NORTHEASTERN STORM BUSTER

Fall, 2014 - *VOL. 19, NO. 4*
Evan L. Heller, Editor/Publisher
Steve DiRienzo, WCM/Contributor
Ingrid Amberger, Webmistress

FEATURES

2 Summer 2014: Stormy with Above Normal Rainfall
By Evan L. Heller & Ingrid Amberger

5 Getting Prepared for Fall Weather
By Steve DiRienzo

7 Dwindling Sunspots: Could This Affect Climate Change?
By Hugh Johnson & Evan L. Heller

9 NWS Albany Wows Crowd with Pet Tornado At the Adirondack Balloon Festival
By John Quinlan & Britt Westergard

DEPARTMENTS

10 Kevin S. Lipton's WEATHER ESSENTIALS The Wind, and the Highs and Lows of Weather

12 From the Editor's Desk

13 WCM Words

Northeastern StormBuster is a quarterly publication of the National Weather Service Forecast Office in Albany, New York, serving the weather spotter, emergency manager, cooperative observer, ham radio, scientific and academic communities, along with weather enthusiasts, who all have a special interest or expertise in the fields of meteorology, hydrology and/or climatology.

SUMMER 2014: STORMY WITH ABOVE NORMAL RAINFALL

Evan L. Heller
Climatologist, NWS Albany, NY

Ingrid Amberger
Senior Meteorologist, NWS Albany, NY

The Summer of 2014 as a whole was a season of slightly above normal temperatures (Table 1). It began with June being a couple of degrees above normal (Table 1), but things trended toward becoming slightly cooler than normal as the season progressed. August was nearly a degree below normal. The warmest day of the season in Albany was July 1st, with a mean of 81.0°; the coolest, with 60.0°, was June 14th. The highest reading for the season was 91°, recorded on both July 1st and 23rd, and the lowest was 46°, on June 1st. Three more summer days recorded 90 degrees or higher (Table 2a).

As previously stated, there were only 4 days this year in Albany during which the high temperature reached 90+ degrees. The normal number of 90+ degrees days a year for Albany is ten. Looking back through 141 years of records to 1874, there have been 34 years with 5 or fewer days of high temperatures of 90+ degrees, and 37 years with 15 days or more. The least number of days was zero, in 1998 alone, and the most was 32, in 1955. The breakdown by month for the past fifteen years, and the highest temperature recorded for each year, is shown in the following table.

Number of 90+ degrees days for Albany, New York by month and year, 2000-2014

Year	April	May	June	July	August	September	Total	Highest Temp
2014	0	0	1	3	0	0	4	**91** July 1st & 23rd
2013	0	1	4	9	0	1	15	**96** July 19th
2012	1	1	4	5	2	0	13	**98** July 17th
2011	0	0	2	6	0	0	8	**99** July 21st
2010	0	1	0	8	3	2	14	**96** July 6th
2009	1	0	0	0	3	0	4	**91** August 17th
2008	0	0	4	2	0	0	6	**96** June 10th
2007	0	0	3	2	4	1	10	**94** June 26th
2006	0	0	2	6	0	0	8	**96** August 1st

2005	0	0	8	3	3	1	15	**94** June 26th
2004	1	0	1	0	0	0	2	**93** June 9th
2003	0	0	3	2	0	0	5	**93** June 26th
2002	1	0	1	8	9	2	21	**96** August 14th
2001	0	0	1	3	5	0	9	**96** August 9th
2000	0	1	2	0	0	0	3	**90** May 9th

Looking at other locations across east central New York…Glens Falls had only 2 days during which the high temperature reached 90+ degrees this year, and Poughkeepsie had 8. Across western New England…both Bennington, VT and Pittsfield, MA had no days, and North Adams, MA had only one.

The lowest high temperature recorded at Albany this past summer was 66° (Table 1), on June 14th, and the highest low, 71°, on July 1st. There were no daily temperature records of any kind set or tied during the summer, but July did make it into the Top 200 Hottest months of all time, tied 8 ways at #141 (Table 3b).

