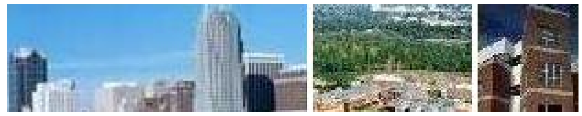
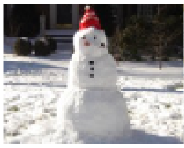
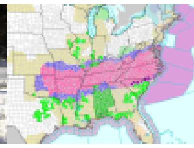
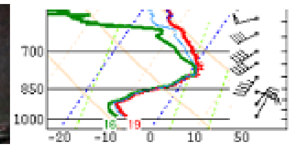
Event Summary
National Weather Service, Raleigh NC

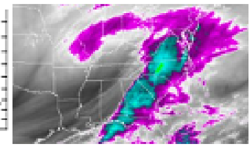
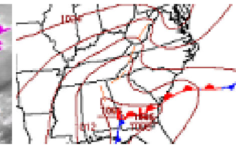


January 29-30, 2010 Winter Storm

Note that this is a PDF version of the event summary and that some links, media or resources may not be avaiable in this format.



Event Headlines

...This winter storm produced a large swath of snow and ice that extended across the southern Rockies into the Southern Plains, Tennessee Valley and eventually the Carolinas and Mid Atlantic...
...Winter Storm Watches were issued for all 31 counties and verified with no false alarms or missed events. The average lead time for all of the watches was 52 hours. Winter Storm Warnings were issued for all 31 counties as well with no false alarms or missed events. The average lead time for all of the Winter Storm Warnings was 33 hours...
...The Raleigh News and Observer reported that there were 1,000 car accidents across the state, some power outages especially in the Southern Piedmont and Mountains, several injuries from car and sledding accidents and one fatality when a pedestrian was killed by snowplow in Wayne County...
...The event followed a hybrid "Miller A/B" surface pattern in which a primary storm system tracks northeastward across the Southeast toward the southern Appalachians with other weak areas of low pressure or troughs extending north and northeast from the low center. This pattern results in a somewhat complex vertical thermal pattern with broad areas of mixed precipitation...
...Nearly 1-2 inches of sleet were observed in central North Carolina which led to reduced snow accumulations but increased longevity of the snow cover...

Event Overview

The surface pattern during the event was consistent with many past significant winter storms in central North Carolina with a storm system tracking east and then northeast across the northern Gulf Coast along with an arctic air mass centered across the eastern Great Lakes.

A strong cold front crossed central North Carolina around 00 UTC on 1/29 and then pushed south into southern Alabama and southern Georgia by 12 UTC on 1/29. A strong 1036 MB arctic high pressure system moved into the Great Lakes region by 18 UTC on 1/29 with subzero dew points. The presence of this very strong, very cold air mass to our north was key in setting the stage for a potential winter storm. As a low pressure system moved east from the Texas coast at 12 UTC to the Louisiana-Mississippi state line by 00 UTC on 1/30, an overrunning pattern developed across the Southeast, with the advection of warm air aloft riding up and over cold air near the surface. The arctic high pressure system to our north was strong enough and in a favorable location across the eastern Great Lakes during the evening of 1/29, to provide a steady supply of cold low level air into central North Carolina.

Higher up in the atmosphere, moisture and lift, two important ingredients for precipitation, steadily increased over North Carolina. At 850 mb, a warm front over the Gulf Coast states began moving northeastward, accompanied by strong confluent southerly flow. By 00 UTC on 1/30, a 40 knot low level jet stretching from the Gulf of Mexico up toward the southern Appalachians was pumping considerable moisture up into the Carolinas, up and over the low level cold air which was locked in over central North Carolina. A strong vortex at 500 mb, located over New Mexico at 00 UTC on 1/29, moved east across the lower Mississippi valley through the 30th, weakening to an open wave as it moved into the southern Appalachians by 00 UTC on 1/31. The approach of this wave brought increased moisture as well as strong lift over North Carolina, supporting the outbreak of precipitation. In the upper levels at 300 mb, upward motion over North Carolina was further intensified by upper level divergence in the right entrance region of the 175 knot jet over New England at 00 UTC on 1/30. All of these factors combined to lead to the development of deep, prolonged, moist upward motion over the region.

Precipitation quickly spread across central North Carolina during the late afternoon and evening of 1/29. By midnight, much of the precipitation had shifted north and east of central North Carolina as a large area of convection developed across southern Georgia and Alabama. Precipitation returned to central North Carolina a few hours after midnight and continued into the morning of 1/30 as the surface low moved northeast, reaching southern Georgia by 12 UTC on 1/30. The surface high pressure system had weakened slightly but remained in a very favorable location to pump low level cold air into central North Carolina, while farther aloft, warmer air kept trying to push over the low level cold air. As a result, precipitation types continued as a wintry mix through 1/30. Over the northern half of central North Carolina, where the low level cold air was deepest and the warm air advection aloft was weak, precipitation fell as mostly snow and sleet. In southern sections, where the surface-based cold layer was shallow with stronger warm air advection aloft, the precipitation was mainly a mixture of sleet and freezing rain.

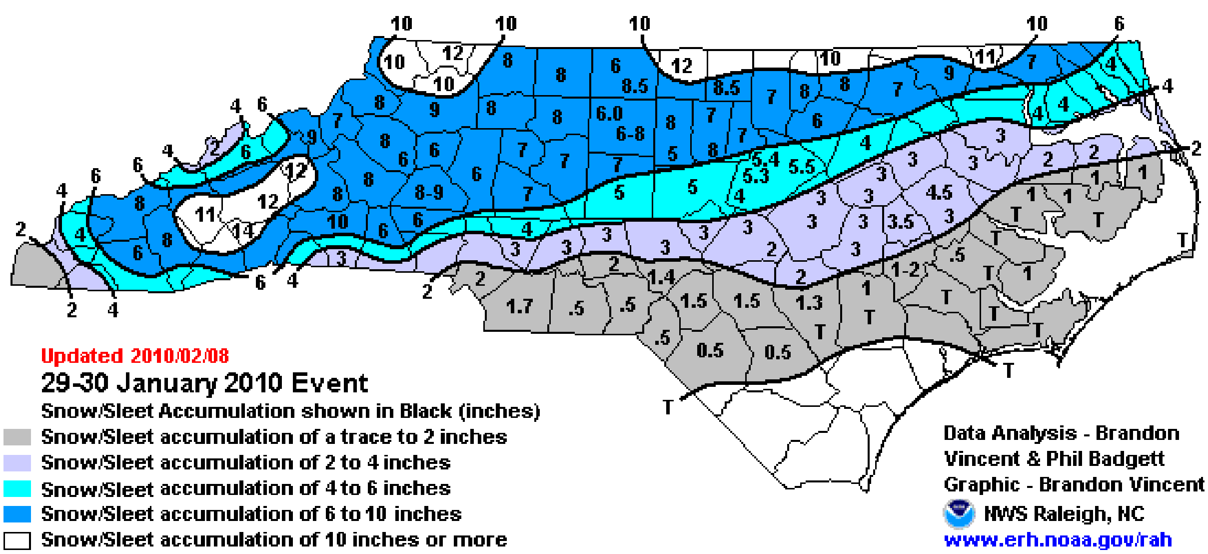
By 18 UTC on 1/30, the storm system had reorganized off the Southeast coastline and was beginning to depart the region. With the nose of the low level jet heading to our east, the mid level trough axis weakening further and shearing out over the Southeast, and the upper level jet core over New England heading out over the Atlantic, the lift over North Carolina was diminishing quickly, and precipitation ended from west to east during the early afternoon on 1/30.

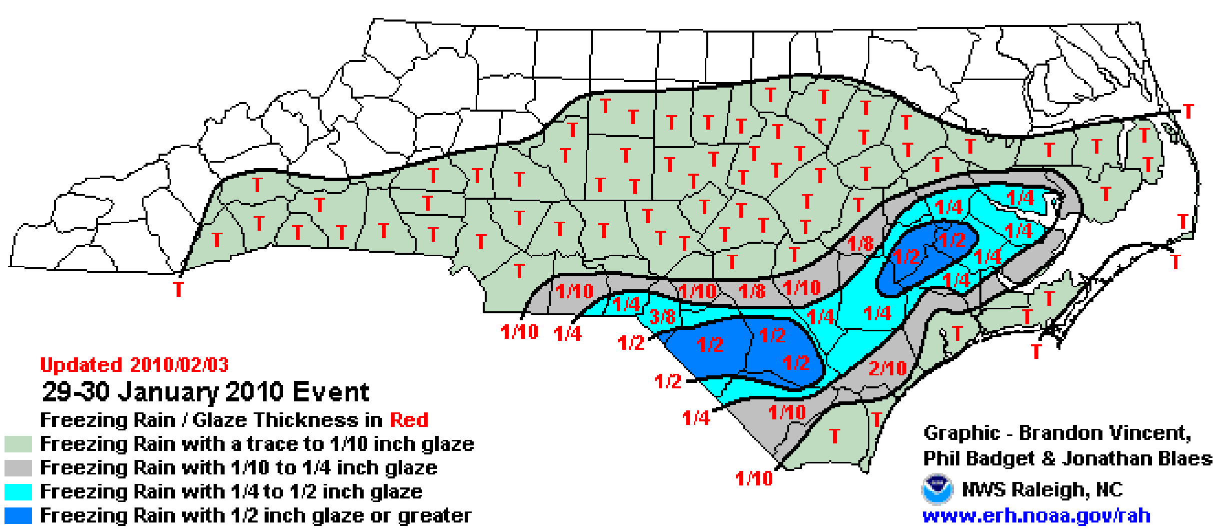
A large swath of 6-10 inches of snow with a little sleet fell across northern and western North Carolina with some locations immediately near the Virginia border and in the higher elevations of the mountains receiving around a foot of snow. Further south, 2-6 inches of snow and sleet fell along with some freezing rain fell across a good portion of the Piedmont including the Triangle and Charlotte metro areas. Around an inch of sleet with a little snow and up to a quarter of an inch of freezing rain fell across portions of the Southern Piedmont, Sandhills, southern Coastal Plain and central coastal region.

