supply interruption over parts of Central Luzon, Metro Manila, and CALABARZON.

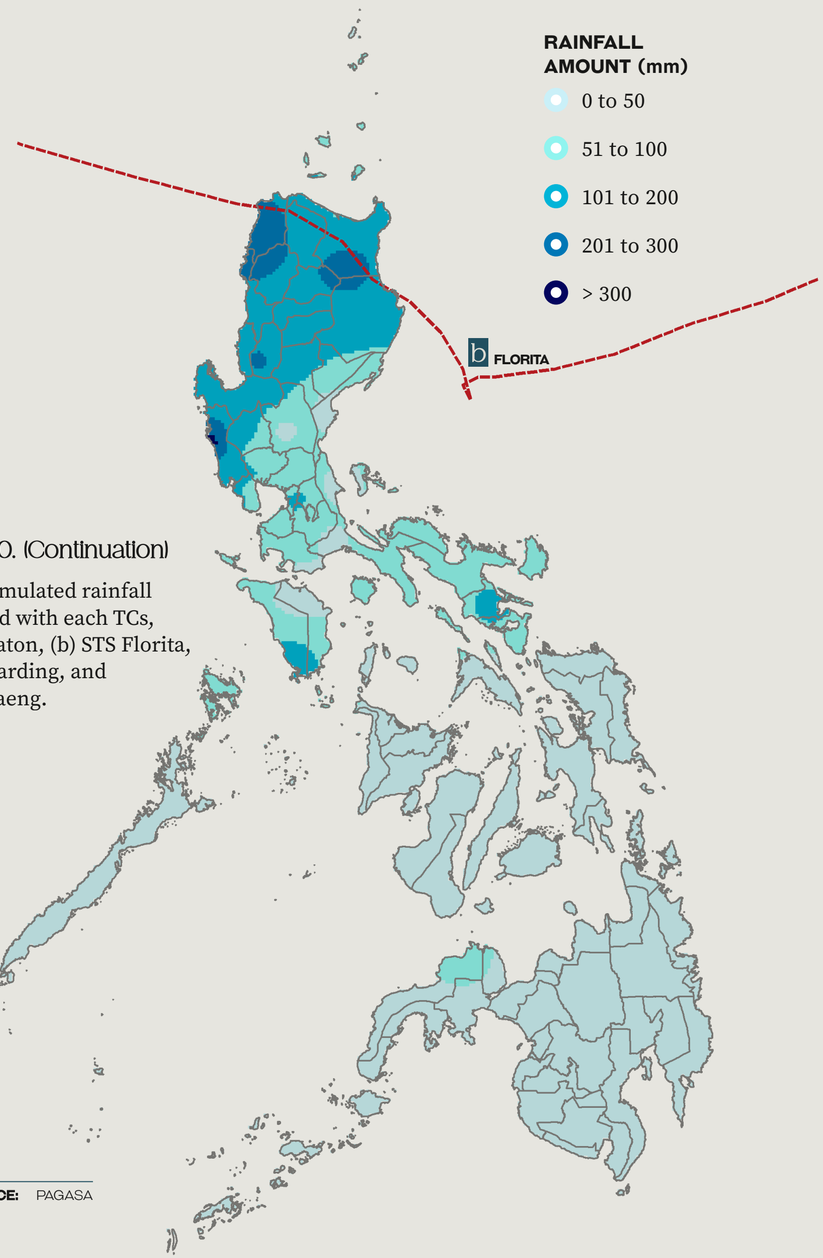



Figure 20. (Continuation)

The accumulated rainfall associated with each TCs, (a) TS Agaton, (b) STS Florita, (c) STY Karding, and (d) STS Paeng.

Around 44 cities or municipalities declared a state of calamity, and 1,451,649 individuals were affected in Luzon. It incurred the second highest total cost of damage to both agriculture and infrastructure, amounting to PHP 3.3 billion.

Lastly, **STS Paeng (Nalgae)**, the fifth tropical cyclone to make landfall, brought the costliest damage. It developed into a Tropical Depression on October 26 initially moving westward then intensified into Tropical Storm the next day. After two days, it intensified as a Severe Tropical Storm before traversing Southern Luzon and initially made landfall in Catanduanes. It made four other landfalls in Camarines Sur, Buenavista (Quezon), Marinduque, and Sariaya (Quezon).

