NORTHEASTERN STORM BUSTER

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FEATURES

DEPARTMENTS

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.

THE 100TH ANNIVERSARY OF THE 1914 RECORD FLOOD AT SCHENECTADY, NEW YORK

Steve DiRienzo
Warning Coordination Meteorologist, NWS Albany

This year is the 100th anniversary of the record flood at Schenectady, New York. The record flood on the Mohawk River at Schenectady, New York occurred on 28 March 1914. This flood was accompanied by large ice floes and ice jams which did considerable damage to local infrastructure. More recent damaging floods with ice floes and ice jams occurred at Schenectady in January of 1996 and March of 2007.

Fig 1. United States Geological Survey gauge house, Lock 7, Mohawk River, before and after the 1914 ice jam.

Because getting direct measurements of river ice thickness is dangerous and discouraged, the National Weather Service Forecast Office in Albany estimates ice thickness based on a numerical equation developed by the U.S. Army Cold Regions Research and Engineering Laboratory (USACE, 2002):

$h_j = \alpha\sqrt{U_j}$

where h_j = calculated ice thickness on day j

$\alpha \approx 0.4$ (constant from WFO ALY studies)

U_j = Accumulated Freezing Degree Days from freezeup to day j

Accumulated freezing degree days are based on the daily average air temperature of a river basin in question. For river ice to increase in the basin on a particular day, daily average air temperature for that day has to average below freezing (32°F). We don't have measurements at every point across all river basins, but nearby measurement sites provide a good estimate.

When river ice gets to be around 10 or 11 inches thick or more, it becomes rigid enough to cause significant ice jams if it breaks up quickly before it has a chance to candle or rot. Ice jams cause flooding and structural damage along the Mohawk River every few years. There are also ice jam trouble spots along many other streams and rivers in the Albany Forecast Area.

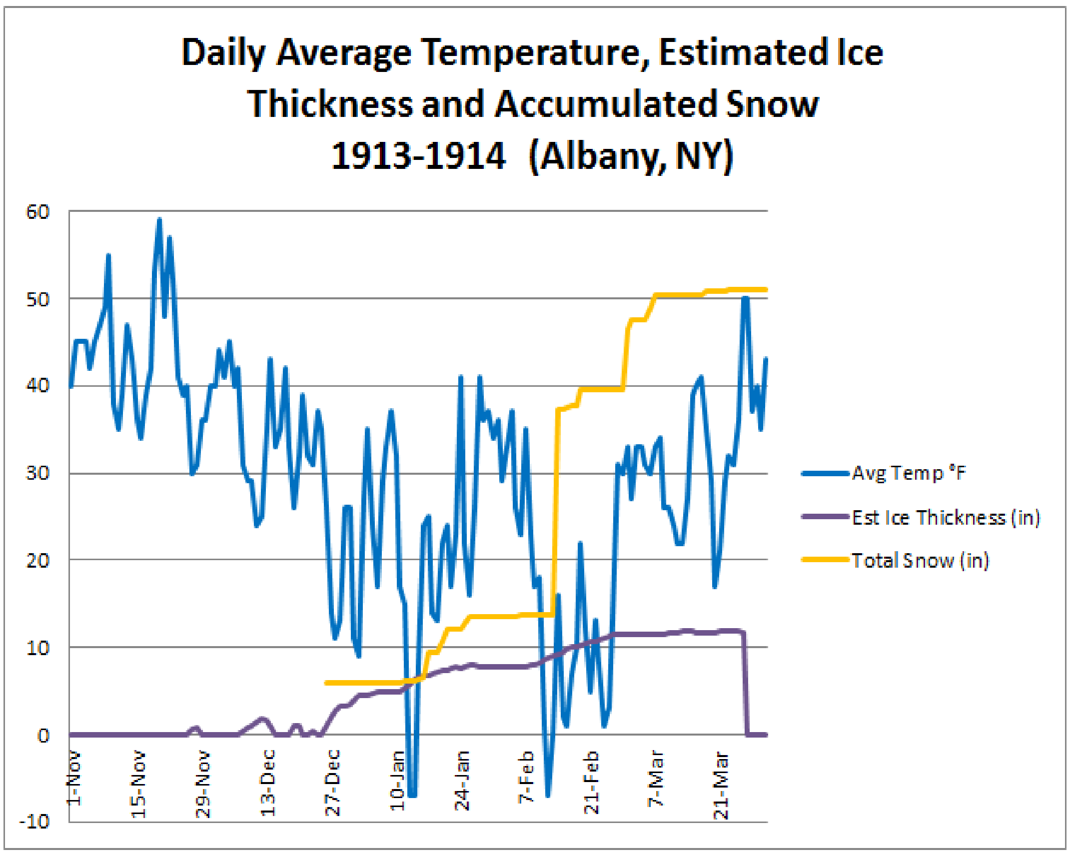


Fig 2. Estimated ice thickness and snowfall during the ice thickening period based on the Albany, New York observations from the winter of 1913-1914.