Much of the precipitation on the 29th fell as snow in Greensboro (KGSO), Raleigh (KRDU), and the NWS office in Raleigh (KRAH). On the 30th, sleet mixed in with the snow during the early morning hours. , Most of the precipitation in Raleigh fell as sleet after 400 AM while in Greensboro, the snow changed to mainly sleet after 900 AM. The mixed precipitation resulted in low snow ratios as seen in the table below.

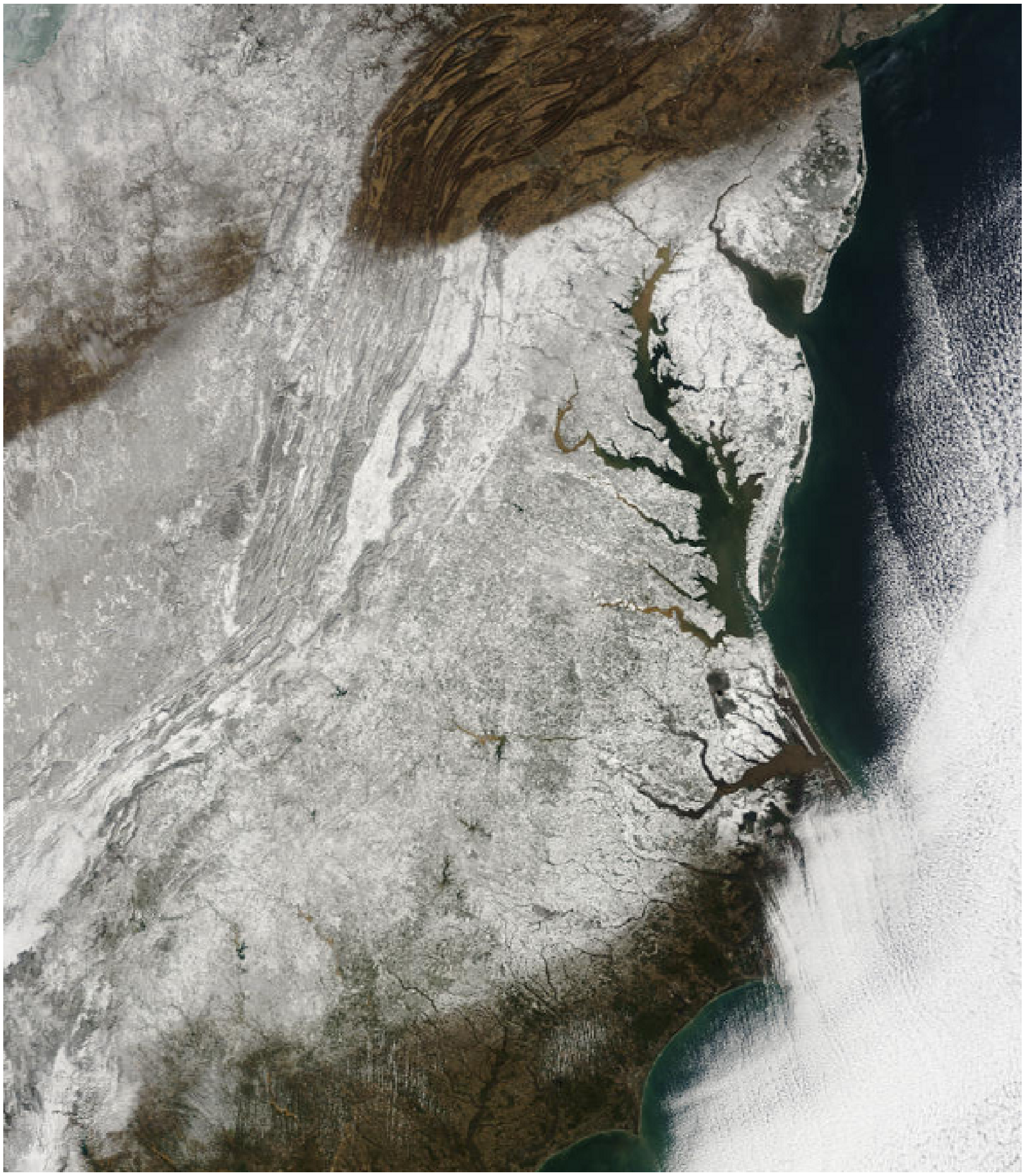
	January 29th			January 30th			Event Total		
	Liquid eq.	Snow/Sleet	Ratio	Liquid eq	Snow/Sleet	Ratio	Liquid eq	Snow/Sleet	Ratio
KGSO	0.17	2.2	13:1	0.49	4.2	8.5:1	0.66	6.4	9.7:1
KRDU	0.10	1.4	14:1	0.61	3.6	5.9:1	0.71	5.0	7:1
KRAH	0.19	2.1	11:1	0.54	3.2	5.9:1	0.73	5.3	7:1

Snow/Sleet and Freezing Rain Accumulation Maps





MODIS Terra Satellite Image Showing Snow Cover from 2010/01/31



Surface Analysis

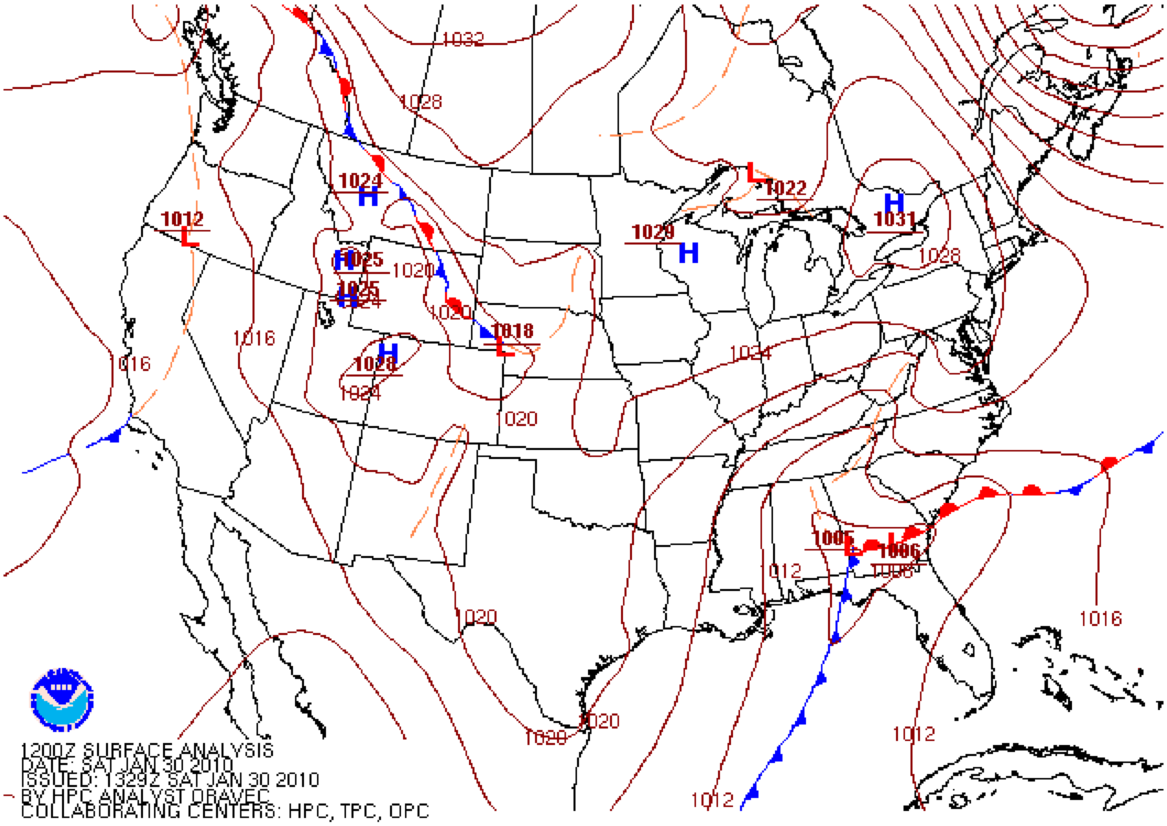
The surface pattern during the event was consistent with many past significant winter storms in central North Carolina with a storm system tracking east and then northeast across the northern Gulf Coast along with an arctic air mass centered across the eastern Great Lakes.

