



The Whispering Trades



Volume 4, Issue 2 • December 2016

National Weather Service | San Juan, Puerto Rico

From the Corner of the MIC @ WFO San Juan



By: Roberto García-Hiraldo, MIC

The 2016 Atlantic hurricane season, was the most active Atlantic hurricane season since 2012. There were a total of fifteen named storms, seven hurricanes, and four major hurricanes. This is not surprising as most outlooks were predicting above average activity due to higher than normal sea surface temperatures and a high probability of La Niña conditions. The strongest, deadliest and costliest tropical cyclone of the season was Hurricane Matthew, the first category 5 to form in almost a decade. Up to 1,659 deaths can be attributed to it.

However, Puerto Rico and the U.S. Virgin Islands were very fortunate once again as no tropical cyclone came near our area. The only tropical cyclone that entered the eastern Caribbean was precisely, Hurricane Matthew, which passed several hundred miles to our south. Even at that distance, we suffered marine impacts as coastal flooding and beach erosion were reported along the southern and west coasts of the islands. Although this goes to show that an active season outlook does not necessarily mean a direct impact to our local islands, the message continues to be the same.

"We must remember, it only takes one hurricane."



We are now experiencing the driest and coolest part of the year in the northern Caribbean. Although it is less active, when it comes to weather, it is the time of the year when large northerly swells begin to impact our Atlantic beaches resulting in high surf conditions and deadly rip currents.

These marine conditions are especially dangerous when we consider that thousands of tourists arrive to the U.S. Virgin Islands and Puerto Rico to enjoy the warm waters and tranquil climate.

From the Corner of the MIC @ WFO San Juan

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By: Roberto García-Hiraldo, MIC

“We should always get prepared and be ready to face these threats even when a season is forecast to be below normal.”



In the past, rip currents and rough marine conditions have claimed the lives of too many people annually. The National Weather Service Forecast Office in San Juan takes this very seriously.



As part of our effort to achieve our mission to save life and property, we started to issue a number of products to alert residents and visitors whenever hazardous conditions were expected. Today we are proud to report that thanks to this effort and the help of the Puerto Rico Emergency Management Agency (PREMA) and the Virgin Islands Territorial Emergency Management Agency (VITEMA), the deaths associated with rip currents have diminished significantly. However, there is still more work to do. We will continue in our effort until there are no more deaths associated to hazardous marine conditions. We want you to enjoy our beaches and climate and we want you to do it responsibly. We want to encourage you, as you go through your daily activities, to keep abreast of the current weather and marine conditions and be ready to act accordingly.

2016 Climate Review for Puerto Rico and the U.S. Virgin Islands

By: Odalys Martinez, Senior Forecaster

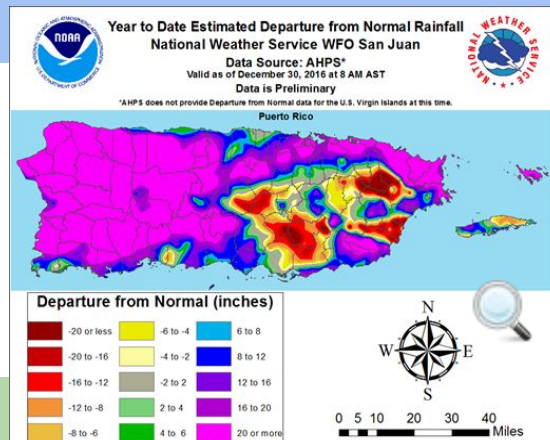
Synopsis

Near normal rainfall was observed across Puerto Rico the first half of 2016 with extremely wet conditions observed during late fall. Warm to hot temperatures were observed across the area. Near to slightly above normal rainfall was observed across St Croix, although Henry E. Rohlsen Airport in St Croix reported below normal rainfall. Near normal rainfall was observed across St Thomas.