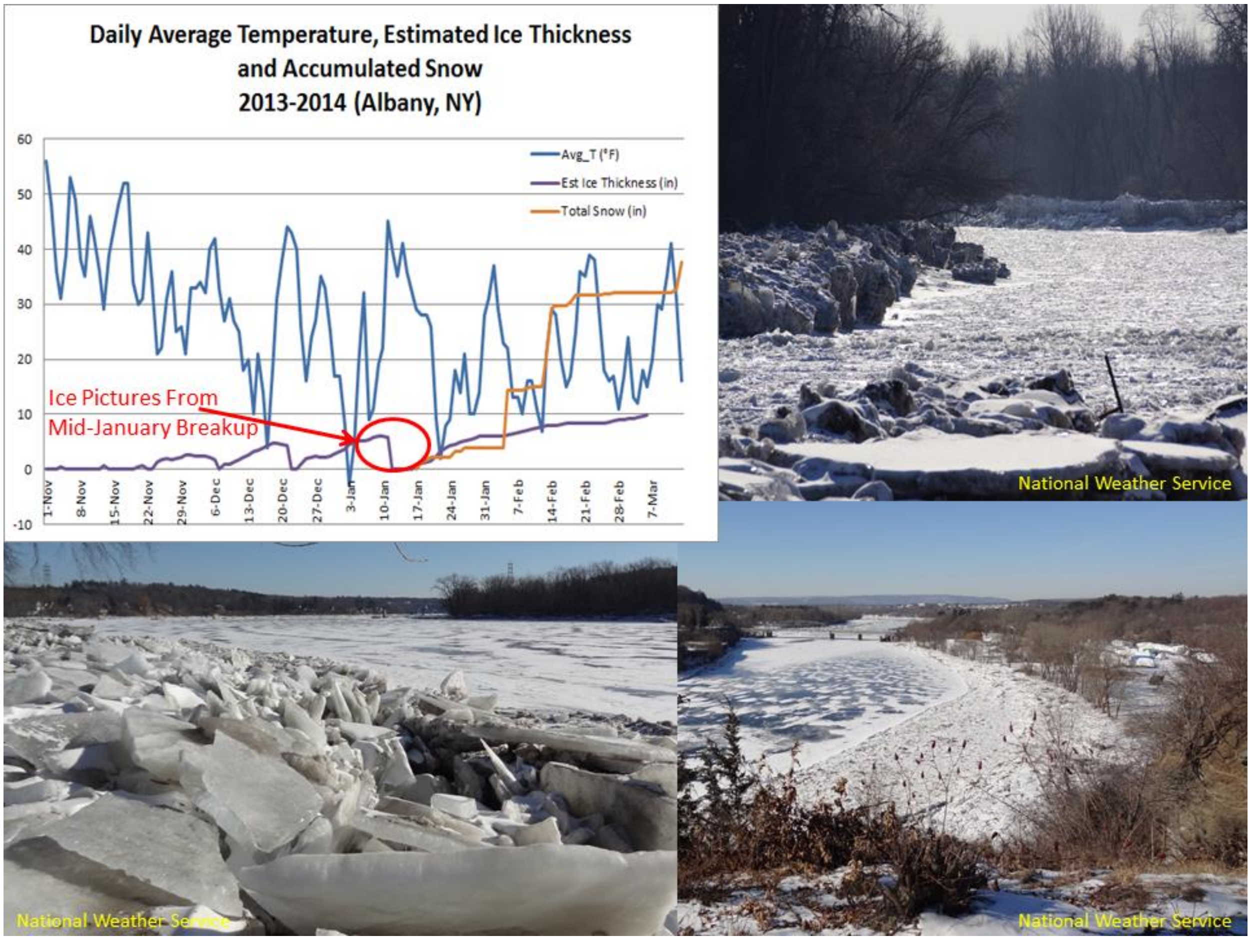


Fig 3. Estimated ice thickness and snowfall during the ice thickening period based on the Albany, New York observations as of March 13, 2014. Pictures show ice from a breakup that occurred in mid-January 2014.

Based on estimations, ice has become thick enough on the rivers this winter for significant ice jams – at least across the northern part of the Albany Forecast Area. Should breakup occur quickly, be alert for possible ice jams and ice jam flooding. We need a 7-10 day period of mild, sunny days, with nights below freezing, to gradually rot and break up the ice, and help alleviate the ice jam and ice jam flood threat. If you see an ice jam or ice jam flooding, please notify the National Weather Service.

References

USACE (2002) Engineering and Design: Ice Engineering. U.S. Army Corps of Engineers Engineer Manual 1110-2-1612.

USING GIS FOR SNOWFALL VERIFICATION

Joe Villani
Meteorologist, NWS Albany

Starting this winter season (2013-14), NWS Albany officially began using a new methodology to verify snowfall using Geographic Information Systems (GIS). This has allowed us to create a graphical representation of snowfall across our forecast area for each significant snow event. This new approach is more science-based in that we can now objectively look at snowfall maps based on interpolated snowfall reports. This is much more sophisticated than what had been done previously because only point-to-point forecast comparisons were performed. Now, meteorologists can get a more representative and visual perspective of snowfall across our area.