A strong cold front crossed central North Carolina around 00 UTC on 1/29 and then pushed south into southern Alabama and southern Georgia by 12 UTC on 1/29. A strong 1036 MB arctic high pressure system moved into the Great Lakes region by 18 UTC on 1/29 with subzero dew points setting the stage for a potential winter storm.

Meanwhile a low pressure system moved east from the Texas coast at 12 UTC to the Louisiana-Mississippi state line by 00 UTC on 1/30. A large overrunning pattern developed across the Southeast as rather a large expanse of warm advection moved across the Deep South. The cold arctic high pressure system was strong enough (>1025 mb) and in a favored location across the eastern Great Lakes during the evening of 1/30 to support wintry precipitation across much of central North Carolina.

The precipitation quickly spread east into nearly all of central North Carolina during the evening and early overnight and persisted for most of the overnight as the low pressure system moved northeast reaching far southern Georgia by 12 UTC. The high pressure system had weakened slightly overnight but it remained in a very favorable location for wintry precipitation in central North Carolina. By 18 UTC, the low pressure had reorganized off the Southeast coastline and was beginning to depart the region.

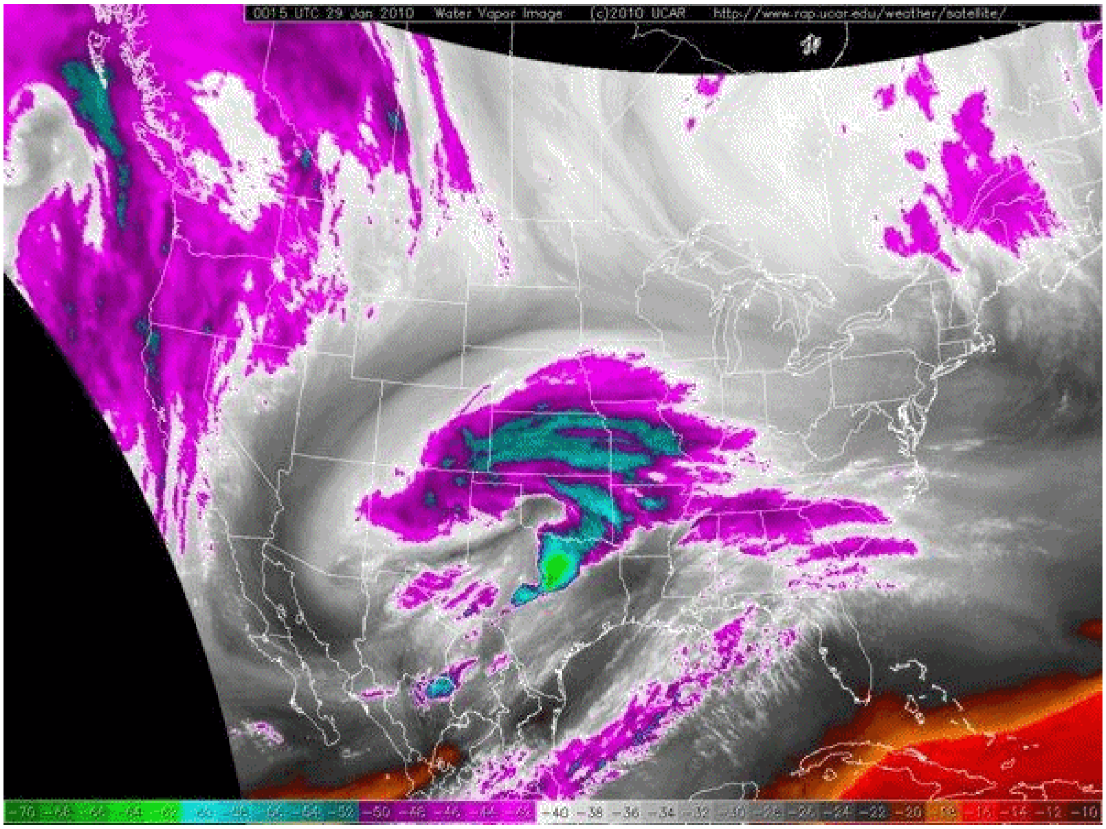
A **Java Loop** of surface analysis imagery from 12 UTC January 28 through 06 UTC January 31, 2010 shows the arrival of the cold air just ahead of the developing storm system in the deep south, a classic winter storm scenario for central North Carolina.



Satellite Imagery

Water vapor imagery was used to monitor the multiple short wave troughs that were evident in the larger long wave trough as well as the development and progression of a significant dry slot that moved across the Deep South and eventually the Carolinas.

A **Java Loop** of water vapor imagery from 0615 UTC on January 29 through 1215 UTC on January 31, 2010 is available.



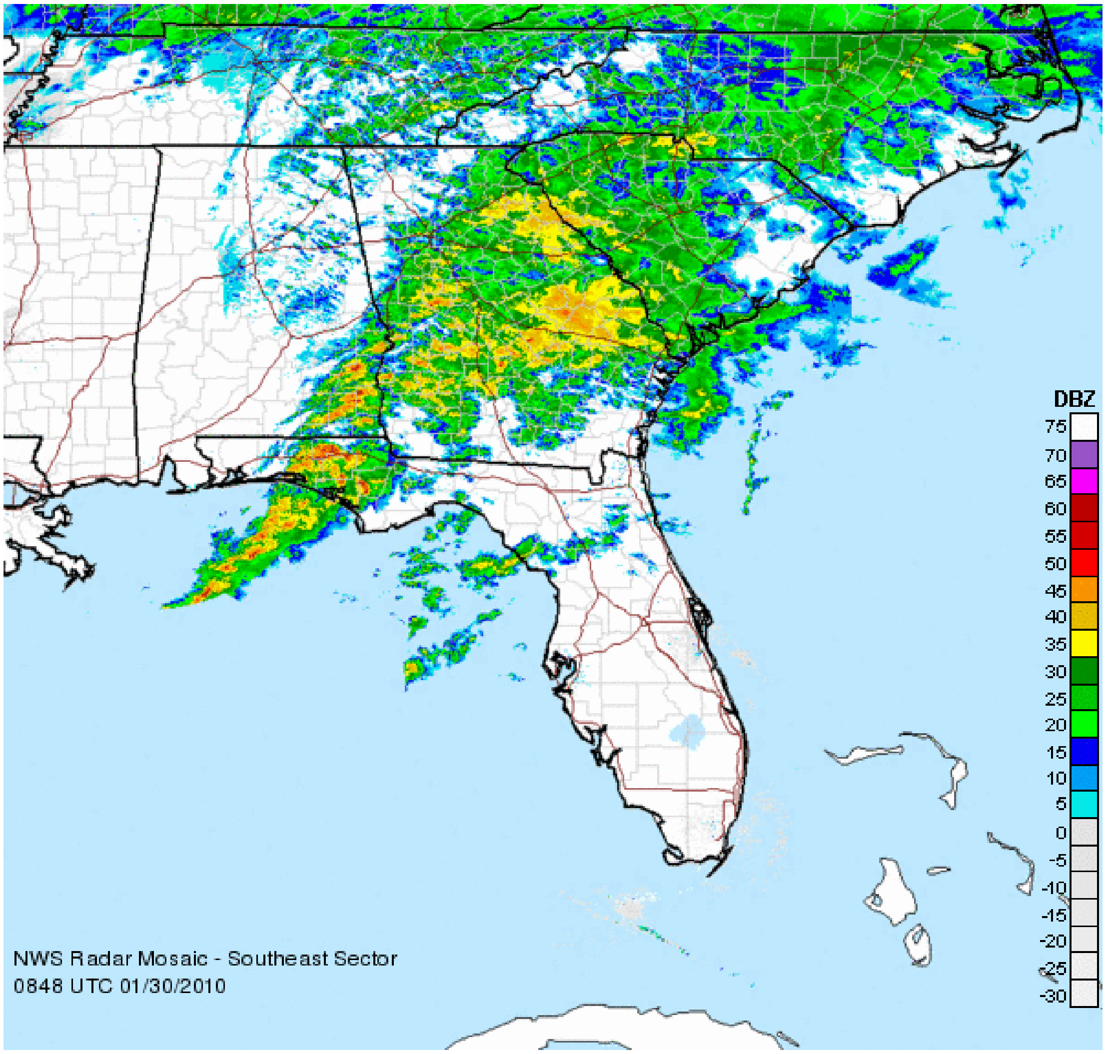
Southeast Regional Radar Imagery

Regional radar imagery first indicated a band of light reflectivity returns moving into central North Carolina after 20 UTC on 1/29. These reflectivity returns were associated with a lowering mid level cloud deck and some virga as shown in the Micro Rain Radar in Greensboro at 15:00 local time or 20 UTC. The band of precipitation extending from west to east across North Carolina appeared to be driven by lower-mid level frontogensis and warm advection. This precipitation started reaching the ground between 22 UTC and 00 UTC on 1/30 in the Triad and Triangle.

