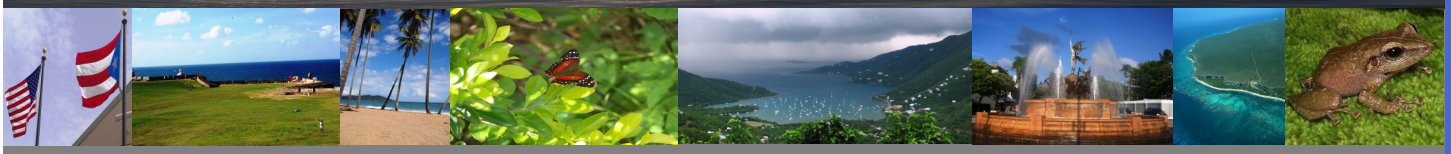
The Whispering Trades



VOLUME 1, ISSUE 2

DECEMBER 2013

National Weather Service | San Juan, Puerto Rico

From the Desk of the Meteorologist In Charge

By: Roberto García

INSIDE THIS ISSUE:

Greetings! It is a great pleasure to write to you as the Meteorologist- In- Charge of the National Weather Service Office in San Juan, Puerto Rico.

It has been an honor to serve the Puerto Rico and The U.S. Virgin Island residents and visitors for the past year. Although the 2013 hurricane season was relatively quiet for the eastern Caribbean, it was not uneventful. We had the threat of two developing tropical cyclones, first Tropical Storm Chantal in July and second, Tropical Storm Gabrielle in September. In addition, the San Juan Metropolitan area experienced record breaking rainfall during the latter part of July as an active tropical wave affected the region. This event alone caused more damage and disruptions than any of the aforementioned cyclones. This event also served as a reminder that it does not have to be a tropical storm or hurricane to pose a threat to life and property.

The 2013 Atlantic Hurricane Season is now over, but the message will continue to be the same for future seasons. It does not matter how active or inactive a season is expected to be, "it only takes one". We should always be prepared and review our family preparedness plan before the beginning of the season.

Now we move into the driest and coolest portion of the year, December through March. During this part of the year, we are more focused on the holidays and weather conditions tend to be relegated to second place. However, even during the dry season, significant weather events can occur that could pose a threat to life and property. Events like the Three Kings Day flooding in 1992 come to mind in which over twenty people lost their lives as they were going home from the day's festivities.

This year I invite you to celebrate responsibly with your relatives and keep aware of the latest weather conditions and forecasts by visiting our webpage at www.weather.gov/sanjuan.

I hope you find the following articles in this 2013 winter (holidays) version of WFO San Juan Newsletter informative.

Roberto Garcia, MIC

Record Rainfall event of the July 18 Tropical Wave: Synopsis

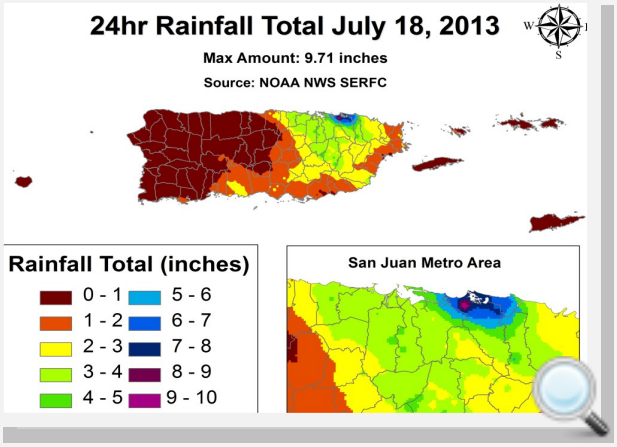
By: Amaryllis Cotto

During the night hours of July 17, 2013, a tropical wave (TW) moved across the Lesser Antilles. By the early morning hours of July 18, at approximately 7 am, it slowly moved westward making its way towards the U.S. Virgin Islands' Atlantic and Caribbean waters.

Thereafter, it continued to intensify, peaking during the early afternoon hours over the eastern half of Puerto Rico, including Vieques, Culebra, and the U.S. Virgin Islands. During these hours, very heavy rainfall, intense frequent lightning, downbursts, gusty winds, severe flash floods, and mudslides affected these regions.

The most significant outcome from this TW was the accumulated rainfall total of 9.23 inches recorded at the Luis Munoz Marin International Airport and in the San Juan Metro Area. This broke the past daily rainfall record which was established by Hurricane Hugo on September 18, 1989.

This event also placed the month of July as the wettest July on record with a total of 14.18 inches of accumulated rainfall. To that date, 2013 was then ranked as the third wettest start to a year at the San Juan Metro Area with 50.00 inches.

