# Peak Performance

Winter 2012-2013

Performance Branch, NWS Office of Climate, Water, and Weather Services, Silver Spring, Maryland


**This Issue: March 2013**



# Three New Contractors Join the Performance Branch

By Doug Young, NWS Headquarters

The Performance Branch gratefully welcomed three new contractors in November 2012: Tandi Sunarto, Guynell Pittman, and David Rancourt **(Figure 1)**. These new team members replaced three of our long-standing contractors who moved onto other challenges during the summer and fall of 2012.

Under the leadership of Lhou Mechtat, Senior Software Engineer and single remaining incumbent from our previous contract, these new employees will play a vital role in ensuring our Performance Management system is more efficient, reliable, accessible, secure, and more resilient to environmental impacts on the infrastructure.

To help you get to know these new employees better, I asked Tandi, Guy, and Dave if they could share a little bit about themselves.

**Tandi Sunarto** — Tandi was born and grew up in Indonesia in a tropical climate and attended a small college in Minnesota where he experienced snow and below zero weather for the first time in his life. He enjoys cooking, learning guitar, and collecting/building plastic model airplanes. Tandi is working on designing and creating a universal data importer and verification utility for the Performance Branch.

**Guynell Pittman** — Guy was born and raised in Maryland and says he loves it here. He previously lived in Altoona, Pennsylvania, for

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Three New Contractors Join the Performance Branch – Continued from Page 1

three years where he attended South Hills School of Business and Technology. Guy graduated in 2010 with an Associate Degree in Computer Information Systems, Specialized Technology. Guy said that he's always been interested in computers since he was a kid. His main area of focus in the IT industry is programming; he finds it to be the most challenging career and that's what makes it fun and exciting to him. Guy is really enthusiastic about the project that he has been working on in the Performance Branch—a new product importer application that will run on a timely basis and download and process products such as buoy observations, marine forecasts and guidance models and a few other products. In his free time, Guy enjoys reading or playing *Call of Duty* online.

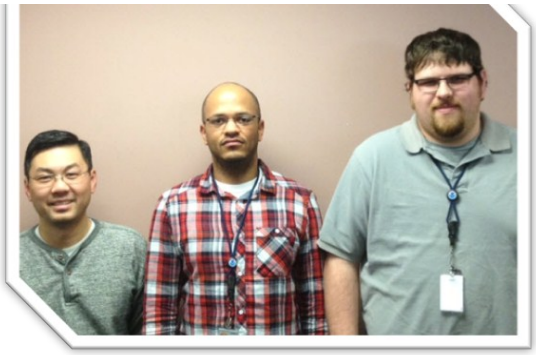

**Figure 1**: New Performance Management Contractors– From left to right, Tandi Sunarto, Guynell Pittman, and David Rancourt

**David Rancourt** — Dave is from Cleveland, Ohio, attended Rochester Institute of Technology (RIT, Rochester, New York) and majored in Networking & Systems Administration. He played goalie for RIT's hockey team and played on the 2009 USA World Championship Team currently mentoring deaf goalies across the USA from age 5 up to the college ranks. At the NWS, Dave is focused on daily systems tasks of NOAA8203, Performance Management System, and maintaining the integrity of the data NOAA8203 provides. He also works closely with the software development team to ensure that our systems can run our customized software to its fullest potential.

Once again, we welcome Tandi, Guy, and Dave to the OCWWS Performance Branch and look forward to working with them as we strive to further the mission and goals of the NWS.

# Results of the National Weather Service 2012 Customer Satisfaction Survey

By Sal Romano, NWS Headquarters

A team of NWS employees developed the NWS 2012 Annual Customer Satisfaction Survey questions. The independent survey firm Claes Fornell International (CFI) administered the survey, which had 24, 272 respondents between September 21, 2012 and October 22, 2012. CFI measures customer satisfaction with the American Customer Satisfaction Index (ACSI), the standard methodology used across public and private sectors to evaluate public opinion and help prioritize organizational changes that will improve the customer experience. The 2012 NWS survey resulted in a score of 84 on a scale of 0 to 100, which is considered "excellent" by CFI. By comparison, the score is *16 points higher* than the aggregate Federal Government ACSI of 68.