For the driest and wettest years on record visit:

<http://www.weather.gov/media/sju/climo/stats/TopYears.pdf>

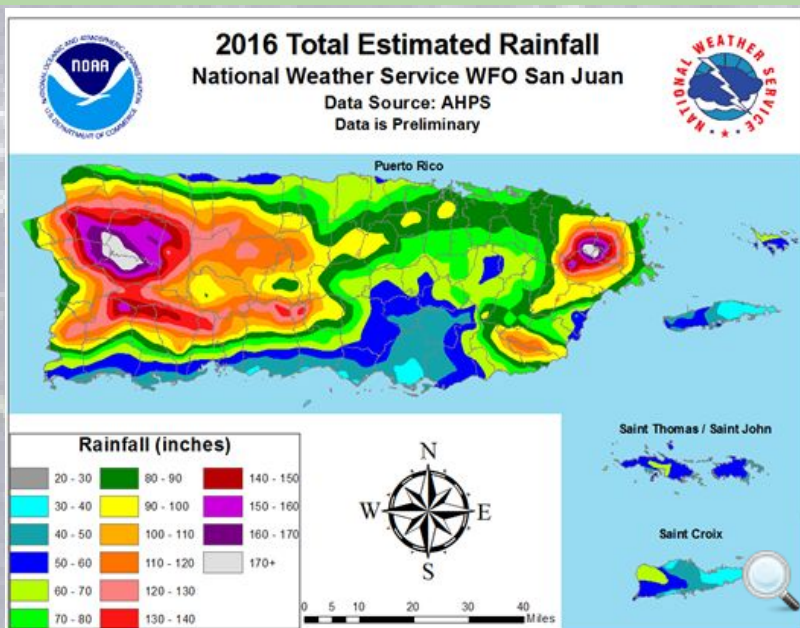
Figure 1.
2016 Departure from Normal Rainfall



Near to above normal rainfall was observed across most of Puerto Rico with warm to hot temperatures. Based on the [Advance Hydrologic Prediction Service \(AHPS\)](#), a surplus of 15 to 20+ inches was reported across western and northern PR (Fig 1), with some areas across the southeast and the eastern interior of the island reporting 50 to 90 percent of its normal rainfall.

Based on the Cooperative Observer Network Data (COOP), a preliminary island-wide rainfall total of 74.21 inches was reported, which is 11.71 inches above the normal rainfall. 34.33 and 45.79 inches were reported across St Thomas/St John and St Croix, respectively (island-wide). This is around 80 and 115 percent of its normal rainfall, respectively.

Figure 2. 2016 Rainfall



For rainfall accumulation and percent of normal per climate division visit:

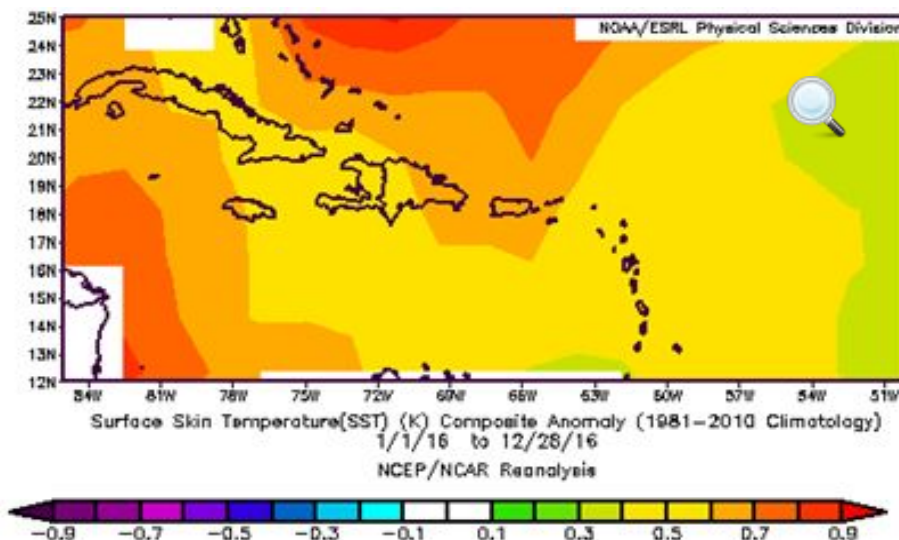
<http://www.weather.gov/sju/averagerainfall>

