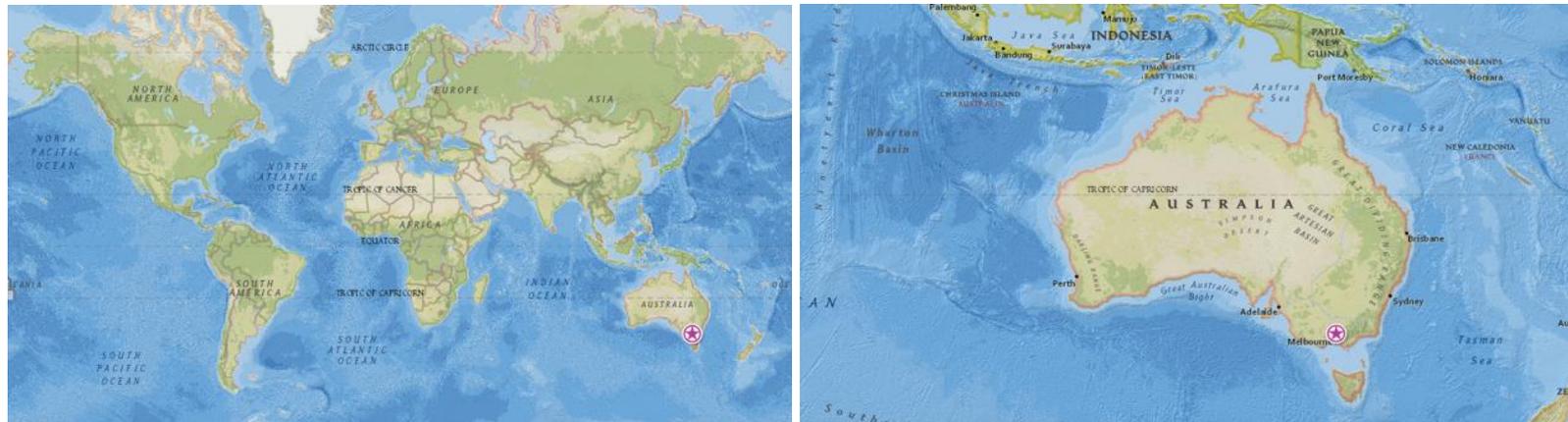


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January February March April May June July August Sept October Nov Dec

Precipitation Data: Melbourne, Australia

Location: -37.814 S, 144.9633 E Elevation=18.69 ft



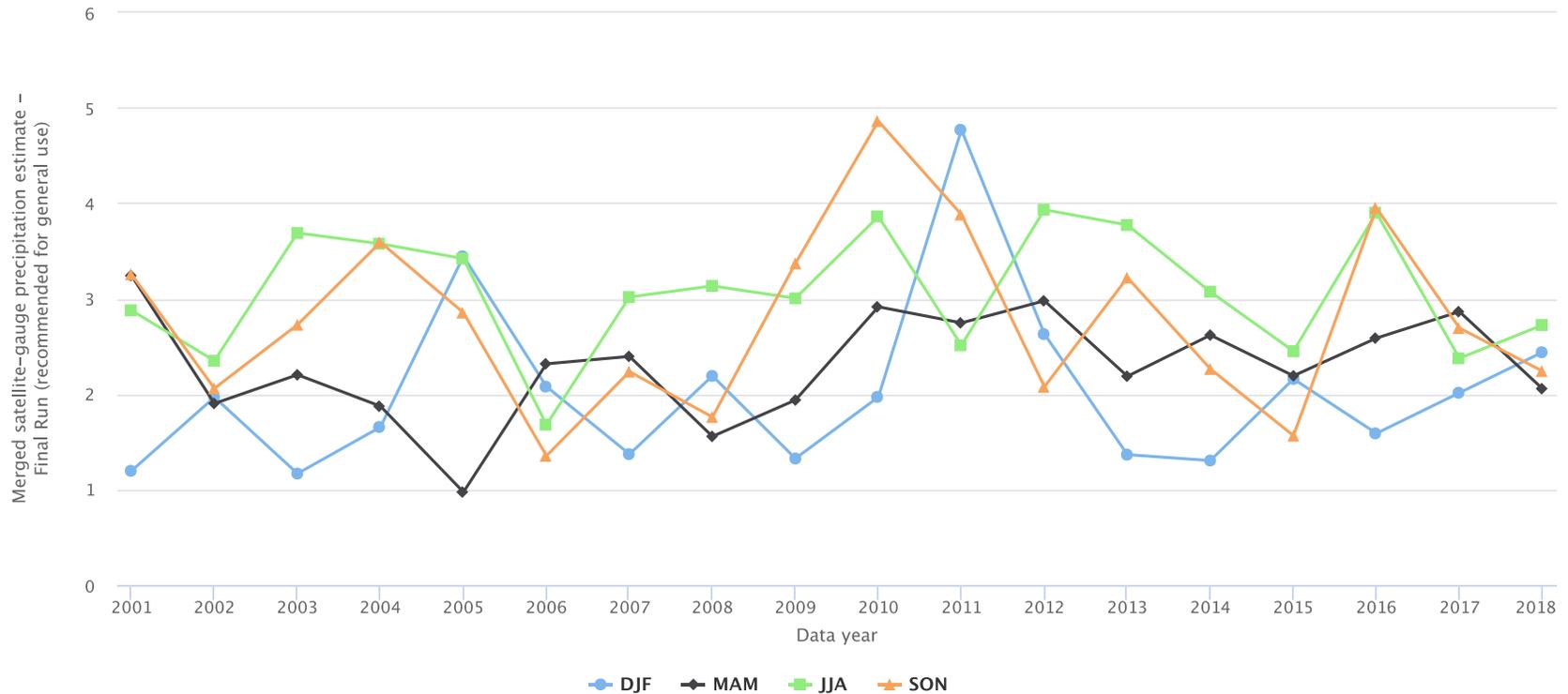
Map credit: <http://mapmaker.nationalgeographic.org/>

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
2	2	2	2	3	3	3	3	3	3	3	2	31

Average Monthly Precipitation Climatology 2001-2018 (IMERG) (converted to inches/month and rounded to whole numbers)

Interannual Time Series

Average Merged satellite-gauge precipitation estimate - Final Run (recommended for general use) monthly 0.1 deg. [GPM GPM_3IMERGM v06] inch/month for 2000-Dec - 2018-03-01 00:00:00Z, Region 144.9633E, 37.8139S



Highcharts.com

From late 1996 through mid-2010, much of southern Australia suffered from a prolonged period of dry conditions, known as the *Millennium Drought*. These conditions were particularly severe for the densely populated areas in the southeast, including the city of Melbourne. Scientists at the University of Melbourne found that this was the worst drought suffered in this region for the past 400 years. In Melbourne, the city's water storages dropped from almost full in October 1996 to being only one-third full in June 2010. Water restrictions were put in place, and water consumption fell by 22%. People in this area have been able to reduce their water usage to about two-thirds of a bucket of water per person per day. A new seawater desalination plant was constructed in 2012 at a cost of 4 billion dollars to increase access to freshwater resources.