By around 05 UTC, the band of light to moderate snow had begin to push north and east as the low level frontogensis shifted toward northeastern North Carolina. In addition, the regional radar reflectivity at 04 UTC and 05 UTC showed a large area of convection across southern Georgia and Alabama which appeared to be reducing precipitation across northern Georgia and South Carolina. The convection was expected near the northern Gulf Coast and reduced precipitation amounts downstream of the convection were not totally surprising but the large area of reduced precipitation just upstream of central North Carolina at 06 UTC was troubling.

The radar reflectivity coverage filled in across South Carolina and North Carolina, especially between 07-10 UTC. Steady precipitation fell across much of central North Carolina for several hours before tapering off from Southwest-Northeast after 15 UTC. Mainly spotty light rain or freezing rain fell during the afternoon hours. A narrow band of snow showers moved east across northern and central North Carolina during the evening as the upper level trough axis moved east across the Mid Atlantic.

A **Java Loop** of Southeast regional radar imagery from 1758 UTC on January 29 through 0658 on January 31, 2010 is available.



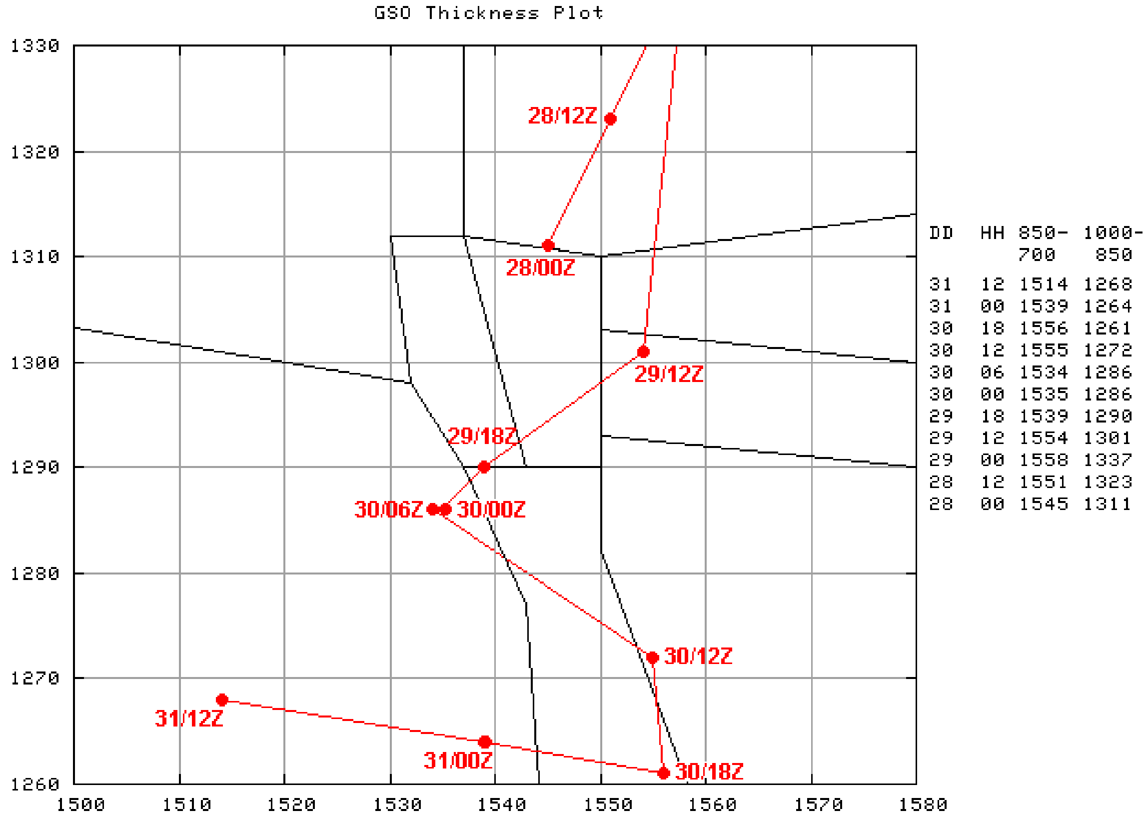
TREND's Predominant P-type Nomogram

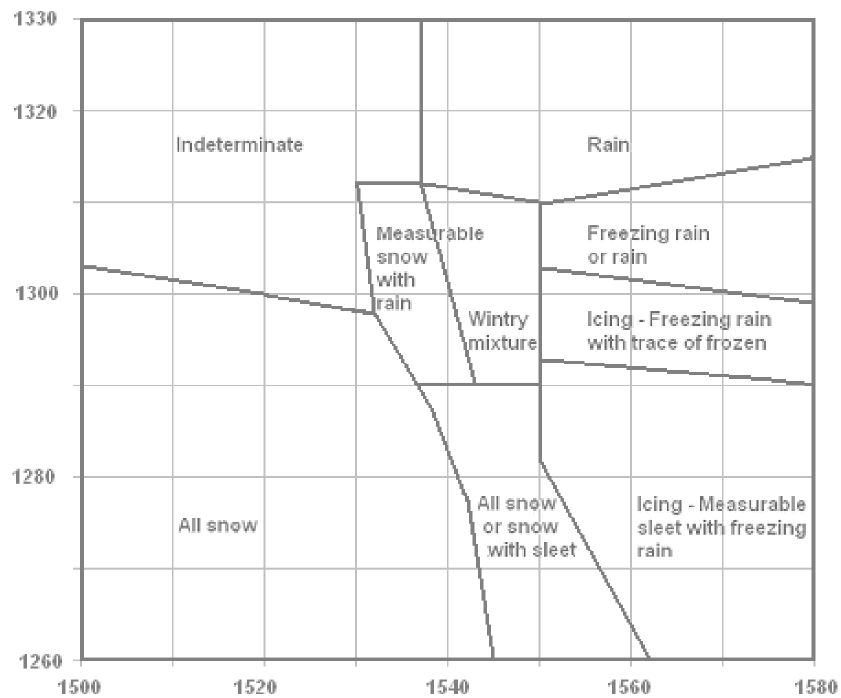
The nomogram to the right shows the distribution of precipitation (p-type) TREND's as a function of partial thickness values. Close examination of precipitation events over the past 30 years accounts for the boundaries on the nomogram separating the various p-type areas. Mid level thickness values increase from left to right along the x axis. Low level thickness values increase from bottom to top along the y-axis.

The nomogram to the right displays the observed thickness values from the 12 and 6 hourly RAOB's at KGSO from 00 UTC on 1/28 through 12 UTC on 1/31. During the afternoon of the 28th, temperatures reached the upper 50s to lower 60s across central North Carolina resulting in a warm low level thickness of 1337 meters. A strong cold front crossed central North Carolina around 00 UTC on January 29 with cold advection persisting throughout the 29th, resulting in a 51 meter low level thickness drop from 00 UTC on 1/29 to 00 UTC 1/30.

During the afternoon and evening of 1/29, the observed thickness pattern evolved into more of a snow signature as the observed thicknesses reach and then fall below the critical 1290/1540 meter threshold where the sounding should be all below freezing, indicative of snow. There was very little thermal advection between 00 UTC and 06 UTC on 1/30 as the thickness plots essentially remain stationary. During this period, KGSO reported light snow with up to 3 inches of snow accumulation.

After 06 UTC, the snow began to mix with and then become mostly sleet with some snow after 12 UTC. The KGSO RAOB from 12 UTC on 1/30 shows a small warm nose with temperatures near or just above freezing around 775 hPa. The thickness pattern as plotted on the nomogram during this period provided snow or mixed snow/sleet, with a small probability of some sleet mixed with freezing rain. By 18 UTC, the KGSO RAOB showed a slightly more prominent warm nose with considerable drying aloft . In fact, the drying aloft likely resulted in the limited availability of snow flakes or ice crystals and the tendency for much of the precipitation during the late morning or afternoon to fall as sleet or freezing rain.


