Prevailing Winds

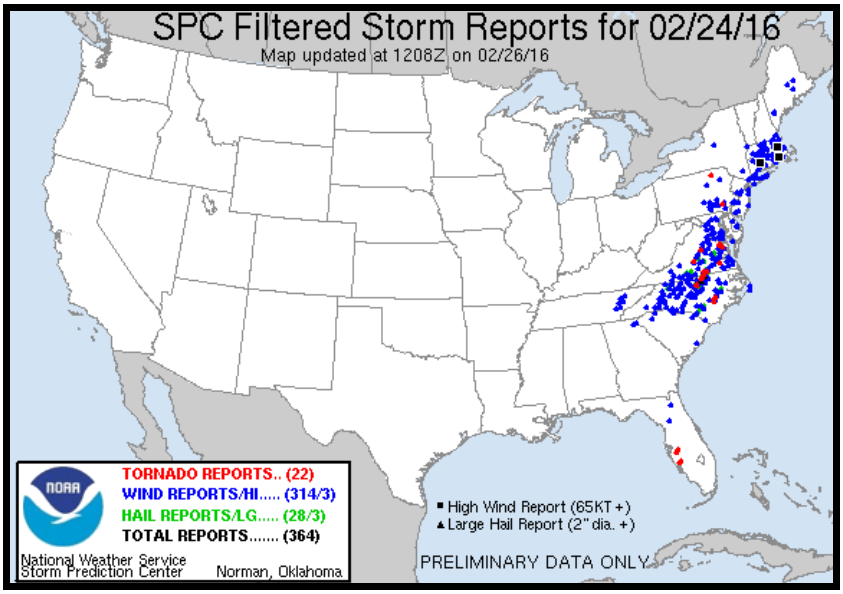
Volume 6, Issue 1 May 15, 2016

Inside this Issue:

Nighttime Severe Weather - A Rare Occurrence!

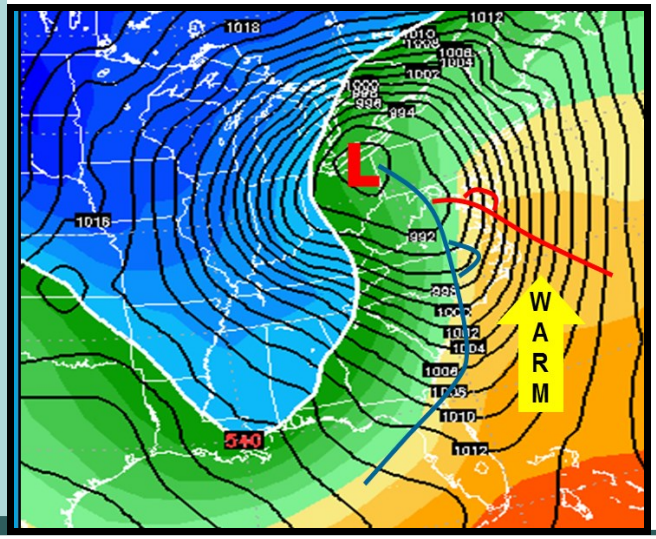
by Joe DelliCarpini, Science and Operations Officer

A line of severe thunderstorms produced wind gusts of 50 to 70 mph across much of southern New England during the evening of February 24 into the early morning of February 25, which resulted in widespread wind damage and tens of thousands of power outages. It is extremely rare to have a severe weather outbreak in February in this part of the country. In fact, records indicate the last time something of this magnitude occurred this time of year was in 1997!



Above: Storm Reports for February 24-25, 2016. Note the unusually high number of damage reports from the Carolinas into southern New England.

So what caused this rare severe weather outbreak? Strong low pressure tracking across the eastern Great Lakes brought unusually warm and unstable air into southern New England, much like we see during the spring or fall. Winds were unusually strong just a few thousand feet off the ground, on the order of 80 to 100 mph! As thunderstorms developed in the warm air that night, they were able to bring most of those stronger wind speeds down to the ground. The bulk of the severe weather occurred from 11pm to 6 am, which is quite rare for severe weather to occur during the night (remember August 4, 2015?). Looking at the CIPS Analogs, the top 15 analogs had no severe weather reports in southern New England. This event was so anomalous that there was no other weather pattern that could match it, especially during the winter!



Left: Weather Map at 7 pm Wednesday, February 24

Even though there were many reports of wind damage (downed trees, wires, and large branches) we were fortunate in that there were no injuries. Since these storms rolled through during the middle of the night, most people were inside. There certainly could have been a different outcome if this happened during the day.

NWS Taunton Hosts Media Workshop

by Stephanie Dunten, Meteorologist

Above: Some of the NWS Taunton Media Workshop attendees

Every two years, the NWS office in Taunton holds a media workshop for the TV meteorologists across southern New England. This year's media workshop drew 33 meteorologists from all of the area TV markets (Hartford, Springfield, Boston and Providence). The workshop was held over two sessions which allowed attendees to choose which day was most convenient for them. This option helped the office to attract a record number of TV meteorologists.

The weather in Southern New England has been quite active since the last workshop in 2014, especially with the Winter Snow Blitz of 2015 and a significant severe weather event on August 4th. Bob Thompson, MIC, kicked off each session by stating, "We are all part of the broader Weather Enterprise and depend closely upon each other to provide the best information to the public, especially when hazardous weather threatens people's safety." The staff at NWS Taunton reviewed several cases studies which led to a group discussion on how to best communicate hazardous weather uncertainty to the public. The staff also discussed new technology and policies including this office's probabilistic snow forecasts, the GOES-R satellite, and the MESO-SAILS upgrade for the Doppler Radar. In addition, WFO personnel gave everyone a tutorial on the new webpage as well as the XMACIS climate page.

The NWS Taunton office has found these workshops to be very successful and received numerous positive comments from those who attended this year. Steve Cascione, a long-time TV meteorologist at ABC-6 in Providence, commented "Thanks for hosting the workshop. I found it very informative." Danielle Vollmar, WCVB-TV meteorologist in Boston stated, "The media workshop was a great way to get us TV & NWS meteorologists who work all kinds of crazy hours in a room together to talk about our favorite subject, weather of course. I loved catching up with everyone and learned a lot too!" Others in attendance echoed both of their sentiments. The staff always enjoys interacting with their TV colleagues at these workshops and looks forward to hosting the next one in 2018.

Above: NWS Taunton Meteorologist-In-Charge Bob Thompson speaks to the group about coastal flood initiatives

MIC Musings

by Robert Thompson, Meteorologist-In-Charge

We have a collision of sorts to deal with. The expectations train for accurate and consistent forecast/warning information with ever longer lead times occasionally meets head on with the forecast uncertainty train. Ouch!