Paeng's trough and the shear line brought heavy rains to parts of Visayas and Mindanao even before it passed over Southern Luzon. Gusty conditions were also observed over most of the country.

Paeng emerged as the most economically damaging, with losses amounting to a staggering PHP 13 billion. A state of calamity was declared in 35 cities and municipalities.

As these names retire from the roster of Philippine tropical cyclones, they are now replaced with **Ada, Francisco, Kiyapo,** and **Pilandok**, respectively.

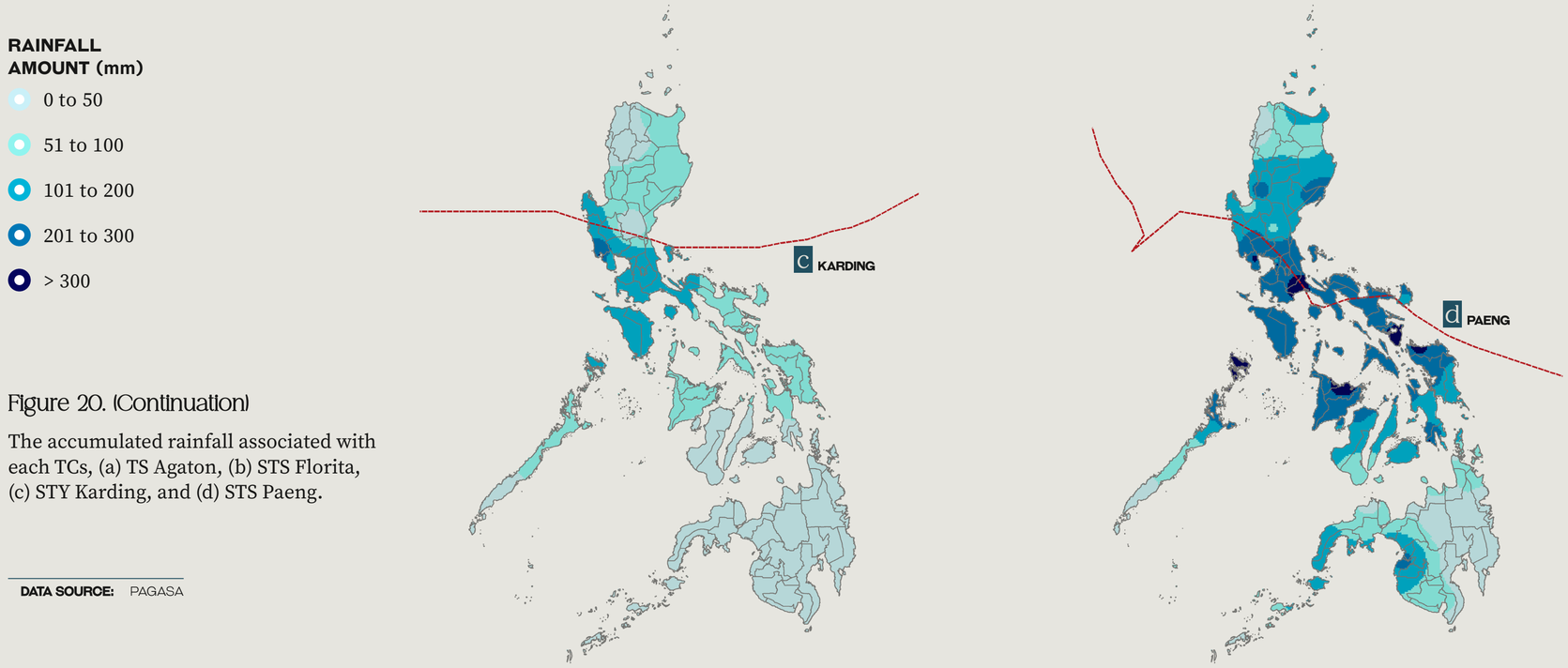


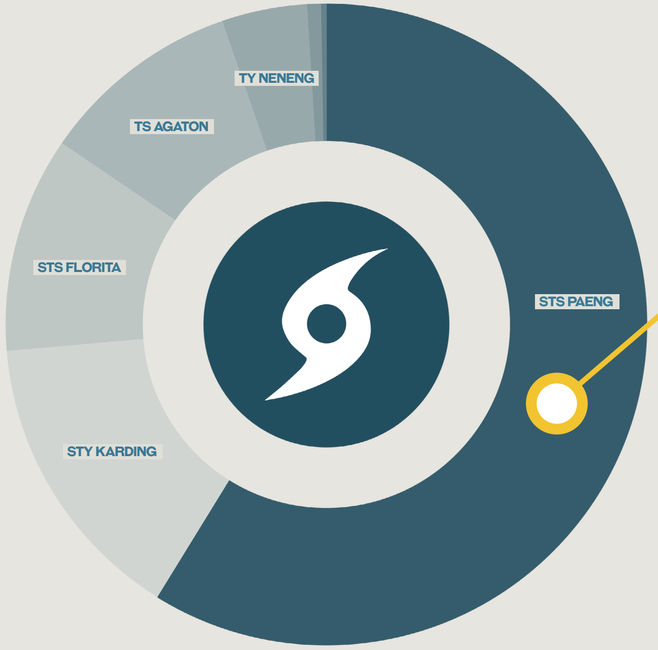

Figure 20. (Continuation)

The accumulated rainfall associated with each TCs, (a) TS Agaton, (b) STS Florita, (c) STY Karding, and (d) STS Paeng.

DATA SOURCE: PAGASA

# Loss and Damage Due to TCs and Associated Hazards

**TROPICAL CYCLONES IN 2022 INCURRED A NATIONWIDE TOTAL COST OF DAMAGE AMOUNTING TO PHP 22 BILLION. MORE THAN HALF (67.3%) WERE DAMAGE TO AGRICULTURE.**




Of the five tropical cyclones that made landfall, **STS Paeng** caused the highest damage in agriculture and infrastructure, amounting to PHP 13 billion, which accounted for more than half (59%) of total cost of TC-related damages.