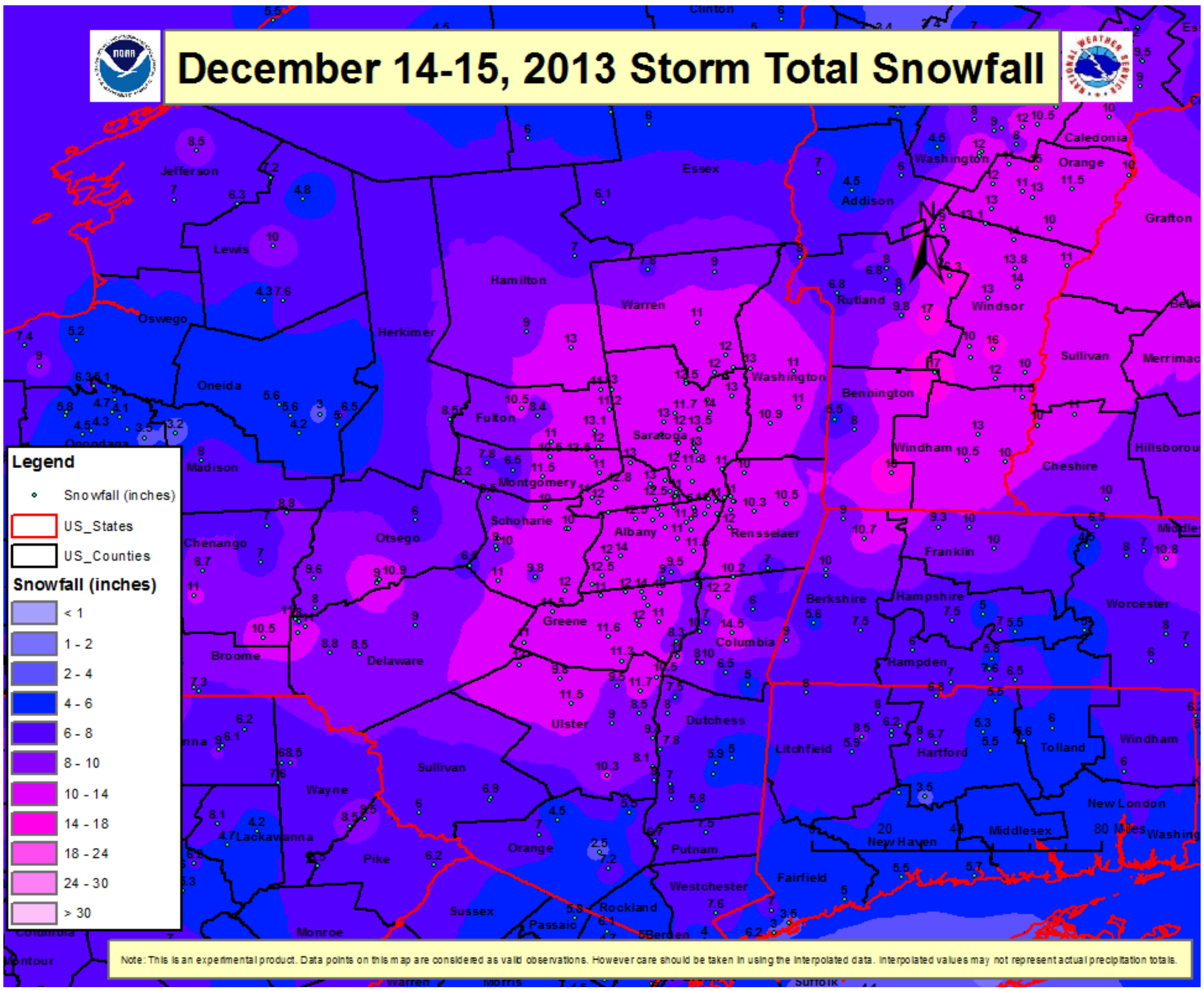


Figure 1 (Click on map for larger view)

This new process involves several steps. First, after a storm, storm-total snowfall reports are compiled, and careful quality control is done. Next, snowfall reports are imported into the ArcGIS software based on the latitude and longitude for each point. Finally, an interpolation scheme is run using the ArcGIS software to create a snowfall map. For consistency, colors are synchronized to match our forecast snowfall maps on our webpage. As an additional step, we also run a "zonal statistics" function to compute the mean snowfall within each of our forecast zones.