July made another Top 200 list this past summer…200 Wettest. The 6.87" total placed it alone at #69. Four summer days recorded an inch or more of precipitation (Table 2a), but only one set a daily record when, on June 25th, 1.61" fell (Table 3a), breaking the 1947 record for the date. Aside from these records, any remaining records for the season in Albany were wind-related. Precipitation for June and, especially, July were above normal, while August recorded a deficit of nearly 2 inches (Table 1). The season ended up with 1.85" greater than normal rainfall.

There were four daily wind records (Table 3a-c), spread out fairly evenly across the season. The one that stands out is from August 5th, which broke the daily record. Produced with a thunderstorm, it not only is the season's peak gust at 53 mph, but it was out of the east, one of the highest gusts ever recorded from an easterly direction at Albany. The thunderstorms that helped produce some of the summer day's higher gusts occurred on a total of 17 days, pretty close to the seasonal normal of 15 thunderstorm days. Taking the entire National Weather Service's Albany Forecast Area as a whole, the number of thunderstorm days would be far greater. The windiest date in Albany was on the thunderstorm date of June 18th, with an average wind speed for the day of 13.7 mph. The most tranquil day in the city was August 19th, with an average wind speed of just 1.2 mph. Partly cloudy days far outnumbered clear and cloudy days combined by 64% to 36% (Tables 4a-c).

STATS

	JUN	JUL	AUG	SEASON
Average High Temperature/Departure from Normal	79.7°/+1.8°	82.1°/-0.2°	79.3°/-1.1°	80.4°/+0.2°
Average Low Temperature/Departure from Normal	58.9°/+2.4°	62.7°/+1.3°	59.3°/-0.6°	60.3°/+1.0°
Mean Temperature/ Departure From Normal	69.3°/+2.1°	72.4°/+0.6°	69.3°/-0.8°	70.3°/+0.6°
High Daily Mean Temperature/Date	77.0°/17th	81.0°/1st	74.5°/27th	
Low Daily Mean Temperature /Date	60.0°/14th	66.0°/29th	60.5°/15th	
Highest Temperature reading/Date	90°/17th	91°/1st & 23rd	86°/5th, 11th & 26th	
Lowest Temperature reading/Date	46°/1st	53°/18th	49°/29th	
Lowest Maximum Temperature reading/Date	66°/14th	73°/4th	68°/15th & 22nd	
Highest Minimum Temperature reading/Date	69°/25th	71°/1st	69°/31st	
Total Precipitation/Departure from Normal	4.77"/+0.98"	6.87"/+2.75"	1.58"/-1.88"	13.22"/+1.85"
Total Snowfall/Departure from Normal	0.0"/-	0.0"/-	0.0"/-	0.0"/-
Maximum Precipitation/Date	1.61"/25th	1.42"/27th	0.49"/21st	
Maximum Snowfall/Date	0.0"/-	0.0"/-	0.0"/-	

Table 1

NORMALS, OBSERVED DAYS & DATES

NORMALS & OBS. DAYS	JUN	JUL	AUG	SEASON
NORMALS				
High	77.9°	82.3°	80.4°	80.2°
Low	56.5°	61.4°	59.9°	59.3°
Mean	**67.2°**	**71.8°**	**70.1°**	**69.7°**
Precipitation	**3.79"**	**4.12"**	**3.46"**	**11.37"**
Snow	**0.0"**	**0.0"**	**0.0"**	**0.0"**
OBS TEMP. DAYS				
High 90° or above	1	3	0	4/92
Low 70° or above	0	5	0	5/92
High 32° or below	0	0	0	0/92
Low 32° or below	0	0	0	0/92
Low 0° or below	0	0	0	0/92
OBS. PRECIP DAYS				
Days T+	15	18	16	49/92/53%
Days 0.01"+	10	12	10	32/92/35%
Days 0.10"+	6	11	4	21/92/23%
Days 0.25"+	4	8	2	14/92/15%
Days 0.50"+	3	6	0	9/92/10%
Days 1.00"+	2	2	0	4/92/4%

Table 2a

NOTABLE TEMP, PRECIP & SNOW DATES	JUN	JUL	AUG
none	-	-	-

Table 2b

RECORDS

ELEMENT	JUNE	
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	40 mph/W/3rd (tie)	40 mph/W/1998
Daily Maximum Precipitation/Date | Previous Record/Year	1.61"/25th	1.33"/1947