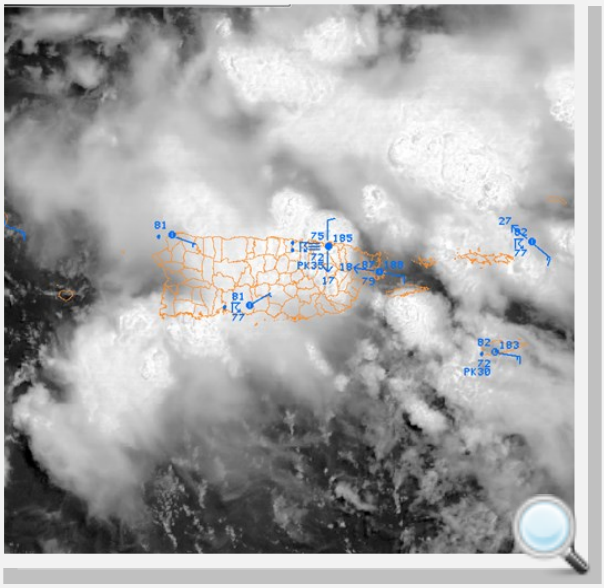


Map with the 24 hours rainfall totals on July 18 for Puerto Rico and the U.S. Virgin Islands.

The Weather Forecast Office in San Juan alerted the public of the approaching TW several days ahead of time and indicated the high humidity levels embedded within the system. The dynamic configuration during this event was very complicated and rare; examination of exactly how the dynamics influenced and interacted with one another is currently being analyzed.

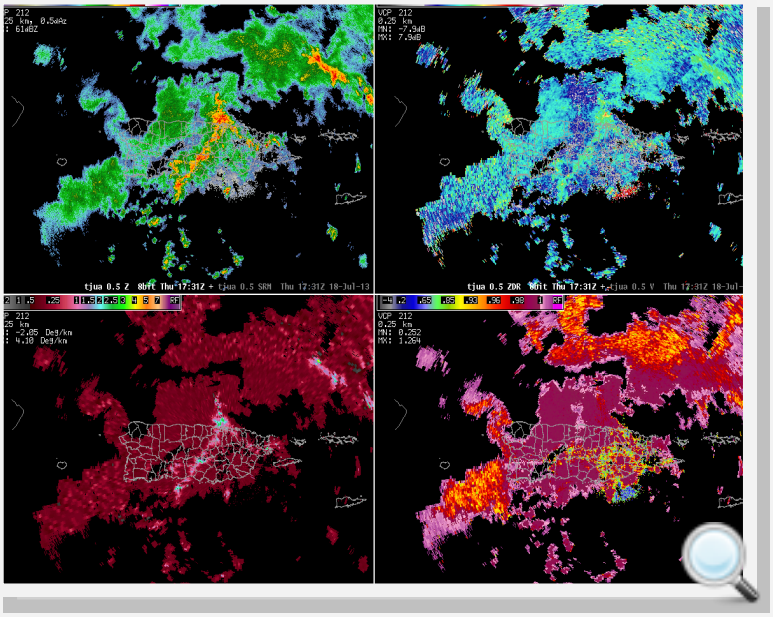
Based on the satellite imagery of July 17 and 18, the TW moved quickly at approximately 20-25 knots over the eastern Atlantic and slowed significantly once reaching the eastern region of the local islands. Satellite; visible and water vapor imagery also depicted strong winds advecting lines of moisture and convection from the Intertropical Convergence Zone located to the south of the region.

Record Rainfall event of the July 18 Tropical Wave (Cont.)



Visible imagery from July 18, 2013, 1545z (11:45 am AST).

Conceptually, the interaction between merging winds, strong convection, outflow and sea breeze boundaries intensified the already chaotic activity concentrated across the eastern half of the region. The Dual Pol radar, Water Vapor and Visible imagery clearly depicted these interactions.



Radar imagery from July 18, 2013 1731z (1:31 pm AST) at 0.5 degrees. Top left: reflectivity. Top right: ZDR. Bottom left: KDP. Bottom right: CC.

The dense cloud coverage across the western half of Puerto Rico restricted the diurnal heating which then greatly inhibited the development of convection over this area. Climatologically, diurnal heating is a major factor in the development of showers and thunderstorms during this time of the year.

Behind the Scenes at PR Emergency Management Agency

By: Krizia Negrón

July 18, 2013 will be remembered by the staff at NWS San Juan as the "9.23 inches of rainfall day". Although a Flash Flood Watch was in place since the previous night, it was particularly difficult to anticipate a rainfall event that turned into such a rare, extreme event. It was so rare that it became the wettest day on record at the Luis Munoz Marin airport in San Juan. The previous record was set during the passage of Hurricane Hugo across our area, with a total of 8.84 inches on September 18, 1989.

