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FEATURES

DEPARTMENTS

THE BIPOLAR BEHAVIOR OF THE PAST TWO WINTERS

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As many probably remember, the winter of 2010/11 was snowy and cold across our region. As we approached the winter of 2011/12, a major nor'easter slammed areas mainly south and east of Albany prior to Halloween, causing heavy wet snow to knock out power to millions. Many wondered if that unusually early snowstorm was a harbinger of the winter to come.

As it turned out, despite having somewhat similar antecedent conditions to the winter of 2010/11, snowfall this past winter was well below normal, and it was the least snowiest winter since 1988/89. Temperatures ran well above normal, and it was also the mildest winter since 2001/02.

The past two winters featured a negative or cold cycle of the El Niño Southern Oscillation, (ENSO), otherwise known as La Niña. The La Niña this past winter was a little weaker than the strong one of 2010/11. The Pacific Decadal Oscillation (PDO) remained in its cold phase, and in fact, appeared to have strengthened even deeper into the cold phase than last winter.

So, why did the past two winters turn out to be so completely different? Last year, much of the winter saw a large high pressure block in the atmosphere near Greenland, which forced the polar Jetstream to dive well south of our region. This jetstream combined forces with the Pacific Jetstream, and became the conduit for strong storms to churn up the eastern seaboard and deposit huge amounts of snow. Meteorologists refer to this persistent blocking pattern as the Negative Atlantic Oscillation (-NAO).

In stark contrast, the Atlantic Oscillation this past winter was strongly positive (+NAO); instead of high pressure, a large low pressure polar vortex area was parked over Greenland, and high pressure was planted near the Azores well to the south. This setup forced the polar jet stream to remain unseasonably far to the north, often near or even to the north of the Canadian border for a portion of the season. The Pacific Jetstream remained well south of our region. The net result was that many storms missed our region, and those that hit were not all that strong.

Okay, so why the drastic difference in these North Atlantic Oscillation patterns? One possible reason for the huge switch in the NAO could be that the Quasi-Biennial Oscillation (QBO) last winter was in its negative, or easterly, phase. The QBO is a 29-month cycle that sees lower stratospheric winds switch from east to west in a binary mode. When the stratospheric winds are easterly, the tropospheric winds that steer the weather patterns tend to be weaker. This, in turn, favors high-pressure blocking in the North Atlantic. The QBO had actually switched to its positive westerly phase very late during the winter of 2010/11, but has remained in that phase this past winter. In the positive or westerly phase of the QBO, the winds are westerly in the lower stratosphere, and much stronger in the troposphere. In this stage, there is a tendency for less blocking in the Greenland area of the North Atlantic, favoring a +NAO.

Another change with this past winter was a flare-up of solar activity. Some scientists argue that when the sun becomes more active, there is a tendency for the sun's surface to be slightly hotter, which could help the earth warm a little more than usual.

However, as mild as our winter was, Alaska endured one of its coldest and snowiest winters on record. Brutal winter cold and heavy snows plagued much of Eastern Europe, with snow as far south as Greece. While the Polar Jetstream remained well north over North America, it plunged unusually far southward across Eastern Europe and into Asia.

Mild weather has continued well into March as of this writing. However, keep in mind that just because we had a mild winter does not necessarily mean the rest of spring, or even summer, will be above normal. There is even a chance we will see more snow this spring, so you might not want to put away the snow blower for the season just yet.□

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http://cstar.cestm.albany.edu:7775/skywarn/Talks.htm