Table 3a

ELEMENT	JULY	
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	43 mph/SW/7th	37 mph/SW/1944
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	37 mph/SW/23rd	36/SW/2012
200 All-Time Hottest Months Value/Rank | Remarks	72.4°/#141	8-way tie
200 All-Time Wettest Months Value/Rank | Remarks	6.87"/#69	

Table 3b

ELEMENT	AUGUST	
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	53 mph/E/5th	48 mph/NW/1988

Table 3c

ELEMENT	SUMMER	
none	none	None

Table 3d

MISCELLANEOUS

JUNE

Average Wind Speed/Departure from Normal	6.3 mph/-1.0 mph
Peak Wind/Direction/Date	40 mph/WSW/3rd
Windiest Day Average Value/Date	13.7 mph/18th
Calmest Day Average Value/Date	1.9 mph/22nd
# Clear Days	3
# Partly Cloudy Days	21
# Cloudy Days	8
Dense Fog Dates (code 2)	None
Thunder Dates (code 3)	3rd, 4th, 16th-18th & 25th
Sleet Dates (code 4)	None
Hail Dates (code 5)	None
Freezing Rain Dates (code 6)	None

Table 4a

JULY

Average Wind Speed/Departure from Normal	6.4 mph/-0.3 mph
Peak Wind/Direction/Date	45 mph/W/9th
Windiest Day Average Value/Date	13.3 mph/5th
Calmest Day Average Value/Date	1.7 mph/18th
# Clear Days	5
# Partly Cloudy Days	21
# Cloudy Days	5
Dense Fog Dates (code 2)	14th
Thunder Dates (code 3)	1st-3rd, 7th-9th, 23rd, 27th & 28th
Sleet Dates (code 4)	None
Hail Dates (code 5)	None
Freezing Rain Dates (code 6)	None

Table 4b

AUGUST

Average Wind Speed/Departure from Normal	5.1 mph/-1.4 mph
Peak Wind/Direction/Date	53 mph/E/5th
Windiest Day Average Value/Date	10.4 mph/30th
Calmest Day Average Value/Date	1.2 mph/19th
# Clear Days	6
# Partly Cloudy Days	17
# Cloudy Days	8
Dense Fog Dates (code 2)	11th, 19th & 24th
Thunder Dates (code 3)	5th & 7th
Sleet Dates (code 4)	None
Hail Dates (code 5)	None
Freezing Rain Dates (code 6)	None

Table 4c

For more climate data and records, please visit our climate page at: www.weather.gov/albany/Climate

GETTING PREPARED FOR FALL WEATHER

Steve DiRienzo
Warning Coordination Meteorologist, NWS Albany, NY

Fall is a season of change for the Albany Forecast Area. September often begins with warm, humid conditions and the threat of severe weather and tropical storms. October usually sees frost, the first wind storms of the cool season as large extra-tropical cyclones transit near or over our area, and a continued threat of tropical storms. Every now and then an October snowstorm fells trees still covered with leaves. November is usually the beginning of the snow season, especially across the high terrain, and the threat of strong wind storms continues.

The following is a list of notable fall storms with some links for reference. This is not meant to be an all-inclusive list, but a list to give an idea of what weather conditions to be prepared for in the fall so you can be fall-weather-ready.

Notable Fall Hurricanes and tropical storms:
Great New England Hurricane (September 1938)
Floods and winds caused heavy damage in the Albany Forecast Area.
http://www.weather.gov/okx/1938HurricaneHome
http://www.weather.gov/box/1938hurricane

Hurricane Hazel (October 1954)
High wind gusts across the forecast area with heavy tree damage, and power and phone outages. Wind gust of 113 mph at Battery Park, highest ever recorded in New York City.
http://www.aoml.noaa.gov/general/lib/lib1/nhclib/mwreviews/1954.pdf

Hurricane Floyd (September 1999)
http://www.erh.noaa.gov/aly/Past/1999/FLOYD.HTML
http://en.wikipedia.org/wiki/Effects_of_Hurricane_Floyd_in_New_York

Sandy (October 2012)
http://cstar.cestm.albany.edu/PostMortems/CSTARPostMortems/2012/Sandy/sandy2012.htm