Table 6. 2022 Philippine Tropical Cyclones ranked according to total damages

| 2022 TC | DATE | AGRICULTURAL DAMAGE IN PHP | INFRASTRUCTURE DAMAGES IN PHP | TOTAL DAMAGES IN PHP |
|---|---|---|---|---|
| PAENG | Oct 26-31 | 7,214,082,875 | 5,868,503,199 | 13,082,586,074 |
| KARDING | Sep 22-26 | 2,999,272,999 | 304,245,310 | 3,303,518,309 |
| FLORITA | Aug 21-24 | 1,855,024,612 | 571,100,000 | 2,426,124,612 |
| AGATON | Apr 9-12 | 2,264,638,032 | 6,950,000 | 2,271,588,032 |
| NENENG | Oct 13-16 | 503,654,794 | 450,715,000 | 954,369,794 |
| MAYMAY | Oct 10-13 | 114,350,000 | 14,252,147 | 128,602,147 |
| HENRY | Aug 31-Sep 4 | – | 61,372,000 | 61,372,000 |
| ESTER | Jul 29-31 | 5,453,240 | – | 5,453,240 |
| GRAND TOTAL | | **14,956,476,552** | **7,277,137,656** | **22,233,614,208** |

**DATA SOURCE:** NDRRMC

Region II, specifically Cagayan Valley, incurred the most significant damages, accumulating a staggering PHP 4 billion in total. Regions VI and III experienced damages amounting to PHP 3 billion each.