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January February March April May June July August Sept October Nov Dec

Precipitation Data : Bentiu, South Sudan

Location: 9.2333 E, 29.8333 N Elevation= 1,138 ft



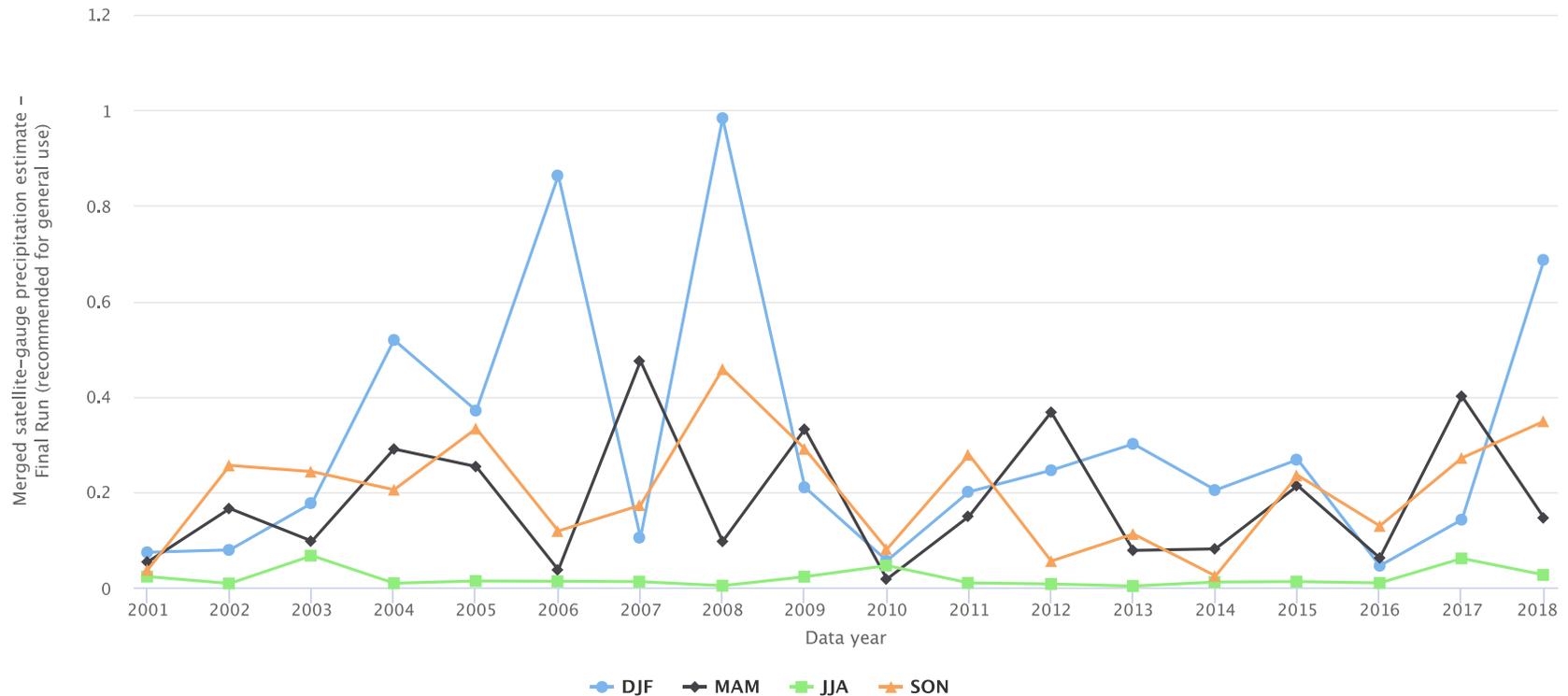
Map credit: <http://mapmaker.nationalgeographic.org/>

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
0	0	0	1	3	5	7	8	5	3	0	0	32

Average Monthly Precipitation Climatology 2001-2018 (IMERG) (converted to inches/month and rounded to whole numbers)

Interannual Time Series

Average Merged satellite-gauge precipitation estimate - Final Run (recommended for general use) monthly 0.1 deg. [GPM GPM_3IMERGM v06] inch/month for 2000-Dec - 2018-03-01 00:00:00Z, Region 9.2333E, 29.8333N



Highcharts.com

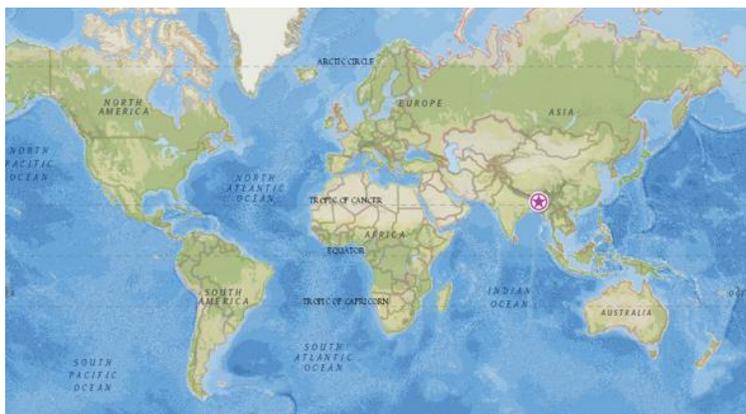
Severe drought and ongoing violence in Somalia and South Sudan have put 8.7 million people at risk of severe food insecurity.. In South Sudan, nearly 50% of the population in this country suffers from malnutrition, which includes over 1.2 million children under the age of five years old. There are many factors at play here, including the fact that the violence is causing many people to be unable to grow crops or raise animals. This has resulted in trade and local markets being disrupted, and both food and fuel prices have spiked. Many countries around the world are attempting to assist by providing both monetary and food resources, but there continue to be problems with being able to safely deliver these resources to people in need.

