Great Lakes to Northeast Major Winter Storm
February 7-9, 2013
By: Jason Krekeler, WPC Meteorologist

Meteorological Overview: A major winter storm affected the Great Lakes with up to a foot of snow and the Northeast with 1-3 feet of snow on February 7-9, 2013 (Fig 1). This storm underwent "bomb" cyclogenesis, dropping 24 millibars (mb) in 24 hours from 994 mb at 1200 UTC Feb 8th to 970 mb at 1200 UTC Feb 9th (Fig 2). The main culprit for the rapid intensification was the phasing of the northern and southern stream jets and merging of their respective mid-level energy. The state of the atmosphere on the days leading up to the intense cyclogenesis was characterized by zonal flow, but an anomalous ridge in place in the North Atlantic and upstream digging trough over California lead to a rapid amplification of the flow pattern across the U.S. from Feb 6th to Feb 9th (Fig 3).

Southern stream energy over the Mexican plateau moved into the Gulf of Mexico by 0600 UTC on Feb 7th leading to the development of a surface cyclone off the Texas coast. The northern stream energy originated in the Gulf of Alaska, and crossed the Northern Rockies before a surface cyclone developed in Montana by 1200 UTC Feb 7th. A trough digging into the southwest U.S. led to upstream amplification, including the simultaneous amplification of both the southern and northern stream troughs moving into the eastern U.S. With downstream blocking in place, the troughs were forced to phase along the Eastern Seaboard. The merging of the two systems took place from roughly 0000 to 0600 UTC on the 9th and coincided with the period of most intense snowfall rates and rapid deepening of the surface low in the Atlantic. The confluence of the southern and northern stream 250 mb jets began around 0000 UTC on the 9th. By this time, the amplification of the flow pattern had turned the surface low northeastward up the Mid Atlantic coast, with a position south of Cape Cod. The merging of the mid-level vorticity maxima occurred between 0000 – 0600 UTC on the 9th with the strengthening southern stream storm absorbing the northern stream energy. Another factor that led to the rapid intensification at this time was strong upper level divergence due to the coupled jet entrance/exit regions of the jet streaks immediately upstream and downstream of the consolidating vorticity center.

Strong surface frontogenesis created a low-level lifting mechanism for heavy snowfall to develop. Anomalous high pressure in place across eastern Canada allowed the sub-freezing surface temperatures to stay in place as the storm advected the warmer marine layer toward the New England coast, allowing a strong front to set up in a north-south orientation along the coast. At 850 mb, a very strong easterly jet developed in response to the strong baroclinicity at the surface. 70-kt easterly 850 mb winds observed at Chatham, MA indicated a strong low-level jet supplying Atlantic moisture westward into the cold sector of the storm. A strong mesoscale banding feature set up across central Long Island and central Connecticut just west of the strong surface baroclinicity and at the nose of the 850 mb jet. Snowfall rates of 3-4" per hour were observed in this band, with one report of 6" in one hour in central Connecticut.

Impacts: Major impacts were felt across the Northeast where 1-3 feet of snow fell. Portland had a record snowfall with 31.9", and Boston received its fifth highest total with 24.9". Hartford received its second highest total with 22.8". Hamden, CT received 40" of snow, which was the highest amount of the storm. Hurricane-force winds along the coast caused coastal flooding in Massachusetts and Boston received its fourth highest storm surge of 4.2 feet. Over 600,000 people lost power during the storm and over 6,000 flights were cancelled. 18 fatalities, mostly traffic-related, were attributed to the storm.

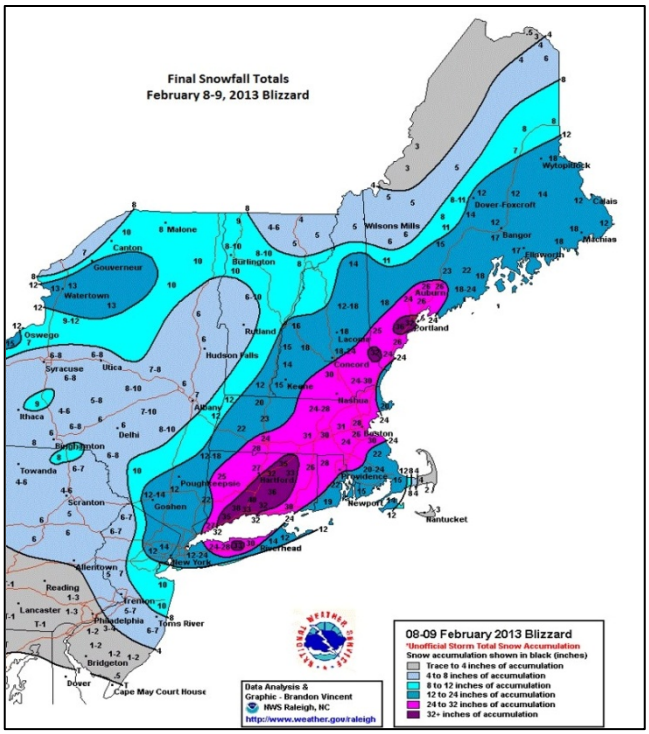

Fig 1. Snow totals for February 8-9, 2013
(Courtesy NWS Raleigh, NC)