WINTER 2011-12: MUCH ABOVE NORMAL TEMPS; MUCH BELOW NORMAL SNOW

Evan L. Heller
Climatologist, NWS Albany

When Albany, New York received its first five inches of snowfall in late October of last year, a full month before it was normal to have accumulated that amount, many probably believed that it was going to be one of our snowiest seasons of record. However…things were quite the contrary...at least up until now. For the next four months, Albany would receive just 13 inches more of the fluffy stuff. For the three climatological winter months of December through February, the 12.8" of snowfall Albany International Airport received was only 29 percent of the normal amount for the period (See Table 1). Being that the period was only slightly drier than normal, it would have to be the mild temperatures that had the most to do with the snow deficit, with Albany receiving mostly rain instead. Indeed, temperatures each month averaged 6 to 7 degrees above normal (Table 1). About a third of the seasonal total of snowfall, 4.0", came on the very last day of climatological winter, which wouldn't have existed had this been one of the 75 percent of other years. But Leap Year happened upon us this year, and as a result of this special date getting to experience only one-quarter the weather of any other calendar dates, there wound up being an easy daily snowfall record to break. The 4.0" record snowfall for the 29th blew the previous record out of the water, and this previous record was set only the last time Leap Year came around, in 2008, when just 0.8" of snowfall was enough to do the job (Table 3c). The 4.0" amount was the first half of the season's only major winter snow event thus far (the snow season actually considered to be from October through May). Another 4.8" was received on March 1st. December was the least snowiest month of the season, with just 0.7" received. This places the month at #6 for Least Snowiest December. The other two months fell short of making their respective Top Ten lists.

Despite the relative warmth of the season, there was only one daily temperature record of any kind. On December 15th, the temperature failed to drop below 41 degrees, and this high minimum value only tied the record set in 1975 (table 3a). Temperatures averaged increasingly above normal toward February, and

February broke into all three Top Ten warm monthly temperature records lists (Table 3c), the only month of the season to set a monthly Top Ten temperature record. The average high temperature at Albany was 40.9°, placing it at #4 amongst the Ten Warmest Mean Maximum Februarys. The average low was 23.2°, placing it at #6 amongst the Ten Warmest Mean Minimum Februarys. And the resulting mean of 32.1°, which was 7.1° above normal, placed it at #7 amongst the Ten Warmest Februarys. The average temperature for the season was 31.6°, 6.5° above normal, making the Winter of 2011-12 the 8th warmest on record (Table 3d). On only two dates during the season, January 15th and 22nd, did temperatures drop as low as zero degrees. Only nine other years dating all the way back to 1874 saw fewer days get down to zero.

Other records include, for December (Table 3a), one for daily precipitation on the 7th, and one for wind speed, new information to Albany's climate database, on the 16th. More new wind record data was reflected by February 25th falling into the category of 200 Windiest Dates, with its 20.5 m.p.h. average daily wind speed. It tied 4 ways at #111 (Table 3c). The other Top 200 list broken into was the 200 Driest Months of all time, exercised by the month of February. The exactly 1.00" total placed it in a 3-way tie at #116.

Another unusual feature of the 2011-12 winter season was the lack of cloudy days. Indeed this would have helped keep temperatures warmer than normal, and snow, off the ground. More than half the days averaged partly cloudy, which implies adequate sunshine (Tables 4a-c). Though clear skies were not common, December at least tends to have quite a few more cloudy days than it actually did. The 2011-12 winter season will probably go down as being the one that Old Man Winter forgot.□

STATS

	DEC	JAN	FEB	SEASON
Avg. High/Dep. From Norm.	42.2°/+6.2°	37.0°/+5.9°	40.9°/+6.6°	40.0°/+6.2°
Avg. Low/Dep. From Norm.	25.7°/+5.6°	20.3°/+7.0°	23.2°/+7.5°	23.1°/+6.7°
Mean/ Dep. From Norm.	34.0°/+6.0°	28.6°/+6.4°	32.1°/+7.1°	31.6°/+6.5°
High Daily Mean/date	48.0°/6th	41.0°/24th	49.5°/1st	
Low Daily Mean/date	19.0°/18th	6.5°/15th	16.0°/12th	
Highest reading/date	57°/6th	51°/1st & 31st	59°/1st	
Lowest reading/date	13°/18th	0°/15th & 22nd	9°/12th	
Lowest Max reading/date	25°/18th	13°/15th	23°/12th	
Highest Min reading/date	41°/15th & 22nd	35°/24th	40°/1st	
Ttl. Precip./Dep. Fm. Norm.	3.76"/+1.00"	2.26"/-0.45"	1.00"/-1.27"	7.02"/-0.72"
Ttl. Snowfall/Dep. Fm.Nrm.	0.7"/-12.1"	7.5"/-10.5"	4.6"/-8.1"	12.8"/-30.7"
Maximum Precip./date	1.43"/7th	0.67"/27th	0.43"/29th	
Maximum Snowfall/date	0.5"/8th	2.6"/12th	4.0"/29th	

Table 1

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NORMALS, OBSERVED DAYS & DATES

