A method for determining the historical climatology of East Coast Winter Storms

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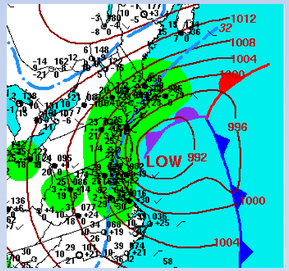
East Coast Winter Storms (ECWS) are among the most severe weather phenomena to impact the Northeastern United States. These storms may bring heavy precipitation, strong winds, and flooding to coastal and interior areas of the eastern coast. Hirsch *et. al.* (2001) and subsequent data keeping has provided an accurate history of ECWS for the past 60 years. Climatology of storms prior to this period, however, is less readily available. Utilizing hourly surface climate data being processed as part of the **Climate Database Modernization Program** (CDMP), a method for determining when ECWS are occurring has been developed for the pre-1948 period.

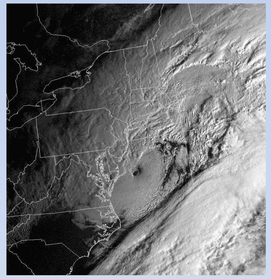
CDMP is a partnership between the National Climatic Data Center and private industry to make historical climate data available for research purposes. At the Northeast Regional Climate Center in Ithaca, New York, final quality control and processing of this data is accomplished. In this particular project, 1928-1948 SAO (Surface Airways Observations) data was used from the following stations:

Station Name	*WBAN*	*Latitude*	*Longitude*	*Elevation*
Bangor International Airport	14606	44° 48' N	68° 49' W	154 feet
Providence T.F. Green Airport	14765	41° 43' N	71° 26' W	66 feet
New Haven Tweed Airport	14758	41° 16′ N	72° 53′ W	6 feet
New York LaGuardia Airport	14732	40° 46′ N	73° 52′ W	52 feet
Trenton, New Jersey	14773	40° 13′ N	74° 46′ W	125 feet
Philadelphia International Airport	13739	39° 52' N	75° 14' W	27 feet

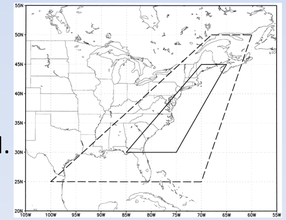
A program was written in python to identify potential East Coast Winter Storms from the datasets. The following set of criteria was used for any given hourly observation:

- *Wind Direction.* Winds had to be between 330 degrees and 60 degrees.
- *Sea Level Pressure.* Pressure had to be 30.00 inches of mercury or less.
- *Pressure drop.* The pressure must have fallen *or* risen by at least 0.04 inches of mercury in the past hour.
- *Number of hours.* To be flagged, a day, or one 24-hour period, had to contain at least two hours which met the above guidelines.
- A minor adjustment to the program was made in order to eliminate false alarms created by non-coastal storms that moved through the Ohio Valley. This involved eliminating any valid observation if the minimum pressure during the 24-hour period occurred while winds were anywhere from 90 to 270 degrees, the southern half of the wind rose.



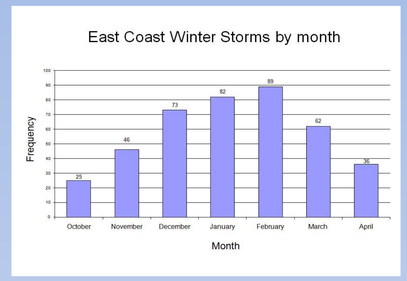


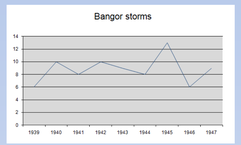
To verify the accuracy of the program, its results for 1949- present were compared to the storms found by Hirsch et. al. (2001) during this period in their study. They used NCEP-NCAR Reanalysis datasets to determine ECWS. When the results of the program were compared to Hirsch, **336** of the **352** storms found by the program were verified. The program was most skillful at identifying "**strong**" ECWS, defined by the NRCC as storms with winds of at least 52 MPH. Please also note that the figure to the right was used by Hirsch to identify possible low pressure systems(dashed lines) and potential ECWS (solid lines).

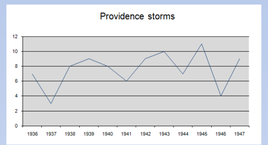


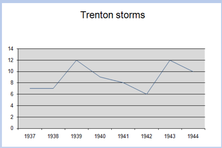
The results obtained gave a good snapshot of ECWS activity during the 1930's and 1940's. The data also correlated well with the results from the Hirsch study.

As seen to the right, ECWS develop between October and April, with the peak in January and February. Annual frequency of ECWS could vary considerably, with no distinct trend during the period. This can be seen in the following graphs of storms per year at three of the stations:



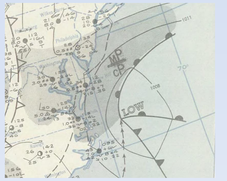




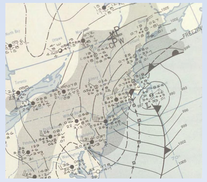


One likely explanation for the sometimes stark contrast in yearly ECWS frequency is the El Niño phenomena. When the Southern Oscillation Index (SOI) was negative, indicating El Niño, there were generally more ECWS. The presence of El Niño or lack thereof is used to forecast the likely number of ECWS in a given season.

Numerous historically significant ECWS were identified by the program. One example is the "**Post- Christmas Day Blizzard of 1947.**" A strong low moved up the east coast December 26th and 27th, pummeling the Northeast and New York City especially. The storm briefly stalled over Long Island on the 26th, bringing the city to a complete standstill and causing about 80 deaths. 26.4 inches of snow were reported at Central Park, while the highest mark was an impressive 30.5 inches at Yonkers.



December 26, 1947



December 27, 1947