Table 7. 2022 Philippine Tropical Cyclones (TC) ranked according to affected population

| 2022 TC | DATE | NO. OF AFFECTED POPULATION |
|---|---|---|
| STS Paeng (*Nalgae*) | Oct 26-31 | 5,982,377 |
| TS Agaton (*Megi*) | Apr 9-12 | 2,298,780 |
| STY Karding (*Noru*) | Sep 22-26 | 1,451,649 |
| TY Neneng (*Nesat*) | Oct 13-16 | 191,330 |
| STS Florita (*Ma-on*) | Aug 21-24 | 131,235 |
| TD Maymay | Oct 10-13 | 43,799 |
| TD Ester (*Trases*) | Jul 29-31 | 13,218 |
| TD Obet | Oct 19-22 | 10,894 |
| STY Henry (*Hinnamnor*) | Aug 31-Sep 4 | 2,442 |
| TS Rosal (*Pakhar*) | Dec 10-12 | 55 |
| GRAND TOTAL | | 10,125,779 |

DATA SOURCE: NDRRMC

Among the affected provinces, Cagayan emerged with the highest total damages, reaching PHP 2 billion. Provinces with at least PHP 1 billion in overall damages included Capiz, Isabela, Nueva Ecija, Iloilo, Maguindanao, Quezon, and Camarines Sur.

Tropical Cyclones in 2022 affected a total of 10,125,779 people in the country. Nueva Ecija, Maguindanao, Iloilo, Capiz, and Cavite are the top five provinces with the highest number of affected population.