NORMALS & OBS. DAYS	DEC	JAN	FEB	SEASON
NORMALS				
High	36.0°	31.1°	34.3°	33.8°
Low	20.1°	13.3°	15.7°	16.4°
Mean	28.0°	22.2°	25.0°	25.1°
Precipitation	2.76"	2.71"	2.27"	7.74"
Snow	12.8"	18.0"	12.7"	43.5"
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	3	9	2	14/90
Low 32° or below	23	29	27	79/90
Low 0° or below	0	2	0	2/90
OBS. PRECIP DAYS				
Days T+	20	25	17	62/90/68%
Days 0.01"+	10	11	7	28/90/31%
Days 0.10"+	7	5	3	15/90/17%
Days 0.25"+	4	4	2	10/90/11%
Days 0.50"+	3	2	0	5/90/6%
Days 1.00"+	1	0	0	1/90/1%

Table 2a

NOTABLE PRECIP & SNOW DATES	DEC	JAN	FEB
1.00"+ pcpn. value/date	1.43"/7th	-	-
3.5"+ snow value/date	-	-	4.0"/29th

Table 2b

RECORDS

ELEMENT	DECEMBER	
Daily High Minimum Temperature/Date | Previous Record/Year	41° (tie)/15th	41°/1975
Daily Precipitation/Date | Previous Record/Year	1.43"/7th	0.88"/1976
Daily Wind Speed/Direction/Date/ | Previous Record/Year	54 m.p.h./NW/16th	-/-
Top Ten Least Snowiest Decembers Value/Rank | Remarks	0.7"/#6	-

Table 3a

ELEMENT	JANUARY	
Zero Degree Date Value/Date | Remarks	0°/15th	-
Zero Degree Date Value/Date | Remarks	0°/22nd	-

Table 3b

ELEMENT	FEBRUARY	
Daily Snowfall/Date | Previous Record/Year	4.0"/29th	0.8"/2008
Top Ten Warmest Februarys Mean Value/Rank | Remarks	32.1°/#7	3-way tie
Top Ten Warmest Mean Max Februarys Value/Rank | Remarks	40.9°/#4	-
Top Ten Warmest Mean Min Februarys Value/Rank | Remarks	23.2°/#6	-
Top 200 Driest Months of All-Time Value/Rank | Remarks	1.00"/#116	3-way tie
Top 200 Windiest Dates All-Time-Avg Value/Date | Rank/Rmk	20.5 m.p.h./25th	#111/4-way tie
Major Snow Event Amount (6.5" or greater)/Date(s) | Remarks	8.8"/29th-March 1st	-

Table 3c

ELEMENT	WINTER	
Top Ten Warmest Winters Average Value/Rank | Remarks	31.6/#8	-

Table 3d

MISCELLANEOUS
DECEMBER

Avg. wind speed/Dep. Fm. Norm.	7.6 mph/-1.0 mph
Peak wind/direction/date	54 mph/WNW/16th
Windiest day avg. value/date	16.7 mph/15th
Calmest day avg. value/date	2.2 mph/30th
# Clear days	5
# Partly Cloudy days	14
# Cloudy days	12
Dense fog dates (code 2)	-
Thunder dates (code 3)	-
Sleet dates (code 4)	21st
Hail dates (code 5)	-
Freezing rain dates (code 6)	31st

Table 4a

JANUARY

Avg. wind speed/Dep. Fm Norm.	8.5 mph/-0.3 mph
Peak wind/direction/date	48 mph/WNW/18th
Windiest day avg. value/date	16.3 mph/18th
Calmest day avg. value/date	2.2 mph/22nd
# Clear days	1
# Partly Cloudy days	18
# Cloudy days	12
Dense fog dates (code 2)	-
Thunder dates (code 3)	-
Sleet dates (code 4)	11th, 12th & 26th
Hail dates (code 5)	-
Freezing rain dates (code 6)	23rd & 26th

Table 4b

FEBRUARY

Avg. wind speed/Dep. Fm Norm.	7.6 mph/-1.6 mph
Peak wind/direction/date	46 mph/W/25th
Windiest day avg. value/date	20.5 mph/25th
Calmest day avg. value/date	1.3 mph/8th
# Clear days	2
# Partly Cloudy days	17
# Cloudy days	10
Dense fog dates (code 2)	29th
Thunder dates (code 3)	-
Sleet dates (code 4)	16th, 24th & 29th
Hail dates (code 5)	-
Freezing rain dates (code 6)	29th