GSO Thickness Plot
1330
1320
1310
1300
1290
1280
1270
1260
1500
1510
1520
1530
1540
1550
1560
1570
1580
28/12Z
28/00Z
29/12Z
29/18Z
30/06Z
30/00Z
30/12Z
31/12Z
31/00Z
30/18Z
DD HH 850- 1000-
700 850
31 12 1514 1268
31 00 1539 1264
30 18 1556 1261
30 12 1555 1272
30 06 1534 1286
30 00 1535 1286
29 18 1539 1290
29 12 1554 1301
29 00 1558 1337
28 12 1551 1323
28 00 1545 1311


1330
1320
1300
1280
1260
1500
1520
1540
1560
1580
Indeterminate
Rain
Measurable snow with rain
Freezing rain or rain
Wintry mixture
Icing - Freezing rain with trace of frozen
All snow
All snow or snow with sleet
Icing - Measurable sleet with freezing rain

Observations for GREENSBORO PIEDMONT, NC (GSO)

STN	TIME DD/HHMM	PMSL hPa	ALTM inHg	TMP F	DEW F	RH %	DIR deg	SPD kt	GUS kt	VIS mile	CLOUDS			Weather	MIN F	MAX F	P01 in	PCP in	SNO in
GSO	31/1154	1021.3	30.12	16	12	84	10	4		10.0	CLR				14	20			3
GSO	31/1054	1020.5	30.10	16	13	87	340	3		10.0	CLR								
GSO	31/0954	1019.3	30.06	16	12	84	0	0		9.0	CLR								
GSO	31/0854	1018.7	30.05	18	14	84	0	0		10.0	CLR								
GSO	31/0754	1018.2	30.03	20	15	81	0	0		10.0	SCT046								
GSO	31/0654	1017.5	30.01	20	15	81	360	3		10.0	BKN050								
GSO	31/0554	1016.8	29.99	20	15	81	0	0		10.0	FEW025	SCT040	BKN050		19	21	0.00	0.00	3
GSO	31/0454	1016.4	29.98	21	15	77	20	6		7.0	FEW035	SCT042	BKN095	S-			0.00		
GSO	31/0354	1015.9	29.97	21	14	74	20	7		7.0	BKN040	OVC080		S-			0.00		
GSO	31/0254	1015.8	29.97	21	14	74	20	8		10.0	FEW012	OVC034					0.00	0.00	
GSO	31/0154	1015.1	29.94	20	13	74	20	9	16	10.0	SCT012	OVC037							
GSO	31/0054	1014.4	29.92	19	14	80	20	9	17	4.0	SCT012	BKN037	OVC065	H			0.00		
GSO	30/2354	1014.1	29.91	19	14	80	30	7		1.0	BKN012	OVC027		S-	19	20	0.00	0.01	3
GSO	30/2254	1013.4	29.90	20	13	74	30	11		7.0	FEW009	BKN015	OVC020	ZL-			0.00		
GSO	30/2154	1013.0	29.89	20	15	81	30	10		4.0	BKN012	OVC017		H			0.00		
GSO	30/2054	1013.2	29.89	20	15	81	20	11	15	3.0	OVC012			IP-			0.00	0.01	
GSO	30/1954	1013.1	29.89	20	14	77	30	14	21	2.5	BKN014	OVC028		IP-			0.00		
GSO	30/1854	1014.1	29.92	20	14	77	20	12	21	1.8	FEW016	OVC028		IP-F			0.01		
GSO	30/1754	1015.2	29.95	20	14	77	30	12		1.8	BKN021	OVC031		IP-F	20	24	0.01	0.20	4
GSO	30/1654	1016.0	29.98	21	16	81	30	11		1.0	FEW013	BKN023	OVC031	IP-F			0.03		
GSO	30/1554	1016.5	29.99	20	15	81	30	15	21	0.8	SCT012	OVC024		IP-F			0.03		
GSO	30/1454	1017.8	30.03	21	17	84	40	11	18	0.8	SCT012	BKN020	OVC027	IP-F			0.03	0.13	
GSO	30/1354	1018.7	30.06	22	18	84	30	7		0.8	SCT012	BKN018	OVC027	IP-S-F			0.05		
GSO	30/1254	1018.7	30.06	23	19	85	60	13		1.2	BKN009	OVC025		IP-S-F			0.05		
GSO	30/1154	1018.0	30.04	25	20	81	60	12		2.5	BKN012	BKN025	OVC032	IP-S-F	25	28	0.02	0.25	5
GSO	30/1054	1017.8	30.03	26	22	84	60	14	20	9.0	BKN009	BKN014	OVC039	IP-S-			0.02		
GSO	30/0954	1018.4	30.05	26	22	84	70	14		1.2	BKN009	OVC015		S-F			0.02		
GSO	30/0854	1019.8	30.09	26	23	88	80	11		1.0	BKN003	OVC010		S-F			0.08	0.19	
GSO	30/0754	1020.1	30.10	26	23	88	70	11		0.5	BKN002	OVC009		SIF			0.06		
GSO	30/0654	1021.6	30.15	27	23	85	70	16		0.2	BKN002	OVC008		S+IF			0.05		
GSO	30/0554	1022.2	30.17	27	24	89	70	10		1.2	SCT006	BKN009	OVC029	S-F	27	30	0.03	0.13	3
GSO	30/0454	1021.8	30.15	28	25	88	80	8		1.5	FEW005	SCT009	OVC017	S-F			0.02		
GSO	30/0354	1022.9	30.19	29	26	89	70	9		1.5	FEW005	BKN011	OVC016	S-F			0.02		
GSO	30/0254	1024.1	30.22	29	25	85	60	7		1.5	SCT007	OVC011		S-F			0.02	0.06	
GSO	30/0154	1024.7	30.24	29	25	85	90	4		1.2	SCT008	OVC011		S-F			0.02		
GSO	30/0054	1025.3	30.26	29	26	89	0	0		1.5	BKN016	OVC024		S-F			0.02		
GSO	29/2354		30.27	28	27	93	0	0		0.8	BKN010	OVC023		S-F			0.00		
GSO	29/1654	1026.3	30.30	38	10	31	90	7		10.0	SCT110								
GSO	29/1554	1027.2	30.32	37	9	31	70	9		10.0	SCT110								
GSO	29/1454	1026.5	30.30	36	10	34	60	13		10.0	CLR								
GSO	29/1354	1026.8	30.31	35	10	35	30	10		10.0	CLR								
GSO	29/1254	1025.9	30.29	33	11	39	30	8		10.0	CLR								
GSO	29/1154	1024.4	30.24	34	10	36	40	10		10.0	CLR	33 43			33	43			

AMDAR Aircraft Soundings

AMDAR is an acronym for **Aircraft Meteorological DAat and Reporting** (AMDAR) which is an international effort within the World Meteorological Organization to coordinate the collection of environmental observations from commercial aircraft. In the United States, we often refer to the **Meteorological Data Collection and Reporting System** (MDCRS) which is a private/public partnership facilitating the collection of atmospheric measurements from commercial aircraft to improve aviation safety.

AMDAR Aircraft Soundings are very useful for short term forecasting situations where conditions are changing rapidly and in particular for aviation forecasting. Regarding winter weather events, AMDAR data can provide forecasters with the height of the freezing level, the presence of elevated warm layers, indications of thermal advection and dry layers. All of these are necessary for accurate precipitation type forecasts. The availability of this upper air data at times and locations where RAOB data may be lacking is invaluable.

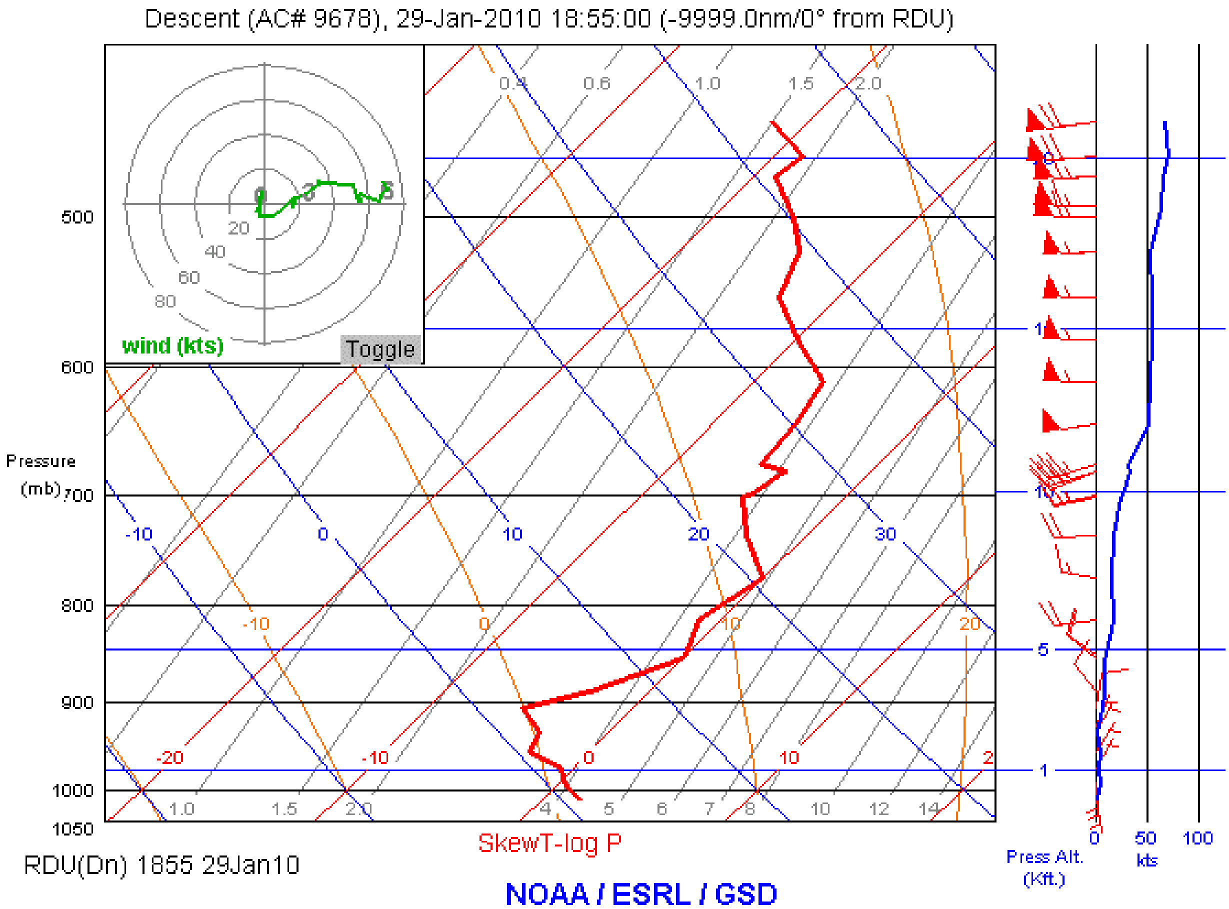
The image below contains a loop of AMDAR soundings at Raleigh-Durham International Airport (KRDU) during the event from 1855 UTC on January 29 through 1840 UTC on January 30, 2010. During the 27 hour period in which significant precipitation was falling across central North Carolina (1800 UTC on 1/29 through 21 UTC on 1/30), there were a total of 14 AMDAR soundings available via NOAA/GSD at KRDU. This is around a half to a third of the normal number of observations. Specifically on Saturday, January 30th, there were 7 AMDAR observations at KRDU compared to the previous 10 Saturdays which averaged 25.9 observations.