The Center of Emergency Operations (COE) of the Puerto Rico Emergency Management Agency (PREMA) got to work within an hour of activation. Locally, during these type of events, our personnel are at the weather office issuing advisories and warnings, getting reports from the public and media, doing interviews and alerting people about the current conditions. However, on this particular day, I got "stranded" at the COE, thus getting the opportunity to witness how different State personnel work hand-in-hand to help the public during emergency situations.

At the COE, many coordination calls and interactions take place within minutes as the emergency evolves bringing together numerous emergency agencies. No matter the type of emergency, the COE gets activated and their ultimate goal is to make sure every situation is being handled as quickly as possible. While on site, I was able to keep direct communications between COE and the NWS office, aiding with the flow of reports and weather updates between the offices.

I also got the opportunity to brief senior officials of some cooperating agencies, including the Secretary of the Governor of Puerto Rico. This exceptional opportunity made it clear than when we work together with the common mission of saving life and property, it is possible to achieve this goal.

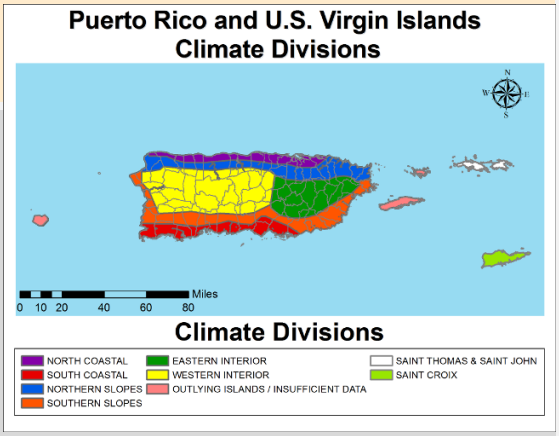
Meteorologist Intern Krizia Negron (seated) gives a weather briefing to PREMA's director Miguel Ríos and personnel.

Local officials assisting during flooding. Photo from local newspaper.

Regional Climate Summary through December 5, 2013

By: **Odalys Martínez**

Statistically, 2013 began with a rainfall deficit across the local islands with just 56% of the normal precipitation falling across all of Puerto Rico and USVI. The scenario changed around March and April when the transition toward the wet season started, however dryness persisted across the southern areas of Puerto Rico. From May through August, a rainfall surplus of about 26 inches was reported at TJSJ with 121% of the normal precipitation falling across all Puerto Rico. In fact, summer 2013 was the second wettest summer on record at TJSJ with a rainfall total of 32.88 inches between June and August. One of the factors for this rainfall surplus was a strong tropical wave that affected the area on July 18 (see article pages 2-3 about the Record Rainfall). Beginning in September and continuing into October, a deficit in rainfall accumulations was notable across the local area. This deficit was associated with a lack of tropical systems across the local area (see article page 10 about the 2013 Hurricane Season).



Climate data through December 5 indicates that during the calendar year of 2013, the average maximum temperature at the Luis Muñoz Marin International Airport (TJSJ) in San Juan Puerto Rico was approximately 0.2 ºF warmer than the 30 year average as computed from the National Climate Data Center (NCDC). The average temperature was below normal for 31% of the year; while above normal temperatures were observed 43% of the year. The average minimum temperature at TJSJ was 75.3 ºF, which is 0.1 ºF below normal in respect to the 30 year average. The highest maximum temperature reached at TJSJ this year was 96 ºF on Sunday September 29, breaking the old record of 94 ºF set back in 2001. It has not been that warm since September 18, 1995. Across the U.S. Virgin Islands, the mean annual temperature at Henry E. Rohlsen Airport (TISX) in Saint Croix and Cyril King Airport (TIST) in Saint Thomas was 80.7 and 81.1 ºF, which is 0.3 and 0.5 ºF above normal respectively.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	ANNUAL
North Coastal	78%	52%	120%	71%	213%	196%	184%	125%	71%	80%	111%	118%
South Coastal	22%	69%	90%	126%	67%	59%	87%	57%	148%	67%	92%	80%
Northern Slopes	60%	46%	110%	50%	165%	113%	150%	102%	172%	66%	108%	104%
Southern Slopes	28%	64%	104%	88%	81%	88%	119%	88%	141%	72%	113%	90%
Eastern Interior	78%	61%	155%	97%	141%	127%	132%	113%	108%	87%	81%	107%
Western Interior	45%	51%	121%	113%	158%	130%	129%	93%	70%	77%	102%	99%
Saint Croix	80%	61%	141%	126%	164%	273%	85%	144%	94%	72%	125%	124%
Saint Thomas/ Saint John (white)	70%	37%	129%	82%	154%	140%	129%	102%	87%	42%	191%	106%

Tabular Display of normal precipitation per climate zones for 2013. Data retrieved from 52 COOP stations across Puerto Rico and US Virgin Islands.