2016 Climate Review for Puerto Rico and the U.S. Virgin Islands

By: Odalys Martínez, Senior Forecaster

After El Niño reached its peak late in 2015, El Niño weakened to a moderate state by spring 2016 and dissipated by early summer. ENSO neutral conditions were observed late summer/early fall with La Niña conditions noted by late fall. In terms of Sea Surface Temperatures (SSTs); SSTs around the forecast area were above average much of the year (Fig 3).

Figure 3. Surface Skin Temperature (SST) Anomaly for the Caribbean from Jan 1 - Dec 28 2016.



Under a fading El Niño and ENSO neutral/developing La Niña, as well as above average SSTs, near to slightly above normal rainfall was observed early/mid 2016 with wet to extremely wet conditions observed during late fall. Although October and November are climatologically wet months across the local islands, October and November 2016 can be described as wet and extremely wet, respectively. Based on AHPS, 150 to 300 percent above the normal rainfall was observed during November. These showers and thunderstorms produced widespread urban as well as river flooding across most of Puerto Rico.

Minor flooding was also reported across the outlying islands. These wetting rains alleviated the long-term drought, and after 157 weeks with abnormally dry and/or drought conditions, the U.S. Drought Monitor removed PR from its weekly assessment. In terms of temperature, the mean annual temperature for Puerto Rico was 78.5°F which is approximately 1.7°F warmer than the 30-year average from the National Centers for Environmental Information (NCEI).

Temperatures across Puerto Rico ranged from 99°F in Aguirre on the 6th of September, to 52°F in Adjuntas on the 15th of January. This pattern of above normal temperatures was observed across most of the Caribbean region.

2016 Climate Review for Puerto Rico and the U.S. Virgin Islands

By: Odalys Martínez, Senior Forecaster

The shower activity early in 2017 has been observed over and north of the Cordillera Central, Sierra de Luquillo as well as the outlying islands. Based on AHPS, there are 90-day rainfall deficits of 2 to 8 inches with isolated areas near 16 inches across the eastern half of Puerto Rico. Across the U.S. Virgin Islands, and based on primary climatological data sites such as Henry E. Rohlsen AP in Saint Croix and Cyril E. King AP in Saint Thomas, rainfall deficits are near 2 inches. This is consistent with the transition and the onset of the dry season across the local islands. In fact, the U.S. Drought Monitor classifies the south coast and the eastern third of Puerto Rico as abnormally dry.

U.S. Drought Monitor Puerto Rico

February 28, 2017

(Released Thursday March 2, 2017)
Valid 7 a.m. EST

Statistics type:

Categorical Percent Area

Export table:



Week	None	D0	D1	D2	D3	D4
Current 2017-02-28	53.94	46.06	0.00	0.00	0.00	0.00
Last Week 2017-02-21	100.00	0.00	0.00	0.00	0.00	0.00
3 Months Ago 2016-11-29	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 2016-12-27	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 2016-09-27	87.90	7.36	4.73	0.00	0.00	0.00
One Year Ago 2016-03-01	57.00	24.18	13.85	4.97	0.00	0.00

Estimated Population in Drought Areas: 0

[View More Statistics](#)

Intensity:

D0 (Abnormally Dry)

D2 (Severe Drought)

D4 (Exceptional Drought)

D1 (Moderate Drought)

D3 (Extreme Drought)

Typically, the dry season continues across the local islands through the end of March with a transition during April and the onset of the wet season on May. ENSO conditions are currently neutral with no impact on Caribbean rainfall expected. Warm Sea Surface Temperatures (SSTs) in the NW Caribbean may lead to above-average humidity and atmospheric instability going out of the dry season, which tilts the odds towards a wetter first half of the wet season. With SSTs remaining above average throughout the region's, air temperatures, especially at night, are also expected to be warmer than average.