Notable Fall Severe Weather:
September 4, 2011 Tornado: Strong EF1 in Montgomery County.
http://cstar.cestm.albany.edu/PostMortems/CSTARPostMortems/2011/Sep_4_Tornado/4SeptemberTornado.htm

Notable Fall Heat Wave: August 27 - September 5, 1953. Longest heat wave (10 consecutive days reaching 90°F or above) since daily temperature records began here at Albany in 1874, and also the last time Albany, NY reached 100°F (September 2nd and 3rd, 1953). The following are the maximum temperatures for each day during the stretch: 94°F, 94°F, 95°F, 98°F, 93°F, 96°F, 100°F, 100°F, 95°F, 90°F.
http://www.weather.gov/media/aly/Climate/heatwaves.pdf

Notable Fall Wind Storms:
Great Appalachian Storm of November 24-27, 1950.

Mainly a wind storm for the Albany Forecast Area although heavy rain fell in the eastern Catskills. Sustained winds of 50-60 MPH with a gust to 83 MPH here at Albany, a gust to 94 MPH at New York City, and Hartford, Connecticut gusted to 100 MPH. Wind damage was extensive, with many trees and power lines blown down across the region.
http://docs.lib.noaa.gov/rescue/mwr/078/mwr-078-11-0204.pdf

Notable Fall Floods:
Vermont Flood of November 3-4, 1927
Atwood, R.E. (1927). Stories and pictures of the Vermont flood November, 1927. Burlington, VT: Free Press Printing Co.

October 1955 Flood
Part of a trifecta of storms that included Hurricanes Connie and Diane in August of 1955.
http://pubs.usgs.gov/wsp/1420/report.pdf (Warning!! Big File. 867 pages!)

Notable Fall Snow Storms:
October 4, 1987 Snowstorm
http://www.erh.noaa.gov/aly/Past/1987_Oct/Oct_4_1987.htm

October 29, 2011 Snowstorm
http://cstar.cestm.albany.edu/PostMortems/CSTARPostMortems/2011/October%20Snowstorm/October2011snowstorm.htm

Thanksgiving Snowstorm of November 24, 1971
Heavy snow began on the day before Thanksgiving and continued into Thanksgiving Day. Albany picked up 22.5", our greatest November snowfall on record, with amounts up to 30" reported in our forecast area. This storm turned the busiest travel day of the year into a nightmare, with many stranded travelers not making it to their destinations on Thanksgiving.

DWINDLING SUNSPOTS: COULD THIS AFFECT CLIMATE CHANGE?

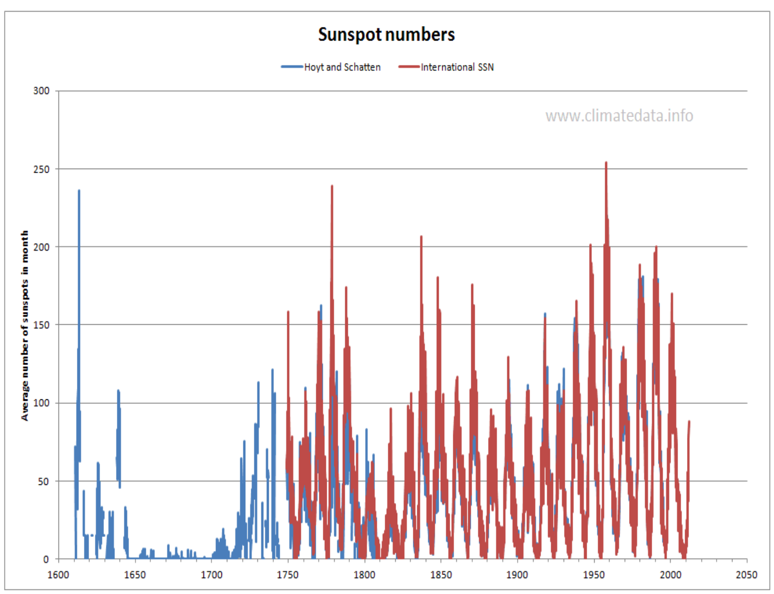
Hugh Johnson
Meteorologist, NWS Albany, NY

