**New England Winter Storm – 29-30 December, 2016**
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## Meteorological Overview:

To conclude 2016, a powerful winter storm took shape across much of New England with the heaviest snowfall concentrating over eastern New Hampshire into interior Maine. These regions saw anywhere from 1 to 2 feet of snow (Figure 1) as deformation bands formed within a well-defined comma-head on the back side of a rapidly strengthening surface cyclone. During a 6-hour period, the sea level pressure dropped by 18 hPa down to 973 hPa (06 UTC 30 December) while crossing the central coast of Maine (Figure 2). Local buoys off the New England coast reported over 50 knot sustained winds during the intense cyclogenesis process.

The initial synoptic-scale pattern leading up to this event was characterized by a quasi-zonal flow of low amplitude. Eventual amplification across the Northern Plains led to further deepening of the parent upper trough while it moved toward the Ohio/Tennessee valleys. Temporal comparisons of local upper air analyses showed 500 hPa wind fields nearly doubling in strength to over 110 knots by 12 UTC on 29 December as the upper trough started to become negatively-tilted. The attendant height falls spreading toward the northeastern United States significantly cooled the tropospheric columns with Upton, New York (OKX) reporting a 500 hPa temperature fall of -16°C in 24-hours. Intense, persistent warm advection ensued in advance of the ejecting shortwave, pumping ample Atlantic moisture into the northeastern states. Based on local 00 UTC sounding data, precipitable water values along the enhanced moisture plume began to spike, nearing an inch over coastal Massachusetts (roughly in the 95$^{th}$ percentile relative to climatology).

Ahead of the advancing shortwave, warm advection processes spread light to moderate precipitation into New England on the afternoon of 29 December. Initially, marginal boundary layer temperatures along the coastal locales kept a cold rain as the dominant precipitation type given strong easterly flow off the Atlantic. Otherwise, a 1030-hPa surface anticyclone positioned over eastern Quebec helped maintain much colder temperatures across locations removed from maritime influences. Later into the evening and overnight hours, rapid intensification of the coastal low led to a more expansive precipitation shield with intense banding evident in regional radar imagery. These areas of moderate to heavy snow bands formed along and to the north and west of an intense region of 850-700 hPa frontogenesis with such values nearly tripling in value between 18-00 UTC (Figure 3a). Thundersnow was reported from eastern Massachusetts northward into southeastern Maine as an intensifying deformation band pivoted through coastal New England (Figure 3b). Steep mid-level lapse rates within the -10°C to -20°C zone (general region of dendritic growth) from the 00 UTC sounding at Gray, Maine (GYX) suggested the potential for convective elements in this winter storm. Observed rates were on the order 4-6”/hour, particularly across southeastern Maine, which led to some hefty snowfall totals. Observations across the state indicated over 2 feet fell north of Portland, Maine with a maximum of 29” in Kingfield. The event finally wound down early on 30 December as the system lifted into eastern Quebec with some lingering lake effect snow showers falling in the wake.

## Impacts:

The combination of a wet heavy snow coupled with strong winds led to widespread power outages and downed trees. These adverse conditions led to a number of automobile accidents as well as road closures across the region. It appears one fatality can be attributed to the dangerous road conditions in Vermont. Elsewhere, the weight of the heavy snow caused a domed structure utilized by student athletes to collapse on the campus of the University of Maine in Orono.

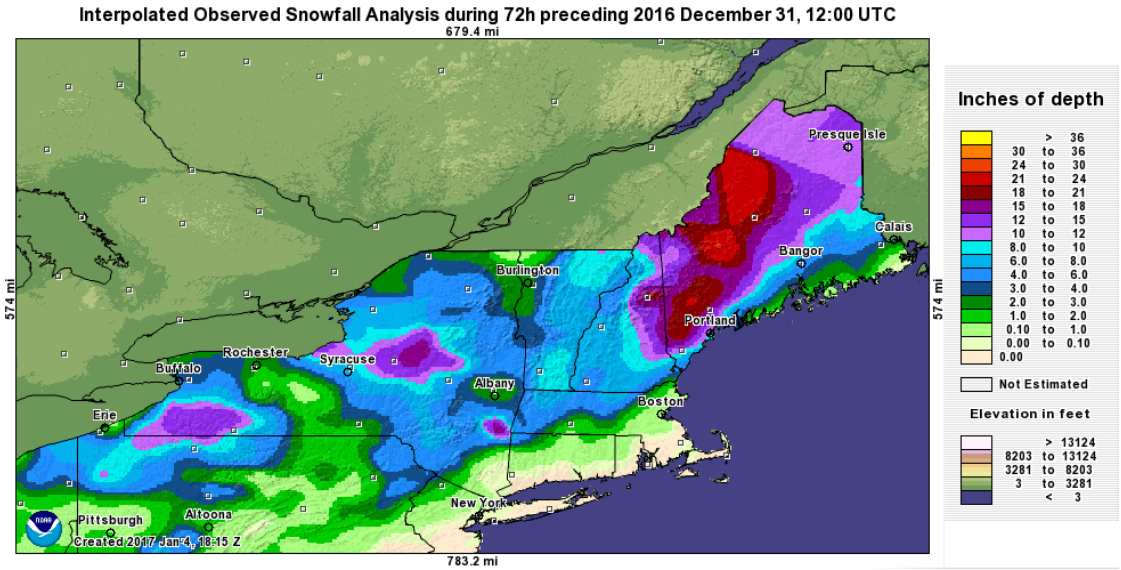


**Figure 1:** Total snowfall (inches) during the 29-30 December winter storm (image from National Operational Hydrologic Remote Sensing Center)

