NEWSLETTER

National Weather Association

No. 10 – 7 July 2010

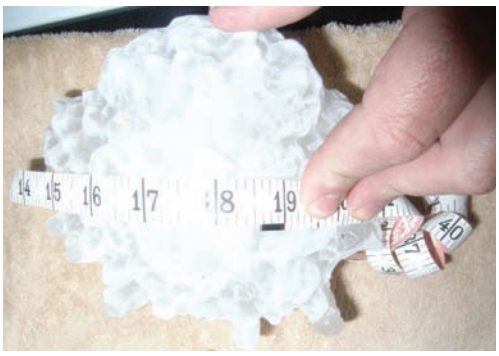
New National Hail Records Set in South Dakota

A hailstone that broke U.S. records to become the heaviest hailstone and the hailstone with the largest diameter fell in Vivian, S.D., on July 23, 2010.

Les Scott found the hailstone after the storm passed, stored it in his freezer and contacted the National Weather Service (NWS). Warning Coordination Meteorologist David Hintz of the NWS Aberdeen office measured the diameter and circumference of the stone. The diameter was eight inches and the circumference 18 5/8 inches. The hailstone was later taken to the Post Office and weighed on a federally certified scale. It weighed 1.9375 pounds.

The National Oceanic and Atmospheric Administration (NOAA) National Climate Extremes Committee evaluated the hailstone's measurements and made the final determination that it broke both records.

The hailstone that previously held the record for the largest diameter, seven inches, fell in Aurora, Neb., on June 22, 2003. That hailstone still holds the U.S. record as having the largest circumference of 18.75 inches. A 1.67 pounds hailstone was the previous record holder for weight; it fell in Coffeyville, Kan., Sept. 3, 1970.



Hailstone that fell in Vivian, S.D., on July 23. Photo courtesty of David Hintz of the NWS.

(Details on this hailstone are on the NWS Aberdeen website: http://www.crh.noaa.gov/abr/?n=stormdamagetemplate.)

Visit http://www.ncdc.noaa.gov/extremes/ncec/ for other extreme weather record information.

Inside This Edition

NWA President's Message – Getting on to the Future

In operational forecasting, how do we get to some future (hopefully improved) state of operations? A network of Doppler radars didn't just spring up. Implementing and maintaining our radars, satellites and other observing systems, and getting their data into forecast operations, requires tremendous planning from those in the weather community. As new technologies emerge, like for radar dual-polarization (soon) and phased array (down-the-road), focused and careful planning, and most importantly funding, are required. How does the weather enterprise develop priorities on choosing which technologies to implement? How do we transition weather research findings into operations; a process referred to as "research-to-operations" (R2O). And how is that funding secured for developing new weather technologies and research; a difficult problem anytime, but especially during these austere times? This month I'll highlight one way future weather research projects are identified and prioritized.

A recently-released report from the National Research Council (NRC) "*When Weather Matters: Science and Services to Meet Critical Societal Needs*" attempts to identify future weather research and R20 issues. The NRC, founded in 1916 as a private, nonprofit institution, provides expert science and technology policy advice to elected leaders and policy makers in the Federal Government and to the public. Their reports carry clout on Capitol Hill and throughout various Federal agencies. This 146-page NRC report was funded jointly by NASA, NOAA and the National Science

See PRESIDENT, page 4

Want to tee up in the NWA Annual Meeting Golf Tournie? See page 7

River Forecasting: Part I— Quantitative Precipitation Estimation

River forecasting is a lesser-known function of the National Weather Service. Thirteen River Forecast Centers, or "RFCs" (Figure 1), provide daily forecasts of river levels and discharges for more than 1600 sites; many additional sites receive forecasts when high water threatens. These forecasts are used by emergency officials to help prepare for flooding, by industrial and shipping interests who require a certain level of water for their operations, and by private citizens for recreational and other purposes.

To forecast the river level and discharge at a point, it is necessary to know how much precipitation has fallen recently and how quickly it will make its way into the river ("local flow"), as well as how much water will be coming from upstream ("routed flow"). A forecast of precipitation for some period into the future ("forecast mean areal precipitation" or FMAP) is also needed. This article will focus on how precipitation is estimated.

Mean areal precipitation (MAP) is one of the primary inputs to the river forecasting model. Estimates of precipitation are largely derived from a combination of radar data and precipitation gauge reports, although where radar and rain gauge estimates aren't available, satellite precipitation estimates are sometimes used. This information is used to compute MAP - the liquid equivalent of precipitation averaged over each river basin. Since this number is an average, it may be misleading. If heavier rain occurred closer to the river gauge with lighter rain elsewhere in the basin, the river will rise quicker at the forecast point than a basin-averaged rain would suggest (Figures 2a and 2b). RFC forecasters can adjust these numbers accordingly for a more representative result.