In terms of precipitation, 2013 currently ranks as the 6th wettest year in nearly 115 years of record keeping in the San Juan Metro Area. A rainfall total of 81.87 inches was reported at TJSJ, which is 29.67 inches above normal. Not surprisingly, 2013 also ranks as the 4th wettest year on record at TIST with a rainfall total of 52.50 inches. Overall, 2013 has produced 220 days of measurable rain at TJSJ, which means 65% of days where 0.01 inch or more accumulated. Meanwhile, 138 and 157 days of measurable rain were reported at TIST and TISX respectively, resulting in 44 and 46% of the days where 0.01 inch or more accumulated.

Tornados: They can occur in Puerto Rico

By: **Carlos M. Anselmi-Molina, Ernesto Rodríguez and Robert Mitchell**

During this year, our office received several reports of tornadoes across our County Warning Area (CWA). This uncommon atmospheric phenomenon has awoken the curiosity of our islanders. For that reason we would like to explain how and why they occur.

First of all, let's define a tornado. It is a violently rotating funnel shape column of air that extends from the base of a thunderstorm to the ground, if it does not touch the ground; it is known as a funnel cloud. Many people are confused about the difference between a Waterspout and a Tornado. Although both are rotating columns of air in contact with a surface, the waterspout is in contact with water. As soon as a waterspout moves inland, it is then called a tornado.

The second question that inevitably comes to mind after we define a tornado is: how does a tornado form? Some of the most devastating tornadoes form from supercells, which are rotating thunderstorms with well-defined inner circulations, or mesocyclones (NOAA Severe Storm Laboratory). However, tornados in Puerto Rico form mainly from pulse storms or multicells and in a relatively low-shear environment. Although in Puerto Rico vertical wind shear is usually low, some shear (change of wind direction and/or speed) is needed to create horizontal vortices near the ground. As those horizontal vortices interact with the local topography, they get tilted and tornadoes can form (Figure 1).

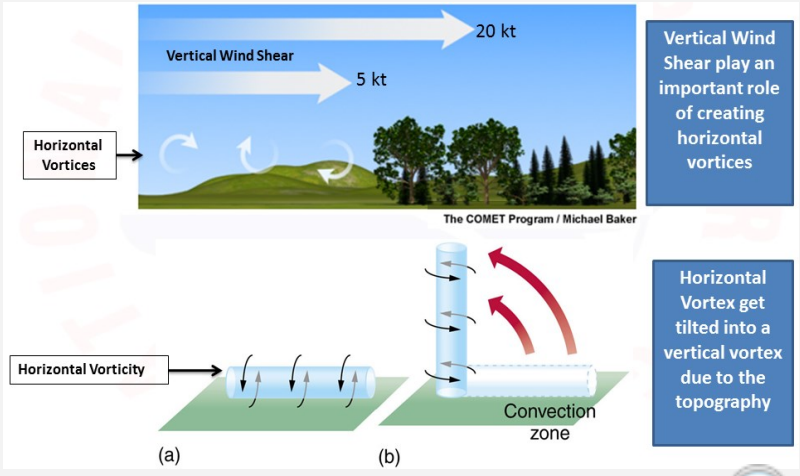


Figure 1. Vortices interaction with topography. Vertical wind shear is a change of winds (velocity and/or direction) with height.

We have pieced together part of the puzzle; now, let's review what occurred on October 1, 2013 in Aguada, PR. The environmental conditions were characterized by ventilation aloft induced by a Tropical Upper Tropospheric Trough (TUTT) just east of Puerto Rico. At low levels, a surface high pressure north of the area was producing a northeasterly trade wind flow across the Northeast Caribbean Islands. Those conditions enhanced the development of afternoon convection over southwestern Puerto Rico. At 2:45 PM AST, one thunderstorm deviated to the right of the mean flow. As the right mover storm moved northwest, it interacted with the local topography augmenting the low level wind convergence and the rotation of the storm.

Tornados: They can occur in Puerto Rico (Cont.)

A collision of outflow winds (boundary collision) generated from the strong thunderstorm and the sea breeze front (Figure 2), occurred along the boundary between Añasco and Aguada.