A CFI representative briefed the NWS 2012 Customer Satisfaction Survey results at National Weather Service Headquarters (NWSHQ) on Tuesday, January 15, 2013. The briefing was well attended at NWSHQ and in the regions via Webinar.

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## Results of the National Weather Service 2012 Customer Satisfaction Survey – Continued from Page 2

The survey results are contained in a report and can be reviewed through a Web Portal provided by CFI. Below is the link to the 2012 Customer Satisfaction Survey Report, Briefing, and Web Portal:
https://verification.nws.noaa.gov/content/pm/evaluation/program.aspx

Here are a few key results and interesting findings from the 2012 survey:

- Users continue to be very likely to use NWS in the future, take action based on information received and are likely to recommend that other folks use NWS.

- Almost all respondents use NWS Web Sources to get weather information – many use local/cable TV and over a third are now using mobile devices (rising year on year).

- Most respondents think that a tornado warning is accurate when a tornado is observed within 5-10 miles of their location.

- Just under half of respondents have a **hazardous weather emergency preparedness kit**. Those with a kit typically have had it for more than two years and most often claim "general preparedness" as the reason for its creation; those with no kit usually claim "don't know what to include" or "isn't necessary" as the reason for not having one.

- Most respondents also have a **hazardous weather safety plan** and have had it for over two years. Consistent with the reason given for creating a hazardous weather emergency preparedness kit, the clear majority created the safety plan for general preparedness purposes – also consistent with those not having a kit, those without a safety plan aren't sure what to include or don't think a plan is necessary.

- Regardless of NWS region, 75 percent of respondents were **very likely** to take cover if a warning was issued. Reasons why respondents would not take action vary; many feel **that previous experience leads them to believe their location would not be in danger** (or they are in a location where tornados are rare).

## Ships Ahoy! Marine Verification is Being Updated Again

By Brent MacAloney, NWS Headquarters

As you have likely read in previous issues of the *Peak Performance Newsletter*, the Performance Branch has experienced quite a bit of turnover in the past year with regards to our contracted programming positions. Fortunately, most of these vacancies have been filled, but losing over 30 years of programming expertise did not come without a cost. At the time of the programmer's departure, the Performance Branch was unable to continue supporting and providing new data to several of the verification programs, such as the Point Forecast Matrices (temperature, probability of precipitation, and sky cover), National Fire Danger Rating System, Quantitative Precipitation Forecast, Marine Forecast (wind speed/direction and wave height) and River Forecast (RFC-based).

We are happy to announce that through some long, frustrating hours spent trying to better understand the marine verification matching routine and the raw marine forecast and

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## Ships Ahoy! Marine Verification is Being Updated Again – Continued from Page 3

observation data it uses, the Legacy Marine Forecast Verification Stats on Demand program (located: https://verification.nws.noaa.gov/marine/classic/request.aspx) is currently being updated between the 5th and 10th of the following month, as has been done in the past. This likely comes as welcomed news to those who use the legacy marine verification data to track an office's or region's performance.

There still exists one last outstanding issue with the marine verification though. The data that is being uploaded to Stats on Demand is only the match of forecast and observations. Unfortunately, there are some issues with the format of the model guidance data that is causing the data matching routine to break. This is an issue that we will continue to try and fix as time becomes available. If there's any good news out of this, it is that we are still collecting the model guidance data and we are hopeful that we will be able to backfill it to the point where the format issue began.

Also on a positive front, the new programmers on our team are busily working to rewrite the importers used to parse the buoy and CMAN observations and marine forecast data. After that, the marine forecast/guidance/observation routine will be rewritten and the program will be as good as new with several new features that we believe all of you using this data will find very useful. The most important of these features will be the ability to easily add and remove verification points from the database. Until this project is completed, we appreciate your patience as we continue to return our services to the level that everyone has come to expect out of the Performance Branch.