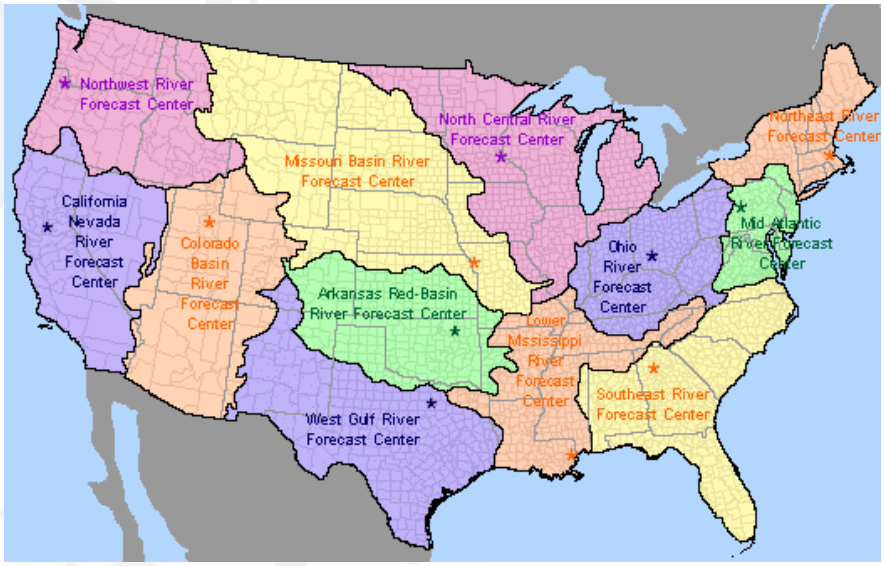


Figure 1. National Weather Service River Forecast Centers' areas of responsibility. (Alaska-Pacific River Forecast Center not shown)

If much or all of the precipitation is frozen, its entry into the river may be significantly delayed. Many RFCs incorporate observed and forecast temperatures into their river models to estimate the rate and amount of snowpack accumulation, and the snowmelt that will subsequently enter the river system. Warm rain on top of a wet snowpack can send large amounts of water into the river very quickly.

Part II of this article will discuss how estimated precipitation and water from upstream are incorporated into the river forecast.

Christine McGehee
Hydrologist, NWS Southeast River Forecast Center
Professional Development Committee

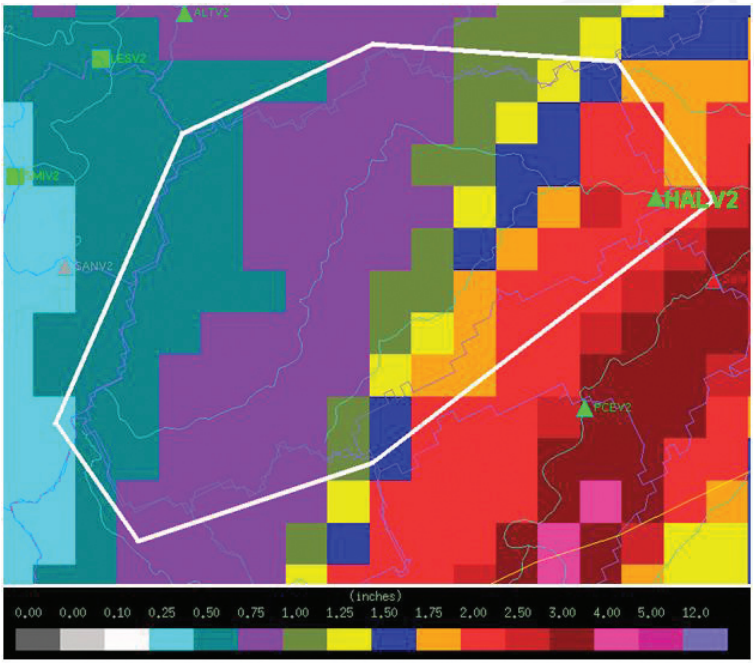


Figure 2a. Six hour radar precipitation accumulation ending March 29, 2010, at 06 UTC. This river basin (within white line) received as much as 2.50-2.99 inches of rain at its downstream end and lesser amounts in its headwaters. The river will rise more quickly at the outlet point, HALV2, than it would have if the rain had fallen more evenly.