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January February March April May June July August Sept October Nov Dec

Precipitation Data : Cherrapunji, India

Location: 25.277 N, 91.7264 E Elevation=4,869 ft



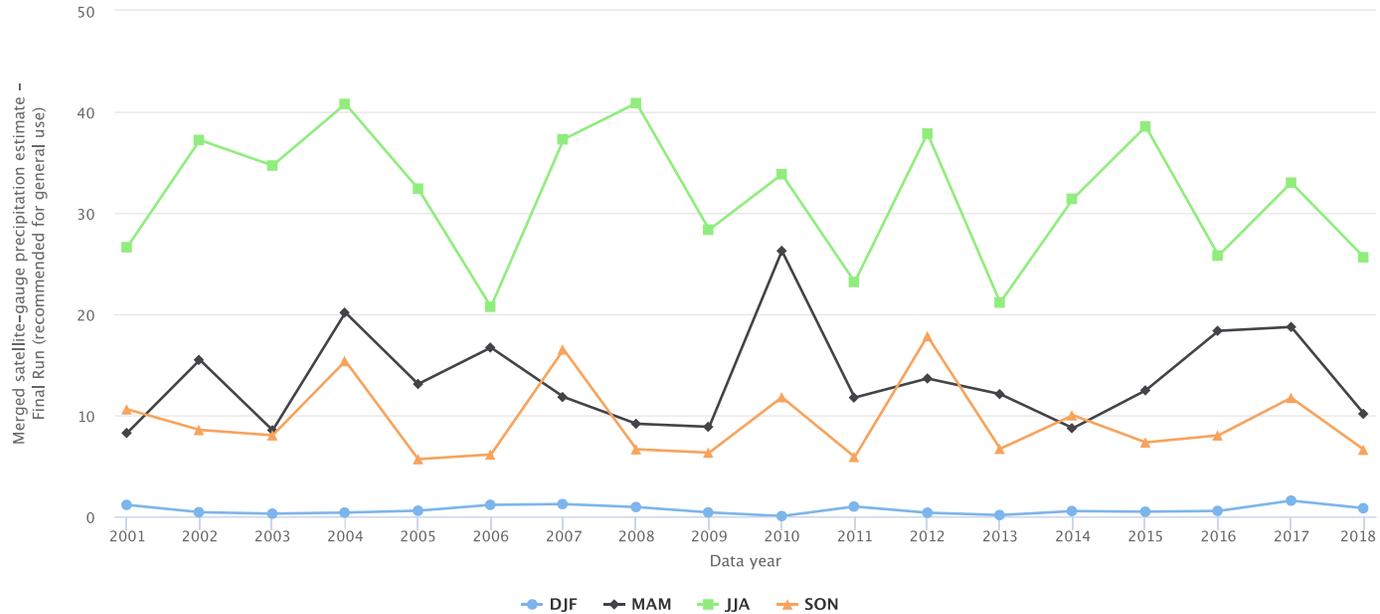
Map credit: <http://mapmaker.nationalgeographic.org/>

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
0	1	3	13	19	25	22	20	15	7	1	0	126

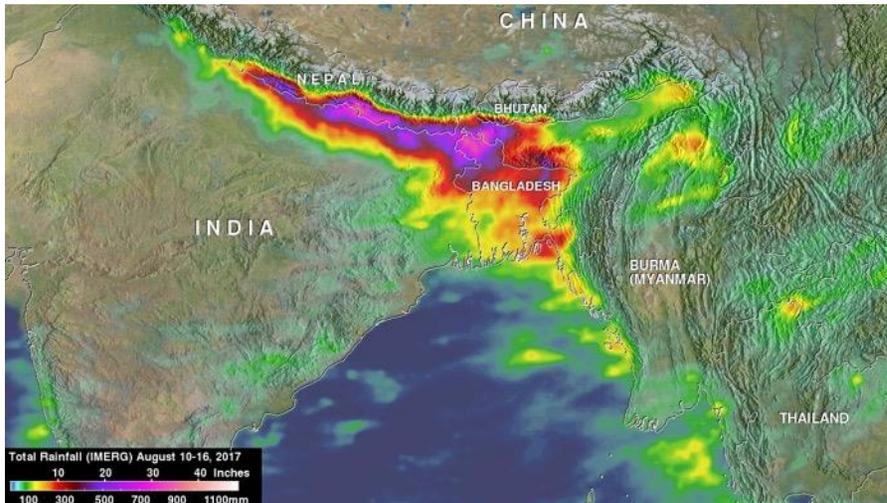
Average Monthly Precipitation Climatology 2001-2018 (IMERG) (converted to inches/month and rounded to whole numbers)

Interannual Time Series

Average Merged satellite-gauge precipitation estimate - Final Run (recommended for general use) monthly 0.1 deg. [GPM GPM_3IMERGM v06] inch/month for 2000-Dec - 2018-03-01 00:00:00Z, Region 91.7264E, 25.2777N



Highcharts.com



Extremely heavy monsoon rains fell in July through September 2017 in parts of northern India, Bangladesh, and Nepal. Over 41 million people were affected by the floods and landslides which resulted from these heavy rains, causing the deaths of over 1,200 people and damaging or destroying over 800,000 houses.

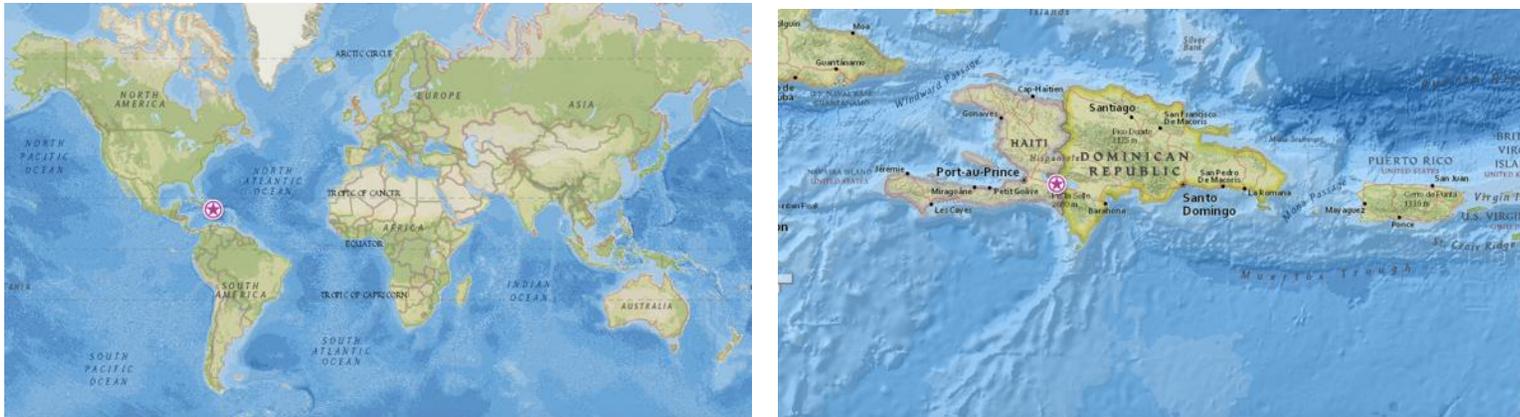
Knowing how much precipitation will fall during monsoon season can help government officials and health professionals prepare for these extreme events. Hazard mapping and early warning systems can reduce the devastation caused by landslides.