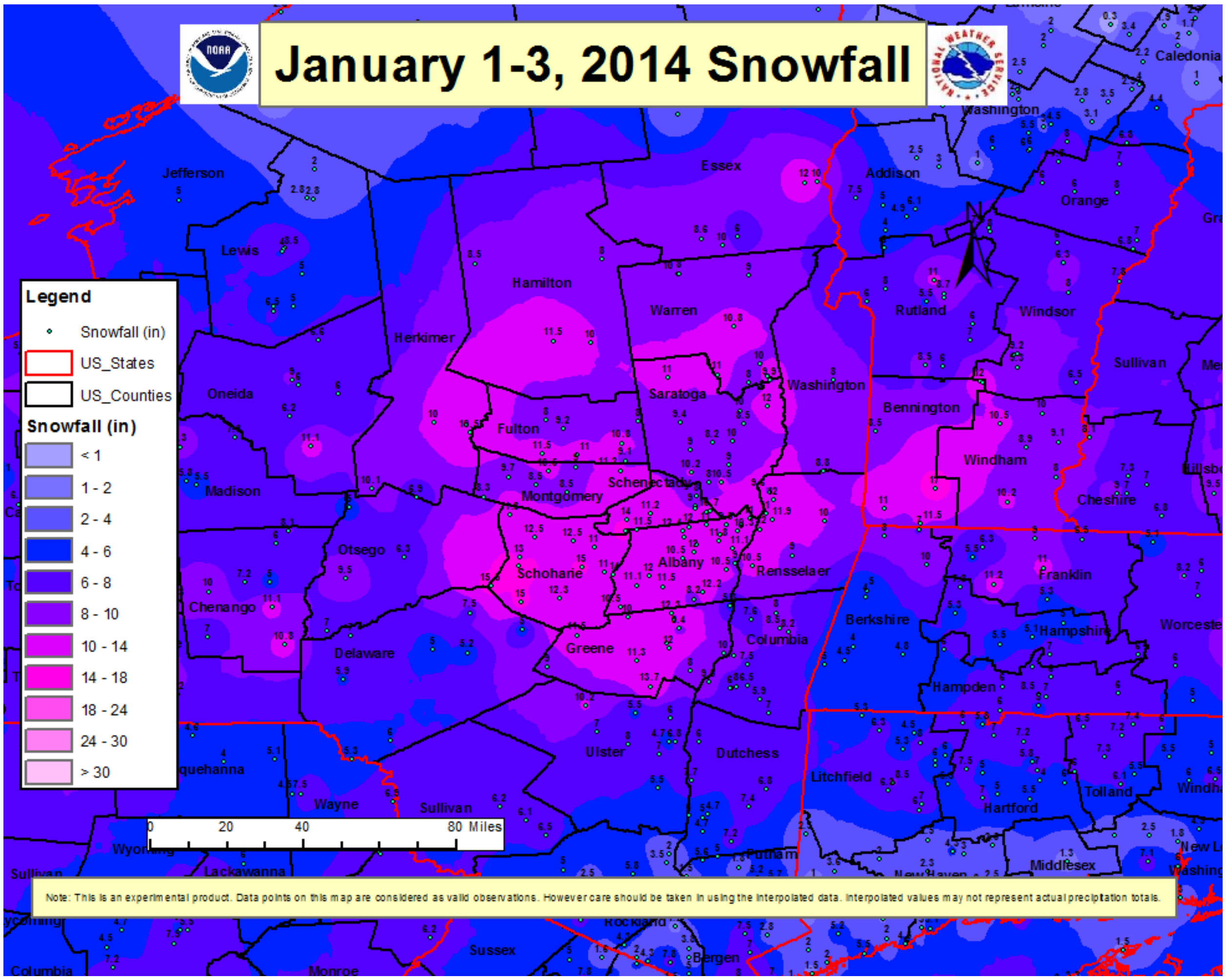


Figure 2 (Click on map for larger view)

The first significant snow storm we were able to use this new method for was the December 14-15, 2013 event. Looking at the map (Figure 1), a large swath of the heaviest snowfall (10-14 inches) fell from the eastern Catskills northward through the greater Capital District, eastern Mohawk Valley, the Lake George-Saratoga Region, and southern Vermont. Another significant snow storm occurred just after the New Year, from January 1-3, 2014. This storm (Figure 2) produced similar snowfall totals to the December 14-15 event. The biggest snow storm of the season thus far in terms of snowfall amounts and areal coverage has been the February 13-14, 2014 storm (Figure 3). A large area of 10 to 24+ inches of snow occurred across much of the region from the Capital Region southward. This time, less snow fell across the Mohawk Valley and Adirondacks.

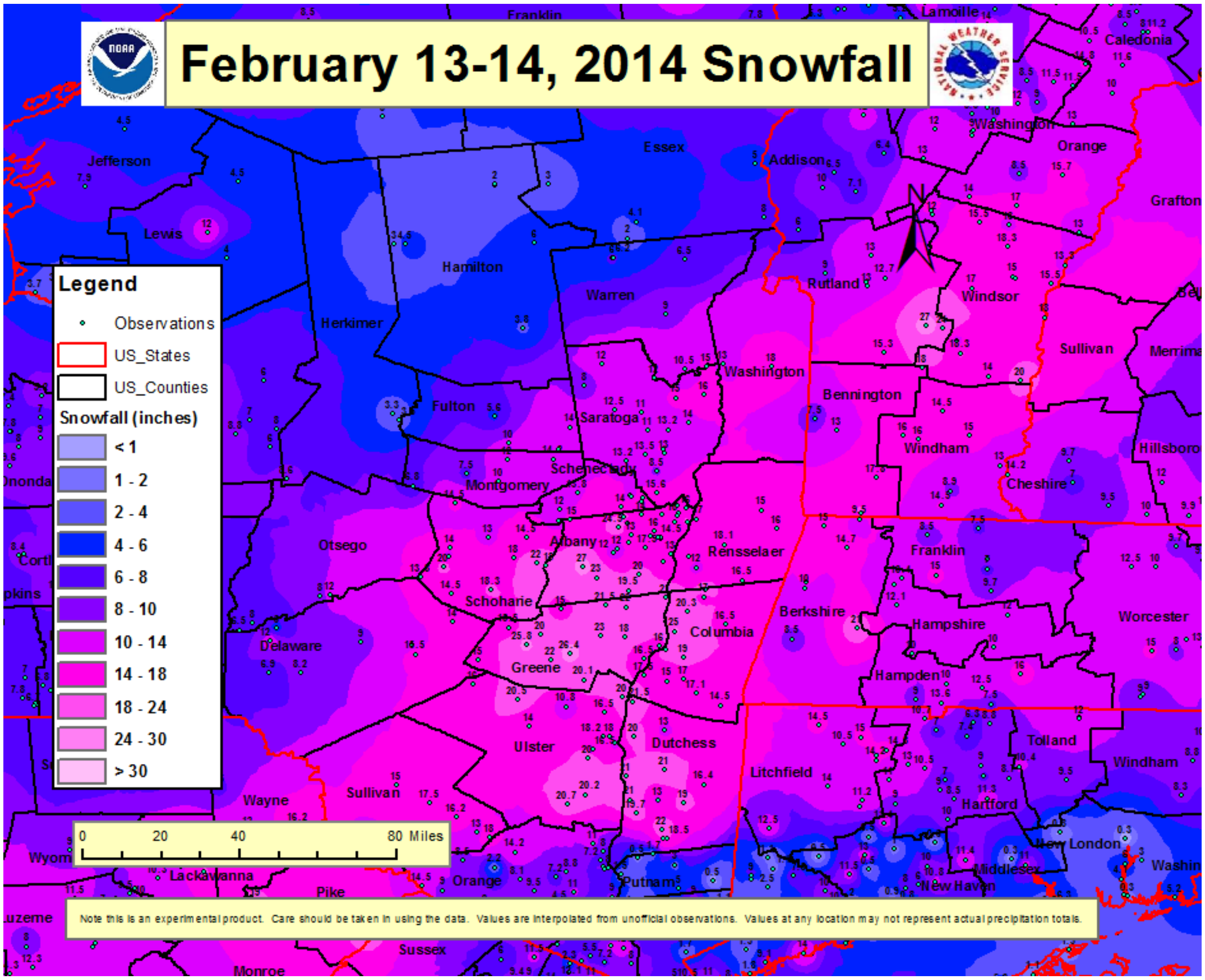


Figure 3 (Click on map for larger view)