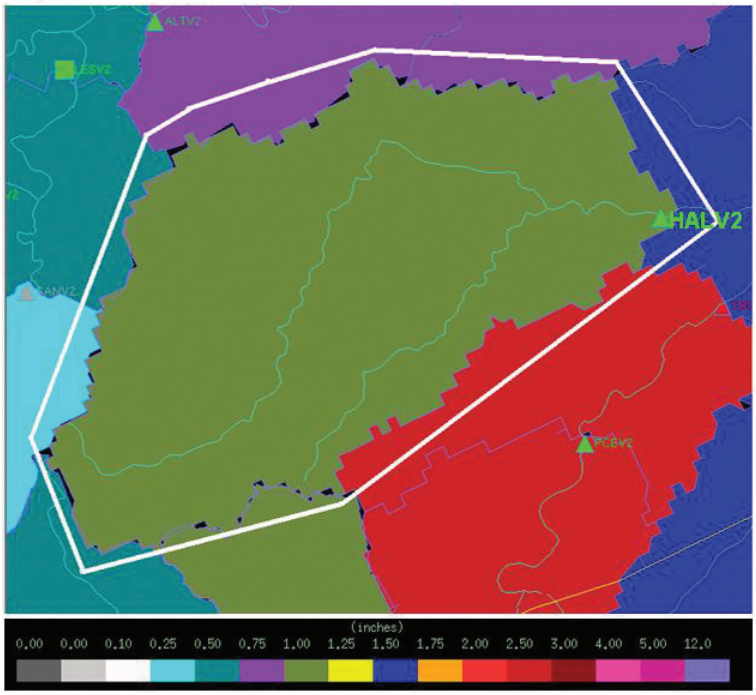


Figure 2b. Hourly Mean Areal Precipitation (MAPX) accumulation for the same period. MAPX calculates an average of 1.00-1.24 inches over the entire basin for the six-hour period. The river model will bring this rain into the river too gradually.

NWA Member News: Dr. Kenneth C. Crawford

Dr. Kenneth C. Crawford was honored for 20 years of service at the Oklahoma Climatological Survey (OCS) and the University of Oklahoma (OU) during a retirement reception held on April 16. Dr. Crawford's list of accomplishments at OCS and OU were quite significant and pioneering.

Even though he retired from these institutions, he continues his work as a meteorologist. Dr. Crawford has been the Vice Administrator of the Korean Meteorological Association (KMA) since August of 2009.

Dr. Crawford was the Director of OCS and the Oklahoma State Climatologist from December 1989 – December 2009. He was a Regent's Professor of Meteorology at OU from December 1989 to July 2010, but remains connected with the University through his work at KMA.

His accomplishments during the past 20 years include the creation of the Oklahoma Mesonet, the OK-FIRST program designed to mentor public safety officials, the Oklahoma Mesonet's educational-outreach program EarthStorm, mentoring many young scientists including 39 OU graduate students and providing leadership in the development of weather and climate services for OCS and the Mesonet.

From 1961 to 1989, Crawford held many positions in the National Weather Service (NWS). He was the Oklahoma Area Manager and the Meteorologist in Charge of the Norman/Oklahoma City office just prior to his move to OCS and OU. He returned to the NWS as a senior visiting scientist for two periods from 2003-2006.

The NWA and other professional organizations have benefitted from Dr. Crawford's expertise. He served the NWA as president in 1988 and as a councilor from 1990-1991. He was the NWA "*Member of the Year*" in 1991. He is a fellow of the AMS and a past-president of the American Association of State Climatologists.

35th NWA Annual Meeting: Pre-register Now!

The NWA 35th Annual Meeting will be held from Oct. 2 – 7, 2010 at the Marriott Tucson University Park Hotel, Tucson, Ariz.

ANNUAL MEETING PREREGISTRATION (through Sept. 24): The preregistration fee includes a pre-print volume with program and abstracts. For the period of days registered, it also includes: admission to all oral presentations, poster sessions, and exhibit sessions plus coffee/refreshment breaks. Full registration includes the Wednesday Awards Luncheon. Registration after the preregistration period will result in fee increases of $15 to $50.

Annual Meeting Hotel Information:

Marriott Tucson University Park
NWA room rates (reserve by Sept. 1 to get these rates!): Single & Double room rate: $106.00; Standard Suites: $139.00
Call 1-800-228-9290 and request the National Weather Association 2010 Annual Meeting rate to reserve your room.
www.marriott.com/hotels/travel/tusup-tucson-marriott-university-park/.