For the seasonal forecast visit or click here:

<http://rcc.cimh.edu.bb/long-range-forecasts/caricof-climate-outlooks>

Something About Our Parent Agency—NOAA

Part One

By: Walter Snell, Senior Forecaster

Introduction

Wherever you see the logo for the National Weather Service (NWS) (upper right hand corner) you'll often see another for the National Oceanic and Atmospheric Administration (NOAA) (upper left hand corner). That is because NOAA is our parent organization.

Did you know?

NOAA is the only federal agency with operational responsibility to protect and preserve ocean, coastal and Great Lakes resources and to provide critical and accurate weather, climate and ecological forecasts that support national safety and commerce.

Forecasting the weather for much of the *world* is a big job, but it is just one piece of the whole task of understanding the physical world. We can do our job better because NOAA is also concerned with the entire environment from the surface of the sun to the depths of the ocean. The National Weather Service provides forecasts, and warnings of severe weather and climate prediction under NOAA, but NOAA also supports marine commerce, fisheries management and coastal restoration. We are proud to be part of their role in protecting life and property and conserving and protecting natural resources through timely information.

NOAA's Mission

NOAA's mission is science, service and stewardship. As with any great endeavor, it doesn't just happen, it requires extensive planning; even more so when you are an agency with a budget of \$5.98 billion (2016 proposed). Part of that planning is outlined in a strategic document called: "[Research and Development at NOAA: Environmental Understanding to Ensure America's Vital and Sustainable Future, A Five Year Strategic Plan 2013-2017](#)".

In the next several issues we'd like to share with you some of the philosophy that guides NOAA, and the goals it has for sustaining the future of the National Weather Service and that of the country as set out in the Five Year Strategic Plan.



Something About Our Parent Agency—NOAA

Part One

By: Walter Snell, Senior Forecaster

NOAA's Vision

NOAA's vision for the Nation: Resilience in the face of change. Research and Development is a critical part of NOAA's mission in that vision. The research objectives and targets represent what results NOAA wants to see. These objectives explain what NOAA will do as they work with their partners in academia, industry, the nonprofit sector and government at all levels.

NOAA has set bold goals despite uncertainty, knowing that some targets may not be met. They expect to learn as much from the results that they do not expect as from those they do. One thing they know: they must make clear goals before trying to reach them.

NOAA's Five Year Plan

NOAA's 5-year plan will guide the activities that NOAA funds or conducts through its internal laboratories, science centers, cooperative institutes, grant recipients, Sea Grant programs and contractors.

"Research" is the 'systematic study directed toward a more complete scientific knowledge or understanding of the subject studied.'

"Development" is the 'systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices or systems or methods, including design development and improvement of prototypes and new processes.'

In the Next Issue

We will explore the requirements NOAA sees for new knowledge and technology as defined by a series of key questions that respond to each goal or objective.

NOAA's Goal

NOAA's goal is to strive for Research and Development that are intended to simultaneously improve their fundamental understanding of the world and yield applications that are both useful and used.

NOAA's Research and Development will lead to improved understanding of the earth-system from global to local scales, improved ability to forecast weather, climate and resources, increased understanding of ecosystem health.

Watch, Warning and Advisory

By: Walter Snell, Senior Forecaster

Watch

VS

Warning

VS

Advisory

In ancient days, no city was without a look out guard on *watch* to sound the alarm of an approaching army. Sailors still stand *watches* on board ships, reporting on sea conditions and approaching ship--or worse--torpedoes. It's the same for weather.

A *watch* is issued if there is a higher potential for something serious to happen something that might be a threat to life or property, whether flooding or tornadoes, severe thunderstorms or tsunamis.

Watches are issued to give heightened awareness to those who need to act quickly during those weather events. The ideal issuance time is 6 to 48 hours before the event. Emergency managers need to bring on extra staffing, add patrols, staff call centers on a 24 hours basis. Marine operators may need to move ships to another less vulnerable coast or bring their fleet into port. Heads of households are responsible to keep a closer eye on children's whereabouts and secure property which might be in danger.