**TOTAL COST OF DAMAGE DUE TO 2022 TCs (in millions, Php)**

- up to 500
- 500 to 1,000
- 1,001 to 1,500
- 1,501 to 2,000
- > 2,000

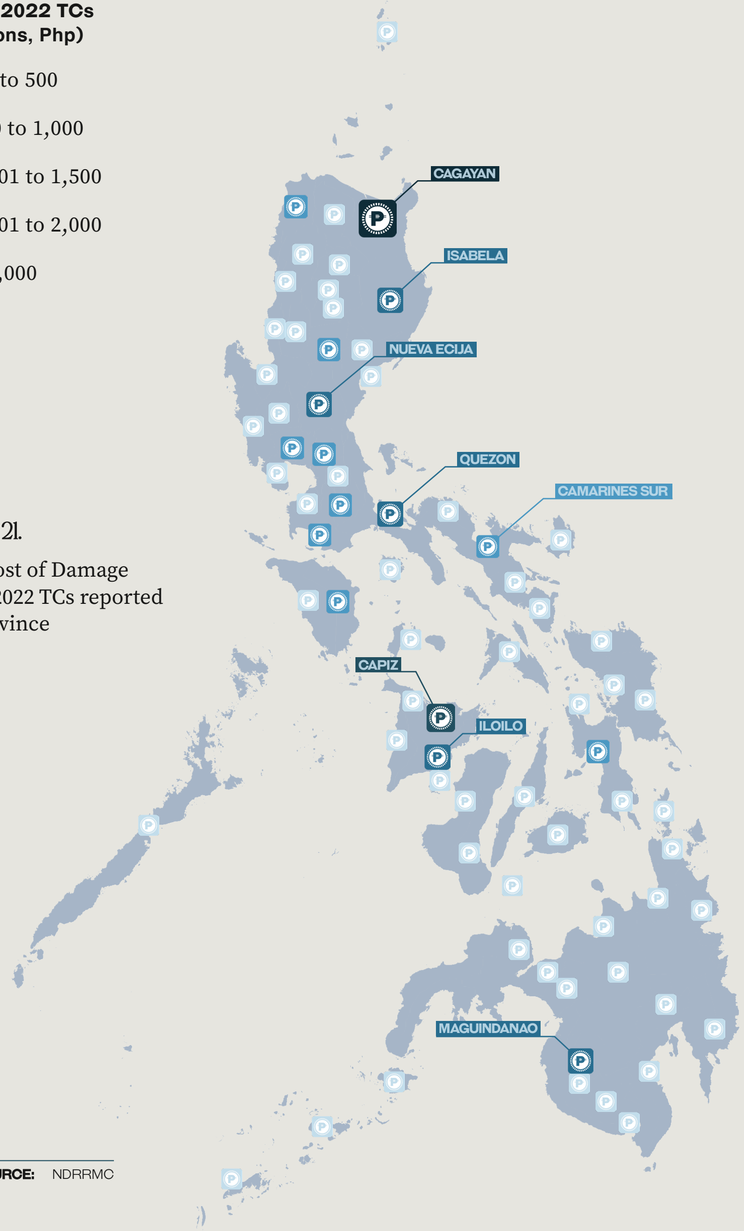



Figure 21.
Total Cost of Damage due to 2022 TCs reported per province

DATA SOURCE: NDRRMC

# Other incidents caused by weather- and climate- related events

**ASIDE FROM TC-RELATED DAMAGES, A TOTAL OF 359 WEATHER- AND CLIMATE-RELATED INCIDENTS OCCURRED IN 2022. THESE WERE FURTHER CATEGORIZED INTO 25 UNIQUE CASES. MOST WERE FLOODING WHICH IS TYPICAL OF A LA NIÑA EVENT.**

Majority of the flooding cases occurred in Mindanao, with Regions 10, 12, and BARMM recording at least 30 incidents. With 27 cases, Maguindanao was the most flooded province in 2022.

These incidents resulted in a total of PHP 916,113,399 worth of damage to agriculture, infrastructure, private properties, and other sectors. Flooding incidents, which claimed 20 lives and displaced more than 200,000 families, accounted for one-third of the total damages, amounting to PHP 326,086,131.

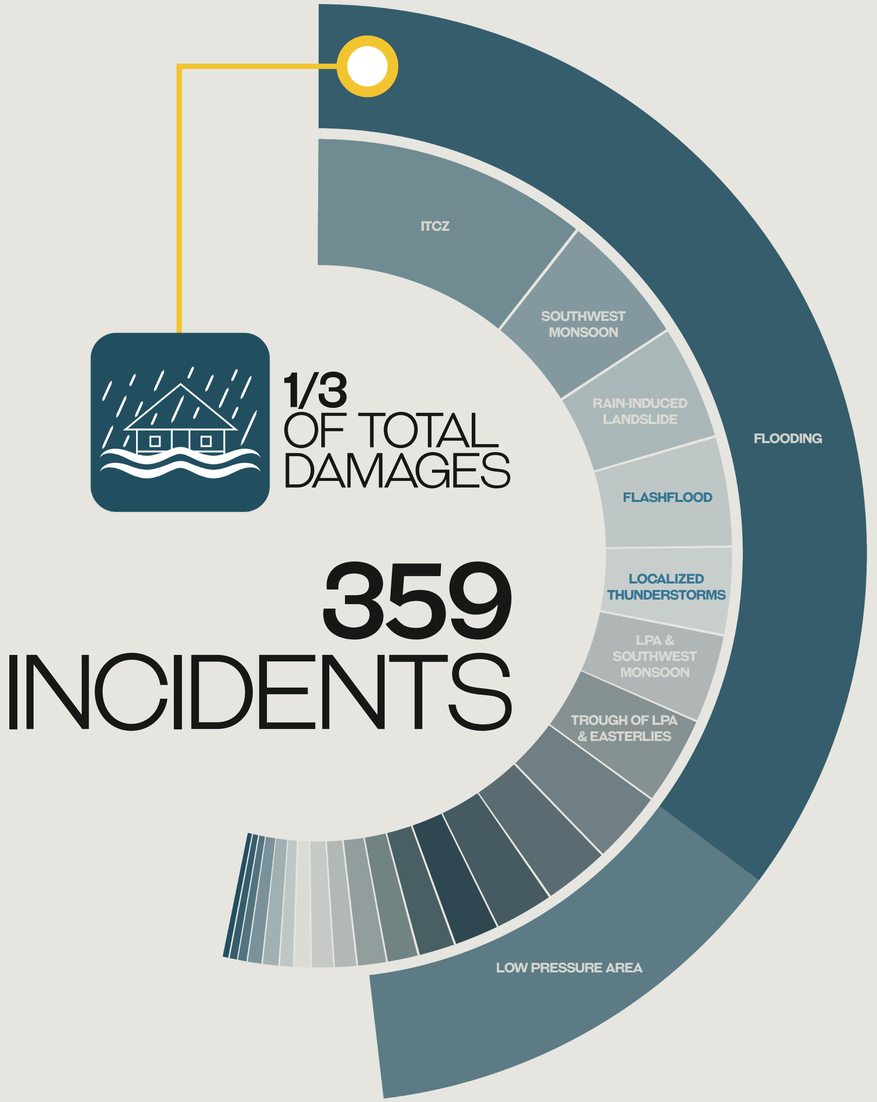



Figure 22. Breakdown of monitored incidents of natural hazards (other than TCs) in 2022.