Pre-registration Fees *(through Sept. 24):*

Sun., Oct. 3: Broadcast Workshop and DVD Swap (8 a.m.–11 p.m.)
- $100 NWA members and presenters
- $50 students and retired members
- $140 for non-members
- $95 for non-member students and retired

Sun., Oct. 3: Student Seminar and Resume night session (1 p.m.–11 p.m.)
- $35 NWA student members
- $50 for non-member students

Mon.–Thurs., Oct. 4 - 7: General Sessions/Activities $240 NWA members and presenters
- $125 students and retired members
- $280 for non-members
- $175 for non-member students and retired

Special One-Day Rates for period Oct. 4 – 7
- $95 NWA members and presenters
- $50 students and retired members
- $120 for non-members
- $90 for non-member students and retired

Special: All events Sun.–Thurs.
- $330 NWA members
- $410 for non-members

Special Student: All events, Sun.–Thurs.
- $145 NWA members
- $215 for non-members

If a non-member joins, they will immediately be eligible for the member rates

Additional Links

Main meeting page:
http://www.nwas.org/meetings/nwa2010/

Registration page:
www.nwa-registration.org/register.shtml

One day registration page:
www.nwa-registration.org/registerbyday.shtml

Help: Your Input is Critical

The National Weather Service is seeking comments on the draft of their strategic plan. This plan will guide the organization over the next 10 years. The public comment period is open through Sept. 7, and NWS Director Jack Hayes invites everyone to provide their comments.

The Plan is at: www.weather.gov/com/stratplan/#

PRESIDENT from front

Foundation. It contains findings and recommendations from a special committee set up under the NRC's Board on Atmospheric Sciences and Climate (BASC); the "Committee on Progress and Priorities of U.S. Weather Research and Research-to-Operations (R20) Activities."

The committee was comprised of eight experts from across the weather enterprise representing academia, research and the private sectors. They met several times since July 2009, and interacted with nearly 50 experts in weather research and operations. The report was peer-reviewed by an independent group of weather experts. While the report isn't a "*...comprehensive assessment of the state of U.S. weather research nor the transition of research findings into operations...*", it does provide "*...the committee's judgment and recommendations on the most pressing, high-level, weather-focused research challenges and R2O needs...*" the U.S. faces.

Three broad areas are covered in the report: established and emerging needs, and socioeconomics. The report contains eight recommendations. Though funded by federal agencies, the report's authors believe the recommendations are relevant to all sectors in the weather enterprise including agency decision makers, policy makers, research scientists, academia, the private sector, public and private user groups and even the general public. Four recommendations deal with areas previously identified as important high-value national goals but that have yet to be realized: 1) global non-hydrostatic coupled modeling, 2) quantitative precipitation forecasting, 3) hydrologic predictions and 4) mesoscale observations. Three recommendations deal with important, emerging issues: 5) predictions of "high impact" weather, 6) urban meteorology and 7) renewable energy development. The eighth recommendation cuts across all of the previous seven recommendations: 8) improvement of socioeconomic research and capacity. This last addresses fundamental issues in determining how, when and why weather information (like warnings) is or isn't used.

Also, the eighth recommendation on socioeconomic issues supports the NWA Council's decision last year to form a new Committee on Societal Impacts of Weather and Climate, which is chaired by Kevin Barjenbruch. Last month's lead story in the NWA Newsletter (June 2010) focused on societal impact. I encourage you to read that short article that helps explain what "societal impact" is and how we in the operational weather enterprise are involved with it. This year's NWA Annual Meeting directly supports the need for considering societal impacts.

So, to better understand where weather research is likely headed in the coming years, I encourage you to read this report. A PDF version can be downloaded for free at http://dels.nas.edu/Report/When-Weather-Matters-Science-Service/12888). The report's recommendations can potentially impact how we in the operational forecast community do business. Finally, the report calls for increased collaboration and dialogue among a wide range of disciplines and organizations to focus energies on developing priorities and defining specific actions for planning and executing future weather research and transitioning that research to operations. You can (and should) play a role in this collaboration and dialogue: keep apprised for opportunities to do so. Making your voice heard by those at the agency policymaking level can be a challenge; however, many federal agencies (including NOAA) participate in and/or organize meetings of weather enterprise stakeholders where they seek comments and feedback on a variety of issues, including weather research and R2O. One such meeting was held last March (2010) in Washington, D.C. at National Weather Service Headquarters.