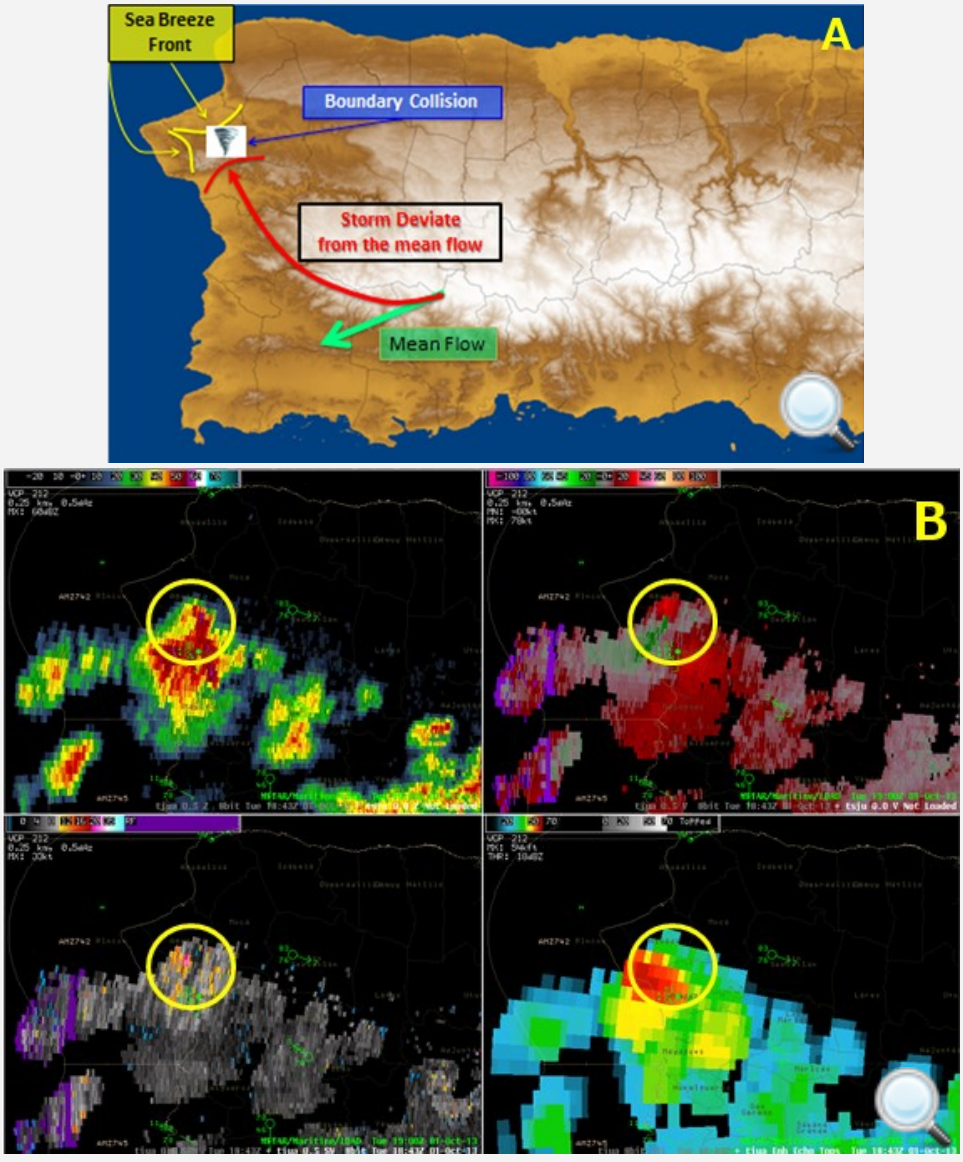


Figure 2. Scenario that happened at Barrio Atalaya, Aguada, PR. A) Local topography enhanced the low level convergence and the rotation of the storm. B) Radar scans at 2:45 pm AST on Oct 1, 2013. Top left: hook echo showed by the radar reflectivity (Z) product. Top right: storm relative motion (SRM) showed a gate-to-gate signal. Bottom left: shear variations observed with the spectral width product. Bottom right: maximum echo top seen by the radar was 54,000 ft.

This collision created the perfect environment for the formation of a tornado and the rest, like they say, “is history”.

The Tsunami Ready Program at NWS San Juan

By: Ernesto Morales

The National Weather Service's TsunamiReady recognition program is a collaborative effort involving emergency management officials at the federal, state, and local levels in cooperation with local communities which promotes the preparation for areas with a tsunami risk.

Since 2006, The Seismic Network of Puerto Rico (Red Sísmica de Puerto Rico, RSPR) and the National Weather Service have worked together to implement the TsunamiReady program. As a bonus, this program has helped emergency managers strengthen their local operations and infrastructure. TsunamiReady communities are better prepared to save lives through better planning, education and awareness. Communities have fewer fatalities and property damage if they plan before a tsunami arrives. No community is tsunami proof, but TsunamiReady can help minimize loss to communities. Many of our schools, playgrounds, hospitals, factories and homes are often built in areas vulnerable to tsunamis. The TsunamiReady Program, developed by the National Weather Service, is designed to help cities, towns, counties, universities and other large sites in coastal areas reduce the potential for disastrous tsunami-related consequences. In Puerto Rico, NOAA has granted funds to the RSPR to assist municipalities so that they can achieve TsunamiReady designations. As of Dec 18, 37 of the 44 coastal municipalities of Puerto Rico, including Culebra and Vieques, are recognized as TsunamiReady. The final seven municipalities are very near completion and working to fulfill the program requirements. The National Weather Service is also working with the U.S. Virgin Islands Emergency Management Agency (VITEMA) to make the U.S. Virgin Islands TsunamiReady by early 2014. Recently, their evacuation zones and routes have been submitted and approved by the Governor.