The greatly reduced number of Saturday observations is likely attributed to the large number of weather related flight cancellations at KRDU. While there were still flights at KRDU, most of them were likely non passenger aircraft and there were no observations between 0449 UTC and 1522 UTC. The lack of observations during this period was unfortunate as this was the period in which precipitation was transitioning from snow to sleet near KRDU. This event points out one of the limitations of the AMDAR data, is the lack of observations during some significant weather events when flight operations are cancelled.

The AMDAR soundings at KRDU clearly show the increased southwesterly flow in the 850 hPa to 700 hPa layer between 03 and 15 UTC and the resultant warming. At the same time the dramatic cooling in the near surface layer is evident with the boundary layer temperatures dropping from near 0 deg C at 2354 UTC 1/29 to around -6 deg C at 1522 UTC 1/30.

As noted previously, the development of the warm nose aloft and the dramatic cooling in the near surface layer at KRDU was observed with AMDAR aircraft soundings from 2354 UTC 01/29 | 0355 UTC 01/30 | 0357 UTC 01/30 | 0449 UTC 01/30 | 1522 UTC 01/30 and 1840 UTC 01/30.

A **Java Loop** of AMDAR soundings at KRDU from 1855 UTC on January 29 through 1840 UTC on January 30, 2010 that can be stopped, controlled and zoomed is available.



NWS Raleigh Local High Resolution WRF Model Output

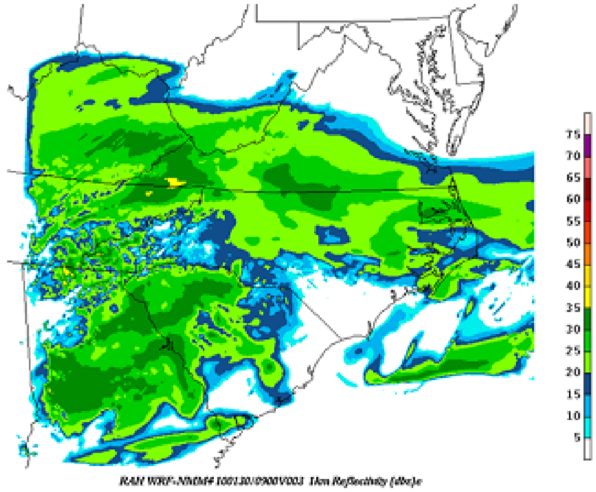
Within the past year, NWS Raleigh has been developing a local high resolution modeling capability. We expect to use the model in both an operational and research capacity to help refine phenomena related to smaller scale weather events that are common to our area. In addition, the model will allow us to produce and examine model fields that are not readily available to support operational needs as well as research and collaborative projects. Finally, we expect that the overall knowledge and understanding of how numerical weather prediction models (NWP) operate will increase, resulting in improved NWP utilization at our office.

One of bigger forecast concerns for this storm as the event unfolded, was the rapid eastward motion of the dry slot over the lower Mississippi Valley and a large area of convection that developed across southern Georgia and Alabama which appeared to be reducing precipitation across northern Georgia and South Carolina. Forecasters were not necessarily surprised at the convection near the northern Gulf Coast, but the lack of precipitation downstream of the convection and upstream of central North Carolina was troubling.

The local 4km WRF NMM produced at WFO Raleigh indicated the lull in precipitation across central and southeastern North Carolina and eastern South Carolina around midnight would give way to widespread precipitation. The model also highlighted the west to east band of snow across central North Carolina around midnight while also indicating the reduction of precipitation during the late morning and early afternoon on 1/30.

A PDF file containing the local 4km WRF NMM produced at WFO Raleigh with regional reflectivity imagery from 07 UTC through 20

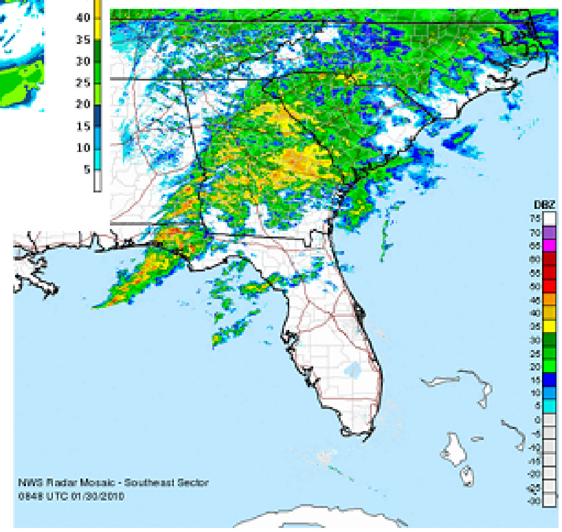
UTC on 1/30 provides an hourly comparison.



F03 Valid 09 UTC 01/30/10

RAH WRF NMM 4km - 06 UTC 01/30 init (top left)

Southeast Reflectivity (bottom right)



Hourly 4 inch (0.1m) Soil Temperatures

The image below (click on it to enlarge) shows the hourly 4 inch soil temperatures at 7 locations across central North Carolina from midnight on January 27 through midnight on February 2, 2010.

First note that this winter storm was preceded by a few mild days with temperatures reaching the 50s and 60s on January 24th and 25th and again on January 28th when max temperatures reached the upper 50s to lower 60s across central North Carolina. During this warm period the 0.1m (4 inch) soil temperatures reached the mid 40s to around 50 during the late afternoon hours. The amount of diurnal and spatial variability in the data is impressive with diurnal spreads of nearly 10 degrees F during the sunny milder days.