Evan L. Heller
Climatologist, NWS Albany, NY

When scientists look at all the possible factors that may contribute to climate change, one aspect that cannot be overlooked is the periodic heat fluctuations that take place in the photosphere, or outer surface of the sun. The photosphere has dark spots in it, known as sunspots, and they fluctuate. It might seem that the more sunspots there are on the sun, the cooler the photosphere should be because the sunspots are dark, and therefore they ought to radiate cooler temperatures. As it turns out, however, the more sunspots there are, the warmer the sun's surface is, by up to 0.2 percent. This is because sunspots are correlated to a more active photosphere, in which there is more magnetic force and heat. The 0.2 percent seems like a small number, but any fluctuation over an area that emits temperatures over 10,000 degrees Fahrenheit is substantial, even at a tiny fraction of a percent.

A normal sunspot cycle from peak to peak is about 11 years, but it can vary anywhere from 9 to 14 years. The last sunspot cycle peak ended earlier this year. Some scientists believe that we are heading for at least a 100-year minimum in sunspot activity. A few even claim sunspot activity could approach the level of the Maunder minimum during the next sunspot cycle. The next cycle will peak around 2025, with the minimum expected to be sometime in 2019.

Sunspot activity has been tracked for many centuries, and their strength and length of cycle have varied quite a bit. The chart below shows the many sunspot cycles since 1600. Notice the lack of sunspot activity between 1650 and 1715; this lull in activity is known as the Maunder Minimum. This was the same time the northern hemisphere was going through the "Little Ice Age", a time of exceptionally cold winters when the large rivers in Europe froze and many people died of starvation due to crop failures. Another sunspot minimum was noted in the early 1800s when there was a notable cool-down in the Northern Hemisphere. The notorious "Year Without a Summer", in 1816, where crops failed in New England, came right after an unusually low sunspot minimum. In this case, however, it should be noted that there was a significant volcanic eruption of Mt. Tambora in Malaysia in 1815 that likely also contributed to this specific cooling.



There was a resurgence of sunspots starting around 1940, which lasted through about 1990. Initially, the climate in the Northern Hemisphere appeared to cool a little through the mid-70s, but then warmed significantly from the late 70s until the late 90s. Since the late 90s, there has been a gradual decrease in the number of sunspots. Could this mean the earth may "cool" again? New calculations indicate that the earth's warming has, at the very least, slowed down quite a bit since the "Super El Nino" of 1998. This is the same time frame in which sunspot activity began declining.

There are scientists who believe that the lack of sunspots has little to do with global cooling. They feel, rather, that ocean surface temperatures, volcanic eruptions and, of course, carbon dioxide (CO_2) emissions, have much more of an effect on the warming or cooling of our planet. Right now, both the Pacific Ocean and Atlantic Ocean surface temperatures are in their "cold phase".

If sunspot activity should decline sharply, it will be interesting to see if the earth will actually start cooling, despite the many tons of CO_2 that will likely be emitted into the atmosphere over the next decade. While the elements of climate change are fairly well-understood separately, there is far less certainty as to how they all work in combination. This means there is serious doubt about how climate change will ultimately play out.

NWS ALBANY WOWS CROWD WITH PET TORNADO AT THE ADIRONDACK BALLOON FESTIVAL

John Quinlan
Senior Meteorologist, NWS Albany, NY

Britt Westergard
Senior Service Hydrologist, NWS Albany, NY

NWS Albany Staff Members John Quinlan (Lead Forecaster) and Britt Westergard (Senior Service Hydrologist) had a table at the 42nd annual Adirondack Balloon Festival which was held at the Floyd Bennett Memorial Airport near Glens Falls, New York on Saturday, September 20th. During Saturday afternoon and early evening, more than 650 visitors stopped by to see the "tornado in a bottle" demonstration, and to pick up Sky Watcher charts and "Turn Around, Don't Drown" magnets. The cloud charts were particularly popular with the younger set: more than 500 charts were handed out. Unfortunately, wind speeds at the surface and aloft were too strong for any balloons to ascend on Saturday. However, a few balloons did try to inflate, and, after dark, the "moon glow" was replaced by synchronized (to music) burner glows from many balloonists. The balloon community seems particularly weather-savvy, as many suggestions to check out our website at weather.gov/albany were met with comments such as "I'm on that site all the time!"