**DATA SOURCE:** NDRRMC

INTERACTIVE

# NOTABLE WEATHER EVENTS IN 2022

**OTHER THAN THE TROPICAL CYCLONES (TCS), THE OCCURRENCE OF A "TRIPLE-DIP" LA NIÑA, DAGUPAN'S HIGHEST RECORDED HEAT INDEX, AND THE 'TORNADO WIND' IN STA. CRUZ, MANILA ALSO MADE ROUNDS IN NEWS BULLETINS, OUTLETS AND SOCIAL MEDIA IN 2022.**

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

# MAJOR MODES OF CLIMATE VARIABILITY IN THE PHILIPPINES


### ITCZ

Rainfall is influenced by the location of the Inter-Tropical Convergence Zone (ITCZ), where the northeasterly winds in the Northern Hemisphere and the southeasterly winds in the Southern Hemisphere converge along the equator. From December to February, the ITCZ is located south of the equator. It moves northward until it reaches north of the Philippines around August to September, and then moves southward before December.

### ENSO

El Niño-Southern Oscillation (ENSO) refers to the ocean component (El Niño) and the atmospheric component (Southern Oscillation) of a naturally occurring phenomenon that originates in the Pacific Ocean. El Niño and La Niña refer to the pattern of above or below average sea surface temperatures in the central and eastern Pacific that leads to a major shift in weather patterns across the Pacific. ENSO is the most important source of inter-annual variability of rainfall in the Philippines.


## MONSOONS

A monsoon is a persistent wind pattern generated by a large weather system that lasts for several months and affects large areas. There are two monsoon seasons in the country: Southwest Monsoon (Habagat) and Northeast Monsoon (Amihan).
Habagat usually means wet conditions in the western sections of the country from June to September. Habagat usually brings significant amount of rainfall that triggers flooding and landslides, and is sometimes further enhanced by the presence of tropical cyclones in PAR. The Northeast Monsoon (Amihan) features cool and dry breeze with prolonged periods of successive cloudless days. It affects the eastern sections of the country from November to February.

## TROPICAL CYCLONES

Tropical Cyclone (TC) is the general term for a cyclone that originates over tropical oceans. TCs are low pressure systems in which winds spin inward in a circularly symmetric spiral, bringing with it intense rain and winds. TCs are categorized further based on wind intensity. In March 2022, PAGASA revised the threshold intensities (maximum wind speed) for tropical cyclone categories. The 2022 TCs are classified according to the new category.

Other modes of variability include the Pacific Decadal Oscillation (PDO) which is characterized by patterns of sea surface temperature anomalies over the North Pacific. It has warm and cold phases that last for decades. During warm (cold) phases of the PDO, the Madden-Julian Oscillation (MJO) is another tropical mode of variability that can influence the intra-seasonal variations in rainfall over the Philippines. The MJO is typically a 30- to 60-day (but may also range from 20 to 90 days) oscillation that moves eastward near the equator, and involves variations in wind, and rainfall.

For more information about these different modes of variability, visit the Philippine Climate Change Assessment WG1 at https://bit.ly/PhilCCAWG1-Cycle1.

# DATA SOURCES

Climate and Agrometeorological Data Section and Impact Assessment and Applications Section - Philippine Atmospheric, Geophysical and Astronomical Services Administration.

National Disaster Risk Reduction and Management Council

NOAA's International Best Track Archive for Climate Stewardship (IBTrACS) data, accessed on [2024, February 28]

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# ABOUT THE OSCAR M. LOPEZ CENTER

The Oscar M. Lopez Center is a non-profit organization born out of a private sector initiative to enhance support for research and innovative solutions towards climate change adaptation and disaster risk management. It is principled on the role that science must play in building the resilience of communities through actionable knowledge.