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January February March April May June July August Sept October Nov Dec

Precipitation Data: Jimani, Dominican Republic

Location: 18.49169 N, -71.85022 W Elevation= 102 ft



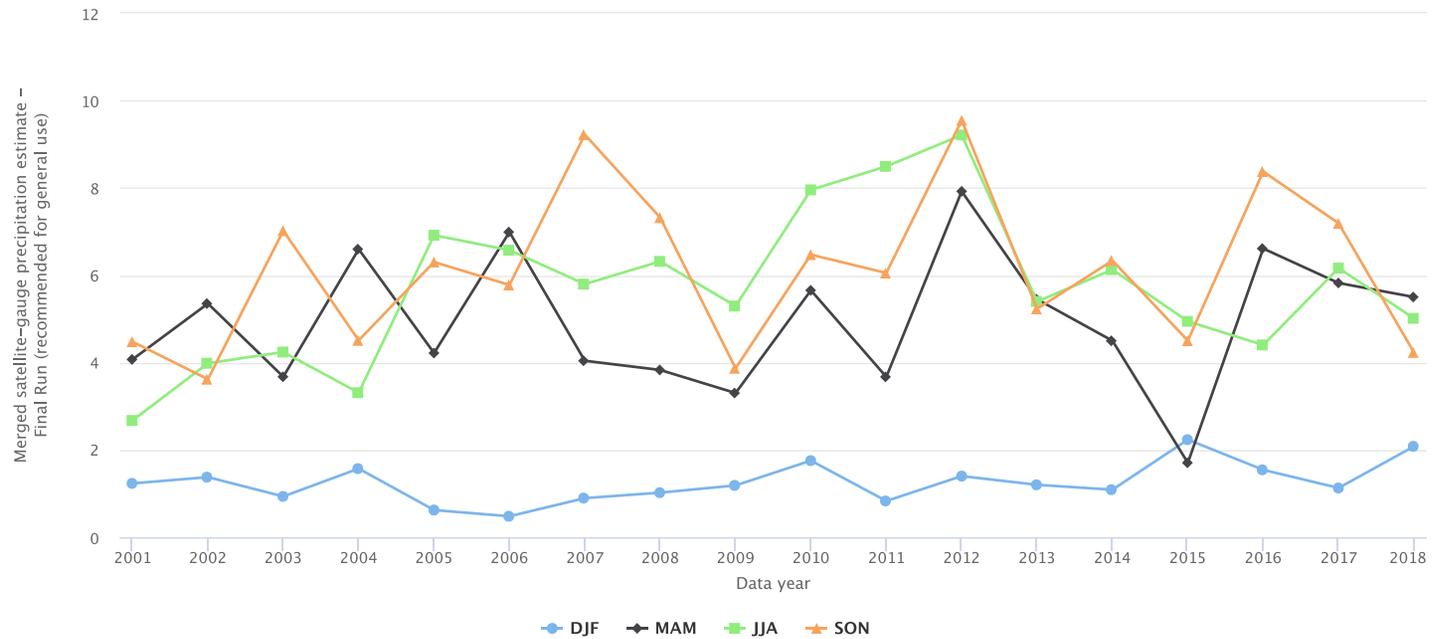
Map credit: <http://mapmaker.nationalgeographic.org/>

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1	1	2	5	7	5	5	7	7	8	4	1	53

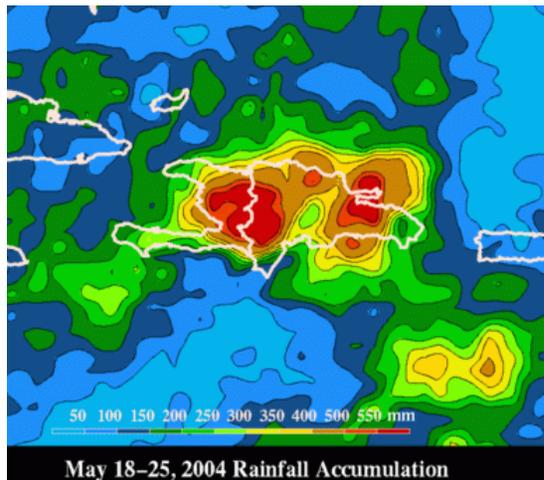
Average Monthly Precipitation Climatology 2001-2018 (IMERG) (converted to inches/month and rounded to whole numbers)

Interannual Time Series

Average Merged satellite-gauge precipitation estimate – Final Run (recommended for general use) monthly 0,1 deg. [GPM GPM_3IMERGM v06] inch/month for 2000–Dec – 2018-03-01 00:00:00Z, Region 71.85W, 18.333N



Highcharts.com



Between May 18th and May 25, 2004, heavy rains caused significant damage to those living in the Dominican Republic and Haiti in the Caribbean. Many landslides occurred in addition to heavy flooding, resulting in the deaths of almost 2,000 people and damaging over 1,300 homes. The worst of the damage happened in the town of Jimani, near the border of Haiti and the Dominican Republic. A key factor in the intensity of the landslide devastation was determined to be the amount of deforestation that had taken place within the floodplains of the rivers along with the construction of many new homes along the rivers.

Satellite data such as IMERG products can be used to determine landslide susceptibility and improve forecasting of these deadly extreme events.