Recently, on July 21, 2010, as a representative of the NWS, I presented information on providing early warnings of tornadoes at a public briefing on Capitol Hill. The briefing, organized by the Congressional Hazards Caucus, featured short presentations from Dr. John Snow, Regents' Professor of Meteorology and Dean Emeritus, College of Atmospheric and Geographic Sciences, the University of Oklahoma; Dr. Roger Wakimoto, Director, National Center for Atmospheric Research (NCAR) in Boulder and me. Prior to the briefing, I enjoyed several conversations with my fellow presenters, including a discussion with Dr. Wakimoto about the differing physical mechanisms for tornadoes that build "up" from the surface as opposed to those that descend from a storm. Dr. Snow, when asked by a Hill staffer what was needed to provide better lead times for tornado warnings, responded that not only do we need improved observations (from satellites, better radars and mesonet data), but improved prediction models of storm-scale (1-10 km) phenomena are just as important. These improved models will require extraordinary increases in high performance computing, with "petaflop" machine performance necessary. Rapid, real-time data assimilation of the plethora of observations is also part of the modeling equation. Dr. Snow was also one of the eight weather experts who helped draft the NRC report "*When Weather Matters...*" reviewed earlier in this message.

Finally, I encourage each of you to consider attending all or a portion of our 35th NWA Annual Meeting, Oct. 2-7, in Tucson, Ariz. This year's Program Committee, Chaired by Erik Pytlak, has assembled an excellent program to spotlight the Meeting's theme of "*Fire and Ice: Science and Society*." I'm looking forward to an exciting meeting and hope to see you there.

Any questions/comments, please feel free to send email to me: President@nwas.org.

Steve Zubrick
NWA President

NWA Posts Operating Loss for 2009

Increased expenses associated with launching the Member's Only Portal, in-depth strategic planning, printing, postage coupled with a drop in dues, investing and broadcast certification income led to an operating loss in 2009. The losses were covered by transferring funds from investment reserves.

At the end of 2009, NWA reserves, which include two corporate bonds, a bond index fund and a stock index fund, were valued at $135, 292 — down from $171,497 at the beginning of the year.

The following is from the NWA 990 IRS tax return filed in May.

INCOME	
Contributions, gifts, grants	19330
Program service revenue*	141965
Membership dues	96766
Investment income	7710
Profit from logo item sales	770
Total Revenue	266541
EXPENSES	
Grants, scholarships	10500
Salaries	92130
Professional fees**	24125
Occupancy, rent, utilities	18787
Printing, postage, shipping	72051
Other expenses***	108361
Total Expenses	325954
Operating deficit for 2009	-59407
Increase in value of investments	15134
Reduction in Net Worth	-44273
Net Worth	
January 1, 2009	242348
December 31, 2009	198075

**Program service revenue*
- Annual meeting income
- Broadcast certification income
- Subscriptions
- Digest author page charges

***Professional fees*
- Strategic planning
- Member portal Web site upgrade
- CPA

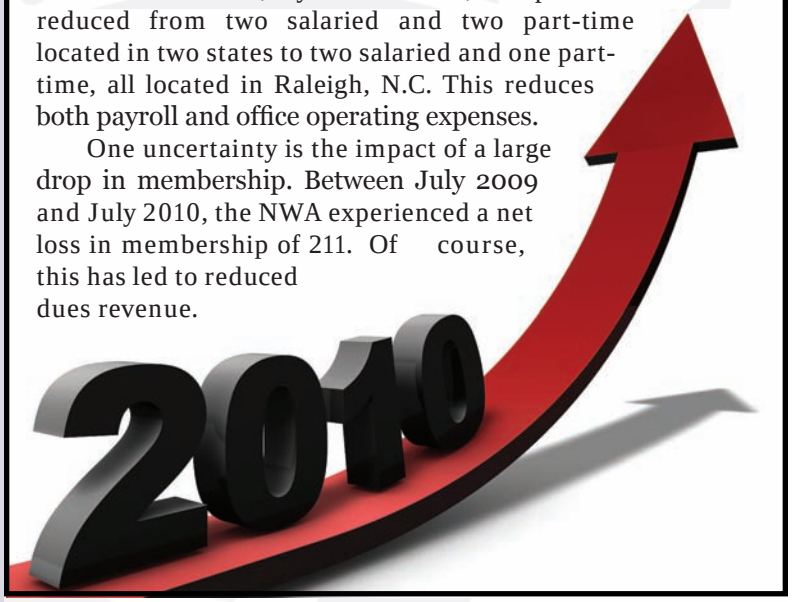
****Other expenses*
- Annual meeting expenses
- IT expenses
- Travel
- Office equipment & supplies
- Bank and credit card service charges

NWA Budget Situation Much Brighter for 2010!!

The NWA is expected to balance the 2010 operating budget primarily as a result of a reduction in expenses. The launch of the Member's Only Portal on the website is the primary reason for this. In 2010, the NWA offered members a reduced dues rate if the member opted to access the *Newsletters* and *National Weather Digest* electronically. Approximately 75 percent of the membership requested this option, leading to a dramatic reduction in printing and postage costs.