The early spring snowstorm of March 21 was a case in point. This was one of those events that seem to accelerate the aging process for forecasters – public and private alike! A couple of the international models began advertising a major winter storm (sub 980 mb low pressure center passing slowly past the Cape and Islands with plenty of cold air in place over most of southern New England). This potential "blockbuster" appeared from model run to model run up to a little more than 3 days ahead of the event. The domestic Global Forecast System (GFS) model and most (but not all) of its ensembles depicted a significantly weaker and farther offshore storm with much less impact. As we got within 2 to 3 days of the event, the international models shifted to a weaker and farther offshore solution, although not to the same extreme as the GFS and the North American Mesoscale (NAM) models which limited any consequential snowfall at all to just the Cape and Islands. By the time we got to the Friday before the anticipated Monday storm, the duty NWS forecaster was not expecting a blockbuster but a storm significant enough to warrant a Winter Storm Watch for much of eastern Massachusetts and Rhode Island. And then night followed day, and the overnight runs Friday night depicted nearly a complete miss for southern New England, although a few ensemble runs still brought the track closer to the coast. Faced with the dilemma of a forecast threatening to bust big time but wary of making a sudden, wide shift in the forecast (especially with some ensemble runs making a closer pass), the overnight forecaster trimmed back the Winter Storm Watch but did not yield to the temptation to completely cancel the watch for all areas. As that forecaster slept (or at least attempted to), social media lit up with scathing criticism of the NWS decision to not drop the watch entirely in the face of the latest operational model runs. The criticism lasted until the next set of model runs, which brought the storm back (not as a blockbuster but significant enough to warrant the watch)! As we got closer to the event, the NWS short term forecasters converted Winter Storm Watches to Warnings or Advisories. In the end, the heaviest band of snow fell just outside the warning area (in Worcester County), and most areas with Warning/Advisory headlines received 3 to 6 inches of snow, not as far off the mark as one might expect from just looking at the Warning/Advisory headlines.

Among many other interesting findings, an evaluation of the meteorological processes at play with the March 21 event revealed some sources of uncertainty. The various computer models struggled with the resolution of and interaction among multiple energy sources. Errors crept into the operational model runs due to sparsity of observed data when various pieces of energy were still over the Pacific Ocean and Arctic region as well as due to uncertainties of the subtropical jet structure traced back to processes associated with this year's El Nino phenomenon. Furthermore, the degree/timing to which these various packets of energy would phase proved to be instrumental to the outcome. Snowfall probabilities disseminated via the web communicated some idea of the uncertainty inherent with this system. Yet, state department of transportation agency officials, state emergency managers, and other key decision-makers had to make yes/no resource allocation decisions, some as early as Friday (three days before) due to the intervening weekend. And so we arrived at crunch time: when the customer expectations train met the uncertainty train head on. Indeed, on that Friday the NWS forecaster had to hold off the temptation of being too deterministic while also aware of the need for customers to prepare for a potential high impact event for the Monday morning commute, school and work schedules, etc.

On the eve of the event, some superintendents were faced with closing or delayed opening decisions. Meanwhile, forecasters still faced uncertainty due to unknowns from the location of one or more heavier bands, distribution of snow/water ratios, melting due to prior warm temperatures, and melting on road surfaces during the daytime portion from late March solar insolation getting through the overcast to the surface.

Cont'd on page 3

Cont'd from pg 3…MIC Musings

In short, with the start of the event only hours away, forecasters still grappled with uncertainty while some partners/ customers struggled with deterministic yes/no decisions.

A takeaway from this event for all was that some weather events lend themselves to more predictability than others. This is not restricted to winter storms. For example, some hurricanes lend themselves to a higher degree of forecast confidence than others due to their surrounding environment. Joaquin, back in the early fall, was on the proverbial fence between two weather systems, and sure enough one set of guidance had the storm going one way while another set of guidance had the storm following a radically different path.

The snowfall probabilities have become a means to help convey uncertainty, including greater uncertainty for some events than others. A few folks have begun to look at applying probabilistic information to other weather elements such as precipitation forecasts, progression of severe thunderstorms and tornadic storms, marine winds, etc. This unveils another challenge, however, since numerical probabilities can be very helpful to some and just an unfortunate reminder of high school math to others. Hence, we are still looking at ways (and ideas from our stakeholders) on how best to visualize the level of uncertainty for an event.

The reality is that it can take days for officials to adequately prepare for a large scale damaging weather event such as a hurricane or hard-hitting nor'easter and hours for damaging thunderstorm or tornadic winds. And prior successes have raised the expectations bar for forecasters. How do we keep these two trains from colliding? The probabilistic information is probably on the right track, although we need to realize that some decision-makers are more comfortable than others working with numerical information. There are times when we know there will be one or more heavy snow bands, but we also know they will probably be narrow and cannot be sure exactly where they will set up. This was another dilemma for March 21. Forecasters expected a heavy snow band (due to mid level frontogenesis forcing) to form northwest of the main precipitation shield but exactly where could not be determined. To make matters even more challenging, the storm did not develop a true coherent "main precipitation shield" (from the cold conveyor belt mechanism) until closer to the Canadian Maritimes. And then consider those National Hurricane Center track projections and error cones. Many people do not comprehend that the error cone illustrates track uncertainty and not the breadth of impacts from a hurricane. In the case of Joaquin, the track projection and associated error cone at one point looked terribly ominous for southern New England but in reality constituted the average of two widely diverging model solutions, one wide left and the other wide right for us.

"We are indeed making progress on forecast accuracy and lead time through advancements in science and technology but need to be honest with and communicate effectively to our partners and customers when the level of uncertainty is especially high."

Where does this leave us? Early warning of a potentially disruptive event gives our partners and customers time to consider their alternatives. We are indeed making progress on forecast accuracy and lead time through advancements in science and technology but need to be honest with and communicate effectively to our partners and customers when the level of uncertainty is especially high (e.g. that early spring snow event). And we need to continue to work collaboratively with social scientists and our partners on the most effective ways to communicate/visualize not only the potential impacts of an event but also the degree of uncertainty associated with the forecast.

2016 Preparedness Week Information

- **March 14th - 18th:** Flood Preparedness Week
- **April 25th - 29th:** Severe Weather Preparedness Week
- **May 21st - 27th:** Safe Boating & Beach Safety Week
- **June 20th - 24th:** Lightning Safety Preparedness Week
- **July 18th - 22nd:** Hurricane Preparedness Week
- **October 31st - Nov 4th:** Winter Weather Preparedness Week

http://www.nws.noaa.gov/om/severeweather/severewxcal.shtml

February 5th 2016 Heavy Wet Snow Resulted in Numerous Power Outages

by Hayden Frank, Lead Forecaster

Above: Heavy wet snow at the NWS Office in Taunton, MA

The first four days of February were incredibly mild for southern New England. High temperatures topped out well into the 60s on February 1st, followed by mainly 50s over the next 3 days. The very mild weather would set the stage for a damaging wet snowstorm across much of the region.