We have also been able to take this process one step further by graphically and mathematically comparing our forecasts to observed snowfall. This has enabled us to see how accurate our snowfall forecasts are after an event. An example of this can be seen in Figure 4, which shows NWS Albany's snowfall forecast bias (in inches) for the February 13-14, 2014 snow storm. The warm colors indicate an under-forecast (low bias), while blue colors indicate an over-forecast (high bias).

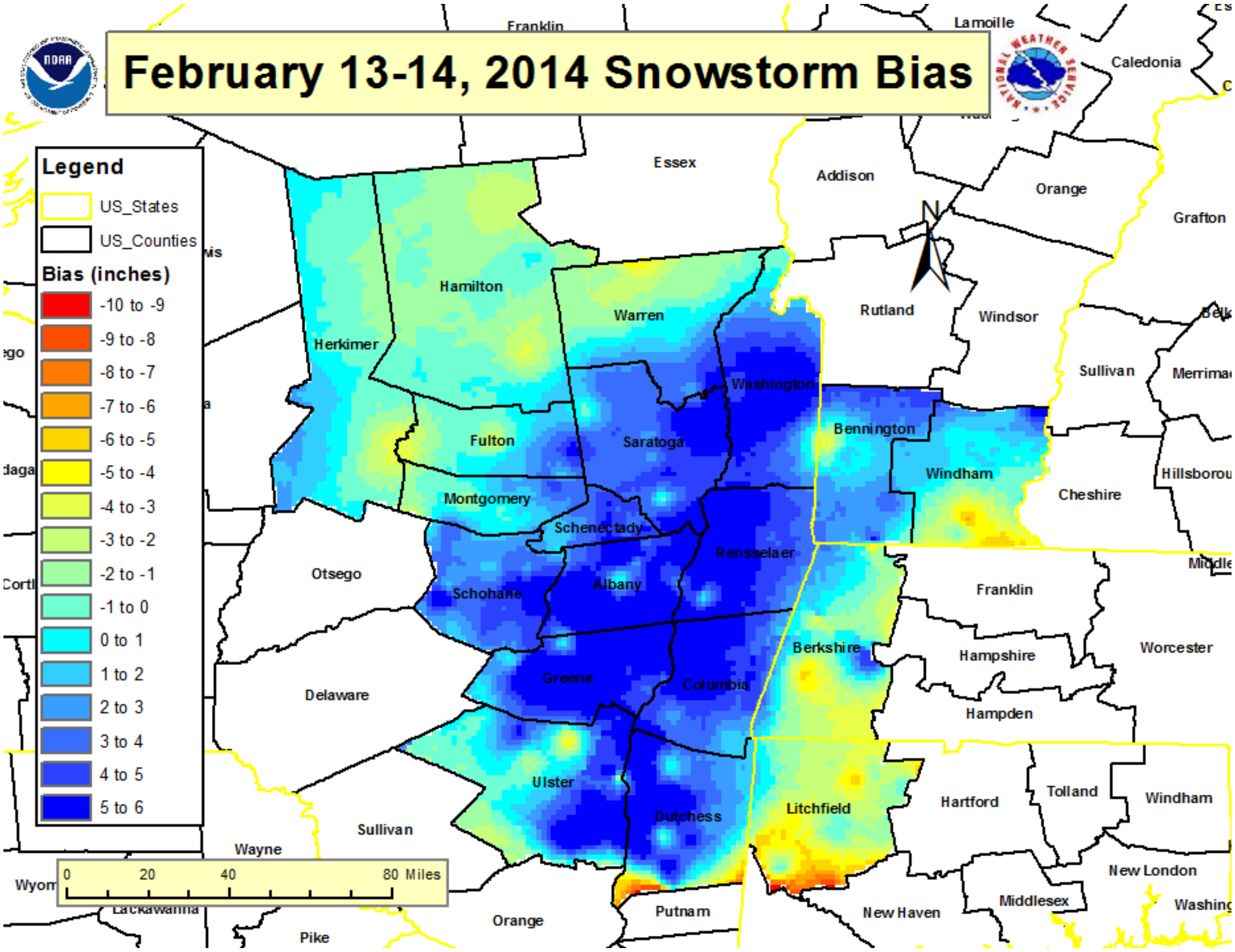


Figure 4 (Click on map for larger view)

Overall, this new method of examining snowfall after an event has been a big step forward for our office in terms of utilizing GIS technology to improve our operations. We will continue to evaluate new ways of incorporating GIS to help us here at NWS Albany become better forecasters.

THE COLDER THAN NORMAL WINTER OF 2013-14

Evan L. Heller
Climatologist, NWS Albany

It was a colder than normal winter in Albany, but despite how cold it seemed, it was only 2.5º below normal (Table 1). This equated to being cold enough to produce only 2 ties of daily temperature records; a low maximum on December 14th, and a low mean on January 3rd (Tables 3a-c). February was the most below normal of the three winter months, and both it and January placed in the top 200 of all-time Coldest Months. Temperatures dipped to zero or below ten days out of the season's 90 (Table 2b). Perhaps what stood out most about the cold of the season were the three separate periods of deep freezes, the last of which extended into early March. These are periods of 10 or more consecutive days where the high temperature failed to get above freezing. There was also one cold wave, a period of 3 or more consecutive days where the temperature dipped to zero or lower, that occurred right after the New Year.