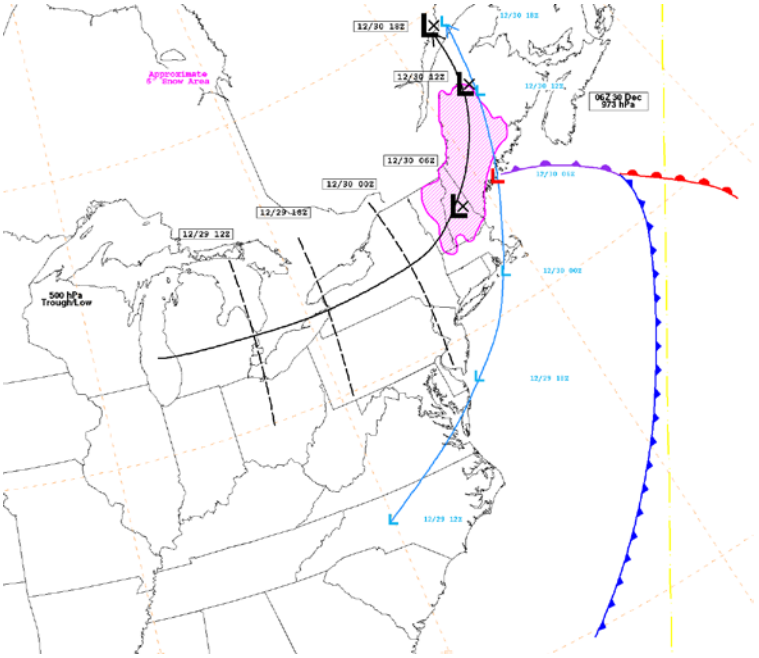

**Figure 2:** 500 hPa low tracks (black), surface low track (light blue), frontal analyses at 06 UTC on 30 December, and snowfall axis 6” & above (pink)

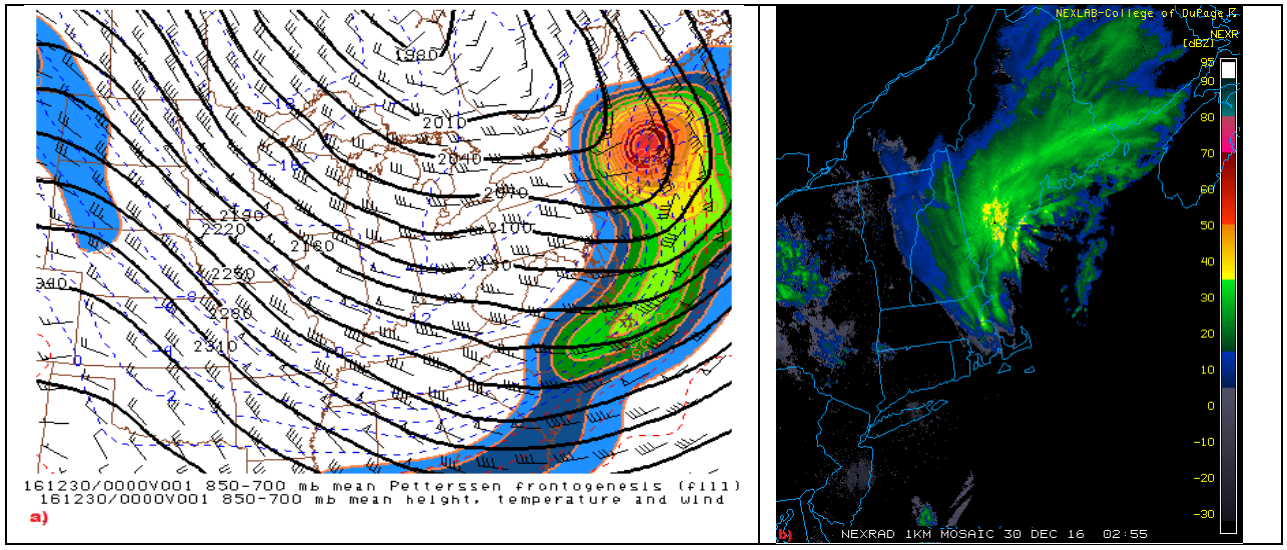


**Figure 3: (a)** 850-700 hPa mean Petterssen frontogenesis (color fill), 850-700 hPa mean height (black), temperature, and wind at 00 UTC on 30 December **(b)** 1-km regional radar imagery at 0255 UTC on 30 December (credit to College of DuPage)