A cold front crossed the region on February 4th and temperatures gradually began to cool down. The cold front then stalled off the New England coast and a wave of low pressure worked northeastward along the front. Rain began falling on the night of February 4th as temperatures fell into the 30s. Colder air continued to drain into the region, allowing rain to change to heavy wet snow during the early to mid-morning hours of February 5th. The snow fell heavy at times through the afternoon, until drier air finally worked in from the northwest and the low pressure system moved away from the region.

Snowfall amounts ranged between 5 and 10 inches across much of the region with localized 12 inch amounts. This was a heavy wet snow and it fell with temperatures near 32 degrees. The result was significant tree damage resulting in numerous power outages. Downed trees and power lines blocked several roads for a time. At one point, about 150,000 households in Massachusetts and Rhode Island were without power. Unfortunately, power lines were not the only things taken down by the falling trees. Two fatalities occurred when large tree limbs fell on a 6 year old girl and a 48 year old man, in separate incidents in Canton, Massachusetts.

This storm was a reminder that even though this was one of the mildest meteorological winters on record, there were still a few significant winter storms. Snowfall amounts do not always reflect the greatest impacts of a storm. In this case, while certainly not a blockbuster winter storm in terms of snowfall amounts, the wet nature of the snow did have a lasting impact on Southern New England residents, particularly those of Canton, Massachusetts.

Above: Heavy wet snow in Westborough, MA

WX1BOX Amateur Radio Operations: Winter 2015-2016 Season

By: Robert Macedo, Amateur Radio Coordinator

Above: SRD'15 Operations - seated on left - KB1REQ-Jeremy Breef-Pilz and standing is W3EVE-Steve Schwarm, seated on the right is KD1CY-Rob Macedo and KB1KQW-Jim Palmer. Photo by: KI1U-Mike Corey

While the winter season of 2015-2016 wasn't as active as last year, there were a number of amateur radio SKYWARN operations that took place over the past few months. WX1BOX also participated in the annual SKYWARN Recognition Day event which is seemingly an annual kickoff to the winter season. We will summarize the key winter events and SKYWARN Recognition Day in our winter season Amateur Radio Operations report from the desk of WX1BOX.

SKYWARN Recognition Day 2015 (SRD'15) at the National Weather Service (NWS) in Taunton, was another successful operation. There were 11 amateur radio operators that operated or supported SRD'15. They made 473 total contacts with 463 unique contacts to 57 different NWS forecast offices earning the operation the 'F3 Tornado Certificate.' A highlight from the 2015 SKYWARN Recognition Day event was Saturday evening, 7 year old Alanna Robidoux, made contact with WX4NHC, the Amateur Radio Station at the National Hurricane Center via Echolink as a 3rd party contact. She did very well and is interested in getting her amateur radio license very soon.

WX1BOX amateur radio operations were active 7 times during the winter season. This included two activations for blizzards (January 23rd-24th 2016 and February 8th 2016), a high wind and strong thunderstorm event on Tuesday February 16th, the strong to severe thunderstorm and high wind event of Thursday March 17th, the winter storm of March 21st, and back-to-back activations on Sunday April 3rd and Monday April 4th for the late season winter storms. Notable SKYWARN Self-Activations included the Friday February 5th snowstorm with significant wet snow accumulation and damage reports, the overnight severe thunderstorm and high wind event on February 24th and 25th, and the Thursday March 31st damaging wind event.

WX1BOX Amateur Radio operations were active for two southeast New England blizzards. The first blizzard on Saturday January 23rd-Sunday January 24th brought severe impacts to the mid-Atlantic states with the heaviest part of the storm grazing southern New England. However it created enough impact for heavy snowfall and a period of blizzard conditions. SKYWARN Nets on local area repeaters were active with call-ups on a periodic basis. Strong to damaging winds occurred with wind gusts in the 45-65 mph range with wind gusts as high as 73 mph on Nantucket Island. This led to scattered pockets of tree and wire damage and power outages. Portions of southeast New England met blizzard criteria. Snowfall amounts were in the 7-15" range across southeast Massachusetts with 3-8" across portions of Rhode Island and Connecticut. As the storm departed, minor to moderate coastal flooding along east coastal Massachusetts occurred on the morning high tide of Sunday January 24th.

Above: New Bedford, Massachusetts Photo By: KA1RSY-Ed Caron

On Friday February 5th, a major winter storm with moderate to heavy rain changing over to heavy snow impacted southern New England. Widespread 6-12" of snow with isolated higher amounts across Connecticut, Rhode Island and central and eastern Massachusetts occurred. SKYWARN self-activation was utilized to cover this storm event with periodic SKYWARN Net call-ups on many amateur radio repeater frequencies. The snow was a heavy wet consistency and...

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Cont'd from pg 6…WX1BOX Operations

Above: Downed Power Lines in Acushnet, MA - Photo: Ed Caron-KA1RSY - Acushnet EMA

...when combined with wind gusts in the 30-40 mph range, widespread pockets of tree and wire damage and power outages resulted. At the height of the storm, over 100,000 were without power in Massachusetts alone.

On Monday February 8th, a second blizzard in a 2.5 week period affected southeast New England once again. The track of this storm system was more offshore but close enough to New England to create impacts. Highest snowfall amounts were 5-10" over southeast Massachusetts and Rhode Island including Cape Cod and the Islands. Strong wind gusts in the 40-65 mph range resulted in isolated pockets of tree and power line damage over parts of central and eastern Massachusetts and Rhode Island. The strong winds coupled with the morning high tide cycle resulted in minor to moderate coastal flooding at the time of high tide across north and east facing parts of the coast line. Blizzard conditions were met in several locations in southeast New England at the height of the storm.

An unusual but not unprecedented event impacted much of southern New England late Wednesday evening February 24th through daybreak Thursday morning February 25th. Lines of strong to severe thunderstorms in addition to very strong winds caused numerous pockets of tree and wire damage as well as power outages. Measured wind gusts to hurricane force occurred on Blue Hill in Milton, Massachusetts (83 mph) and in Bristol, Rhode Island (76 mph) with widespread pockets of wind gusts in the 40-70 mph range. Over 40,000 customers were without power in Massachusetts at the height of the severe weather and high wind event. In addition, heavy rainfall occurred with the strong to severe thunderstorms resulting in 1-3" of rainfall over portions of interior Southern New England and some urban and poor drainage flooding issues.