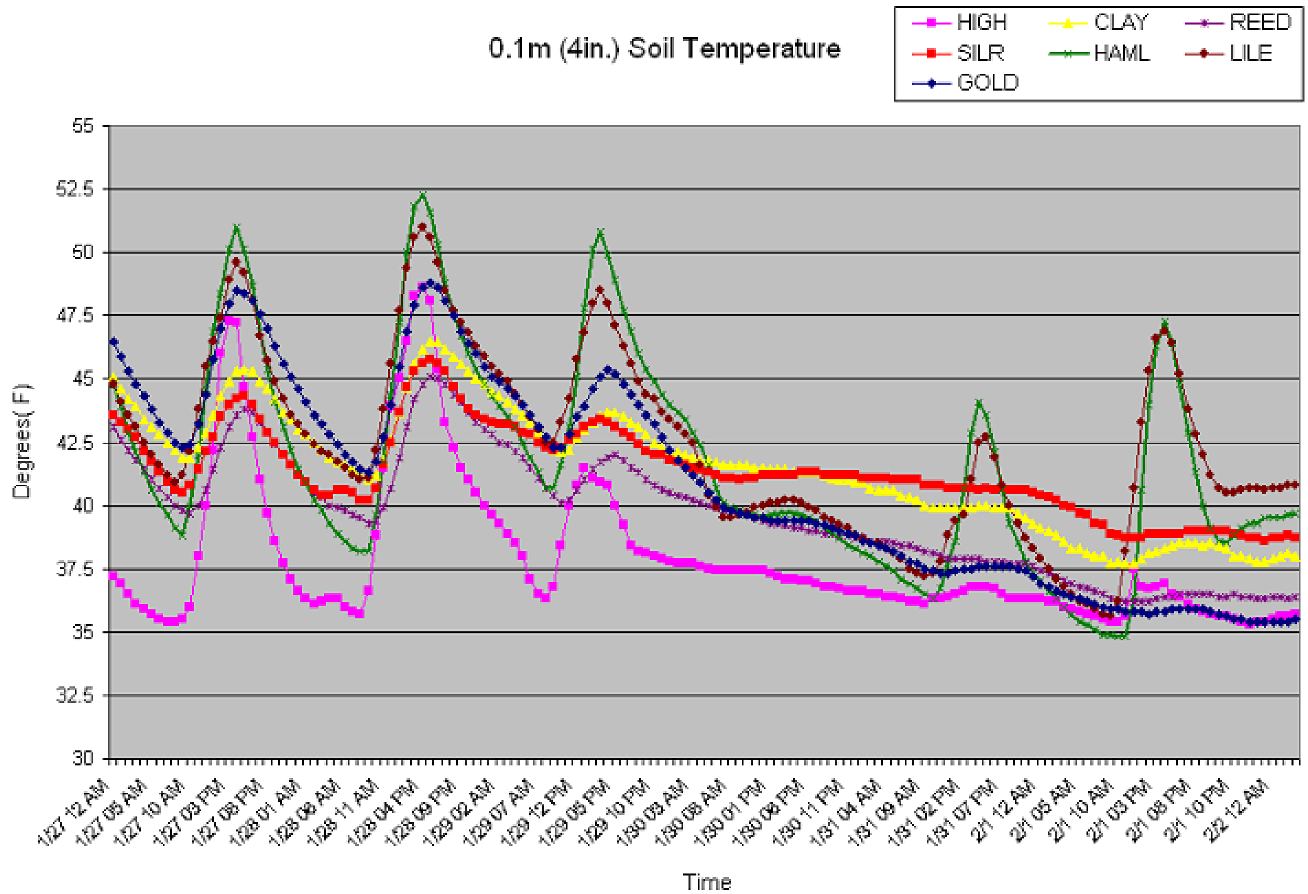
A strong cold front crossed central North Carolina around 00 UTC on January 29 with cold advection persisting throughout the day on the 29th. The strongest cold advection and the coldest air mass was located over the northern portion of central North Carolina and this can be seen in the reduced diurnal spreads on 1/29 at locations such as HIGH, CLAY, REED, SILR, and GOLD.

Once the precipitation begins during the evening of 1/29, the soil temperatures crash and fall into the upper 30s to lower 40s. The soil temperatures continue to fall on 1/30 as snow, sleet, and freezing rain accumulates and the surface temperatures continue to fall.

Note the two stations near the South Carolina border (HAML - Hamlet, NC and LILE - Lilesville, NC) which received very little snow and mostly sleet and freezing rain. Without a notable snow cover, the soil temperatures in these locations experienced a nice soil temperature recovery on 1/31 and 2/1 while the rest of central North Carolina was in a deep freeze.

Past experience has shown that when max soil temperatures during the day preceding a snow fall are in the lower 40s or colder and given modest snow rates with surface temperatures at or near freezing, the snow can be expected to accumulate. Max soil temperatures in most of central North Carolina were in the lower to mid 40s with the mid 40 temperatures confined to the southern Coastal Plain (GOLD) and location near the South Carolina border (HAML and LILE).

HIGH - UNCG Lindale Farm Station, Greensboro NC
CLAY - Central Crops Research Station, Clayton, NC
REED - Reedy Creek Field Laboratory, Raleigh, NC
SILR - Siler City Airport, Siler City, NC
HAML - Hamlet Tower, Hamlet, NC
LILE - NC Electric Cooperative Anson Peaking Plant, Lilesville, NC
GOLD - Cherry Research Station, Goldsboro, NC



CoCoRaHS Observer Network

CoCoRaHS is a grassroots volunteer network of weather observers working together to measure and map precipitation (rain, hail and snow) in their local communities. By using low-cost measurement tools, stressing training and education, and utilizing an interactive web-site, CoCoRaHS aims to provide the highest quality data for natural resource, education and research applications. The only requirements to join are an enthusiasm for watching and reporting weather conditions and a desire to learn more about how weather can effect and impact our lives. North Carolina joined the CoCoRaHS network in 2007. For more information, visit the CoCoRaHS web site at www.cocorahs.org.

The CoCoRaHS Web page provides the ability for CoCoRaHS observers to see their observations mapped out in "real time", as well as providing a wealth of information for our data users. The snow accumulation maps from the CoCoRaHS web site (shown below) were a great resource for WFO RAH. The CoCoRaHS observers in central North Carolina were notified of the potential storm in advance and encouraged to report during the event. Observations from the CoCoRaHS observers were excellent and very timely.

CoCoRaHS Intense Snow Report

Before the storm arrived, CoCoRaHS observers were sent an email thanking them for their help with observations during recent winter events while encouraging them to send observations, especially the immediate *Intense Snow Reports* with the upcoming storm.

NWS Raleigh received 29 CoCoRaHS Intense Snow Reports during this winter storm. An example is shown below with all of the reports available here. The intense snow reports are extremely helpful since it can be difficult to get accurate snow accumulation reports along with information on the various precipitation types and impact during the event and especially at night. Several of the Intense Snow Reports were received late in the evening or overnight when it is very difficult to get reliable information. The value of these reports cannot be overstated.

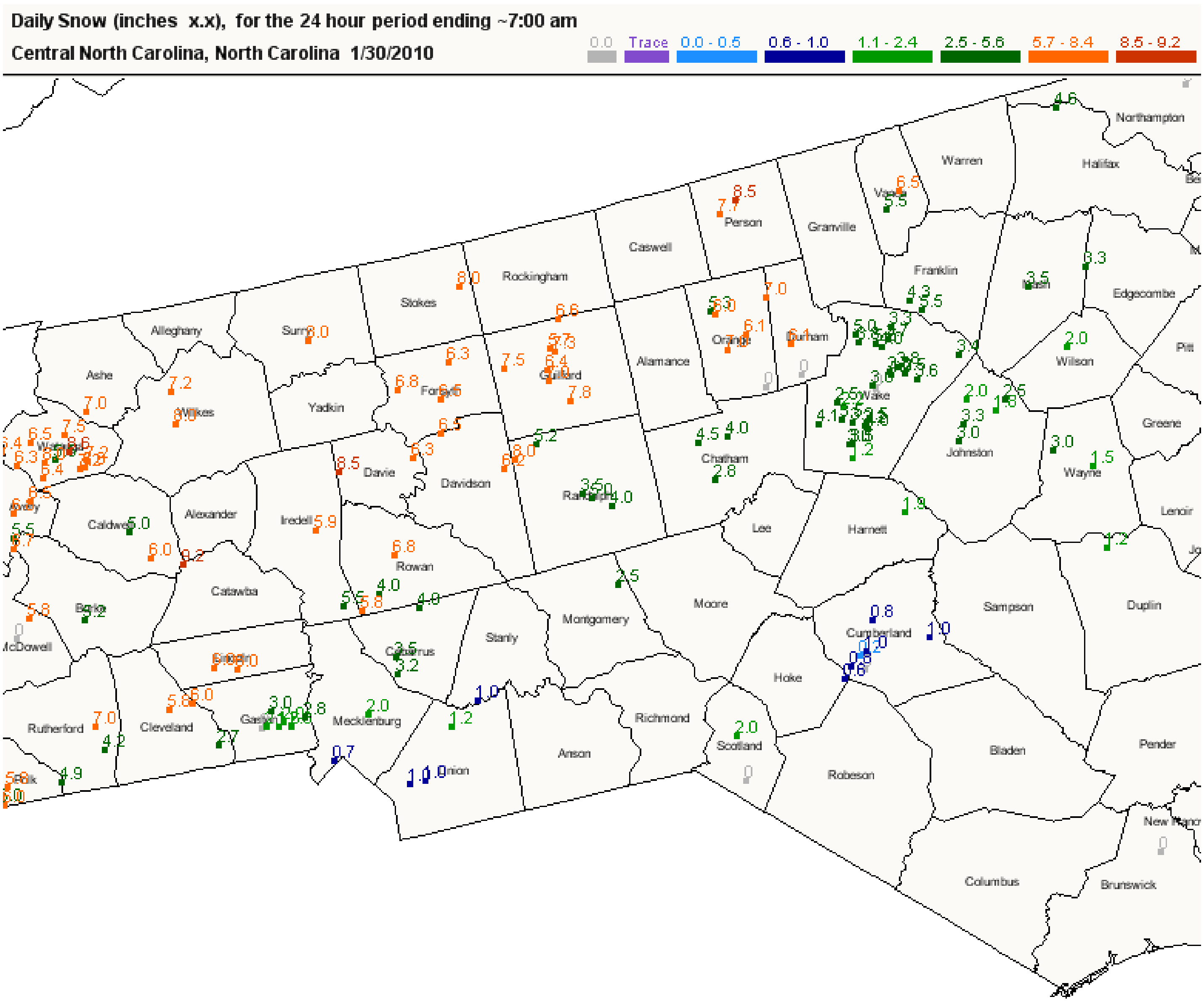
```
NZUS45 KBOU 300247
CCRAHS

intense snow report from CoCoRaHS spotter:

01/29/2010 09:45 PM local time
County: Randolph NC
```