WEATHER *ESSENTIALS*

With Kevin S. Lipton

THE WIND, AND THE HIGHS AND LOWS OF WEATHER

In our last edition of *Weather Essentials*, we discussed fronts, and reviewed the different types. However, in order to have fronts, you need to have air masses of different origin which somehow interact with one another. Well, you need some wind to do this. Wind refers to air in motion, and in particular, it is the horizontal motion of air that we are most concerned with regarding wind. How does wind get started?...with horizontal differences in air pressure.

Air pressure varies on a horizontal scale on earth due to differences in air density. Air density refers to the overall spacing of air molecules. More dense air refers to when the air molecules are packed closer together, while less dense air is when the air molecules are spread further apart from one another. The temperature of the air ultimately determines the air density; when air warms, the air molecules acquire more energy and begin to bounce around and move apart from each other, becoming less dense. When a column of air above the earth's surface becomes less dense, the pressure of the air exerted on the earth's surface also decreases – thus lowering the air pressure as measured on the surface of the earth. On the other hand, when air cools, the air molecules do not bounce around as much, and thus stay closer together, increasing the density of the air and the overall air pressure. Moisture in the air also affects air density and pressure, although not to the extent that temperature does; moist air is less dense than dry air. So, areas of warm, moist air tend to exert the least air pressure on the earth's surface, while areas of cold, dry air exert the most air pressure.

The differing areas of high and low pressure on the earth's surface force air to move horizontally – what we commonly refer to as wind. There are two main forces that allow the wind to move horizontally on the earth's surface as we observe it. The first, and main force, is known as the pressure gradient force. This refers to the force that tries to equalize the differences between high and low pressure areas. Air parcels will flow *AWAY* from areas of high pressure *TOWARD* areas of low pressure. The sharper the difference is between areas of high and low pressure, the FASTER the air parcels will move. We refer to this "sharpness" as the gradient between high and low pressure. The greater the gradient, the faster the air will move away from high pressure areas and toward low pressure areas. On the other hand, if this gradient is weak, then the air will move more slowly in this fashion. On weather maps, we denote lines of equal air pressure as isobars. The gradient would then be indicated by how closely packed the isobars are; the closer together, the stronger the wind will be.

So, if you were to examine a weather map, you might think that the wind would simply blow straight outward from high pressure areas toward low pressure areas, without curving, based purely on the pressure gradient force. However, due to the earth's rotation, the wind also tends to curve; in the Northern Hemisphere, the wind curves to the right of the overall pressure gradient, and in the Southern Hemisphere, it curves to the left. This curving nature is also known as the Coriolis Effect. So, ultimately, based on these two main forces, wind in the Northern Hemisphere tends to move *outward and clockwise relative to the earth's surface (as looking down at a weather map) around high pressure*, and flows *inward and counterclockwise near low pressure areas* (as in Figure 1). Please note that there are indeed other forces that affect wind, but the two mentioned above are the main drivers.

So, high pressure areas have wind which moves outward and clockwise on a horizontal scale. However, if we took a vertical slice of a high pressure area (as in Figure 2), we would see that through a deep layer of the atmosphere above the surface, the air descends, or sinks. This sinking air limits tall clouds and usually prevents significant precipitation from occurring, hence the reason why high pressure areas tend to be associated with relatively "fair" weather. On the other hand, a comparative slice of a low pressure area (also Figure 2) would indicate a deep layer of rising motion above the earth's surface. This rising air is conducive to the development of taller clouds and precipitation, hence the reason low pressure systems are usually associated with "inclement" weather.

Now that you know more about high and low pressure areas, and wind, you will learn more about basic weather map interpretation in our next edition of *Weather Essentials*.