Winter gripped the region one last time as we moved into early April, 2016. A strong storm system and cold front moved through the region on Sunday April 3rd, 2016 resulting in a quick burst of heavy wet snow along with strong wind gusts up to 60 mph. Snowfall of 2-6" was common in interior locations with amounts less than 2" at the coast. The heavy wet snow and strong to damaging winds resulted in pockets of tree and wire damage. At the height of the storm, over 40,000 were without power in the region. The burst of heavy snow quickly moved out of the region by midday but strong winds continued through the mid to late afternoon.

On Monday April 4th, another winter storm would affect the region. This storm system produced widespread snowfall of 2-5" with a heavier band of snow across portions of central Rhode Island and interior southeast Massachusetts, where 5-9" of snow was common. The lack of winds precluded any tree and wire damage. SKYWARN self-activation covered the storm event over the course of the day.

Over the course of these various events for the winter of 2015-2016 season, SKYWARN Spotter and amateur radio SKYWARN Spotter reports have been critical in understanding the conditions that are happening at the surface. These reports help improve forecasts and can tell the general public exactly what the conditions are across the region. They also help the media and emergency management ascertain the conditions during severe weather and winter storm events.

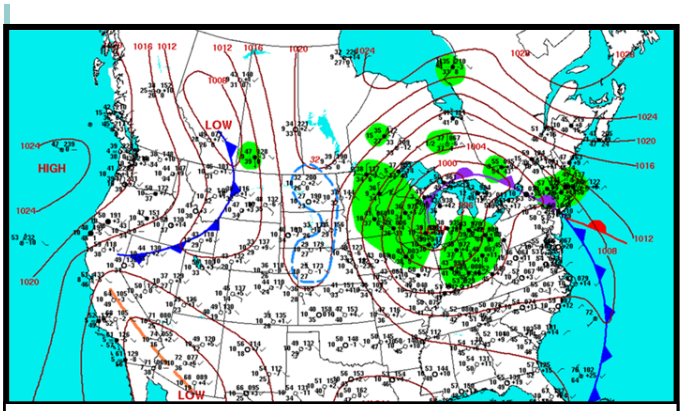
Thanks again to all SKYWARN Spotters for their support during the winter weather season. The amateur radio staff at WX1BOX, the amateur radio station at NWS Taunton, looks forward to working with you as we head towards the severe weather season. We hope to hear from you when weather begins to meet or reach the reporting criteria. If interested in joining the SKYWARN announcement email list sign-up (you don't have to be an amateur radio operator to join): contact Rob Macedo-KD1CY: rmacedo@rcn.com

Above: Downed Utility Pole in Brookline, MA - Photo by: KB1NCG-Marek Kozubal

Learn more about becoming an Amateur Radio Operator: http://www.wx1box.org

The 10th Anniversary of the Mother's Day Floods

by Nicole Belk, Service Hydrologist



Above: Surface map from 7 am EST Friday May 12, 2006 showing a large low pressure system centered over the Great Lakes Region.

Southern New England has not been a stranger to significant flood events within the past 10 or so years. Let's take a brief look into a major flood event that occurred 10 years ago this month- the Mother's Day 2006 Floods. We will be looking specifically at the freshwater flooding that occurred, but keep in mind that coastal flooding occurred as well!

Few likely remember that in 2006 we had a very dry early spring. Boston, Worcester and Providence all had less than 0.60" of rain for the entire month of March, while Hartford only had 0.78". It was the 2nd to 3rd driest March on record for all 4 locations. Through the month of April, rivers and streams were running at well below normal levels. This was fortuitous given what was to happen, however the rains that Mother Nature would provide were no match for area waterways.

The atmosphere aloft set up a "blocking" pattern. This is a weather pattern that, once established, can stay in place for quite some time. For this event the "block" enabled a large upper low to remain centered just to our west, over the Ohio Valley. At the surface, a large low pressure system sat over the Great Lakes Region, with a warm front extending just south of New England. The front remained just south of New England from Friday May 12th thru the Mother's Day Weekend. A deep plume of Atlantic moisture fed into our area. This resulted in a long duration, prolific rainfall event.

While all of southern New England received substantial rainfall from this event, the most extensive rainfall occurred over northeast Massachusetts, east coastal New Hampshire, and far southeast Maine. We will focus on northeast Massachusetts for this newsletter. Storm total rainfall from May 12th to the 16th ranged from 7 to 13 inches across much of Essex, Suffolk, and Middlesex Counties in northeast Massachusetts. The highest storm total was recorded by the Newburyport Cooperative Weather Observer, with a whopping event total of 14.47 inches. This was a LOT of rain!

The flooding that ensued was profound. Area rivers and streams swelled to levels rarely seen. The Merrimack River at Haverhill recorded its third highest crest on record. The Merrimack River at Lowell reached its fourth highest crest on record - a record long enough to include an historical event in April 1852. For the Merrimack River in Massachusetts, this was the most significant flood event since the advent of modern Flood Control in the watershed.

Many communities throughout Northeast Massachusetts were hit hard. Some examples of the flood impacts follow.

- Two fatalities occurred in the vicinity of the Ipswich River. One of the fatalities was reported to have occurred after a person drove around barricades in the road.
- A Presidential Disaster Declaration was made for Essex, Middlesex and Suffolk Counties.
- Drainage systems in Peabody and Salem became overwhelmed, leaving large sections of these two communities inundated by floodwaters.
- Stretches of major highways in northeast Massachusetts were shut down due to flooding, creating traffic gridlock in some communities, and major headaches for many Boston commuters. This included portions of Route 1, I-95, I-93 and Route 2.
- Major flooding occurred on the lower Shawsheen and Spicket Rivers, which meet the Merrimack River in the City of Lawrence. Numerous evacuations occurred in Lawrence, including those from the Mary Immaculate Nursing Home. Incredible flooding occurred around and near the vicinity of Route 114 in Lawrence and the I-495 Exit 42 A/B interchange, near the Lawrence and North Andover town line. The Shawsheen River passes by this area on its way to the Merrimack River, although normally it passes under one small bridge!

Above: Flooding in Andover, MA from the Shawsheen River. Photo by Joseph Zanca and Gerald Girouard.

Impact Based Warnings: New in 2016

by Joe DelliCarpini, Science and Operations Officer

BOSTON
WEATHER FORECAST OFFICE

The format of warning messages for severe thunderstorms and tornadoes has changed little over the past 40 years. Recent studies conducted after major severe weather outbreaks indicated the need to provide information in a clear and concise format, which encourages people to take immediate protective actions, rather than seek confirmation of hazardous weather from multiple sources.

As a result, National Weather Service (NWS) offices in the Central United States began testing a new format to warning messages in order to better communicate severe weather threats. The "Impact-Based Warnings" demonstration was well received and is now expanding across the country in 2016. The goal is to provide more information to media and Emergency Managers, to facilitate improved public response and decision making, and to better meet societal needs in the most life-threatening weather events.