Snowfall records made up the majority of records for the season. The 63.1" inches received during the period was nearly 20 inches above normal. There was one daily record each during January and February (Tables 3a-c). The one on February 5th was the greatest amount received in one calendar day during the period. There were four major snow events of 6.5" or greater accumulation, with at least one during each month. The greatest 24-hour amount was the 14.4" received during the Valentine's Day Storm of 2014, from the 13th to the 14th. With its 28.1" received, February 2014 also wound up being Albany's 7th-greatest February snowfall total of record, and 38th-greatest snowfall total of any month on record (Table 3c).

Precipitation was almost an inch and a half above normal, but there was only one day with an inch or more (Tables 1 and 2a-b). There were no precipitation records per se set during the season, but there was about a week around mid-December that qualified as being a period of wet spell in Albany. There were three daily maximum wind speed records broken, all during January and February (Tables 3b-c).

STATS

	DEC	JAN	FEB	SEASON
Average High Temperature/Departure from Normal	35.5°/-0.3°	28.9°/-1.7°	30.6°/-4.0°	31.7°/-1.9°
Average Low Temperature/Departure from Normal	19.7°/-1.5°	10.6°/-3.9°	13.2°/-4.1°	14.5°/-3.2°
Mean Temperature/ Departure From Normal	**27.6°/-0.9°**	**19.7°/-2.9°**	**21.9°/-4.0°**	**23.1°/-2.5°**
High Daily Mean Temperature/Date	43.5°/21st	44.5°/11th	39.0°/22nd	
Low Daily Mean Temperature /Date	4.0°/17th	-3.0°/3rd	7.0°/12th	
Highest Temperature reading/Date	54°/22nd	56°/11th	51°/22nd	
Lowest Temperature reading/Date	-5°/17th	-12°/4th	-8°/12th	
Lowest Maximum Temperature reading/Date	13°/14th & 17th	5°/3rd	18°/28th	
Highest Minimum Temperature reading/Date	39°/21st	34°/12th & 14th	32°/2nd	
Total Precipitation/Departure from Normal	**3.38"/+0.45"**	**2.31"/-0.28"**	**3.48"/+1.28"**	**9.17"/+1.45"**
Total Snowfall/Departure from Normal	**20.0"/+6.3"**	**15.0"/-2.6"**	**28.1"/+15.7"**	**63.1"/+19.4"**
Maximum Precipitation/Date	0.89"/29th	0.56"/2nd	1.09"/14th	
Maximum Snowfall/Date	6.5"/14th	7.1"/2nd	10.4"/5th	

Table 1

NORMALS, OBSERVED DAYS & DATES

NORMALS & OBS. DAYS	DEC	JAN	FEB	WINTER
NORMALS				
High	35.8°	30.6°	34.6°	33.6°
Low	21.2°	14.5°	17.3°	17.7°
Mean	28.5°	22.6°	25.9°	25.6°
Precipitation	2.93”	2.59”	2.20”	7.72”
Snow	13.7”	17.6”	12.4”	43.7”
OBS TEMP. DAYS				
High 90° or above	0	0	0	0/90
Low 70° or above	0	0	0	0/90
High 32° or below	12	17	18	47/90
Low 32° or below	29	28	28	85/90
Low 0° or below	1	6	3	10/90
OBS. PRECIP DAYS				
Days T+	26	22	20	68/90/76%
Days 0.01”+	17	14	10	41/90/46%
Days 0.10”+	7	5	6	18/90/20%
Days 0.25”+	4	4	4	12/90/13%
Days 0.50”+	3	1	3	7/90/8%
Days 1.00”+	0	0	1	1/90/1%

Table 2a

NOTABLE TEMP, PRECIP & SNOW DATES	DEC	JAN	FEB
Zero Degree Date	17th (-5°)	2nd (-2°)	7th (-1°)
Zero Degree Date	-	3rd (-11°)	8th (-4°)
Zero Degree Date	-	4th (-12°)	12th (-8°)
Zero Degree Date	-	22nd (-6°)	-
Zero Degree Date	-	23rd (-1°)	-
Zero Degree Date	-	29th (-3°)	-
1.00”+ precipitation value/Date	-	-	1.09”/14th
Deep Freeze (10+ days high temp. 32° or less)	-	21st-30th (10 days)	3rd-13th (11 days)
Deep Freeze (10+ days high temp. 32° or less)	-	-	25th-Mar. 6 (10 days)
Cold Wave (3+ days low temp zero or less)	-	2nd-4th (3 days)	-
Wet Spell (3+ days meeting min. meas. pcpn. requirements)	9th-15th (1.38”)	-	-

Table 2b

RECORDS

ELEMENT	DECEMBER	
Daily Low Maximum Temperature Value/Date | Previous Record/Year	13°/14th	13°/1902 (tie)
Major Snow Event (6.5+”) Amount/Date(s) | Remarks	11.5”/14th-15th	-

Table 3a

ELEMENT	JANUARY	
Daily Low Mean Temperature Value/Date | Previous Record/Year	3.0°/3rd	3.0°/1918 (tie)
200 All-Time Coldest Months Value/Rank | Remarks	19.7°/#81	tie
Daily Maximum Snowfall Value/Date | Previous Record/Year	7.1”/2nd	6.8”/1987
Major Snow Event (6.5+”) Amount/Date(s) | Remarks	9.3”/2nd-3rd	-
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	44 mph/W/7th	43 mph/W/1997
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	45 mph/W/26th	44 mph/SE/1989