Asheboro 6.5 SE (number NC-RN-7)
Latitude: 35.650556
Longitude: -79.731944
2.10 inches of snowfall in the past 3 hrs
2.10 inches of snow on the ground

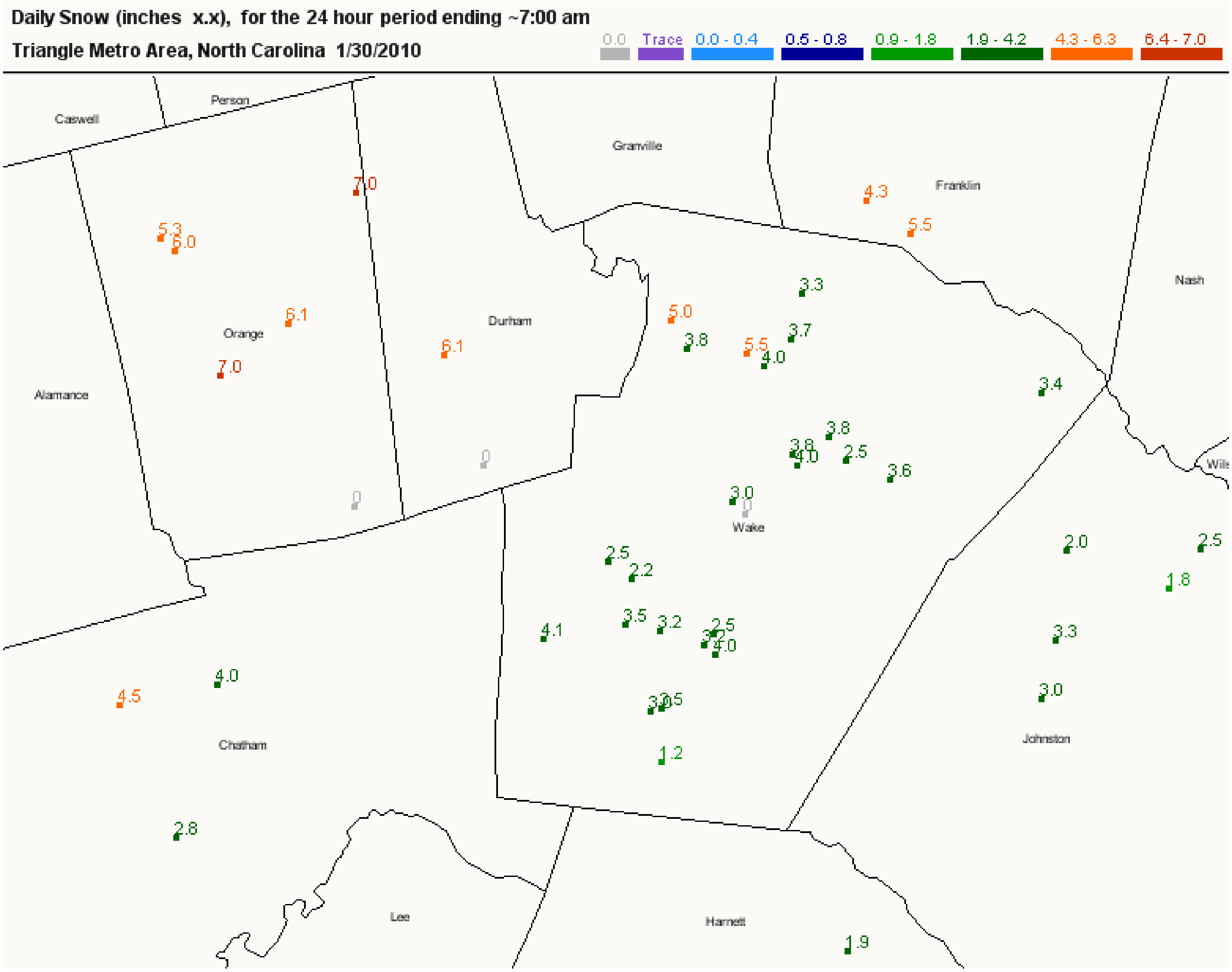
Comments: Snow began falling at 6:05PM. First measurement taken at 9:15, new snowfall was 1.5". Snow depth taken again at 9:45 was 2.1"

Received NWS Boulder Fri Jan 29 19:47:42 2010 MST
Sent to WFOs: RAH

Central North Carolina Snow Accumulation Totals Ending at 7AM on 01/30



Triangle Area Snow Accumulation Totals Ending at 7AM on 01/30



Archived Text Data from the Winter Storm

Select the desired product along with the date and click "Get Archive Data."
Date and time should be selected based on issuance time in GMT (Greenwich Mean Time which equals EST time + 5 hours).

Product ID information for the most frequently used products...

RDUAFDRAH - Area Forecast Discussion
RDUAFMRAH - Area Forecast Matrices
RDUHWORAH - Hazardous Weather Outlook
RDUNOWRAH - Short Term Forecast
RDUPFMRAH - Point Forecast Matrices
RDUPNSRAH - Public Information Statements (snow/ice reports among other items.)
RDUWRKDRT - Soil Temperature Data from the NC State Climate Office
RDUWSWRAH - Winter Storm Watch/Warning/Advisory
RDUZFPRAH - Zone Forecast Products

* Scroll down for list | from | January | 31 | 2010

Get Archive Data

Select Photos and Videos of the Winter Storm

Select Photos

Photos courtesy of Jeremy Gilchrist and Jonathan Blaes. Videos courtesy of Jeremy Gilchrist.

(Click on the image to enlarge the photo)

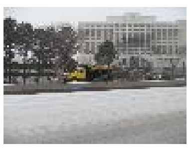




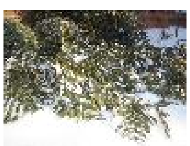
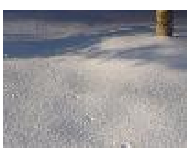
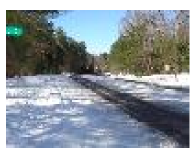








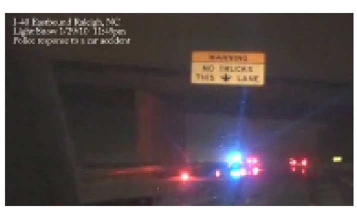


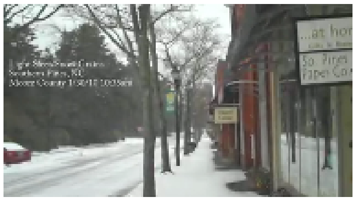





Select Videos

Videos courtesy of Jeremy Gilchrist and Bradley McLamb.

(Click on the image to enlarge the photo or open the video)



Final Thoughts and Lessons Learned

Forecasters took advantage of the very good NWP guidance to issue winter storm watches and warnings just beyond the normal temporal constraints given the higher then typical forecast confidence. The verification numbers were outstanding.

In general terms, in a hybrid Miller A/B storm, with a track fairly close to the coast, it is often very difficult to get a large area of all snow devoid of any mixing.

Using our philosophy of holding onto the current forecast and not making any large scale changes just as the event arrives worked out well during this event. In the radar image below from 06 UTC 1/30, the large void of precipitation down shear of the large convective cluster in GA/AL and up shear of the RAH CWA was alarming. But high resolution model guidance with one or three hourly output, including the local RAH 4km WRF NMM, indicated that the precipitation would fill in.

Numerous briefings were provided to local emergency managers and decision makers during the event via the new NWS Raleigh Briefing Web Page and via other online conferencing software. The ability to share information with users who may be at home or away from the office was invaluable.

Several CoCoRaHS intense snow reports were received by the NWS Raleigh. These reports are especially important since it is very difficult to get accurate snow accumulation reports late at night. The value of these reports cannot be overstated.

Acknowledgements

Many of the images and graphics used in this review were provided by parties outside of WFO RAH. The upper air analysis images and Skew-T diagrams were obtained from the Storm Prediction Center, The University of Wyoming, and the Earth System Research Laboratory - Global Systems Division. . Satellite data was obtained from the National Center for Atmospheric Research. Surface observations provided by the University of Wyoming. The surface analysis graphic was obtained from the Hydrometeorological Prediction Center. Radar imagery was obtained from the National Weather Service web site. AMDAR aircraft sounding data was obtained from the Earth System Research Laboratory - Global Systems Division. Analog medium range guidance and background provided by the CIPS Winter Storm Analog Guidance page. Ground temperatures and adjacent air temperature data provided by CRONOS from the N.C. State Climate Office. CoCoRaHS maps were provided by the CoCoRaHS organization. Micro Rain Radar data was provided by the Renaissance Computing Institute (RENCI). Photographs courtesy of Jeremy Gilchrist and Jonathan Blaes. Videos courtesy of Jeremy Gilchrist and Bradley McLamb.

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