The new format will improve communication of critical information, make it easier and quicker to parse out the most valuable information, will enable broadcasters to prioritize the key warnings in the area, and might highlight a storm that is particularly dangerous. The use of "tags" in the warning message will enable NWS forecasters to express a level of confidence of potential impacts for tornadoes and severe thunderstorms.

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BULLETIN - IMMEDIATE BROADCAST REQUESTED
SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE TAUNTON MA
545 PM EDT THU MAR 17 2016

THE NATIONAL WEATHER SERVICE IN TAUNTON HAS ISSUED A

* SEVERE THUNDERSTORM WARNING FOR...
  SOUTHERN BRISTOL COUNTY IN SOUTHEASTERN MASSACHUSETTS...
  BRISTOL COUNTY IN RHODE ISLAND...
  NORTHEASTERN NEWPORT COUNTY IN RHODE ISLAND...
  NORTHEASTERN KENT COUNTY IN RHODE ISLAND...
  NORTHEASTERN WASHINGTON COUNTY IN RHODE ISLAND...
  SOUTHEASTERN PROVIDENCE COUNTY IN RHODE ISLAND...

* UNTIL 615 PM EDT

* AT 544 PM EDT...DOPPLER RADAR INDICATED A SEVERE THUNDERSTORM
  CAPABLE OF PRODUCING DAMAGING WINDS IN EXCESS OF 60 MPH. THIS STORM
  WAS LOCATED OVER JOHNSTON...AND WAS MOVING EAST AT 65 MPH.

* LOCATIONS IMPACTED INCLUDE...
  PROVIDENCE...NEW BEDFORD...FALL RIVER...WARWICK...CRANSTON...EAST
  PROVIDENCE...COVENTRY...DARTMOUTH...NORTH PROVIDENCE...WEST WARWICK...
  JOHNSTON...BRISTOL...SMITHFIELD...SOMERSET...PORTSMOUTH...BARRINGTON...
  SWANSEA...TIVERTON...WESTPORT AND SEEKONK.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

SEVERE THUNDERSTORMS PRODUCE DAMAGING WINDS AND LARGE HAIL. GO
INDOORS AND STAY AWAY FROM WINDOWS.  DRIVERS SHOULD PREPARE FOR LOW
VISIBILITY AND AVOID FLOODED ROADS.

&&

LAT...LON 4163 7135 4166 7135 4164 7133 4171 7129
      4179 7137 4165 7136 4168 7139 4173 7169
      4190 7161 4178 7112 4175 7113 4178 7111
      4173 7093 4156 7105
TIME...MOT...LOC 2144Z 289DEG 56KT 4179 7155
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BULLETIN - IMMEDIATE BROADCAST REQUESTED
SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE TAUNTON MA
735 PM EDT FRI APR 1 2016

THE NATIONAL WEATHER SERVICE IN TAUNTON HAS ISSUED A

* SEVERE THUNDERSTORM WARNING FOR...
  CENTRAL WINDHAM COUNTY IN NORTHERN CONNECTICUT...
  SOUTHERN TOLLAND COUNTY IN NORTHERN CONNECTICUT...
  SOUTHEASTERN HARTFORD COUNTY IN NORTHERN CONNECTICUT...

* UNTIL 815 PM EDT

* AT 734 PM EDT...A SEVERE THUNDERSTORM WAS LOCATED OVER
  MIDDLETOWN...MOVING NORTHEAST AT 50 MPH.

  HAZARD...60 MPH WIND GUSTS AND PENNY SIZE HAIL.

  SOURCE...RADAR INDICATED.

  IMPACT...EXPECT DAMAGE TO ROOFS...SIDING...AND TREES.

* LOCATIONS IMPACTED INCLUDE...
  GLASTONBURY...MANSFIELD...WINDHAM...PLAINFIELD...WILLIMANTIC...
  KILLINGLY...COVENTRY...HEBRON...PUTNAM...BROOKLYN...MARLBOROUGH...
  COLUMBIA...CANTERBURY...POMFRET...STERLING...ANDOVER...CHAPLIN...HAMPTON...
  EASTFORD AND SCOTLAND.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

FOR YOUR PROTECTION MOVE TO AN INTERIOR ROOM ON THE LOWEST FLOOR OF A
BUILDING.

&&

LAT...LON 4194 7183 4177 7180 4166 7214 4167 7218
      4171 7224 4169 7227 4167 7227 4164 7233
      4161 7233 4159 7239 4160 7241 4158 7246
      4164 7250 4163 7262 4158 7276
TIME...MOT...LOC 2334Z 244DEG 59KT 4158 7261

HAIL...0.75IN
WIND...60MPH

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"Old" Severe Thunderstorm Warning (left) and "new" Impact-Based Warning (right). Note the Hazard, Source, and Impact sections (middle) as well as the Hail and Wind tags (bottom).

Cont'd on page 10

Cont'd from pg 9...Impact Based Warnings

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BULLETIN - EAS ACTIVATION REQUESTED
TORNADO WARNING
NATIONAL WEATHER SERVICE TAUNTON MA
239 PM EDT TUE AUG 4 2015

THE NATIONAL WEATHER SERVICE IN TAUNTON HAS ISSUED A

* TORNADO WARNING FOR...
  CENTRAL WORCESTER COUNTY IN CENTRAL MASSACHUSETTS...
  SOUTHEASTERN FRANKLIN COUNTY IN WESTERN MASSACHUSETTS...

* UNTIL 345 PM EDT

* AT 239 PM EDT...DOPPLER RADAR INDICATED A SEVERE THUNDERSTORM
  CAPABLE OF PRODUCING A TORNADO. THIS DANGEROUS STORM WAS LOCATED
  NEAR NEW SALEM...OR 9 MILES EAST OF AMHERST...AND WAS MOVING EAST
  AT 35 MPH.

* SOME LOCATIONS IMPACTED INCLUDE...
  LEOMINSTER...FITCHBURG...GARDNER...HOLDEN...CLINTON...ATHOL...
  LUNENBURG...LANCASTER...TEMPLETON...RUTLAND...STERLING...WEST
  BOYLSTON...WESTMINSTER...ASHBURNHAM...BARRE...PAXTON...
  HUBBARDSTON...BOYLSTON...PRINCETON AND ASHBY.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

DRIVERS SHOULD NOT TAKE SHELTER UNDER HIGHWAY OVERPASSES. IF YOU
CANNOT SAFELY DRIVE AWAY FROM THE TORNADO...AS A LAST RESORT...EITHER
PARK YOUR VEHICLE AND STAY PUT...OR ABANDON YOUR VEHICLE AND LIE DOWN
IN A LOW LYING AREA. PROTECT YOURSELF FROM FLYING DEBRIS.