# ASK CHUCK!

By Chuck Kluepfel, NWS Headquarters

**Question:** I am trying to compare how well our Terminal Aerodrome Forecasts (TAFs) issued at 1200 Universal Coordinated Time (UTC) compare to our TAFs issued at 0600 UTC. When I am requesting a TAF verification report, I am confused about the TAF begin times option. If I want to verify the 0600 TAF, should I select the 0000-0559 time period (since the 0600 TAF is actually issued around 0530) or the 0600-1159 time period?

**Answer:** To monitor the 0600 UTC scheduled TAF, make the 0600-1159 UTC selection, and ensure that the *Scheduled* box is checked. That is why we labeled the line *TAF Begin Times* and not *TAF Issuance Times*. Contrary to a popular misunderstanding of the TAF rules (which I used to share), the 0600 TAF begins at 0600, and not a minute earlier. For example, assume your old TAF was issued at 0301, and it goes seriously astray at 0545. The 0301 TAF requires an amendment, even though you have already issued the new TAF (scheduled to begin at 0600) as early as 0520. This is a strange system, but those are the rules. According to NWS policy, the 0301 amendment is valid until 0559, unless it is replaced by an amendment issued before 0600. The 0600 scheduled TAF does not replace the old one until 0600, even if the 0600 scheduled TAF was sent on time (during the 0520 to 0540 time window).

# Fly...with Ointment

By Beth McNulty, NWS Headquarters

**Non-TAF Aviation Verification Part 1: CWSU Verification**

While the Terminal Aerodrome Forecast (TAF) is the official flight planning tool, aviation weather support consists of several other products and services. One of those additional services is the Center Weather Service Units (CWSU). CWSUs provide decision support services and aviation forecasts to a more targeted user group then most of their peers within the National Weather Service. The primary consumers of CWSU information are Air Traffic Controllers who work at Air Route Traffic Controller Centers (ARTCCs). At each of the 21 ARTCCs throughout the country CWSU Meteorologists sit side by side with FAA employees to support the FAA's mission of safely and efficiently moving air traffic. Below are four ways CWSUs check the quality of service they provide to the FAA.

The CWSUs keep briefing logs of their verbal services. Most of these briefings are given to the Traffic Management Unit (TMU), Front Line Managers or the Operations Manager who is in charge of the entire operations floor of the ARTCC. The briefing logs should note the time of the briefing, what it was for (i.e., timing of wind shift at airport X, lines of severe storms, expected onset of winter conditions, and similar situations), and who (by position) was briefed. The briefing log is the only physical record of verbal services provided by the CWSU.

A major product, and the only advisory and warning type product, is the Center Weather Advisory (CWA). A CWA is normally issued because an event is unfolding or about to occur (within minutes). It can also be issued as a "nowcast" or short term advisory during or near the onset of a weather event. This product has geographical coverage, goes into the communications circuits, and reaches users inside and outside the FAA. Criteria for CWA issuance is flexible, tailored, and based on weather conditions and/or impact to the National Airspace System (NAS). The flexibility in the CWA product can be an asset for operations, but does make direct meteorological verification very difficult.

Currently, CWAs are quality checked for formatting errors such as proper header, advisory number, and correct date-time group. Event verification/meteorological verification for CWAs can be extremely difficult. Since CWAs are difficult to verify meteorologically, CWSUs are looking at ways to evolve their quality assurance from formatting to impacts. Impact based verification will likely play a larger role in the Quality Management System (QMS) deployed by the FAA and NWS.

A third performance measure used by CWSUs is their rate of participation on the Collaborative Convective Forecast Product (CCFP). The CCFP is jointly derived from inputs by CWSUs and other stakeholders such as ATCSCC, or industry. It's moderated and issued by the Aviation Weather Center (AWC) several times each day during convective weather season (March-October). The CCFP is the official convective en-route forecast for FAA planning. CWSUs are required to participate in the creation of this product when

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Fly...with Ointment - Continued from Page 5

convective weather is possible within their airspace. CWSUs are not scored at this time for the meteorological accuracy. Instead, the CWSU participation is measured as a "frequency of service;" a useful application within the QMS structure.

