

Product/Service Description Document
Experiment: Expansion of use of National Weather Service
Polygon Warnings

PART 1: MISSION CONNECTION

Product / Service Description

Weather Forecast Offices (WFO) issue many watches and warnings on a zone basis. Since many weather events that are covered by these watches and warnings are localized in nature, significant portions of the counties within the warning area may not be affected by the event.

The National Weather Service (NWS) has been utilizing polygon warnings for several years in the severe weather program – including severe thunderstorm and tornado warnings. This experiment is intended to expand the use of polygons to additional hazards in which the NWS can provide more targeted warning information in an effort to reduce the loss of life and property.

Lake effect snow (LES), Snow Squalls and Dust Storms are examples of unique weather events which can cause localized extreme weather with high impact to the public and commerce. In some LES events intense snow bands, with rates of up to three inches an hour, can be common and in extreme cases can exceed four inches per hour. It is known that snowfall rate can have a higher impact than actual snowfall totals. In many cases, the focus of these bands of snow will have widths of only ten to twenty miles across. Another issue is the transient nature that some of these events can exhibit as shifting winds move the high-impact intense snows across the region. During intense snow squalls, visibility can be reduced drastically in a matter of minutes, leading to extremely dangerous driving conditions. WFO Buffalo and other offices serving the Great Lakes issue long-fused Lake Effect Snow Watches and Warnings on a zone basis. WFOs across the Nation issue Winter Storms Watches and Warnings in similar fashion, where significant portions of counties within the warning may not be receiving substantial, if any, snowfall.

WFOs in the Western Region issue Dust Storm Warnings on a zone basis, which out west can cover large areas. Short-duration dust storms can be very localized in nature, and not affect the entire warned area. For example, WFO Phoenix can issue a Dust Storm Warning for a portion of Interstate 10 south of the Phoenix Metro, and due to the zone-based warning, the entire Phoenix Metro area gets alerted to the event.

A proposed solution to more accurately warn for these localized events is the creation of polygon warning areas to delineate the locations of the event and the areas of highest impact over the course of the event. Issuance of the product would be based upon forecaster confidence of the event reaching the event Warning criteria. For example for a LES event- snowfall rate, blizzard-like conditions, total snowfall 7 inches or more in 12 hours, or 9 inches or more in 24 hours. As the lake effect shifts, polygon areas will change spatially and temporally.

Purpose/ Intended Use

Specific warning area forecasts would provide enhanced information as to the highest impact areas. Reducing the size of the False Alarm area increases the effectiveness of the warning.

The science of forecasting localized events such as lake effect snow, snow squalls and dust storms has progressed to where the value of specific warning area information is possible. The ever-increasing use of point specific information through the internet, smartphones, etc. requires the NWS to communicate this location-specific impact information in a more efficient means.

The enhanced information provided in polygon warning areas would allow for a more organized and cost-effective use of public resources to minimize the effects of these high-impact events.

Audience

The polygon warning area is intended for a wide audience. The delineation of areas of impact would not only serve our emergency response and government partners but be a viable method to be used by the broadcast media to display site specific impact information. Anyone needing specific location in time would find this information valuable, including the general public through polygon displays on NWS web pages. Also, for events that alert customers via Wireless Emergency Alerts (WEA), the alerts can be tailored to transmitters within the short-fused warning area, which would address the issue of over-alerting to customers outside the actual area of concern.

Presentation Format

The warning area information will be presented in several formats, increasing the user audience of this product. Graphically, the polygon information would be available via webpage. The vertices of the polygon delineation would be available via text product (similar to the polygon latitude/longitude information on NWS Severe Thunderstorm Warnings). This information would also be made available in a downloadable KML/KMZ file for the higher-end GIS users. Initially the polygons will be tested at WFO Buffalo for LES Events during the winter of 2015-2016 within certain Public Zones along Lake Ontario. Additional testing at a later date will include Dust Storm events.

Evaluation/Feedback Method

Feedback is expected through interaction with core NWS customers and partners, via an OMB approved survey at www.nws.noaa.gov/survey/nws-survey.php?code=LESWP. A verification method including an evaluation of the decrease in false alarm area and affected population will be conducted during the test phase.