Table 4c

DUAL POL RADAR UPGRADE COMING SOON

Thomas A. Wasula
Meteorologist, NWS Albany

This Spring, the National Weather Service (NWS) at Albany will have its biggest radar hardware and software upgrade since the inception of the Weather Surveillance Radar (WSR) – 1988 Doppler (88D). The WSR-88D was deployed to the NWS in Albany in the Fall of 1993. The Albany WSR-88D, otherwise known as KENX, is located in East Berne, New York, near Thatcher Park. The Dual Pol upgrade will take 10 to 14 days, and is now scheduled for the late April to mid-May time-frame. The NWS at Buffalo is having their radar upgraded in early April, and the NWS at Binghamton, in mid-April.

The NWS radars will go from being only horizontally polarized to being both horizontally and vertically polarized, in a Dual Pol system. The vertical polarity being added to the radars will help to better assess hydrometeor type, shape, orientation and size. Dual Pol radar technology will provide better estimates of rainfall and precipitation types. The vertical polarity of potential droplets on the radar will be compared to the horizontal polarity, to see whether the targets have no preferred orientation (e.g. rounder hydrometeors like snowflakes or hail), or if they are somewhat flatter (e.g. plain raindrops). Figure 1 demonstrates how the vertical and horizontal polarity will work with Dual Pol radars to detect the various hydrometeors.

Three new key products will be produced with Dual Pol radars. The three new products are: Differential Reflectivity, Correlation Coefficient and Specific Differential Phase. The new Correlation Coefficient product will provide information about the diversity of hydrometeors, when it compares the horizontal and vertical returns of the radar data. It is a great product for identifying areas of precipitation and non-precipitation. Correlation coefficient values are calculated from zero to one. For example, as shown in Figure 2, high correlation coefficient values close to one (0.96 to 1.0 range) typically indicate uniform rain droplet distributions, whereas values much lower are associated with non-meteorological echoes including birds, bats, and insects. Sometimes, correlation coefficients less than 0.80 can indicate large hail greater than golf-ball size when compared to the differential reflectivity values within the same time frame. Another nice application of the product during the cool season is to identify the melting layer on the radar during a widespread precipitation event. The melting layer shows up as a ring with correlation coefficient values lowered into the 0.80 to 0.95 range.

Several new quantitative precipitation estimation products, and two new algorithms, will be utilized with Dual Pol. The two new algorithms are the Hydrometeor Classification and the Melting Layer. The Hydrometeor Classification algorithm will try to determine if the following targets are occurring on the radar scope: biological targets, ground clutter, ice crystals, dry snow, wet snow, rain, heavy rain, big drops of rain, hail, graupel, range folding or unknown. Figure 3 is an example of the output from the Hydrometeor Classification algorithm. There are several new applications with the Dual Pol data, including: Winter Weather Precipitation-Type Determination; Hail Detection; Tornadic Debris Signatures; Convective Updraft Detection; and Heavy Rain in terms of droplet size and quantity.

Dual Pol radar technology will provide many benefits to our NWS customers. It will help identify non-meteorological targets more easily, and will differentiate between rain, snow and melting snow. Users will be able to better detect hail in a thunderstorm, and better determine areas of heavy rainfall. The various new products will also assist in determining when debris is lofted by tornadoes (e.g., siding and shingles).

Training is available for non-NWS meteorologists, and non-meteorologists who use WSR-88D data, at the following web site:

http://www.wdtb.noaa.gov/courses/dualpol/Outreach/index.html

Potential future StormBuster articles will get into the details of the new products, and further applications of Dual Pol radar technology at Albany.

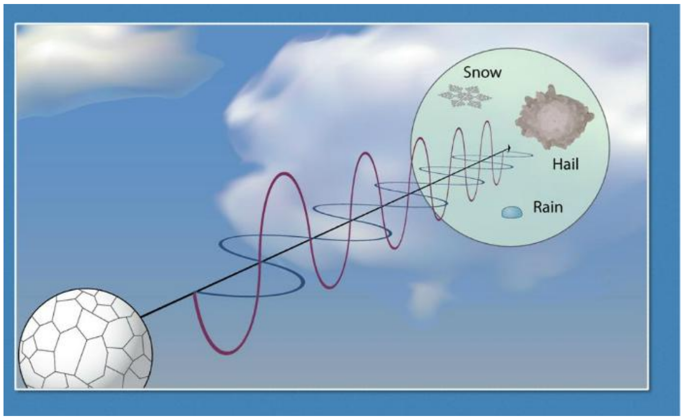

Figure 1: Dual Pol radar picking up different targets based on shape and orientation of the various hydrometeors Source: http://www.wdtb.noaa.gov