Finally, there is one meteorologically-based measure used by all CWSUs. Each CWSU tracks the verification of wind forecasts at a specific airport within their ARTCC airspace. In addition, each CWSU chooses two other elements to track verification statistics. The additional measures may be wind shifts at additional airports within the airspace, or another element regarded as critical to the ARTCC such as fog onset and visibility issues at San Francisco International.

The QMS for CWSUs continues to evolve, but even today the quality of the aviation weather services they provide is viewed in a variety of ways. CWSUs are evaluated for frequency of service, product consistency, and written documentation of service. These steps help ensure the FAA receives the best weather information possible.

**Next : Non-TAF Aviation Verification Part 2,**

**AWC Verification**

# Dealing with an Aging IT Infrastructure During Times of Tight Budgets

By Brent MacAloney, NWS Headquarters

For many in the NWS, the names Hurricane Sandy and the Northeast Blizzard of February 2013 come to mind when you think of the word "superstorm." Here in the Performance Branch we are dealing with our own super-storm of sorts, the daily struggle to manage an increasingly old Information Technology (IT) infrastructure while continuing to server up meaningful and accurate performance data. To help you to understand where we are, it may be worthwhile to give you some background on how the Performance Branch operates.

Pretty much every aspect of the generation of performance management data is done within the Performance Branch. This includes the administration of two data servers located in Kansas City that collect all the raw data used for generation of verification data, development of code that parses the raw forecasts/warnings and matches them with observations, and the administration of the web servers that run Stats on Demand and the other programs on the Performance Management website. In total, we have responsibility of maintaining approximately 8-10 servers at any given time.

Currently, we are in the middle of a super-storm of IT troubles regarding our servers. In some cases we have such a large archive of performance data, we are running out of physical hard drive space, and in other cases we have some old pieces of hardware that have worked hard for 7+ years and are beginning to break down. The problem is that

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# Service Assessment Program

By Sal Romano, NWS Headquarters

## One Completed and One Begun

The **Historic Derecho** Service Assessment was publicly released and the **Hurricane and Post-Tropical Storm Sandy** Service Assessment Team began on-site activities.

**1)** The Historic Derecho of June 29, 2012 service assessment document presents findings and recommendations regarding NWS performance during the derecho of historic proportions that struck the Ohio Valley and Mid-Atlantic states. The derecho traveled for 700 miles, impacting 10 states and Washington, D.C. The hardest hit states were Ohio, West Virginia, Virginia, and Maryland as well as Washington, D.C. The winds generated by this system were intense, with several measured gusts exceeding 80 mph. Unfortunately, 13 people were killed by the extreme winds, mainly by falling trees. An estimated 4 million customers lost power for up to a week. The region impacted by the derecho was also in the midst of a heat wave. The heat, coupled with the loss of power, led to a life-threatening situation. Heat claimed 34 lives in areas without power following the derecho.

The acting NWS Director signed the Historic Derecho Service Assessment document on January 24, 2013. The public release for this service assessment occurred on February 5, 2013.

**2)** Sandy was first identified as a disturbance in the Caribbean by the National Hurricane Center on October 19, 2012. Sandy reached hurricane status on October 24. It made landfall across the Caribbean—first Jamaica, then eastern Cuba and the Bahamas before moving generally northward parallel to the U.S. eastern seaboard. Sandy made landfall just south of Atlantic City, NJ, around 8:00 p.m. EDT on October 29. The storm brought a record water level of 13.88 ft. to New York City's Battery Park and isolated total rainfall amounts of 10 inches to extreme southern New Jersey, Delaware, and Maryland. Wind gusts reached 90 mph along the New Jersey shore and Long Island, NY. Gusts in the Baltimore and Washington metropolitan areas reached over 70 mph, and gusts exceeded 60 mph as far away as Boston and Chicago. The same storm was also responsible for over a foot of snow across portions of the Central Appalachians from North Carolina to Pennsylvania, with parts of West Virginia experiencing blizzard conditions and up to three feet of snow. Sandy's central pressure of 940 millibars was the lowest recorded pressure for a landfalling tropical cyclone north of Cape Hatteras. When Sandy made landfall, it broke Philadelphia's, Harrisburg's, and Baltimore's all time low pressure records.