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PART II: TECHNICAL DESCRIPTION:

Format and Science Basis

A Graphical Forecast Editor (GFE) procedure will be used by forecasters to create an area warranting a polygon. For LES, the primary inputs to the polygon will be forecast snow amount and county based hazards, although other variables related to blizzard-like conditions may be used as well. As an example, one might focus on areas expected to receive >1"/hr within counties designated in a lake effect warning as determined through forecaster collaboration, with the option of choosing a different snow rate and additional forecast elements needed to create a set of highly focused polygons that keys into the most significant areas within a set of counties over a period of time.

This procedure should output a set of COORD...TIME paired lines denoting the polygon and valid time with as few as three and as many as 20 vertices. For lake effect snow and winter storm issuances, these lines will be embedded experimentally within the winter warning product text (WSW) between the && and the \$\$ delineators. The output should resemble the LAT...LON/TIME lines found in short-fused products like Severe Thunderstorm Warnings (SVR). However, to avoid confusion with the operational weather.gov page – COORD will be used instead of LAT...LON/TIME. Since the warning area may change with time, there may be multiple COORD...TIME pairs for each valid time of a polygon. The zone-based warning will continue to be used as the official warning and source for verification, while the polygons will fine tune the hardest hit areas with time. The maximum number of COORD...TIME pairs will depend on the forecaster. Grouping COORD...TIME pairs in 6 or 12 hour increments with 5-6 vertices may provide a desirable text output.

An example below shows a typical warning for a southwest flow lake effect event downwind of Lake Erie. Five counties (in red) are under a warning: Erie, Genesee, Wyoming, Chautauqua, and Cattaraugus, but only a small section of those five counties may be affected during different times. When looking at the warning without polygon detail, it is impossible to see where and when the lake band might be at any given time. Proposed polygons (purple) are then overlaid over the static county based warning. This example shows polygons moving once every several hours.

The text output would have 6 lines of text for this event. Three separate polygons are shown below with a lake band slowly moving northeastward and expanding along Lake Erie. The first two polygons have 5 vertices while the other polygon has 6 vertices. In the scenario below, spotters within each of the 5 counties might eventually verify the warning, although several portions of each county may never see a single snowflake.

```
COORD...4282 7826 4273 7896 4248 7936 4246 7921 4266 7817  
TIME 151230T2100Z-151231T0000Z  
COORD...4295 7806 4304 7826 4292 7887 4267 7903 4282 7829  
TIME 151231T0000Z-151231T1200Z  
COORD...4290 7792 4307 7792 4292 7887 4278 7887 4220 7976 4273 7870  
TIME 151231T1200Z-160101T0000Z
```

Examples:

WWUS41 KBUF 181330
WSWBUF

URGENT - WINTER WEATHER MESSAGE
NATIONAL WEATHER SERVICE BUFFALO NY
930 AM EDT SUN OCT 18 2015

NYZ006-181700-
/O.UPG.KBUF.LE.Y.0027.000000T0000Z-151018T1700Z/
/O.NEW.KBUF.LE.W.0015.151018T1330Z-151018T1700Z/
OSWEGO-
INCLUDING THE CITY OF...OSWEGO
930 AM EDT SUN OCT 18 2015

...LAKE EFFECT SNOW WARNING IN EFFECT UNTIL 1 PM EDT THIS
AFTERNOON...

THE NATIONAL WEATHER SERVICE IN BUFFALO HAS ISSUED A LAKE EFFECT
SNOW WARNING...WHICH IS IN EFFECT UNTIL 1 PM EDT THIS AFTERNOON.
THE LAKE EFFECT SNOW ADVISORY IS NO LONGER IN EFFECT.

* LOCATIONS...CENTRAL OSWEGO COUNTY FROM MEXICO TO PARISH AND
CONSTANTIA.

* TIMING...THROUGH EARLY THIS AFTERNOON.

* ACCUMULATIONS...ADDITIONAL 3 TO 5 INCHES TODAY WILL BRING TOTALS
INTO THE 7 TO 9 INCH RANGE IN LOCALIZED AREAS.

* VISIBILITIES...LESS THAN A QUARTER MILE AT TIMES.