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LAT...LON 4233 7168 4236 7236 4249 7240 4264 7186
      4264 7177
TIME...MOT...LOC 1839Z 254DEG 29KT 4241 7234
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BULLETIN - EAS ACTIVATION REQUESTED
TORNADO WARNING
NATIONAL WEATHER SERVICE ALBANY NY
257 PM EDT FRI JUL 24 2015

THE NATIONAL WEATHER SERVICE IN ALBANY HAS ISSUED A

* TORNADO WARNING FOR...
  EAST CENTRAL SARATOGA COUNTY IN EAST CENTRAL NEW YORK...
  SOUTHWESTERN WASHINGTON COUNTY IN EAST CENTRAL NEW YORK...

* UNTIL 330 PM EDT

* AT 256 PM EDT...A SEVERE THUNDERSTORM CAPABLE OF PRODUCING A
  TORNADO WAS LOCATED NEAR GREENWICH...OR 9 MILES NORTHEAST OF
  SARATOGA SPRINGS...MOVING SOUTH AT 25 MPH.

  HAZARD...TORNADO AND QUARTER SIZE HAIL.

  SOURCE...RADAR INDICATED ROTATION.

  IMPACT...FLYING DEBRIS WILL BE DANGEROUS TO THOSE CAUGHT WITHOUT
           SHELTER. MOBILE HOMES WILL BE DAMAGED OR DESTROYED.
           DAMAGE TO ROOFS...WINDOWS AND VEHICLES WILL OCCUR.  TREE
           DAMAGE IS LIKELY.

* THIS DANGEROUS STORM WILL BE NEAR...
  GREENWICH AROUND 305 PM EDT.

OTHER LOCATIONS IMPACTED BY THIS TORNADIC THUNDERSTORM INCLUDE
SCHUYLERVILLE...THE SARATOGA BATTLLEFIELD...DEANS CORNERS...BALLARD
CORNERS...THOMSON...CLARKS MILLS...STARKS KNOB...BURGOYNE...QUAKER
SPRINGS AND BALD MOUNTAIN.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

TAKE COVER NOW! MOVE TO A BASEMENT OR AN INTERIOR ROOM ON THE LOWEST
FLOOR OF A STURDY BUILDING. AVOID WINDOWS. IF YOU ARE OUTDOORS...IN A
MOBILE HOME...OR IN A VEHICLE...MOVE TO THE CLOSEST SUBSTANTIAL
SHELTER AND PROTECT YOURSELF FROM FLYING DEBRIS.

PLEASE REPORT HAIL SIZE...DAMAGING WINDS AND REPORTS OF TREES DOWN TO
THE NATIONAL WEATHER SERVICE BY EMAIL AT ALB.STORMREPORT@NOAA.GOV...
ON FACEBOOK AT WWW.FACEBOOK.COM/NWSALBANY OR TWITTER @NWSALBANY.

&&

LAT...LON 4315 7373 4319 7356 4302 7345 4297 7374
TIME...MOT...LOC 1856Z 343DEG 22KT 4313 7362

TORNADO...RADAR INDICATED
HAIL...1.00IN
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"Old" Tornado Warning (left) and "new" Impact-Based Warning (right). Note the Hazard, Source, and Impact sections (middle) as well as the Tornado and Hail tags (bottom).

Ideally it has been shown that the new Impact-Based Warnings will improve severe weather risk communication. The new text added to the Impact-Based Warnings specifies particular hazard, source and impact information which is consistent in communicating risk. In fact the hazard information provides details about the nature of the storm and its predicted outcomes.

In a recent study, it has been shown that the Impact-Based Warnings can indeed increase the likelihood that a message recipient will take the suggested protective action. Achieving the ultimate goal that protective action saves lives (Casteel, 2016). This is consistent with the NWS mission of saving life and property and one step closer to a Weather-Ready Nation.

Want to be an official spotter for the NWS? Check out the following dates for a class near you!

5/5/16 - Fitchburg, MA at 7:00 PM
5/10/16 - Canterbury, CT at 7:00 PM
5/16/16 - Orange, MA at 6:30 PM
5/17/16 - Amherst, MA at 7:00 PM
5/25/16 - Braintree, MA at 7:00 PM
6/1/16 - Warwick, RI at 7:00 PM
6/4/16 - Falmouth, MA at 10:00 AM
6/6/16 - Lakeville, MA at 7:00 PM
6/6/16 - Concord, MA at 7:00 PM
6/7/16 - West Newbury, MA at 7:00 PM

More Information: **http://www.weather.gov/skywarnprogram**

Getting to know your NWS Team: Benjamin Sipprell, General Forecaster

Above: Forecaster Benjamin Sipprell.

Benjamin Sipprell heralds from the Southern New England region having been born and raised in southwest Connecticut. Influenced by and immediately following Hurricane Gloria in 1985, Benjamin became determined to become a meteorologist. Through numerous science fair projects and providing weather reports during morning announcements, even participating in his first damage survey with his father after a weak tornado hit his hometown of Monroe, CT in July 1995, Benjamin immersed himself in anything that had to do with meteorology throughout his childhood.

Graduating from Masuk High School in 1999, Benjamin attended The Pennsylvania State University, obtaining a Bachelor of Science Degree in Meteorology in 2003. It was during his tenure at Penn State that he worked with influential mentors such as Dr. Eric Barron on understanding the skill of global climate models in effectively modeling known paleoclimates, and Dr. Paul Markowski towards improved understanding and prediction of convection with the International H_2O Project in the summer of 2002.

After graduating from Penn State, Benjamin continued his education at the University of Wyoming under the direction of his graduate mentor Dr. Bart Geerts. Focusing on a particular case of the International H_2O Project and in-situ data from the Atmospheric Science Department's airborne dual-pol radar, Benjamin and Dr. Geerts published their findings under the title *Fine-scale vertical structure and evolution of a pre-convective dryline on 19 June 2002 (Sipprell, B., and B. Geerts, 2007: Mon. Wea. Rev., 135, 2111–2134).* Benjamin graduated with a Masters in Atmospheric Science in 2005.

Shifting career paths away from research and towards hands-on experience, Benjamin started his career with the National Weather Service (NWS) on April 17th, 2006 as an Intern for NWS Weather Forecast Office (WFO) in St. Louis, MO. Nearly 5 years of field and forecast experience under the tutelage of highly experienced forecasters such as Ron Przybylinski, Benjamin was promoted to General Forecaster at NWS WFO Taunton, MA in January 2011. In the last 5 years serving as General Forecaster, Benjamin has overseen the development and maintenance of our social media program while managing our day-to-day climate and NOAA Weather Radio operations. Benjamin also aids with our web presence on the internet and in decision support services with state and local agencies.