Table 3b

ELEMENT	FEBRUARY	
200 All-Time Coldest Months Value/Rank | Remarks	21.9°/#150	4-way tie
Daily Maximum Snowfall Value/ Date | Previous Record/Year	10.4”/5th	8.1”/2001
Major Snow Event (6.5+”) Amount/Date(s) | Remarks	10.4”/5th	-
Major Snow Event (6.5+”) Amount/Date(s) | Remarks	14.4”/13th-14th	-
Top Ten Snowiest Februaries Value/Rank | Remarks	28.1”/#7	-
100 All-Time Snowiest Months Value/Rank | Remarks	28.1”/#38	3-way tie
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	46 mph/W/27th	41 mph/S/2009

Table 3c

ELEMENT	WINTER	
none	none	none

Table 3d

MISCELLANEOUS

DECEMBER

Average Wind Speed/Departure from Normal	6.2 mph/-1.4 mph
Peak Wind/Direction/Date	40 mph/WNW/30th
Windiest Day Average Value/Date	12.0 mph/30th
Calmest Day Average Value/Date	0.7 mph/4th
# Clear Days	0
# Partly Cloudy Days	16
# Cloudy Days	15
Dense Fog Dates (code 2)	13th, 14th, 15th, 17th 22nd & 23rd
Thunder Dates (code 3)	2nd, 10th, 11th & 12th
Sleet Dates (code 4)	6th, 7th, 9th & 15th
Hail Dates (code 5)	None
Freezing Rain Dates (code 6)	9th & 22nd

Table 4a

JANUARY

Average Wind Speed/Departure from Normal	8.6 mph/-0.2 mph
Peak Wind/Direction/Date	45 mph/WNW/6th & 26th
Windiest Day Average Value/Date	17.3 mph/7th
Calmest Day Average Value/Date	3.6 mph/5th
# Clear Days	3
# Partly Cloudy Days	15
# Cloudy Days	13
Dense Fog Dates (code 2)	6th
Thunder Dates (code 3)	None
Sleet Dates (code 4)	6th
Hail Dates (code 5)	None
Freezing Rain Dates (code 6)	5th

Table 4b

FEBRUARY

Average Wind Speed/Departure from Normal	7.8 mph/-1.3 mph
Peak Wind/Direction/Date	46 mph/WNW/27th
Windiest Day Average Value/Date	17.3 mph/16th
Calmest Day Average Value/Date	2.2 mph/8th
# Clear Days	3
# Partly Cloudy Days	13
# Cloudy Days	12
Dense Fog Dates (code 2)	5th, 13th & 14th
Thunder Dates (code 3)	21st
Sleet Dates (code 4)	20th
Hail Dates (code 5)	None
Freezing Rain Dates (code 6)	13th

Table 4c

WHAT TO EXPECT THIS UPCOMING FIRE WEATHER SEASON

Ian Lee
Meteorologist, NWS Albany

Winter maintains its grasp across the region with bitterly cold temperatures and snow, despite it being the beginning of spring. With spring are supposed come warmer temperatures and a transition from snow to thunderstorms, and bare trees to budding foliage. An aspect of spring that often is overlooked is fire weather. Fire can occur when there is a combination of dry weather conditions, dry fuels and persistent winds. The NWS Albany, NY Fire Weather program locally employs specific meteorological criteria to determine heightened potential for extreme fire danger and/or fire behavior, known as Red Flag (Table 1). A combination of these criteria can promote the issuances of Fire Weather Watches and Red Flag Warnings (RFW). A Red Flag event involves the combination of a critical fire weather pattern of dry weather, gusty winds and warm temperatures in addition to significantly dry fuels.

There are two stages to the fire weather season: Pre Green-Up and Green-Up, determined largely by soil moisture and plant state. Pre Green-Up conditions are characterized by dry leaves/branches with little to no foliage while Green-Up conditions are characterized by increased soil moisture and the presence of lush foliage. Fire potential in the NWS Albany, NY forecast area is highest during the Pre Green-Up stage (typically late March through early May), as a lack of fuel moisture coupled with antecedent dry conditions can promote quick and rapid fire growth/spread.

The large-scale weather setup for fire weather involves an area of warm, dry high pressure across the region for several days. Low pressure systems must also interact with these areas of high pressure in order to generate gusty winds that enhance the risk for fire.

As we approach the beginning of the 2014 NWS Albany, NY fire weather season, it seems almost unimaginable that fire will be of concern this year. The spring season, though, often features quite a roller coaster ride of temperatures, with swings of up to 30 degrees within just a couple of days! For this upcoming season, temperatures will initially be cold, but long-range forecasts from the Climate Prediction Center (CPC) indicate that the region will experience a return to warmer temperatures. Precipitation is also expected to be near normal, featuring climatologically dry weather. So, while this fire weather season may get off to a slow start, the promise of warmer temperatures and drier weather will quickly ramp up the fire potential across the region.

The 2014 NWS Albany, NY fire weather season begins Monday, March 17, and continues into early November. Additionally, a burn ban for the entire state of New York will also be in place from March 16 to May 16 to help reduce the potential of fire ignition. This season, NWS Albany, NY will also issue Special Weather Statements in conjunction with our local fire weather users to raise awareness of “elevated fire risk” days. These statements will also be issued when Red Flag criteria are met, but the temperatures are too cold to support explosive fire behavior (< 50 degrees F). If you would like to keep up with the latest fire weather forecasts this season, you can visit our fire weather page, available at: http://www.weather.gov/aly/EMfire.