For a municipality to be recognized TsunamiReady they need to fulfill the requirements established by the National Weather Service and the local TsunamiReady Committee. The key to the success of this program is the education of the public. The municipalities are required to develop and participate in educational campaigns. Also, they are required to participate in a drill/exercise annually. Depending on the population of the municipality, they are also required to implement different methods of reception and dissemination of the bulletins and alerts from the NWS and RSPR.

It's very important for all Puerto Rico and U.S. Virgin Islands citizens and visitors to learn about the Tsunami danger; especially what to do during a Tsunami event. Visit the Seismic Network webpage at http://redsismica.uprm.edu/ to find the evacuations maps (under "Tsunami") or call your local emergency management officials for more information.

NWS San Juan Gives Back to the Community

By: Krizia Negrón

As part of the 3rd Annual NWS Week of Service, part of our staff and their families gathered on the morning of Sep 21, 2013 in Dorado to take part in the International Coastal Cleanup.

This worldwide event mobilized millions of people in the world's largest volunteer effort for our oceans and waterways. Locally in Puerto Rico, Scuba Dogs Society gathered donations and offered training to "captains" who had volunteered to be "leaders of a beach".

From our office, Meteorologist Intern Krizia Negron volunteered to be the event's Captain, organized the staff and off they went to Dorado.

At the beach, they collected trash and tabulated their findings.

"It was a great opportunity to give back to our community and get a good morning workout!" said Negron as they finished tabulating the numbers. The staff then enjoyed a light lunch to conclude their volunteering efforts.

NWS Employees get together in Mayagüez, PR

By: Althea Austin-Smith

On August 29, 2013, Jeffrey Cupo, chief of the Operations Support Services branch at the NWS Southern Region Headquarters in Fort Worth, Texas wrapped up his visit to the NWS San Juan office with a trip to Mayagüez to meet with Christa von Hillebrandt-Andrade, manager of the NOAA National Weather Service Caribbean Tsunami Warning Program. The Caribbean Tsunami Warning Center is collocated with the Puerto Rico Seismic Network at the University of Puerto Rico in Mayagüez. In attendance with Mr. Cupo was Roberto Garcia, Meteorologist-in-Charge, Ernesto Morales, Warning Coordination Meteorologist, Edward Tirado, Supervisory Information Technology Specialist and Althea Austin-Smith, Senior Service Hydrologist, all of the NWS San Juan office.

Left to right: Jeffrey Cupo, Roberto Garcia, Christa von Hillebrandt-Andrade and Ernesto Morales

The purpose of the visit was to obtain a small tour of the re-vamped facilities of the Center and to offer any other assistance that might be necessary in the near future. These meetings are vital since NOAA plays a supporting role in the operations of the Caribbean Tsunami Warning Center and the Puerto Rico Seismic Network. Roberto Garcia sums it up nicely when he states, "visits with other NWS and NOAA offices in Puerto Rico and the U.S. Virgin Islands are important because it gives us the opportunity to continue to improve the communication, collaboration and support of each other with the common goal of providing citizens, planners, emergency managers and other decision makers with lifesaving information when they need it."

Student Volunteers at NWS San Juan during Summer 2013

By: Ernesto Rodríguez

Four students enrolled in undergraduate programs of meteorology and mechanical engineering participated as volunteers at the NWS San Juan this past summer. Each student spent approximately 200 hours at the office, mainly working on small research projects. They also had the opportunity to understand the work done by our forecasters, hydrologist and meteorological technicians in the operational forecast area and/or in the field.

Suheily Lopez, a meteorology student from University of Puerto Rico at Mayaguez (UPRM), worked with General Forecaster Ernesto Rodriguez on a research project called "Determining weather parameters, indicators for presence of Severe Weather in Puerto Rico". Emmanuel Rodriguez, another meteorology student from UPRM, worked also with Ernesto Rodriguez on a project called "Prevailing weather conditions during waterspout events around Puerto Rico and the U.S. Virgin Islands". Karily Villanueva, a meteorology student from Penn State University (PSU), worked with Senior Forecaster Odalys Martinez on a research project called "Relating the North Atlantic Oscillation and El Niño Oscillation to precipitation patterns in Puerto Rico and the U.S. Virgin Islands". Luis Tavarez, an engineering student, also from UPRM , worked with the Science and Operations Officer, Gary Votaw on a research project called "Remote Sensing Equipment and Saharan Dust". The last week of July, the students presented the results of their research projects to the entire staff during an operational meeting.