The Hurricane Sandy Service Assessment Team completed on-site visits and telephone interviews. The team is writing a draft of the findings, recommendations, and best practices.

# Predicting Thunderstorms in TAF FM Groups

By Chuck Kluepfel, NWS Headquarters

Six months ago, I published a study in this newsletter analyzing the effectiveness of thunderstorm (TS) forecasting in terminal aerodrome forecast (TAF) "Temporary Change" (TEMPO) groups. During the 18-month study period ending June 30, 2012, the Weather Forecast Offices (WFOs) with the most effective TEMPO TS performance tended to use them in a very discriminating manner. The offices with the highest percentages of justified TEMPO TS forecasts tended to have the lowest adjusted biases (close to the ideal value of 1.0), while the offices with lower justified TEMPO TS statistics tended to over-forecast TS in TEMPOs, i.e., the adjusted biases often exceeded 3.0 and sometimes 5.0 (the reason for the need to adjust the bias is explained later). The negative correlation was statistically significant nationally and in each of the four Contiguous United States (CONUS) regions of the National Weather Service. More details on that study can be found in the summer 2012 edition of *Peak Performance*.

This article presents a similar analysis of TS forecasting in "From" (FM) groups for the same time period. FM group effectiveness for thunder can be monitored in the TAF *Stats on Demand* verification program by setting the element to *significant weather* type and the forecast type to *prevailing*. Scheduled and amended TAFs from all times of the day were used. Forecast vs. observed cases of TS occurrence and non-occurrence were placed in 2x2 contingency tables (TS yes, TS no) for each Weather Forecast Office (WFO), and from these tables a 2-category Heidke Skill Score (HSS) was computed for each. This statistic rewards forecasters for successfully predicting thunder in FM groups, while the presence of false alarms and missed events lowers the score. Agency-wide, the HSS for all WFOs ranged from 0.00 to 0.345, with the agency mean at 0.18. These HSS values were correlated with the adjusted bias statistic of TS forecasts in FM groups by each WFO. The bias calculation (total time TS forecasted divided by total time TS observed) must be adjusted because some observed TS are forecasted in TEMPO groups, and others are forecasted in FM groups. This splits the pool of observations available for matching between FM and TEMPO groups so the biases in each study were doubled. The national correlation coefficient of the TS HSS with the adjusted bias for all WFOs was +0.630; however, the correlation in Western Region was much weaker (+0.432), questioning the usefulness of this study for FM groups in the West. If the Western Region offices are removed from the national correlation coefficient in the FM study, it jumps to +0.756. Also, the offices with the highest HSS values tended to have FM-group adjusted biases near an ideal 1.0, while the offices with the lower HSS values tended to under-forecast TS in FM groups, with many adjusted biases under 0.3 and a few at or below 0.1.

The list of top-performing offices in the FM group study was quite different than the list of top-performing offices in the TEMPO group study (see **Table 1** on next page). Only one office got into the "top 20" list in both studies—WFO BMX. In both studies, the top-

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Predicting Thunderstorms in TAF FM Groups – Continued from Page 8

**Table 1.** Verification statistics for TS forecasts in FM groups are provided. The "Top 20" are defined as the WFOs with 2-category HSS values greater than 0.230 during the 18-month period January 2011 to June 2012. The "Top 5" WFOs had 2-category HSS values exceeding 0.280 for the same period.