Additionally, the retirement of the first NWA Assistant Executive Director, Cynthia Nelson, the paid staff has been reduced from two salaried and two part-time located in two states to two salaried and one part-time, all located in Raleigh, N.C. This reduces both payroll and office operating expenses.

One uncertainty is the impact of a large drop in membership. Between July 2009 and July 2010, the NWA experienced a net loss in membership of 211. Of course, this has led to reduced dues revenue.



GFS Updgraded

On July 28, the NWA National Centers for Environmental Prediction (NCEP) implemented an upgrade to the Global Forecast System (GFS) beginning at 1200 UTC.

A significant change was an increase in model resolution from the current "T382" (approximately 35 km horizontal) to T574 (approximately 27 km). This higher resolution will be applied through 192 hours.

More information on this upgrade is available in a WORD document at: http://www.nws.noaa.gov/om/notification/tin10-15aab_gfs.doc

Newsletter History: Who Knew?

In March 1983, the NWA Newsletter reprinted a letter to the editor from a Beaumont, Texas, newspaper submitted by a "retired hurricane chaser." It stated:
"If you are inland, you are safe from hurricanes."

Tropical Cyclone Intensity Change and Lightning Activity

The next generation Geostationary Operational Environmental Satellite (GOES) systems starting with GOES-R (scheduled for late 2015) will include a geostationary lightning mapper (GLM). The GLM will provide nearly continuous locations of total lightning (cloud to ground and intra-cloud) with an accuracy of about 10 km over most of the field of view of GOES-East and -West. This coverage will include nearly all of the regions where tropical cyclones (TCs) occur in the Atlantic and northern East Pacific. This lightning data has the potential to provide new information about the convective structure in TCs and their environments.

Over the past several years, extended range ground based lightning networks have been implemented, including the University of Washington World Wide Lightning Location Network (WWLLN, webflash.ess.washington.edu) and the Vaisala Global Lightning Dataset 360 (GLD360 www.vaisala.com/weather/products/gld360.html). Although these ground-based systems primarily detect cloud-to-ground flashes, they can be used to study TCs and provide a preview of what will be available from GOES-R.

Tropical cyclone lightning studies have identified several relationships with structure and intensity. For individual storms lightning activity tends to have a bimodal structure with radius, with local maxima in strikes near the eyewall (5-100 km radius) and in the rainband regions (200-400 km), with a minimum in between. There is also a strong tendency for increased lightning strikes in the direction of the environmental vertical wind shear vector. For example, for a storm in westerly vertical shear there would be increased lightning on the east side of the storm. Case studies have suggested that there is more eyewall lightning for TCs that are intensifying. However, the timing of when that occurs varies from storm to storm and the lightning peak sometimes occurs after the peak intensity.

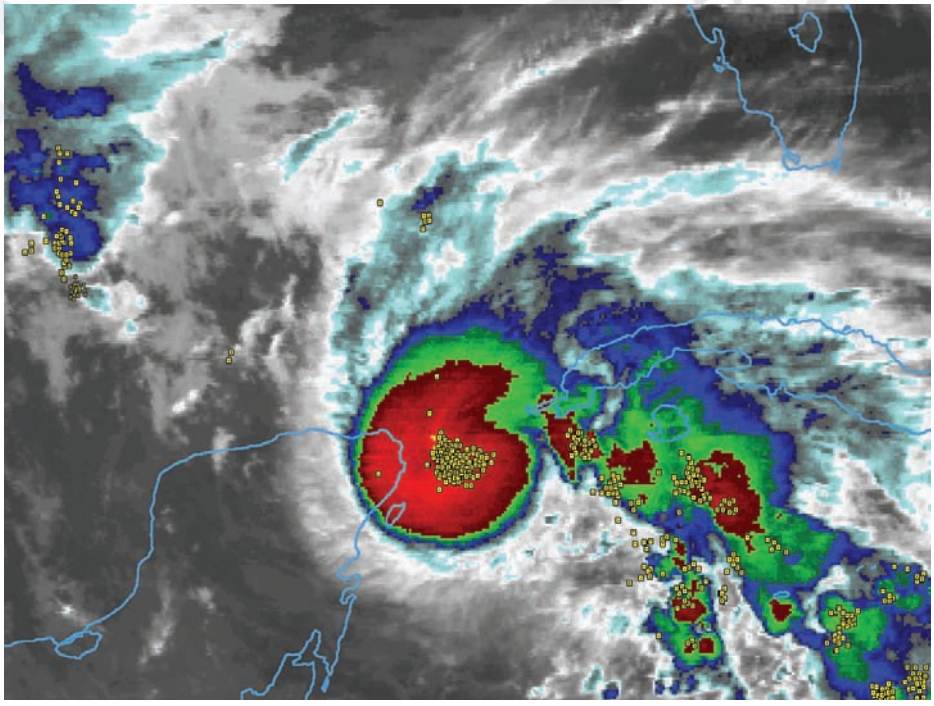


Figure 1. Color enhanced infrared imagery of Hurricane Ida at 15 UTC on 8 November 2009. Lightning locations within two hours of the image from the World Wide Lightning Location Network are indicated by the yellow points.