If your are interested, this Student Volunteer Program will be available again the summer of 2014. You have to be a graduate or undergraduate student enrolled in a science-based program in order to be considered for a volunteer position at NWS San Juan. Contact Roberto García, our Meteorologist in Charge for more information.

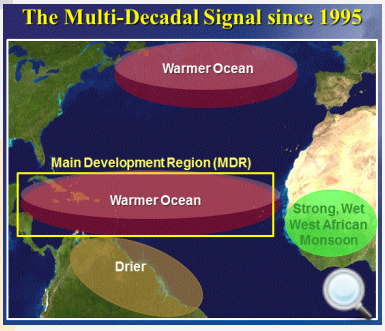
Left to right: Emanuel Rodriguez -UPRM, Luis Tavarez -UPRM, Roberto Garcia -MIC/NWS San Juan, Karily Villanueva –PSU and Suheily Lopez - UPRM.

A Quiet 2013 Atlantic Hurricane Season

By: Félix Castro

Expectations were high for a very active 2013 Atlantic hurricane season. Most ingredients needed to produce an active season were there. Favorable atmospheric conditions and sea surface temperatures were there. The pre-season NOAA forecast called for a very active season with 13-19 storms, 6-9 hurricanes and 3-5 major hurricanes. Through November 30, 13 storms developed, most of them as weak storms with winds not exceeding 50 mph. Only 2 reached hurricane status, both as a minimal category 1 hurricane. No major hurricane developed.

What really happened? At this point, there are three factors that can be linked to this lack of activity in the Atlantic Basin. Firstly, the presence of dense Saharan dust which produces very stable air and does not favor tropical cyclone formation. Secondly, long periods of very dry air at mid-levels of the atmosphere, which also inhibited or hindered the development of tropical cyclones. Thirdly, there is a possibility that we are entering into the multi-decadal phase of below tropical cyclone activity. Tropical multi-decadal signal has contributed to the Atlantic high activity era that began in 1995. This multi-decadal signal is linked to above-average sea surface temperatures in the Main Development Region. For Puerto Rico and the U.S. Virgin Islands, after a busy start with Tropical Storm Chantal in July, and Tropical Storm Gabrielle early in September, everything became quiet, with no other major threat to our local islands.



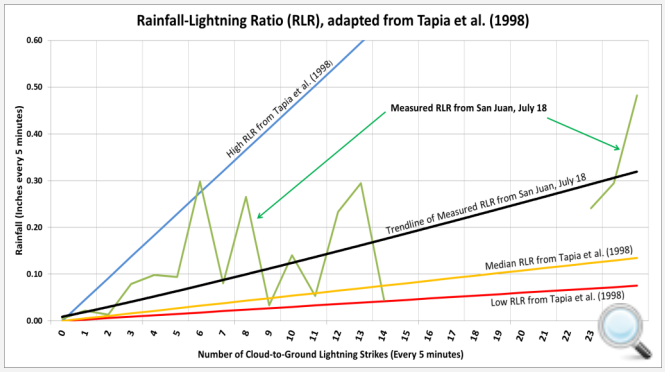
Lightning Strikes and Storm Intensity

By: Gary Votaw

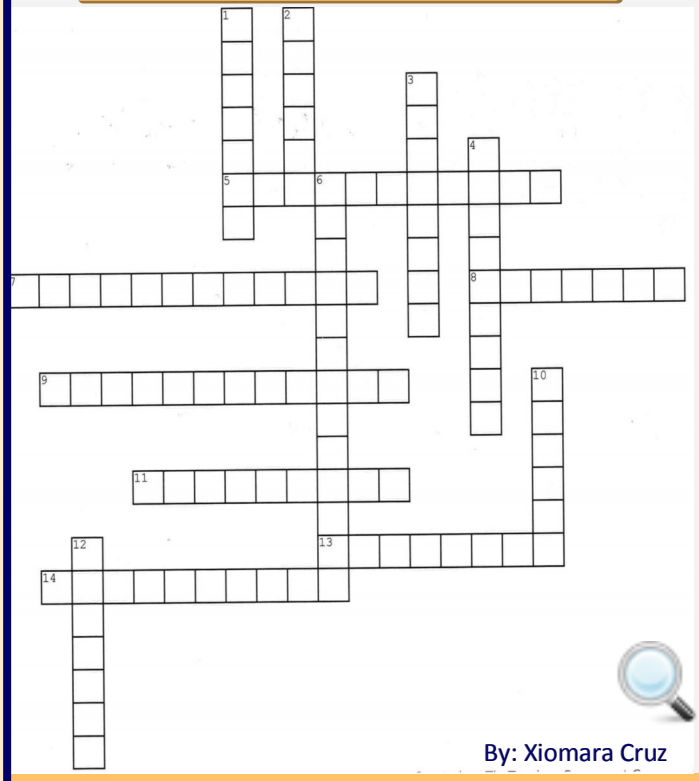
On July 18, 2013 a tropical wave was moving westward over Puerto Rico though it slowed down upon arrival. Several strong convective systems developed downwind of El Yunque and passed over the San Juan Metro area. In only 4 hours, 7½ inches of rain fell at Luis Munoz Marin International Airport, and 9.23 inches fell on this day. In 115 years of recording rainfall in the San Juan area this was the second highest daily rain ever recorded. Almost 3,500 lightning strikes were also recorded within 40 km of the airport, often so close that some wondered if it was an unusual amount of lightning. Or, was the lightning appropriate given the storm intensity?