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January February March April May June July August Sept October Nov Dec

Precipitation Data: Ellicott City, MD

Location: 39.2675 N, -76.7927W Elevation= 180 ft



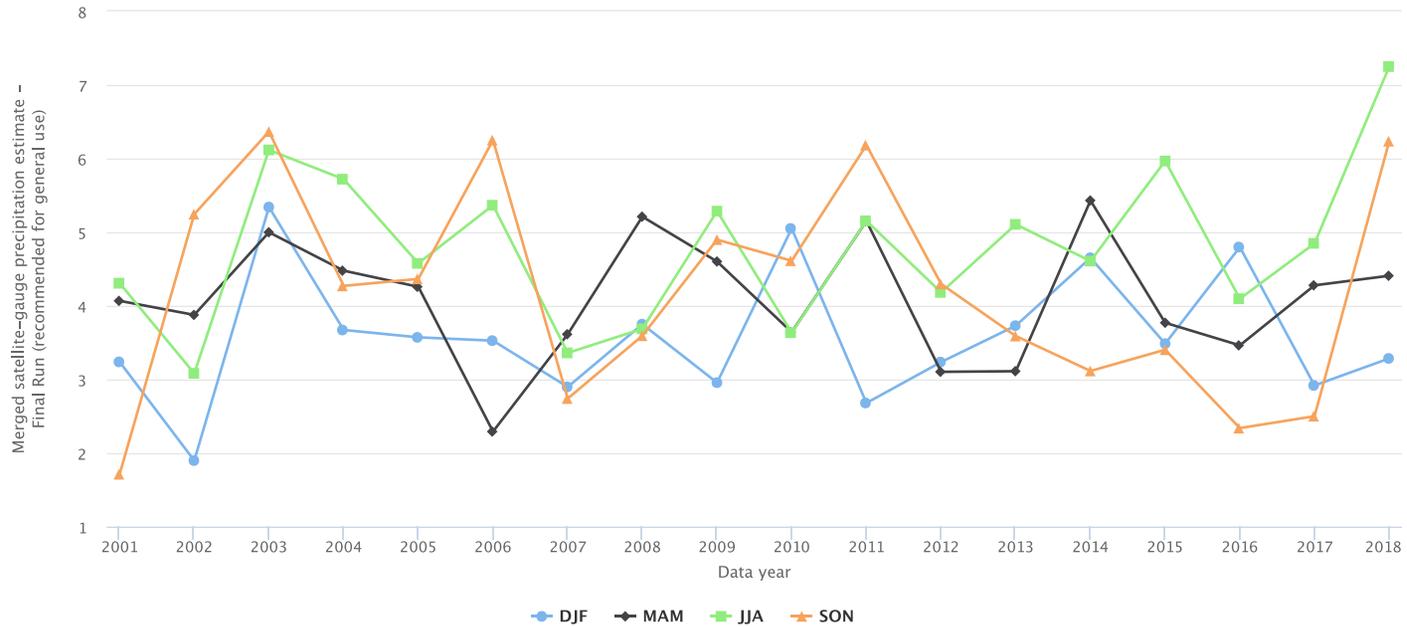
Map credit: <http://mapmaker.nationalgeographic.org/>

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
3	3	4	4	5	5	5	5	5	5	4	4	52

Average Monthly Precipitation Climatology 2001-2018 (IMERG) (converted to inches/month and rounded to whole numbers)

Interannual Time Series

Average Merged satellite-gauge precipitation estimate - Final Run (recommended for general use) monthly 0.1 deg. [GPM GPM_3IMERGM v06] inch/month for 2000-Dec - 2018-03-01 00:00:00Z, Region 76.7927W, 39.2675N



Highcharts.com



On July 30, 2016, a slow-moving line of heavy thunderstorms over parts of central Maryland triggered flash floods and caused devastating flooding in historic Ellicott City, MD. The town suffered substantial damage and about 150 people needed to be rescued. Sadly, two people lost their lives. These storms caused an estimated 22 million dollars in damages as well as 42 million dollars in lost economic activity in this town alone.

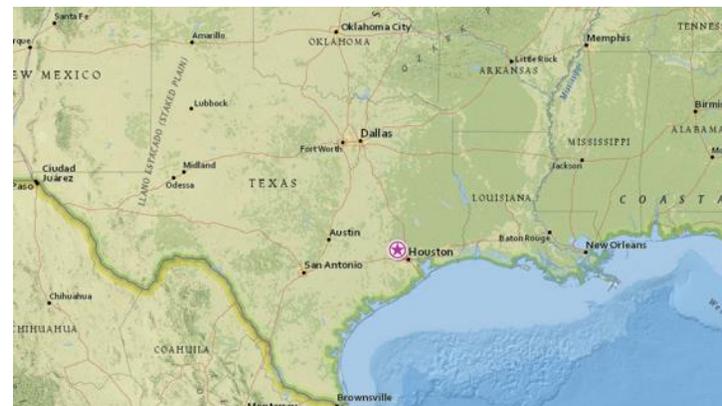
There was another "1,000-year storm" that took place on May 27, 2018 in the same town.

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January February March April May June July August Sept October Nov Dec

Precipitation Data: Houston, TX

Location: 29.7632 N, -95.3632 W Elevation= 98 ft



Map credit: <http://mapmaker.nationalgeographic.org/>

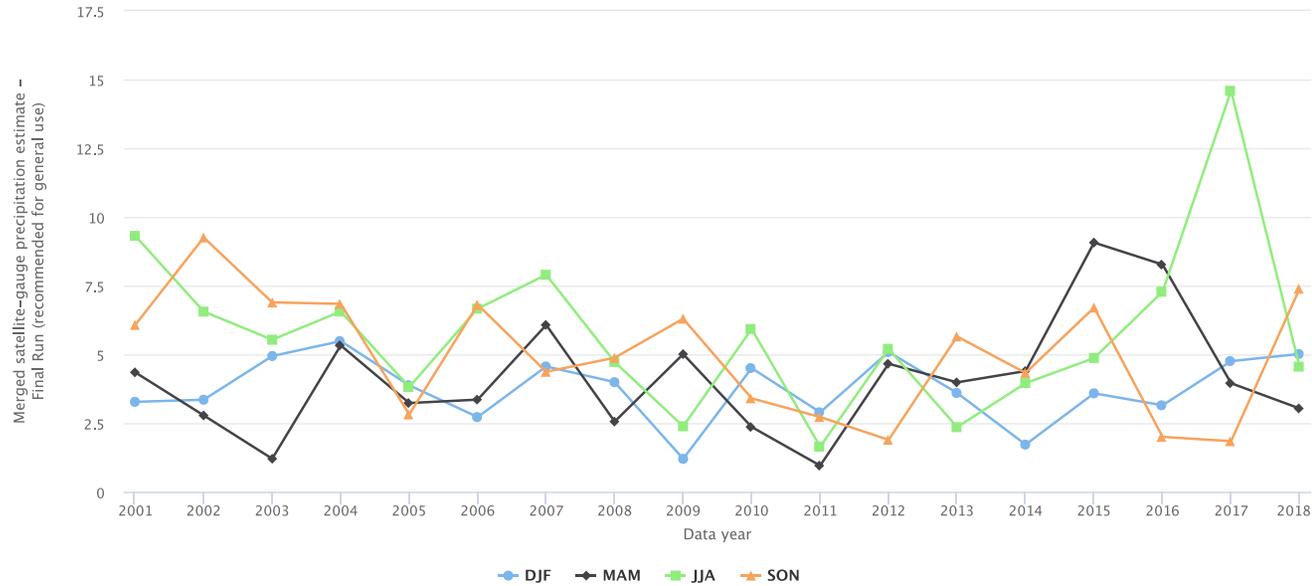
Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
3	3	3	3	4	5	5	5	5	5	3	3	47