| ***Statistics*** | ***January 2011 to June 2012*** | | |
|---|---|---|---|
| | ***"Top 20" WFOs*** | ***"Top 5" WFOs*** | ***Entire NWS*** |
| a. HSS values for FM TS forecasts | 0.275 | 0.316 | 0.180 |
| b. Number hours TS predicted in the first line of a TAF or a FM group | 12,395 | 4507 | 37,620 |
| c. Number hours TS observed | 24,087 | 7231 | 122,717 |
| d. Adjusted bias (2*line b / line c) | 1.0 | 1.2 | 0.6 |
| Top 20 WFOs: BMX, HUN, JAN*, MOB, EWX, BOX, BUF, CAR, RNK, APX, GRR, LMK*, MKX*, DMX, EAX, MPX, SGF*, DDC, TOP*, and AFG. An asterisk (*) denotes one of the top five WFOs. | | | |

performing offices shared one common trait; they issued relatively unbiased TS forecasts. In contrast, the lower-performing offices (not listed in the tables of either study) tended to under-forecast TS in FM groups and over-forecast them in TEMPO groups. It is not surprising that WFOs in very dry climates seemed to struggle the most in both studies. After all, it's very difficult to achieve a high score when you get so few opportunities.

If you're over-forecasting TS in TEMPO groups, we recommend that you wait until you are more certain before forecasting a TS in a TEMPO group. If you expect some thunder in the general area but aren't confident about it occurring at an individual terminal, consider forecasting TS within the vicinity of the terminal (VCTS), i.e., within a 5- to 10-statute mile radius from the control tower. Your certainty that a TS will hit a particular terminal might not be very high when you issue a scheduled TAF, but that could change within an hour or two, as you see the storm approaching on radar. Under those circumstances, we recommend amending once your confidence level reaches 50 percent. The decision to place the TS in a TEMPO or FM group should be based upon the expected duration of the TS, not the forecaster's level of confidence in an event occurrence at the terminal. This appears to be how the top performing offices have maintained their higher scores in FM groups, and this is the kind of service the aviation community needs to meet today's modern air traffic challenges safely and at reasonable cost.

When I was in the field, I used to feel like I was admitting defeat whenever I amended a TAF. I stopped that kind of thinking after I learned there's no shame in issuing amendments when the weather is changing rapidly. It shows we're keeping on top of the weather and this increases people's confidence in our forecasts. Finally, product consistency plays a big role in increasing user confidence in our forecasts, so remember the guidance in NWSI 10-813. If the Collaborative Convective Forecast Product (CCFP) indicates high confidence or high coverage at one or more terminals, or the public forecast is predicting at least a 60 percent chance of thunderstorms, then it is consistent to predict thunder in the appropriate TAFs. Now, go take on the 2013 thunderstorm season!

***Acknowledgement**: I would like to thank Kevin Stone from the OCWWS Aviation Services Branch for reviewing and helping me finalize the text in this article.*

Dealing with an Aging IT Infrastructure During Times of Tight Budgets – Continued from Page 6

many of these issues are occurring at the same time. With very little money in the NWS to spend on upgrading these systems, we must become more resourceful in order to survive. How are we going about doing this? That is the million dollar question.

In a perfect world, someone would give us a $50k – $75k check to restore the performance management system to where it should be. In this budget climate, securing that amount of money is unrealistic. As I embarked on trying to return our servers to a mostly stable status with 99.9% uptime, I started asking around. Who had servers? How were they buying these servers? How often do they refresh these servers? The feedback that I received was both encouraging and discouraging. Starting with the discouraging news was the fact that many of the other offices dealing with operational NWS products and data were on well-funded, 3-year hardware refresh cycles. I would be the happiest man in the world if I could just get us on a 5-year hardware refresh cycle, but alas we are on no hardware refresh cycle. That is discouraging and unlikely to change anytime soon.

The encouraging news was that after this hardware has been refreshed every 3 years, the system owners send it off to government surplus land. I figured if I played my cards right, I could end up securing these systems for the Performance Branch. Granted, we are not talking about state of the art, top line systems, but they are certainly better than the 10-year old systems we currently use. Sure enough, people were willing to help us out in the Performance Branch.