It is well known that the number of lightning strikes can be closely related to the intensity of rain. The ratio of rainfall to lightning has been studied in several locations. One of these was done across east-central Florida during 1992-1993. In that study, the number of cloud-to-ground lightning flashes was counted and correlated with how much rain fell. In the figure on the right, rainfall rate (vertical axis) and the number of lightning strikes (horizontal) are compared in 5-minute intervals.

On a few of these days, a high rainfall to lightning ratio (RLR), represented by the blue line, was recorded on a few days in Florida during these thunderstorms. Heavy rain fell on these days but with relatively few lightning strikes. For most of their studied days, less rain and more lightning was noted (red RLR line). For the actual ratio for the storms in San Juan on July 18, the raw data is rather noisy (green line). There were no 5-minute periods when lightning strikes numbered between 15 and 22 so no measured data is shown for that part of the green line. The black trend line shows that the RLR for July 18 in San Juan was somewhere in the middle, between the extremes observed in Florida. Though it did not seem so, for the amount of rain that occurred, the lightning activity was normal or possibly even slightly below normal!



Lightning Awareness CrossWord Puzzle



By: Xiomara Cruz

Across

5 Physical Phenomena
7 Lightning between Clouds
8 Rumbling Noise
9 Electrical Storm
11 Thunderstorms are ___
13 Not Positive
14 Lightning within Cloud

Down

1 Instant Illumination
2 Electromagnetic
3 Not Negative
4 Electrostatic Bolt
6 Lightning not in clouds
10 Electrical Discharge
12 Safest Place

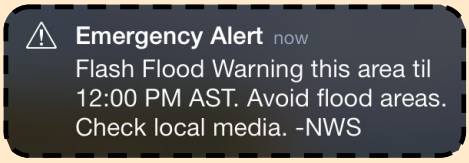
The NWS San Juan Family

"The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy.

NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, public, and global community."

A Weather Alert on My Phone? What's that?

By: Krizia Negrón



If you have a smart phone, you have probably received Wireless Emergency Alerts (WEA) in the past few months. These alerts are emergency messages sent by authorized government agencies/ entities alerting you through your mobile carrier, including FEMA and your local office of the National Weather Service. When you receive one of these alerts, your phone will go off with a unique ringtone or it will vibrate several times (if it's in vibrate mode). It could be a bit annoying however your phone is trying to catch your attention.

These alerts are received based on your current location within the warned area, type of phone, service provider, and signal strength. Even though the alert won't be specific, you can go online and find more information about the possible hazards in your area. For Puerto Rico and the U.S. Virgin Islands, the most common messages will be a Flash Flood Warning or a Tornado Warning. Don't ignore them and be weather aware, especially during weather-active periods. You can visit our webpage www.weather.gov/sju whenever you receive one of these alerts to get more details. Also, to learn more about this new system, go to: www.nws.noaa.gov/com/weatherreadynation/wea.html.

Our 2nd Edition Newsletter Team

Althea Austin-Smith, Service Hydrologist
Xiomara Cruz, Administrative Support Assistant
Krizia Negrón, Meteorologist Intern

Did you know?

The NWS San Juan has a new Awareness webpage! On this new page, you can find information related to the different "Awareness Weeks" the National Weather Service celebrates throughout the year. For each of these weeks, our staff created different images and posts in both English and Spanish to highlight the topics, in order to improve awareness for our customers. These are now available in one location for future reference. Enjoy!
www.srh.noaa.gov/sju/?n=awareness

Crossword Puzzle Answers:
1– Flashes, 2– Charge, 3– Positive, 4– Lightning, 5– Electricity, 6– CloudtoGround, 7– CloudtoCloud, 8– Thunder, 9– Thunderstorm, 10– Strike, 11– Dangerous, 12– Indoors, 13– Negative, 14– Intracloud

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