Average Monthly Precipitation Climatology 1998-2010 (TRMM) (converted to inches/month and rounded to whole numbers)

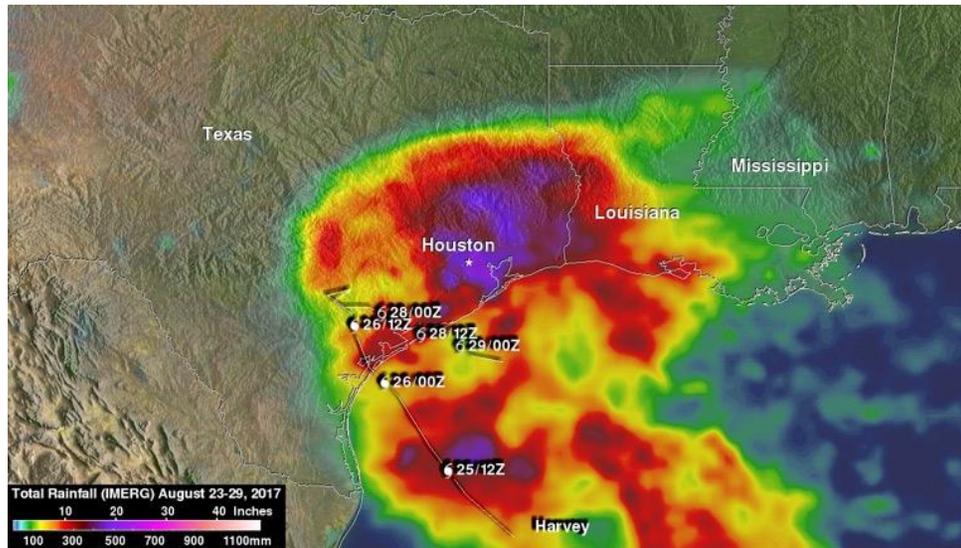


Interannual Time Series

Average Merged satellite-gauge precipitation estimate – Final Run (recommended for general use) monthly 0.1 deg. [GPM GPM_3IMERGM v06] inch/month for 2000–Dec – 2018–03–01 00:00:00Z, Region 95.35W, 29.7499N



Highcharts.com



In August 2017, Hurricane Harvey dropped heavy rainfall as it moved through the Gulf of Mexico and stalled over Texas. This storm tied with Hurricane Katrina (2005) as the costliest tropical cyclone on record, costing \$125 billion dollars in damage. In one four-day period, many parts of Houston received over 40 inches of rainfall, causing unprecedented flooding. An estimated 300,000 homes were damaged, and 103 people in Texas died from storm-related incidents.

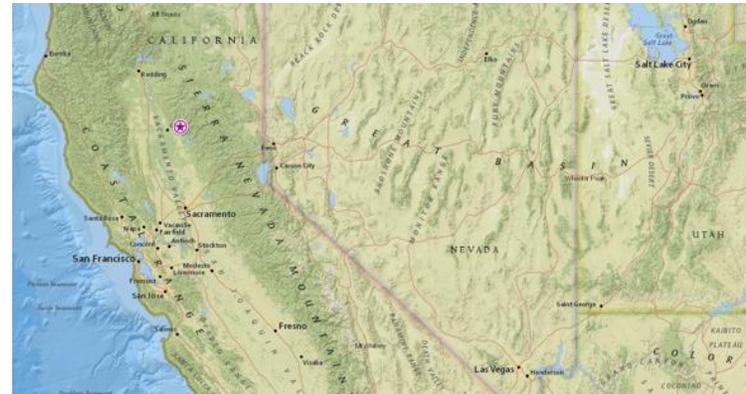
Data from the GPM satellite provides indispensable information for predicting when tropical storms are intensifying as well as giving estimates for how much precipitation may fall during the storm

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January February March April May June July August Sept October Nov Dec

Precipitation Data: Paradise, CA

Location: 45.7 39.767 N, -121/6337 W, Elevation 1,808 ft

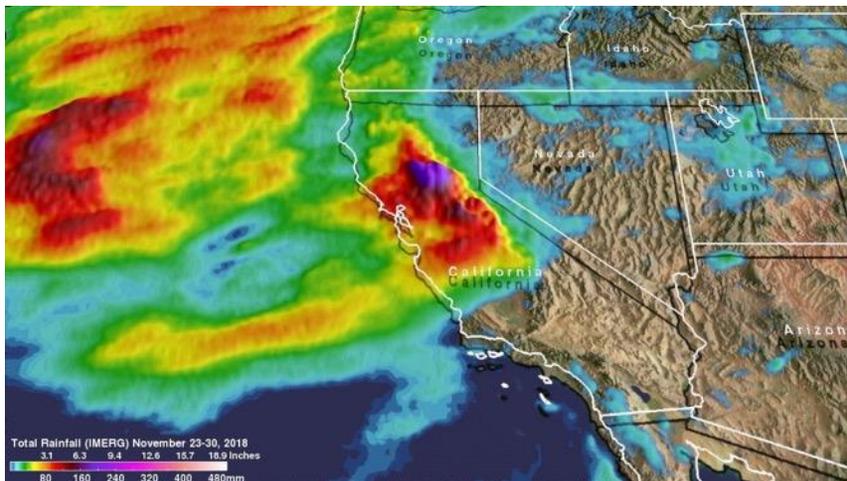
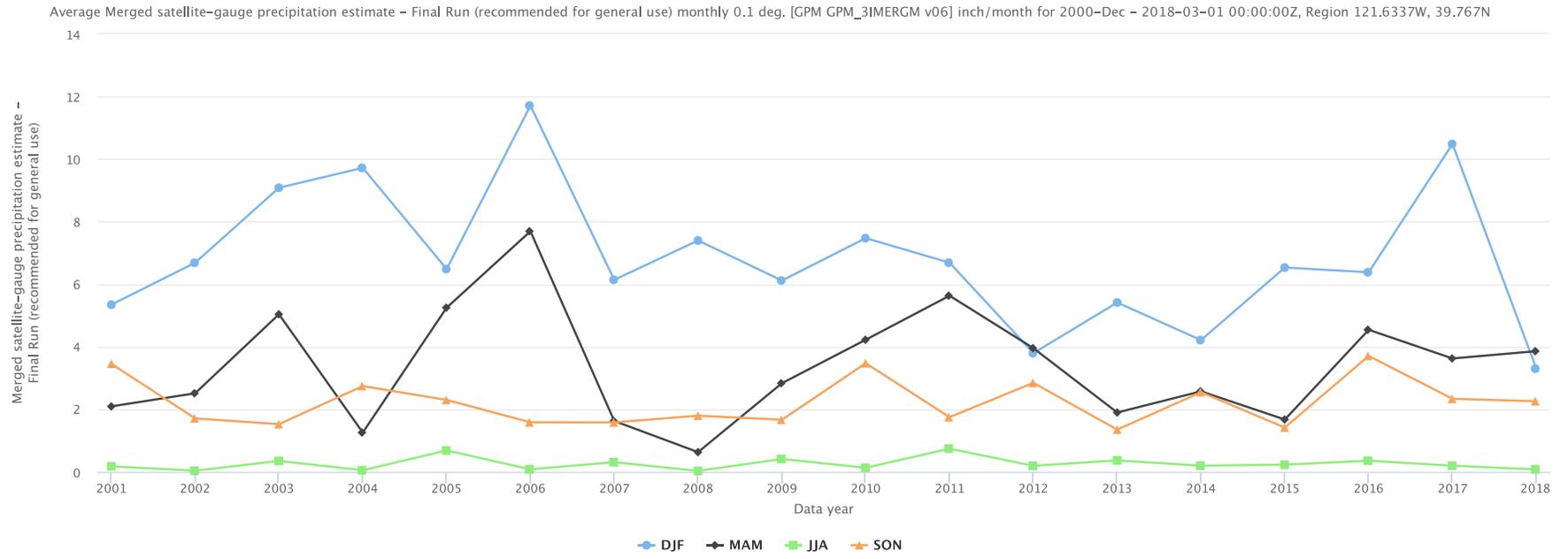