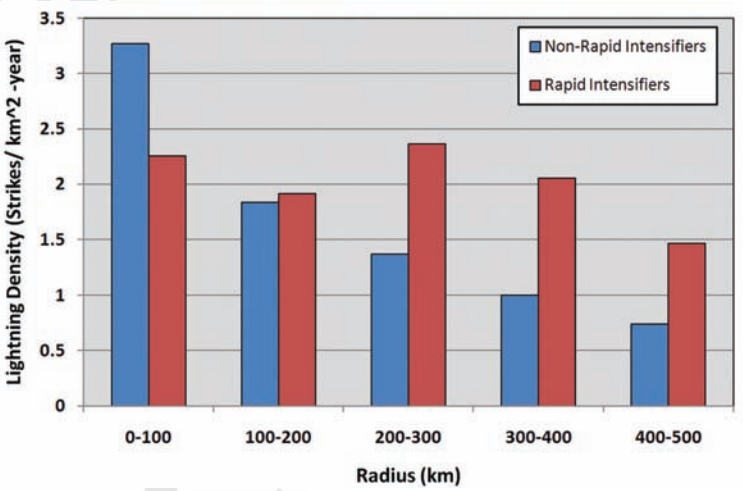


Figure 2. The average lightning density in 100 km annuli from 0 to 500 radius from the center of all Atlantic TCs from 2005-2009. Values are shown for storms where the maximum sustained surface winds increased by 30 kt or more in the following 24 hr (Rapid Intensifiers) and those that did not (Non-Rapid Intensifiers).

To get a better understanding of the relationship between lightning strikes and TC intensity changes, the full life cycles of all Atlantic TCs from 2005-2009 were examined. This period was chosen because a reliable sample of WWLLN data was available. Some WWLLN data is available back to 2003, but the network was too sparse before 2005. Figure 1 shows lightning strikes detected by the WWLLN for Hurricane Ida within two hours of 15 UTC on 08 November 2009. For the quantitative analysis, the lightning strikes were composited relative to the storm centers over six hour intervals. For each six hour interval, the lightning strikes were counted in annuli at 100 km intervals from 0 to 500 km from the storm center. To account for the differing areas of the annuli, the lightning per unit area and time (lightning density) was calculated in each ring. Using a comparison with Atlantic basin lightning climatologies from polar-orbiting satellites, annual adjustments were applied to the lightning density to account for WWLLN station improvements. Units of strikes/km^2-year are used for lightning density for consistency with the climatological analyses.

One of the most difficult but important forecast tasks is the prediction of TC rapid intensity changes. TC rapid intensification is often defined as an increase in the 1 minute maximum sustained winds of 30 kt or greater in 24 hours. The 30 kt per 24 hours change corresponds to the 90th percentile of intensity changes of Atlantic TCs, and is roughly equal to two Saffir-Simpson hurricane categories. Figure 2 shows the lightning density for the five year Atlantic sample for the cases that rapidly intensified and those that did not in the following 24 hours. This figure shows that in the inner core region, the average lightning density was greater for cases that did not rapidly intensify. Thus, from a forecasting point of view, inner core lightning is

See CYCLONE, page 7

Octobers are SOOO Hot in Tucson: How hot are they?

Nah - Octobers are gorgeous in Arizona!

Are you preparing for the 2010 Annual Meeting in Tucson? To help you prepare for your trip, here is some Oct. 2-7 climate information obtained from the NWS Tucson website.

During early October, the normal high temperature is around 88 and the normal low 62. Normal daily precipitation averages 0.04 inches. Evaluating data for the period 1894-2009, the highest temperature recorded from Oct. 2-7 was 102 on Oct. 3, 1993, and the lowest temperature of 39 occurred on Oct. 5 and 6 in 1908.

For those playing in the 2010 Golf Outing, the Oct. 2 rainfall record is 1.73 inches, which occurred in 1970. It should be noted that the one day (midnight to midnight) record rainfall for the month is 2.96 inches which fell on Oct. 1, 1983.

CYCLONE, from page 6

a sign that an intensification phase is nearing its completion and that subsequent rapid intensification is less likely. This observation is consistent with the Hurricane Ida case in Figure 1, which had a considerable amount of lightning activity near the center. Ida reached its peak intensity a few hours later and began to weaken after that time. In contrast, the lightning density in the outer rainband regions in Figure 2 is nearly twice as large for the rapid intensifying cases as for the non- rapidly intensifying cases. Thus, the lightning in the outer radii is a better indicator of rapid intensification.