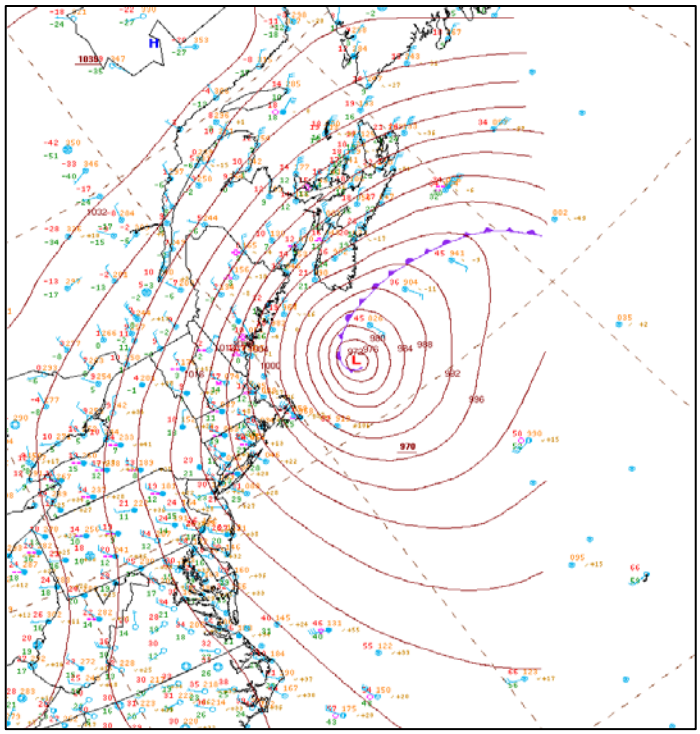

Fig 2. WPC Surface analysis February 9, 2013 1200 UTC

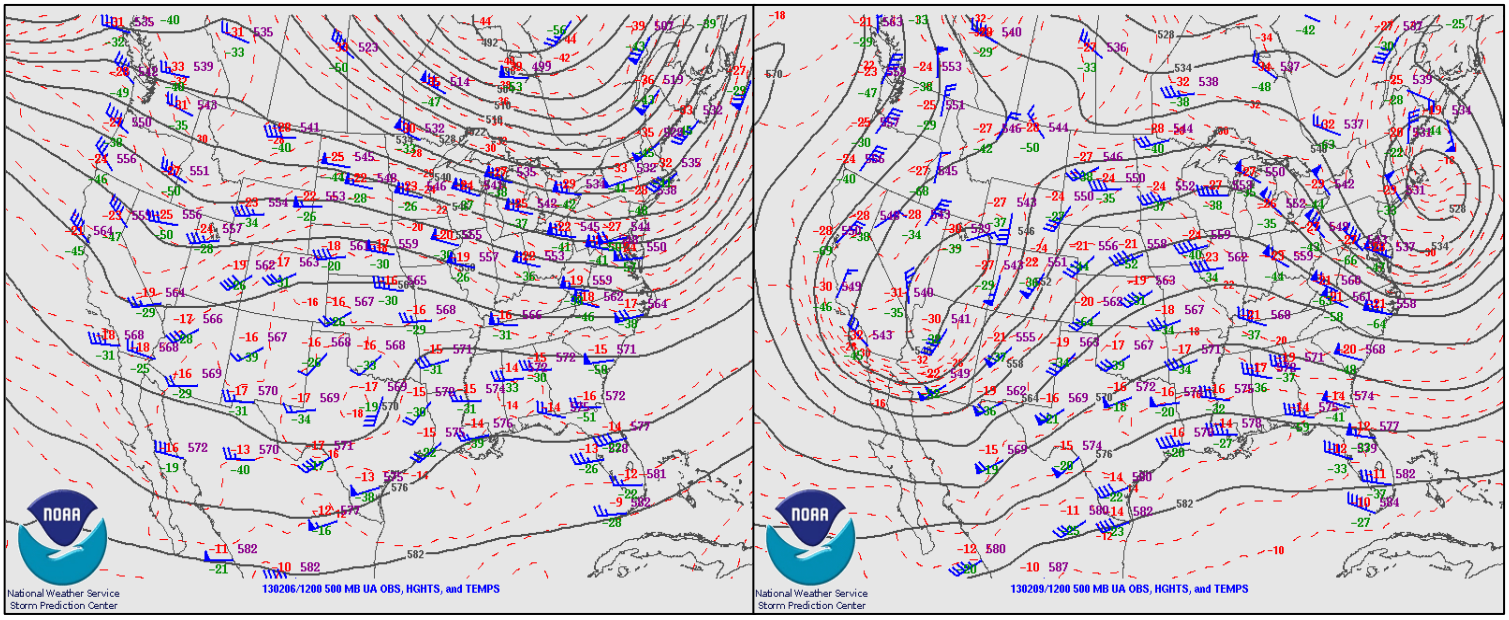

Fig 3. February 6, 2013 1200 UTC and February 9, 2013 1200 UTC (500 mb analysis/temps/obs courtesy Storm Prediction Center)