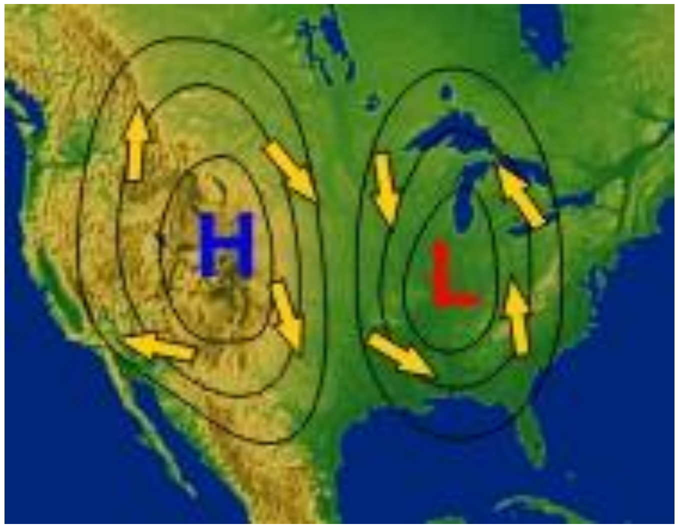


Figure 1. Air flow around areas of Highs (H) and Lows (L) as seen on a weather map. From *NWS Jetstream: Online School for Weather*.

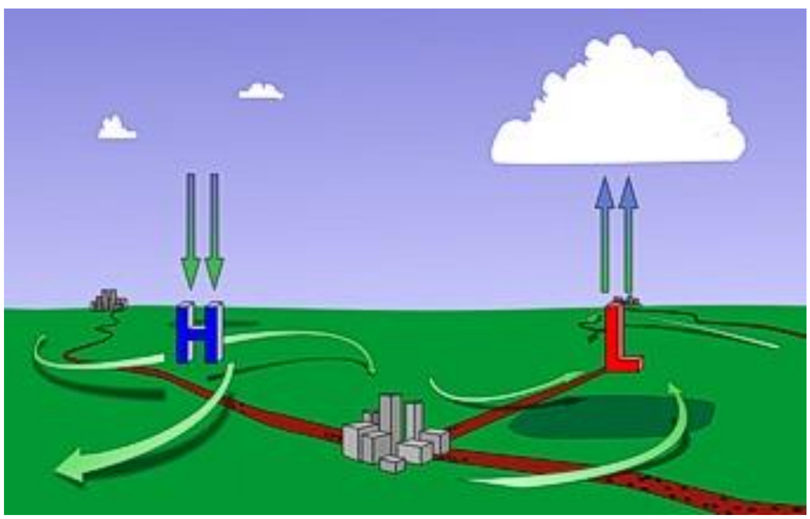


Figure 2. Air flow on a horizontal and vertical scale around Highs (H) and Lows (L). Note the sinking air associated with highs, and the rising air associated with lows. From *NWS Jetstream: Online School for Weather*.

From the Editor's Desk

I write this on the first day of astronomical fall (September 23rd), and already most folks have worn their fall jackets as we have already had a few autumn-like cold fronts pass through the area. Plus, the leaves have begun to change. As we continue heading into this cooling season, we feature three climate-themed articles, as well as a recap of the Adirondack Balloon Festival. The article on sunspots will have you wondering if this winter will be a precursor of things to come as you log up the fireplace, perhaps a little earlier than usual this season. May this issue accompany you and enhance your seasonal joy as you cozy up to it with perhaps a nice, warm blanket and a mug of hot spiced cider. A special thanks goes out to all our contributors…they help make Northeastern StormBuster possible.

WCM Words

Steve DiRienzo
Warning Coordination Meteorologist, NWS Albany

Fall of 2013 was particularly pleasant, with many cool mornings and mild sunny afternoons, and lots of color to the foliage. Here's to another pleasant fall in 2014 as we've had our share of hazardous weather and, unfortunately, winter is not far off. By Veteran's Day, most of the trees will be bare, and the fields, brown, and by Thanksgiving, many of the hill towns will have seen snow. So, enjoy fall as summer goes out in a blaze of glory.

I hope you enjoyed reading this edition of StormBuster. It includes lots of good information; from the 2014 summer climate summary, to information on Sunspots and climate, to weather systems and local outreach. If there are any other particular weather-related items you would like to see covered in a future edition of StormBuster, please let us know.

Here at the National Weather Service, we strive to be the source of unbiased, reliable and consistent weather information. We're here to answer your weather and water questions 24 hours a day, 7 days a week. If you have concerns, please call us. If you have comments on StormBuster, or any of the operations of the National Weather Service, please let me know at Stephen.Dirienzo@noaa.gov.