Criteria	**Pre Green-Up**	**Green-Up**
Wind	Gusts over 25 mph for two or more consecutive hours	Gusts over 25 mph for two or more consecutive hours
Relative Humidity	Less than 30% for two or more consecutive hours	Less than 30% for two or more consecutive hours
Rainfall	Less than ¼ inch during previous 5 or more days	Less than ¼ inch during previous 8 or more days
Fuels	None	Keetch Byram Drought Index (KBDI) above 300
Temperature	Maximum Temperature must be ≥ 50 degrees F	Maximum Temperature must be ≥ 50 degrees F

Table 1. NWS Albany criteria for RFW issuance.

WEATHER *ESSENTIALS*

With Kevin S. Lipton

AIR MASSES: THEIR ORIGINS AND CHARACTERISTICS

Air masses are large bodies of air which have similar characteristics of temperature and moisture over a long horizontal distance. They attain these characteristics largely from the geographic areas over which they form – known as source regions.

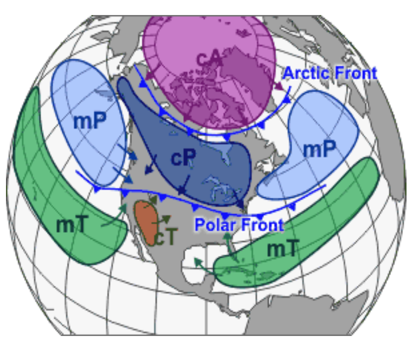
There are four primary air mass source regions. In terms of common thermal characteristics, air masses which form over relatively cold, high latitude areas are known as polar air masses. On the other hand, air masses which form over warmer, lower latitude areas are known as tropical air masses. In terms of common moisture characteristics, air masses which form over oceanic areas, and are relatively moist, are known as maritime air masses, whereas air masses which form over large land masses are known as continental air masses.

So, when we put both the common thermal and moisture characteristics of air masses together, we get air mass classifications. For instance, air masses which form over relatively cool oceans, such as the North Atlantic Ocean or North Pacific Ocean, and are rather chilly and damp, are known as Maritime Polar (mP) air masses. These air masses frequent eastern New York and western New England in the spring and early summer, and often are accompanied by abundant cloud cover, and sometimes spotty light rain, drizzle or fog. In the winter, they may also be accompanied by freezing rain or freezing drizzle. They often give the air a feeling of being "raw". On the other hand, air masses which form over warm oceans, such as the southwest Atlantic Ocean, Gulf of Mexico or southern Pacific Ocean, are relatively warm and humid and are known as Maritime Tropical (mT). These air masses bring us the hot, humid conditions we experience during the spring and summer months across our forecast area and can lead to scattered showers and thunderstorms. In the winter months, these same air masses still bring relatively mild and moist air which, if moving over the relatively cold ground, can lead to widespread fog formation.

Continental air masses tend to be drier because they form over large land masses. The Continental Polar (cP) air masses are cool/cold and dry. They bring our region refreshing relief in the summertime from oppressive heat waves. However, in the late fall, winter and early spring, they also bring us cold air. Continental Tropical (cT) air masses are warm/hot and dry. They often affect portions of the western and south central United States, but rarely reach our region with their maximum potency because there are so many moisture sources that modify this air before it reaches the northeastern U.S. They usually reach us in a somewhat modified form, such as in the summer, when one hot, humid day of, perhaps, an mT air mass is replaced by an equally hot, but only slightly less humid day brought in with a modified cT air mass.

Finally, there is one additional air mass which occasionally affects our region in the winter months, and is very cold, but dry, except for some limited moisture it may pick up on the way to our region. This is known as an Arctic (cA) air mass. These air masses are often described as "bitterly cold". In fact, they were rather frequent across the north central and northeastern U.S. during this past winter!

You may wonder what separates air masses. Well, these are known as fronts. We will discuss fronts, including the various types, and also common weather conditions associated with the different types, in a future Weather Essentials article.



Air masses and their respective source regions. From *NWS Jet+stream: Online School for Weather*.

From the Editor's Desk

Five interesting articles on diverse topics in this issue. Our WCM opens it with a look back at the famous Schenectady Flood on the 100th anniversary. Then, it's back to winter with an introduction to GIS as it's used for snowfall verification in our forecast area. Next, we have a statistical retrospective of our past winter here in Albany. Rounding out the feature articles is a talk about what we can expect for the upcoming fire weather season. Kevin Lipton's Weather Essentials takes us to the world of climatology with a look at air masses. Spring is finally here, but the enjoyment of the warm weather has yet to follow. In the meantime, we hope you enjoy the offerings in this issue.

WCM Words

Steve DiRienzo
Warning Coordination Meteorologist, NWS Albany

Although it's been a long cold winter, the winter weather conditions will eventually end and we'll transition into spring and summer. New seasons bring different weather hazards and forecast challenges. The National Weather Service (NWS) has set aside days and weeks for hazard awareness and preparedness. The week of March 16-22 is NWS Flood Awareness Week. Melting snow and ice, along with rain, often bring flooding to our forecast area in spring. If you live along a river or stream, pay attention to the latest forecasts and make sure you have a plan should flooding threaten.

The next NWS awareness week will be Severe Weather Awareness April 27-May 3. As summer approaches, severe weather season will also begin, with the peak in severe weather between Memorial Day and Labor Day. Although we're not located in the Plains States, we get our share of strong thunderstorms with damaging winds and hail, and even 2 or 3 tornadoes each year. Now is the time to begin planning for severe weather. Know how you will receive alerts, and locate emergency shelters.

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.