Map credit: <http://mapmaker.nationalgeographic.org/>

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
6	6	5	3	1	1	0	0	0	2	4	9	37

Average Monthly Precipitation Climatology 2001-2018 (IMERG) (converted to inches/month and rounded to whole numbers)

Interannual Time Series



In December 2018, heavy precipitation fell in areas of California that had been devastated by wildfires during November 2018. The Camp Fire was the deadliest and most destructive wildfire in California history. This fire caused at least 85 fatalities and caused over 16.5 billion dollars in damages. Drought was a contributing factor as it had been a particularly dry summer.

Flash floods, debris flows, and mudslides occurred as a result of the heavy rainfall in the areas where the wildfires had stripped the regions of vegetation. These storms did replenish the Sierra Nevada snowpack, which is an important source of water for the streams and rivers throughout California.

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January February March April May June July August Sept October Nov Dec

Precipitation Data: Tacloban, Leyte, Philippines

Location: 11.24333 N, 125.0047 E Elevation: 20 ft

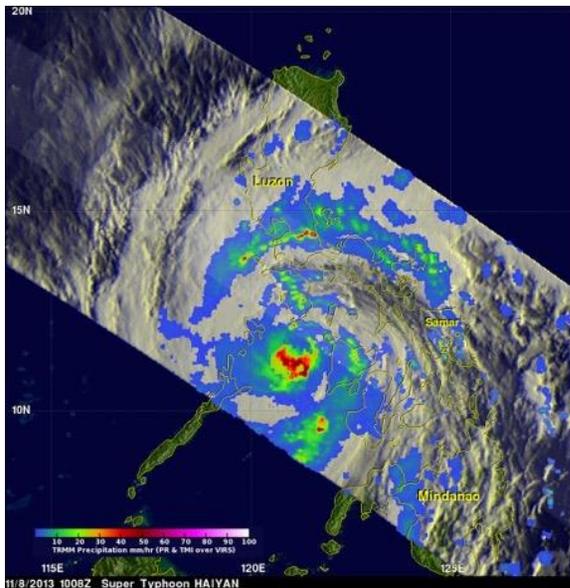
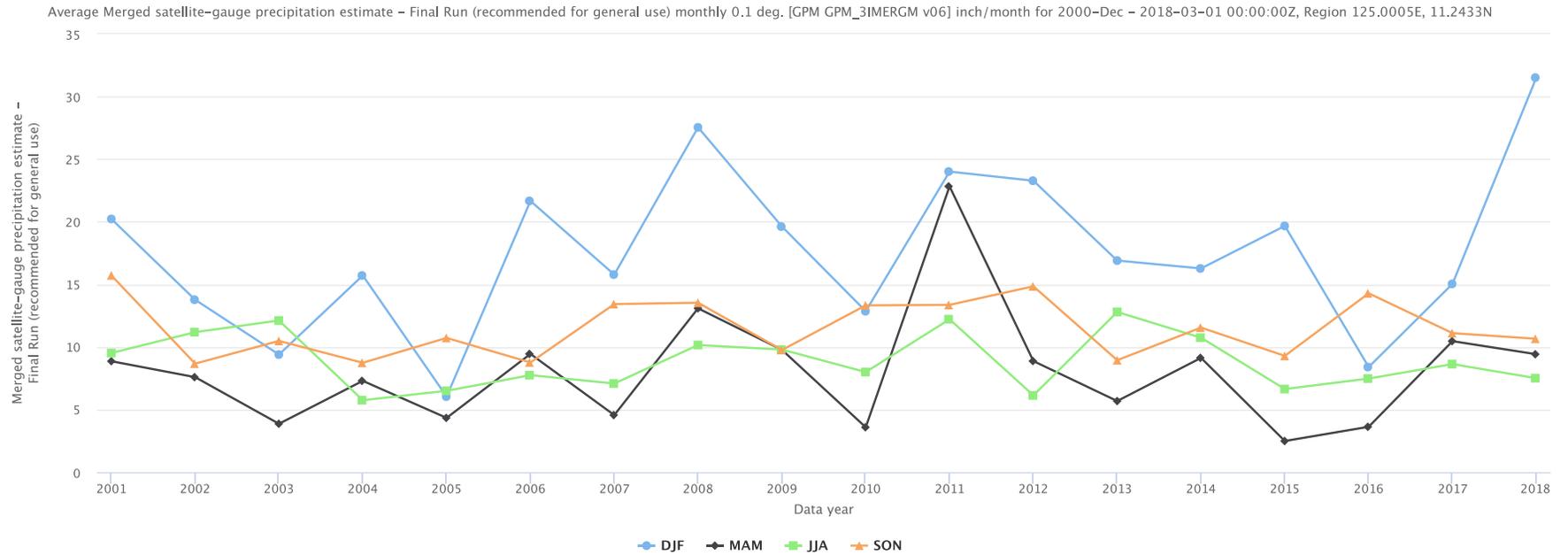