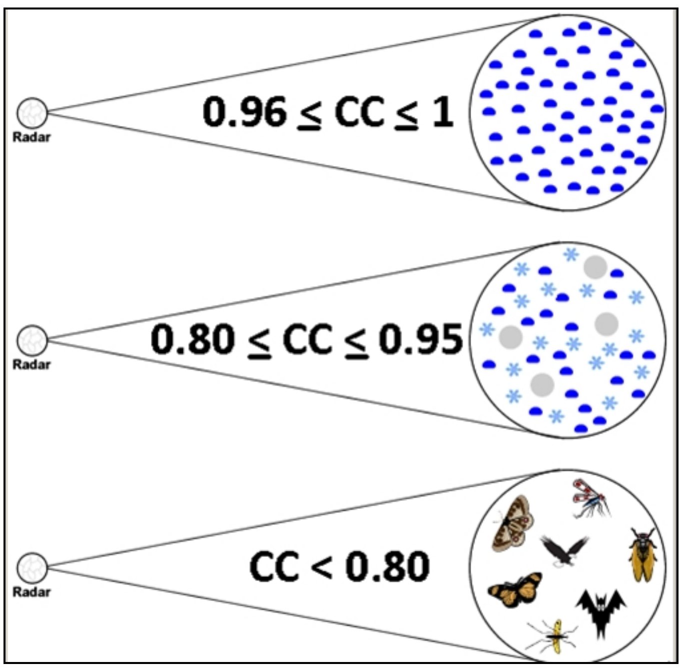

Figure 2: Correlation Coefficient (CC) values based on hydrometeor diversity distributions of type, size, shape and orientation. $0.96 \leq CC \leq 1.0$ values are typically uniform rain droplets; $0.80 \leq CC \leq 0.95$ values are usually mixed hydrometeors (rain droplets, hail, and snowflakes), and $CC < 0.80$ is usually non-meteorological echoes (insects, bats, birds, etc.) but can be extremely large hail at times. Source: http://www.wdtb.noaa.gov

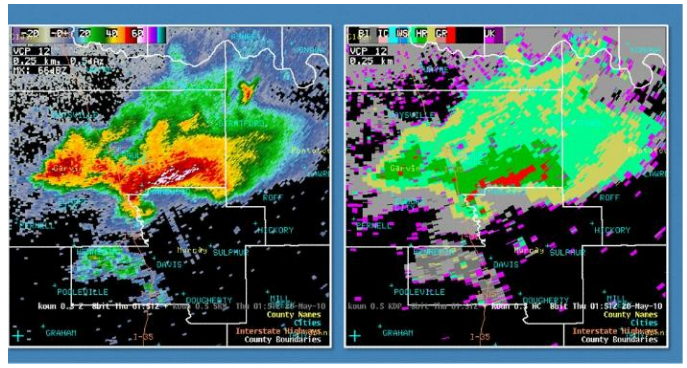

Figure 3: The left image is a traditional base reflectivity product (dBZ), and the right image is the output from the Hydrometeor Classification algorithm with areas in red (hail), dark green (heavy rain), tan (big drops of rain) and light green (rain). Source: http://www.wdtb.noaa.gov

From the Editor's Desk

As I type this, the Vernal Equinox has just arrived, and we are experiencing incredible early Spring warmth. Numerous Albany temperature records have been tied or broken leading up to now, and more is on the way as we progress through late March. This issue opens with two feature articles dealing with our way above normal temperatures and way below normal snowfall. Our third of three features is an update on Albany's upcoming Dual Pol radar system, the arrival of which is right around the corner. Enjoy the offerings… and the unusual warmth, because Mother Nature has a tendency to perform quite the balancing act in the Northeast during early and mid spring.□

WCM Words

Steve DiRienzo

Warning Coordination Meteorologist, NWS Albany

Much of this issue focused on the mild winter. If you are curious about the long range forecasts for temperature and precipitation you can find them at:

http://www.cpc.ncep.noaa.gov/products/predictions/90day/

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