Aside from his passion in meteorology, Benjamin has a love of travel, photography, and the outdoors. Whether strapping on a pair of hiking boots or through the focal point of a lens, Benjamin enjoys escaping into the beauty of nature.

Be sure to find

NWS Boston

on Twitter

http://www.twitter.gov/NWSBoston

NWS Taunton Provides On-Site IDSS for the Boston Marathon

by Stephanie Dunten, Meteorologist

Above: NWS Taunton Forecaster Stephanie Dunten provides a weather briefing at a planning meeting for the Boston Marathon.

The 120th running of the Boston Marathon took place on Monday, April 18th. This is one of the larger events for which the National Weather Service (NWS) Taunton office provides on-site Impact Based Decision Support Services (IDSS), since the Marathon attracts runners from around the world as well as hundreds of thousands of spectators.

In the days leading up to the event, NWS Taunton forecaster Stephanie Dunten attended planning meetings and provided weather briefings to help emergency managers prepare for all types for all types of weather hazard. The office's IDSS shift also sent daily emails to the Massachusetts Emergency Management Agency (MEMA). As John Giarrusso from MEMA exclaimed, "The advantage of having the NWS a part of the MACC (Multi-Agency Coordination Center) is that they were able to give up to date weather forecasts. This is critical information for the Marathon because they are detailing the temperature and wind for the event and what the runners and first responders can expect throughout the day and night."

Early Monday morning, Stephanie arrived at the MEMA "bunker" in Framingham, Massachusetts to provide on-site IDSS. Although the forecast called for near-perfect conditions, there were a few weather concerns. One was the potential for sea breeze development which would result in a head wind for the runners as they approached the finish line in Boston. The other concern was if temperatures would get above 72 degrees since that could severely overheat the runners. Throughout the day, Stephanie provided weather updates so the race organizers were aware of the weather conditions during the race as well as during the cleanup efforts the next day.

As it turned out, a weak sea breeze did develop but was not a significant concern for the runners. However, temperatures reached the lower 70s along the race route, which resulted in some runners being treated for overheating and dehydration.

Even though the weather was not a major issue, NWS Taunton forecasters are well aware that conditions can change rapidly during the Marathon. In past years, forecasters have briefed officials on heavy rain, strong winds, and unseasonably warm temperatures. Providing on-site support helps our office build relationships with our core partners as well as contribute to the goal of a Weather-Ready Nation.

Learn about the NWS's effort to become a Weather Ready Nation: http://www.nwsnoaa.gov/com/weatherreadynation/

Aviation Forecast Challenge - The Sea Breeze

by Scott Reynolds, Meteorologist-in-Charge CWSU - Nashua, NH

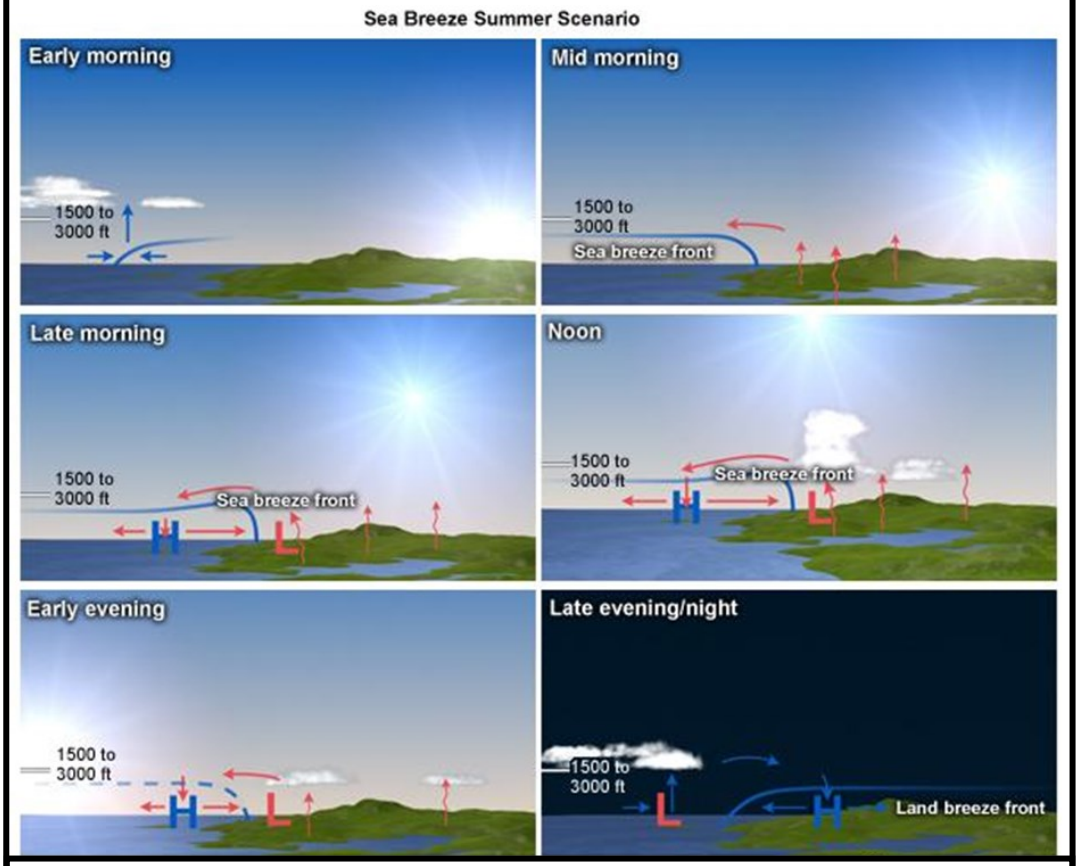
We've all been there – you head off to the beach on a sunny summer day. It's heating up quickly, but by the time you get to the beach, the temperature feels cooler, and the wind is off of the ocean. You just met the sea breeze, a local weather phenomenon that is an important feature for meteorologists to accurately forecast, and not just for the beach-goers.

Formation of a Sea Breeze

A sea breeze can't just form under any conditions. Here in New England, there typically is surface high pressure influencing the area, allowing for winds to be light. This is important because of the need for fairly light winds to begin the process. If the high is too far west (or east), the surface winds may end up being too strong from the north or northeast (or from the southwest), and thus prevent a sea breeze from forming. Aside from light winds, you also need a decent amount of sunshine. Land areas heat more quickly than water during the day, and when the land warms, it causes the air to rise. The resulting circulation that develops has return flow aloft over the water, subsiding air just offshore, and a low level onshore flow.