A *watch* is when we "*watch* for the weather" and set things up for quick action that might not be doable on the very short notice that a warning can have. I imagine myself on a hill overlooking the ocean, observing the increasing roar of the waves and *watching* the darkening of the sky in the storm ward direction with a fresh wind blowing. Maybe it will miss us this time.

"The difference is the intensity of the event."

Advisory

Advisories are informational statements. They are a "head's up" that you may want to take the weather into account when planning your day. Examples are Snow Advisories in the winter; they aren't dangerous, but they may make you change your travel plans.

Watch

Watches are issued when conditions are favorable for a severe weather event. When a Watch is in effect for your area, you should begin preparing for any actions you may need to take should the severe weather event occur.

Warning

Warnings are issued when a severe weather event is occurring or is imminent. If a Warning is issued for your area immediately take action. If it is a Flood Warning, get to higher ground. If it is a Tornado Warning, get to the lowest point in your home.



Does something happen every time a *watch* is issued? Well, hopefully, no! If it did, then we could just issue the *warning* with a longer notice. A *watch* means the event is inherently uncertain or too far away to be sure: the dark sky or ocean from which disaster may not come, like a hurricane 500 miles away. Generally speaking, if the event happens 3 out of 10 times in the long run, we've got the uncertainty level about right. *Warnings* and *advisories* are much more certain. In fact, it is likely that the event is already underway.

Watch, Warning and Advisory

By: Walter Snell, Senior Forecaster

Watch vs Warning vs Advisory

With *watches* out of the way, remembering the difference between *warnings* and *advisories* is much easier. The difference is the intensity of the event.

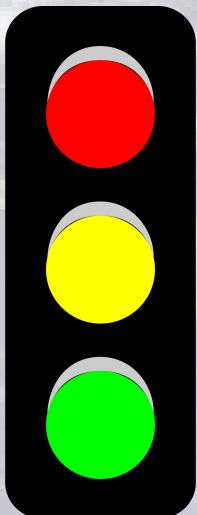
Say that you give someone *advice* about how to get that gum off their carpet. If they don't follow your advice, well, they might get sticky shoes. It is the yellow light at the intersection.

The light is about to change. But if you give someone a *warning* that the bridge is out on the road they are travelling—if they don't follow the *warning*, the consequences would likely be fatal!

Again it is the same for weather. The consequences of an *advisory* are minor, nuisance or perhaps at worst leading to some unwanted expense or cost.

Consider a flood *advisory* for ponding on roads from streams flowing over their banks or poor drainage: The car might stall in deeper than expected water. The tow truck or car repairs could be costly—but usually no one dies. A small craft *advisory* is similar. Some expert sailors might do just fine. And, if the boat capsizes, they might spend a long time in the water—but they'll be okay—if they don't get hit by the boat on the way over.

On the other hand, a *warning* means conditions are dangerous. It is the red light at the intersection—proceeding could be fatal. We warn on flooding that carries the car away and drowns the occupants or the tornado that rips apart homes used as shelter and injures or kills those trying to hide.



Do warned events always happen?

We hope so!

Even if 20% prove to be false alarms, we are still pleased. We want to catch all events. Of course one cannot count on flooding under an advisory to be minor, conditions can and do change. But when we find out about them the *advisory* is upgraded to a *warning*. And that's the difference between *watches*, *warnings* and *advisories*.

How to Submit a Report to the NWS

San Juan, Puerto Rico

By: Félix Castro, Senior Forecaster

Hit Link!

In
English

Hit Link!

In
Spanish

NWS Storm Report Home New About Contact

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Submit a
Storm Report
to the National Weather Service San Juan,
Puerto Rico

This interface is intended to be used solely for the relay of storm information to the NWS. Other comments or information should be sent to the National Weather Service San Juan, Puerto Rico.

Event Location
for date/time/location. Please reference to major roadway or intersection
for location information.