Map credit: <http://mapmaker.nationalgeographic.org/>

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
20	13	11	7	7	9	10	8	10	10	14	21	140

Average Monthly Precipitation Climatology 2001-2018 (IMERG) (converted to inches/month and rounded to whole numbers)

Interannual Time Series



Super Typhoon Haiyan, known in the Philippines as Super Typhoon Yolanda, hit the Philippines on Nov. 7th, 2013. This was one of the deadliest storms for this country, killing over 6,300 people. It may have been the strongest storm to make landfall, with sustained winds estimated at 195 mph. According to United Nations officials, over 11 million people were affected and many left homeless as a result of this tropical cyclone. Most of the catastrophic damage in Tacloban City, on the island of Leyte, occurred during the storm surge, which is primarily caused by the storm's winds pushing the water onshore.

NASA's Earth Science Disaster's Program works to create maps of impacts and potential impacts from storms and make these available to decision makers. By studying powerful storms from the past and developing models using data from many different sources, we are now better able to predict and prevent some of the fatalities from these powerful storms.

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January February March April May June July August Sept October Nov Dec

Precipitation Data: Asunción, Paraguay

Location: - 25.3007 S, -57.6359 W Elevation: 141 ft

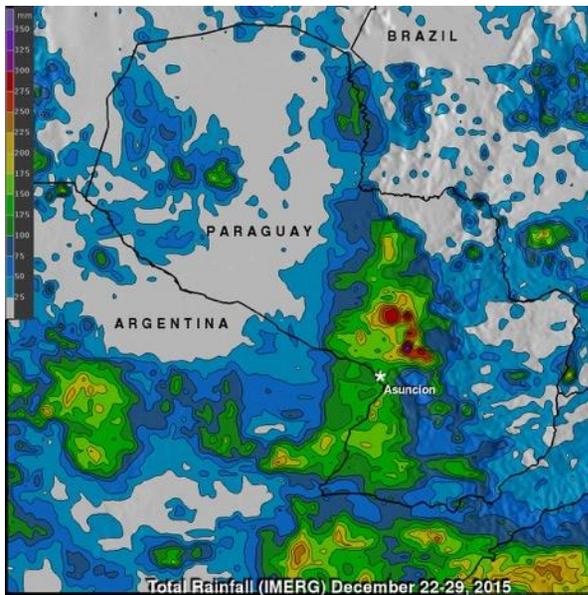
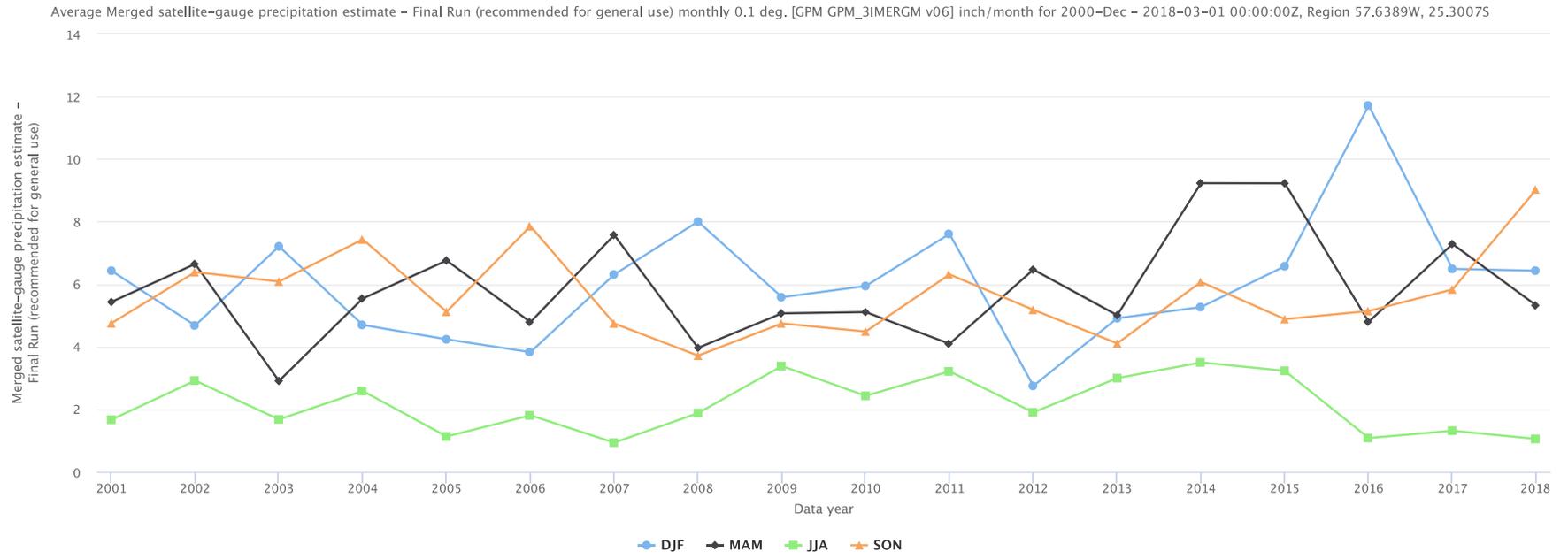


Map credit: <http://mapmaker.nationalgeographic.org/>

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
5	6	5	6	6	3	2	1	3	6	8	7	58

Average Monthly Precipitation Climatology 2001-2018 (IMERG) (converted to inches/month and rounded to whole numbers)

Interannual Time Series



Widespread flooding in late December 2015 affected tens of thousands of people in South America. More than 160,000 people in Paraguay, Argentina, Uruguay, and Brazil were forced to flee their homes, at least 100,000 were from Paraguay. At least six people from Asunción died when the Paraguay River, which flows next to this city, rose at least 24 feet. The Ministry of Public Health and Social Welfare in Paraguay declared an alert for dengue, chikungunya, and Zika throughout the country as they anticipated that the threat of mosquitoes would greatly increase.

The flooding was influenced by the El Niño phenomenon, which raised the intensity and frequency of rain in this region. El Niño is an irregularly occurring and complex series of climatic changes affecting the equatorial Pacific region and beyond every few years, characterized by the appearance of unusually warm, nutrient-poor water off northern Peru and Ecuador, typically in late December.