Cont'd on page 13

Cont'd from pg 12…Sea Breeze



Above: The images below (courtesy of the COMET Program, UCAR, Boulder, CO) show the life cycle of a typical sea breeze circulation.

Once this circulation forms, a sea breeze front forms and (usually) moves inland. The sea breeze front acts in a similar fashion as a more traditional cold front, meaning that you get a wind shift, and cooler air behind the front. How much cooler this air is really depends on how cool the water is. You will see much more of a difference during the spring when water temperatures just offshore are still in the 40s or 50s.

The rising air over land also helps to promote the generation of afternoon clouds and thunderstorms under the right conditions, while the sinking air just off the coast tends to dampen their development. Sea breeze circulations typically weaken and then reverse themselves at night when the land cools faster than the water.

Aviation Impacts

For aviation purposes, accurate forecasting of a sea breeze includes timing of the wind shift, as well as what the wind speed and direction will be behind the front. On a typical spring or summer morning in Boston, aircraft arriving into and departing from Logan may be using runways 27, 22L and 22R, or possibly 33L and 27. Once the sea breeze passes, in order to maintain a headwind on final approach and landing (and keep the pilots happier!), Logan would switch to runways 4L, 4R and 9. However, switching runways takes some time, because you need to make sure all of the arriving aircraft are on the right approach route to utilize the proper runway (s). This can take 15 to 30 minutes, depending on the amount of traffic in the area, so we try to provide as much lead time as we can, in order for air traffic personnel to plan ahead.

While there could be brief delays in air traffic while the runway configuration is changed, this can actually be very beneficial to Logan operations, in that instead of Logan being able to land 36 to 48 aircraft per hour, they could actually land as many as 60 per hour if needed. Just watch out for any thunderstorms that might form along the sea breeze front…they might end up delaying you as well.

For the latest weather information, check out:

www.weather.gov/boston

Get Ready for GOES-R!

by Eleanor Vallier-Talbot, Meteorologist

As the current Geostationary Operational Environmental Satellites (GOES) approach the end of their orbital lifespan, developers from both the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) continue a long term collaboration to improve and increase GOES satellite capabilities. The GOES-R Series, which will include GOES-R, S, T and U, will be the first major satellite upgrade since 1994. GOES-R is scheduled to launch from Cape Canaveral, Florida, on Thursday, October 13, 2016. Once in orbit and operational, the satellite will be known as GOES-16. GOES-S and T are scheduled to launch between 2017 and 2019, while GOES-U will be held until the mid-2020s to prepare for transition to yet another series of GOES satellites.

The GOES-R series will bring enormous increases in temporal, spatial, radiometric and spectral resolutions of current data, as well as introducing new data sets for use in weather and space weather forecasting. The vast increase in satellite information will support weather forecasters in severe weather monitoring and warning operations, nearshore and high seas marine forecasts, and hurricane track and intensity forecasts. The new satellite data will also improve aviation safety and flight planning, solar flare warnings, and increase lead time for severe thunderstorm and tornado warnings. One new instrument aboard GOES-R is the Geostationary Lightning Mapper (GLM), which will provide continuous total lightning, including in-cloud and cloud to cloud, covering both land and ocean within GOES coverage areas. Updated space weather sensors will improve sun and space environmental observations. Improved monitoring will also be gleaned for hydrologic, oceanic and climatic data.

Table 1: Advanced Baseline Imager (ABI) Current and Upgraded Operations

	Current GOES operations	GOES-R Series Operations
Spectral Band Channels	5 (1 visible, 4 IR)	16 (2 visible, 4 near-IR and 10 IR)
Imager Spectral Resolution	1 km visible, 4 km IR	0.5 km visible, 2km IR
Temporal Coverage (5 times faster)	Every 25 minutes full disk, 15 minutes CONUS	Every 5 minutes full disk and CONUS
Rapid Scan Operations	Every 5 minutes	Every minute
Super Rapid Scan Operations (SRSO)	Every 1 minute (Research only)	1000 km² every 30 seconds, or 2 areas every minute

Ensuring user readiness and an efficient transition to operations has been paramount throughout the GOES-R series development. To that end, background and educational components for developing and learning the new capabilities of the satellites are under the auspices of the GOES-R Proving Ground. The GOES-R Program Office has been collaborating with a variety of NOAA, NWS and NASA entities and testbeds across the country. Researchers and forecasters have been developing and evaluating proxy and simulated GOES-R products using current GOES, NASA Terra and Aqua polar orbiting MODIS data and model synthetic satellite data. The Proving Ground is a part of NOAA's Hazardous Weather Testbed, which continues to test new algorithms and products at NCEP centers that will be used across the country once GOES-R series satellites are operational. Presentations at scientific conferences, development of online educational resources and improving communications through social media and other outreach efforts will ensure readiness by the scientific community to use GOES-R data as soon as it is available.

To learn more about the capabilities of the GOES-R satellite series, you can visit www.GOES-R.gov or go to the COMET MetEd training website through the University Center for Atmospheric Research (UCAR) at www.meted.ucar.edu.

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www.weather.gov/boston

The National Weather Service 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, the public, and the global community.

Meteorologist-in-Charge: Robert Thompson

Warning Coordination Meteorologist: Glenn Field

Science and Operations Officer: Joe DelliCarpini

Editor: Stephanie Dunten

2016 Hurricane Names

I	T	R	I	L	I	X	E	A	A	O	B	V	O	R
F	G	L	S	U	L	S	N	M	E	A	A	H	Y	X
C	W	A	V	I	L	R	A	N	L	D	R	R	L	B
H	A	A	S	A	A	P	A	U	L	A	A	E	L	H
R	A	A	L	T	L	N	G	E	A	H	G	E	N	U
T	L	O	T	T	O	B	I	A	S	E	E	R	A	I
L	T	W	K	I	E	N	I	L	I	A	A	B	T	H
X	E	E	F	E	N	R	N	N	I	L	O	C	I	H
E	O	H	H	O	I	A	I	W	E	K	U	E	J	I
A	I	T	B	C	M	G	C	X	A	G	S	J	E	A
L	H	T	H	C	R	H	O	R	E	I	N	J	U	L
I	D	A	N	I	E	L	L	E	L	R	L	O	C	A
Y	R	M	V	E	H	T	E	I	P	C	R	M	W	L
D	Y	L	L	T	E	O	L	P	N	S	A	H	A	N
A	B	L	N	T	R	H	A	L	I	E	T	E	N	O

Find the following names:

ALEX
BONNIE
COLIN
DANIELLE
EARL
FIONA
GASTON
HERMINE
IAN
JULIA
KARL
LISA
MATTHEW
NICOLE
OTTO
PAULA
RICHARD
SHARY
TOBIAS
VIRGINIE
WALTER