Date: (Dec 10 2016)
Time: (06:10:00 AM x Atlantic)

NOTE: Select a Country: (US (WGS84))
Unable to process your submission.
Error Message: (Location permission denied)

2. Event Type (Select all that apply)
Flood
Hail
High Wind Speed
Tornado/Funnel Cloud
Wind Damage
Heavy Rain

3. Additional Details
Provide any additional information that you feel is pertinent to your submission (500 characters maximum).

4. Contact Information
VOLUNTARY and WILL NOT be distributed.
Your Name: (Your Name)
Spotter Id (if assigned): (Spotter Id (if assigned))
Email address: (Email address)
Phone number: (Phone number)
Observer Profile: (General Public)

NOTE: If you have any questions about reporting weather and/or using this reporting form, please contact the SJU Webmaster.

NWS Storm Report Home New About Contact

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Where are we moving?

Impact Decision Support Services (IDSS)

By: Carlos Anselmi, General Forecaster



Figure 1. U.S. National Weather Service/Weather Forecast Office-San Juan IDSS Activities.
A) Meeting with US Forest Service staff to discuss decision making tools & future protocols.
B) Press conference about Tropical Cyclone Impacts. C) Federal and State Deep Partners from the U.S. Virgin Islands and Puerto Rico. D) Drought monitor meeting.

It is imperative for our Country and Organization that we adapt to the upcoming challenges as a science and technology driven agency. Since we seek to provide a high-quality service to save life and property and enhance the economy we must go a step beyond to help our users and partners better exploit NWS products. This will give our public and private sector partners access to all the available tools they need to plan for and to guide the preventive action required to avoid the impacts from any weather misfortune. Impact-Based Decision Support Services (IDSS) is the name for the suite of services we will develop and our focus in providing relevant information to our users and partners. With this information they will be able to plan effectively, and make the best decisions to secure our safety and the economy of the nation.

The National Weather Service (NWS) faces big changes in the upcoming years. Some of these changes are related to population growth and infrastructure vulnerability, resulting in a society more exposed to weather and climate change.

Where are we moving?

Impact Decision Support Services (IDSS)

By: Carlos Anselmi, General Forecaster

The NWS-Weather Forecast Office-San Juan (WFO-SJU) is committed to directing its efforts in fulfillment of our new vision by focusing on identifying the needs of our public and private partners and arranging the means to satisfy those needs. We have been conducting meetings with different agencies to understand what meteorological products they use and how they are using them. In order to have well-informed partners, who can make enlightened decisions for preparations both ahead of and during ongoing-events that would minimize the impacts associated with hazardous weather, we provide support and outreach material. For example, Puerto Rico and the U.S. Virgin Islands were affected by a historic drought during the years 2014 and 2015.

Our office, NWS-WFO-San Juan, worked hard and tirelessly to assist the Drought Committee with the interpretation of Climatological and Meteorological data during the decision making process. This is one of many examples that prove that we are forever committed to serve our partners and to do whatever is necessary to maintain and continually improve the standards and tools necessary to protect life and property.



Key Elements of IDSS?



- Better understanding societal impacts,
- Making our information more relevant to decisions
- Participating directly in decision-making for those decisions fundamental to the role of government, especially protection of life and property
- Counting on market forces to provide diverse decision-support services across the entire economy.

Only by knowing, understanding and working with our partners will we be able to go beyond and to continue providing the high quality and effective service that we have been providing for many years. You can rest assured that it is in this spirit of high ambition that the U.S. National Weather Service will adapt to this fast-evolving era, and become more capable and agile at providing the high quality service, to which you are accustomed, and thus to create a truly Weather Ready Nation.