Founded in 2012, the OML Center was established as a response to an apparent research gap that was alarmingly disproportionate to the climate-related risks and vulnerabilities of the Philippines. The first of its kind in the country, it continues to be the only privately funded grant-giving NGO doing climate change research-based communications.

Propelled by its mandate to harness science in strengthening the climate resilience of the vulnerable, the Center consistently provides the scientific backbone to increase climate change awareness and action in the Philippines.

## Other OML Center Projects


**MGA KWENTO NG KLIMA**

Co-produced with ABS-CBN DocuCentral, Mga Kwento ng Klima is an award-winning documentary chronicling the story of the changing climate in the context of the Filipino experience and how it has shaped the Filipino identity and culture.

Watch the documentary via ABS-CBN News' YouTube Channel or via iWant TFC.


## KLIMAALAM: STEP UP AND STEP IN TO ACT ON CLIMATE

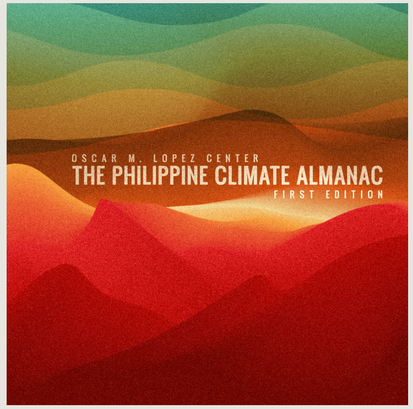
A collaboration with Adarna House, Klimaalam: Step Up and Step In to Act on Climate is an eight-chapter activity book that aims to provide young Filipinos with fundamental knowledge about climate change in the Philippines. The book includes key questions to help younf Filipinos recognize and observe climate impacts, and provide an overview of practical and relatable ways to address them.

Download Klimaalam in full or by chapter at https://www.omlopezcenter.org/our-work/klimaalam.


## MGA KWENTO NG KLIMA SHORT FILMS

Mga Kwento ng Klima (MKK) Short Films is a film competition that aims to capture the unique Filipino experience of climate change and convey the need for urgent climate action through films. This initiative is part of the Center's Balangay Project, which aims to engage a broader network in the discussion on climate change to enable collective action. The MKK Short Films is a continuation of the 60-minute documentary Mga Kwento ng Klima co-produced with ABS-CBN DocuCentral in 2019.

Learn more about the MKK Short Films at https://www.omlopezcenter.org/balangay-film-mkk-short-films-page.




## THE PHILIPPINE CLIMATE ALMANAC

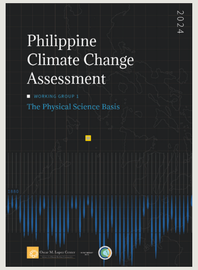
The first of its kind in the country, The Philippine Climate Almanac highlights record-breaking and other significant statistics of climate-related variables, extreme events and disasters across seven decades through data visualizations that we hope audiences outside the scientific and academic communites find compelling.

The Philippine Climate Almanac is available for download at http://www.omlopezcenter.org/the-philippine-climate-almanac.


## CLIMATE, DISASTER AND DEVELOPMENT JOURNAL (CDDJ)

CDDJ is an open access double-blind peer-reviewed journal on all aspects and intersections of climate, disaster, and development. The journal provides a forum for the presentation and sharing of recent research findings within and across these fields.

For more detailed information about the CDDJ, you may visit https://www.cddjournal.org.





## PHILIPPINE CLIMATE CHANGE ASSESSMENT REPORT CYCLE 2

Patterned after the Intergovernmental Panel on Climate Change Assessment Reports, the Philippine Climate Change Assessment (PhilCCA) provides comprehensive information on climate change science in the Philippines through three working groups examining the physical science basis, impacts and adaptation, and mitigation.

More information about PhilCCA at https://www.omlopezcenter.org/the-philippine-climate-change-assessment

Please let us know your thoughts and help us improve the SPC series at https://bit.ly/SPCUserFeedback.

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Science for Climate Resilient Communities

# STATE OF THE 2022 PHILIPPINE CLIMATE