The five year sample of lightning data also showed that lightning activity near TCs is highly transient and that some of the largest outbreaks are associated with increases in the environmental vertical shear around the storm. Vertical shear generally has a negative influence on intensification. These preliminary findings indicate that lightning information has potential forecast applications, but it should be used with caution. The best indicator of rapid intensification is an increase in lightning strikes in the region 200-400 km from the storm center, especially in cases where the environmental shear is low. Further research is needed to quantify these relationships, and to determine if additional information can be obtained from the total lightning measurements that will be available from GOES-R.

Mark DeMaria, NOAA/NESDIS/STAR
Professional Development Committee

** The views, opinions and findings in this report are those of the author and should not be construed as an official NOAA or U.S. government position, policy or decision.*

NWA Sponsored Annual Meetings & Conferences

Aug. 12–13: The 14th Annual High Plains Conference
Sponsored by the High Plains AMS/NWA Chapter, it will be at the Student Union Building on the campus of Dodge City Community College in Dodge City, Kan. (http://www.highplains-amsnwa.org/)

Sept. 17-18: 9th Annual Southeast Severe Storms Symposium
Sponsored by the East Mississippi Chapter of the NWA and AMS, it will be at Mississippi State University. Abstracts due Aug. 15. Registration open until Sept. 10. A Conference Scholarship is also available. (http://www.msstate.edu/org/nwa/index.shtml)

Oct. 2–7: 35th Annual Meeting of the NWA
See page 3 or www.nwas.org for details.

Oct. 24-26: The National Flood Workshop
This conference, sponsored by many agencies including the NWA, will be held in Houston, Texas.

Other Meetings & Conferences

Sept. 27-30: 17th Conference on Satellite Meteorology and Oceanography
This conference sponsored by the American Meteorological Society will be held in Annapolis, Md. (http://www.ametsoc.org/MEET/meetinfo.html)

Oct. 26-27: 2nd WFO Amarillo Decision Support Symposium
This symposium will focus on preparedness, societal impacts, and relationships which help improve the Decision Support Services offered by the NWS and is hosted by the NWS in Amarillo (www.srh.noaa.gov/ama/)

Nov. 2-4: 14th Annual Great Divide Workshop
This workshop will be held at the Crowne Plaza in Billings, Mont. Send abstracts to Wr.Great.Divide.Workshop@noaa.gov by Oct. 1. (www.wrh.noaa.gov/byz/greatdivide/welcome.php)

don't miss these important Tucson deadlines

The 35th Annual NWA Meeting : Oct. 2 – 7, Tucson, Ariz.

Sept. 1 – Last day to obtain NWA rate at the Marriott Tucson University Park

Sept. 24 – Last day for discounted pre-registration fees

See page 3 for full meeting details!

Dates 2 Remember

Aug. 12-13: 14th High Plains Conference, Dodge City, Kan.

Sept. 1: Deadline for obtaining NWA conference rates at Tucson Hotel (see page 3)

Sept. 17-18: 9th Southeast Severe Storms Symposium, Mississippi State, Miss.

Sept. 24: Deadline for pre-registering for Annual Meeting and receiving reduced conference rates

Oct. 2-7: 35th NWA Annual Meeting, Tucson, Ariz.

Oct. 24-26: National Flood Workshop, Houston, Texas

Oct. 27-27: 2nd WFO Amarillo Decision Support Symposium, Amarillo, Texas

See page 7 for more Professional Development Opportunities!

NWA Newsletter (ISSN 0271-1044)

Contributing Editor: Janice Bunting
Editor and Publisher: Steve Harned, Executive Director

Published monthly by the National Weather Association, 228 West Millbrook Road, Raleigh, N.C. (USA) 27609-4304; phone ~ (919) 845-1546; fax ~ (919) 845-2956; exdir@nwas.org; www.nwas.org.

Submit newsletter items directly to the NWA office or to nwanewsletter@nwas.org. Material received by the 25th will be considered for the next month's issue.

Members receive the Newsletter and *National Weather Digest* as part of their regular, student or corporate membership privileges. Printed Newsletter subscriptions are available for $25 per year plus extra shipping costs outside U.S. Single copies are $3. **Address, phone number, email and affiliation changes can now be made online at the member portal.**

Supporting and promoting excellence in operational meteorology and related activities since 1975.

National Weather Association
228 W. Millbrook Rd.
Raleigh, NC 27609-4304

Address Service Requested