The Upper Air Program

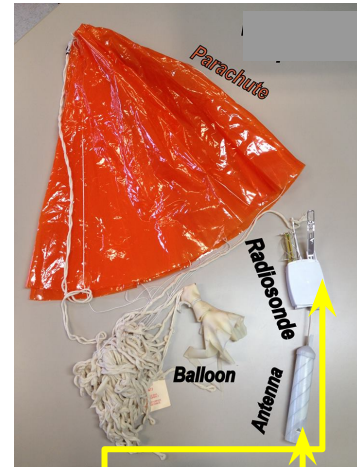
By: Gabriel Lojero, Meteorologist Intern

Since 1930, the National Weather Service (NWS) has measured vertical profiles of pressure, temperature, relative humidity, and wind velocity through the use of balloon and radiosondes. Radiosonde data are essential for accurate weather forecasts.

The coded message containing data from the observation are provided to the telecommunication system for dissemination to government agencies and other data users. The NWS participates in the WMO's World Weather Watch Program by maintaining and operating a network of Rawinsonde stations in the contiguous U.S. There are 69 sites in all: Alaska Region (13), Caribbean (1), and (9) Pacific Region.

Standard observations from all network stations are scheduled twice daily, at 0000 and 1200 Coordinated Universal Time (UTC). Locally, the balloon release is at 7 AM and PM, although the data is recorded as 8 AM and PM observations.

Some
News
Never
Get Old!



The radiosonde is a small instrument carried by a large balloon inflated with hydrogen or helium. The radiosonde is comprised of sensors that measure temperature, humidity, and barometric pressure, a radio transmitter to relay the sensor measurements, a battery and a GPS.

The observation can last up to two hours, with the radiosonde reaching an altitude of over 30 kilometers. During the observation, the radiosonde is exposed to temperatures as cold as -95° Celsius (C), RH values ranging from 0 to 100%, and air pressures of only a few thousandths that of the Earth's surface. A small parachute slows the descent of the radiosonde, minimizing the danger to people and property when it returns to the surface. If a radiosonde is found, it can be sent to the National Logistics Supply Center (NLSC) in the pre-addressed post-paid envelope provided. Usually, due to our geographical location, the radiosondes are lost in the ocean. The reconditioned radiosondes are reused, saving the NWS the cost of a new instrument.

An antenna is used to collect the radio signal. A computer is used to determine the sonde's location, process, encode, and disseminate the data.

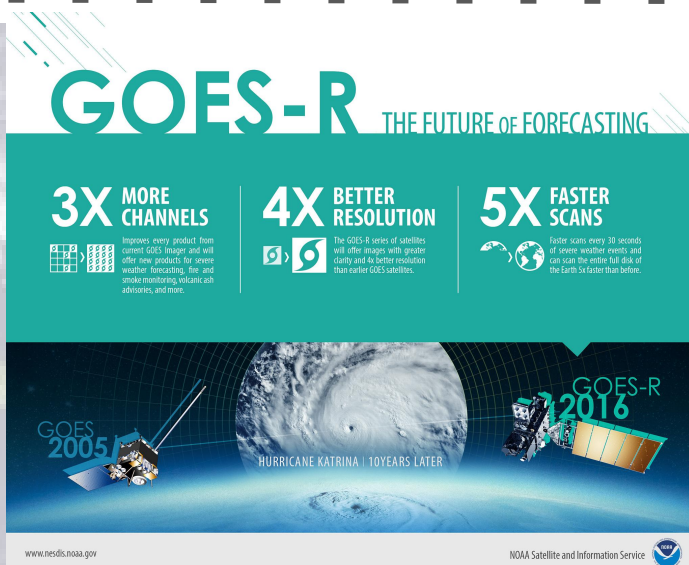
If you want to learn more about The Upper Air Program you can access it at: [UA Program](#)

GOES-R: Next Generation of Environmental Monitoring

By: Ernesto Rodriguez, Science Operations Officer



The new GOES-R satellite was successfully launched on November 19, 2016 at 6:42 PM AST from the Kennedy Space Center in Florida. The GOES-R Series Program is a collaborative effort between the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) to develop, launch and operate the satellites. The new geostationary satellite (GOES-R) represents a major step forward in the observational capabilities available to the NOAA National Weather Service (NWS). The U.S. Secretary of Commerce, Penny Pritzker, described this innovation as: “a quantum leap in weather observation, comparable to moving from black and white TV to HDTV.”