Since January 2013, our new IT specialist, David Rancourt, and I have been working hard to get these repurposed servers into our possession so we may begin using them to serve performance management data. As we do this, there may be some growing pains and periods of frustration. You may realize that some of the Stats on Demand programs are not updated as frequently as you may have been accustomed to or we run into problems where the Performance Management website is unexpectedly taken offline. Trust me, if anyone feels your pain it is me. I long for the days where the only emails I answered dealt with whether I thought a fatality being logged in storm data was directly or indirectly related to a storm or if someone needed my help in understanding the data being displayed in a contingency table.

We would just like to thank you in advance for your patience during this upcoming period of transition to some more stable servers. I guarantee you that we will do our best to let you all know of any planned downtime for the Performance Management website and Stats on Demand programs.

To ensure you get the word on any upcoming outages, please log into the Email Subscriptions section of our website (located: https://verification.nws.noaa.gov/services/user/subscriptions.aspx) and ensure you are signed up to receive our "General Website Announcements."

**The best way to inspire people to superior performance is to convince them by everything you do and by your everyday attitude that you are wholeheartedly supporting them. Harold S. Geneen**

# Snapshot: Service Assessment Actions

- **Remnants of Tropical Storm Lee and the Susquehanna River Basin Flooding of September 6-10, 2011 (Regional Service Assessment)** - Released July 26, 2012
  12 Total Actions, 1(11%) Closed Actions

- **Historic Derecho of June 29, 2012** - Released February 05, 2013
  14 Total Actions, 4(29%) Closed Actions

- **The Missouri/Souris River Floods of May – August 2011 (Regional Service Assessment)** - Released June 05, 2012
  29 Total Actions, 15(52%) Closed Actions

- **May 22, 2011 Joplin Tornado (Regional Service Assessment)** - Released September 20, 2011
  16 Total Actions, 10(62%) Closed Actions

- **Hurricane Irene in August 2011** - Released October 05, 2012
  94 Total Actions, 42(45%) Closed Actions

- **Spring 2011 Mississippi River Floods** - Released April 11, 2012
  31 Total Actions, 13(42%) Closed Actions

- **Washington, D.C. High-Impact, Convective Winter Weather Event of January 26, 2011** - Released April 01, 2011
  6 Total Actions, 6(100%) Closed Actions

- **The Historic Tornado Outbreaks of April 2011** - Released December 19, 2011
  32 Total Actions, 26(81%) Closed Actions

- **Record Floods of Greater Nashville: Including Flooding in Middle Tennessee and Western Kentucky, May 1-4, 2010** - Released January 12, 2011
  17 Total Actions, 16(94%) Closed Actions

- **South Pacific Basin Tsunami of September 29-30, 2009** - Released June 04, 2010
  131 Total Actions, 129(98%) Closed Actions

- **Southeast US Flooding of September 18-23, 2009** - Released May 28, 2010
  29 Total Actions, 29(100%) Closed Actions

- **Mount Redoubt Eruptions of March - April 2009** - Released March 23, 2010
  17 Total Actions, 17(100%) Closed Actions

- **Central US Flooding of June 2008** - Released February 03, 2010
  34 Total Actions, 33(97%) Closed Actions

- **Mother's Day Weekend Tornadoes of May 10, 2008** - Released November 06, 2009
  17 Total Actions, 17(100%) Closed Actions

- **Super Tuesday Tornado Outbreak of February 5-6, 2008** - Released March 02, 2009
  17 Total Actions, 17(100%) Closed Actions

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## *Web Links*

**Stats on Demand**

https://verification.nws.noaa.gov

**Real-Time Forecast System:**

http://rtvs.noaa.gov/

*Questions and comments on this publication should be directed to Freda Walters.*

**Please consider contributing to our next edition:**

**Spring 2013**

**Articles Due:**
**Monday, April 15, 2013**