GOES-R will have 3-times the channels (spectral bands), 4-times the resolution, and it could scan 5-times faster than the GOES-13, GOES-14 and GOES-15 satellites.



Basically, GOES-R will provide images of weather pattern and severe storms as frequently as every 30 seconds, which will contribute to more accurate and reliable weather forecasts and severe weather outlooks. In addition, GOES-R will have the first-ever Geostationary Lightning Mapper (GLM) to provide near-instantaneous lightning observations.

GOES-R: Next Generation of Environmental Monitoring

By: Ernesto Rodriguez, Science Operations Officer



GOES-R will be known as GOES-16 once it reaches geostationary orbit. It will hover over the equator at 89.5° west while it undergoes an extended checkout and validation phase of approximately one year. Then, it will transition to operations immediately afterward. The final GOES-R's operational orbit has not yet been determined.

Currently, all the NWS operational forecasters are preparing for the use of this new observation capability. The objective of the GOES-R professional development courses is to highlight the improvement in spatial and temporal resolution and additional new channels that will be available. These courses will also explain in detail new products and imagery that address a broad range of applications.



By using this great new technology and working with our partners we will be able to take another step forward into becoming a Weather Ready Nation.



Learn more about GOES-R at
www.goes-r.gov

Photo Credit: NOAA Satellites

New Webpage Look

Submitted by: *Xiomara Cruz, Administrative Support Assistant*

The image shows a screenshot of the National Weather Service (NWS) San Juan website. The page features a header with the NWS logo and navigation links: HOME, FORECAST, PAST WEATHER, SAFETY, INFORMATION, EDUCATION, NEWS, SEARCH, and ABOUT. Below the header, there's a section for 'Local forecast by "City, St" or ZIP code' with an input field and a 'Go' button. A 'Customize Your Weather.gov' sidebar is on the left, allowing users to enter their city, state, or ZIP code and choose to remember their preferences. The main content area displays 'NWS San Juan, PR' and a 'Wednesday Morning Forecast' with a map of Puerto Rico showing weather conditions. A yellow starburst graphic with the text 'Click Here!' points to the 'News Headlines' section. A blue callout bubble with the text '<<Better Graphics>>' points to the forecast map. A yellow callout bubble with the text '<<New Product Selector>>' points to a 'Text Product Selector' dropdown menu. A yellow callout bubble with the text '<<Direct Links>>' points to a grid of icons representing various weather products: Tropical, Marine, Beach, Observations, Climate, Storm Reports, Hourly Forecast, Gridded Forecast, Satellite, Fire Weather, Hydrology, and Aviation. A green callout bubble with the text '(Click Tropical)' points to the Tropical icon. A green callout bubble with the text '(Click Facebook)' points to the Facebook icon. A green callout bubble with the text '(Click Tweets)' points to a tweet from @NWSSanJuan. A green callout bubble with the text '<<New Shortcuts for Social Media>>' points to a section showing tweets and Facebook posts from NWS San Juan.

Are You Interested?

Major: Atmospheric Sciences and Meteorology

Submitted by: Xiomara Cruz, Administrative Support Assistant

Meteorology is the field of science that seeks to understand and predict short-term weather as well as long-term climate processes.

Explore atmospheric sciences and meteorology studies and whether it's the right major for you. Learn how to find schools and universities with strong programs for this major.

Meteorology students study the atmosphere (the gases that surround the earth), focusing on the weather and how to forecast it. Areas of study include the climate, the physics of the atmosphere, and chemistry.

Are You Ready To...?

- Go to graduate school if you're interested in conducting research
- Spend time in labs
- Keep up with continually changing technology
- Solve endless problems in calculus, chemistry, and physics
- Collect and interpret data, such as the speed and direction of a storm

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Source: Atmospheric Sciences and Meteorology College Degree Programs -
The College Board

<https://bigfuture.collegeboard.org/majors/physical-sciences-atmospheric-sciences-meteorology>

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