* IMPACTS...A LOCALIZED BAND OF MODERATE TO HEAVY LAKE EFFECT SNOW
WILL PRODUCE SLUSHY AND SLIPPERY TRAVEL ACROSS PORTIONS OF
CENTRAL OSWEGO COUNTY...INCLUDING INTERSTATE 81 NEAR PARISH. THE
WEIGHT OF THE WET SNOW ON TREES MAY RESULT IN A FEW TREE LIMBS
COMING DOWN AND SCATTERED POWER OUTAGES.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

IN LAKE EFFECT SNOW THE WEATHER CAN VARY FROM LOCALLY HEAVY SNOW
IN NARROW BANDS TO CLEAR SKIES JUST A FEW MILES AWAY. IF YOU WILL
BE TRAVELING ACROSS THE REGION BE PREPARED FOR RAPID CHANGES IN
ROAD AND VISIBILITY CONDITIONS.

IF YOU LOSE POWER AND PLAN ON RUNNING A GENERATOR...MAKE SURE
THAT THE GENERATOR IS LOCATED OUTDOORS AND IS PROPERLY
VENTILATED. SPACE HEATERS SHOULD ALSO BE PROPERLY VENTILATED AND
USED ONLY IF THEY ARE OPERATING PROPERLY. MAKE SURE SNOW DOES NOT
BLOCK EXHAUSTS AND FRESH AIR INTAKES FOR HIGH EFFICIENCY FURNACES

AND WATER HEATERS.

STAY TUNED TO NOAA WEATHER RADIO OR YOUR FAVORITE SOURCE OF WEATHER INFORMATION FOR THE LATEST UPDATES. ADDITIONAL DETAILS CAN ALSO BE FOUND AT WWW.WEATHER.GOV/BUFFALO.

REPORT SNOW ACCUMULATION TO THE NATIONAL WEATHER SERVICE IN BUFFALO BY SENDING AN EMAIL TO BUFSTORM.REPORT@NOAA.GOV...POSTING TO THE NWS BUFFALO FACEBOOK PAGE...OR TWEET...USING THE HASHTAG BUFWX

&&

EXPERIMENTAL CONTENT BELOW...DO NOT USE OPERATIONALLY
PLEASE SEE BELOW LINKS FOR MORE INFORMATION ON THIS EXPERIMENT

PRODUCT DESCRIPTION:

PUBLIC INFORMATION STATEMENT:

TO VIEW THE EXPERIMENTAL POLYGONS PLEASE SEE: <http://www.weather.gov/buf/lespolygon>

COORD... 4316 7588 4316 7592 4317 7593 4317 7595

4318 7596 4318 7600 4351 7637 4352 7635

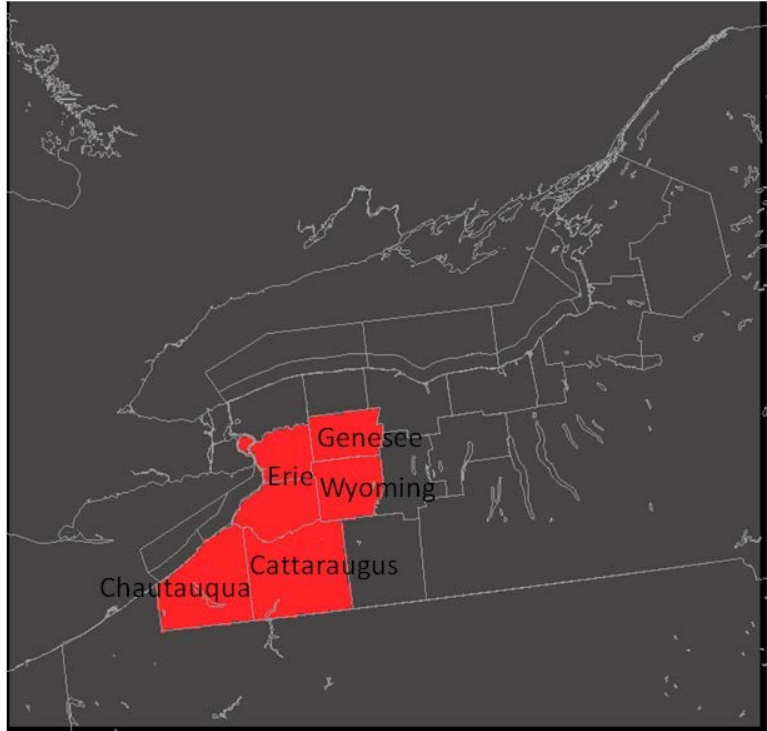
4351 7629 4353 7624 4359 7619 4336 7587

4333 7589 4332 7586

TIME 151018T1330Z-151018T1700Z

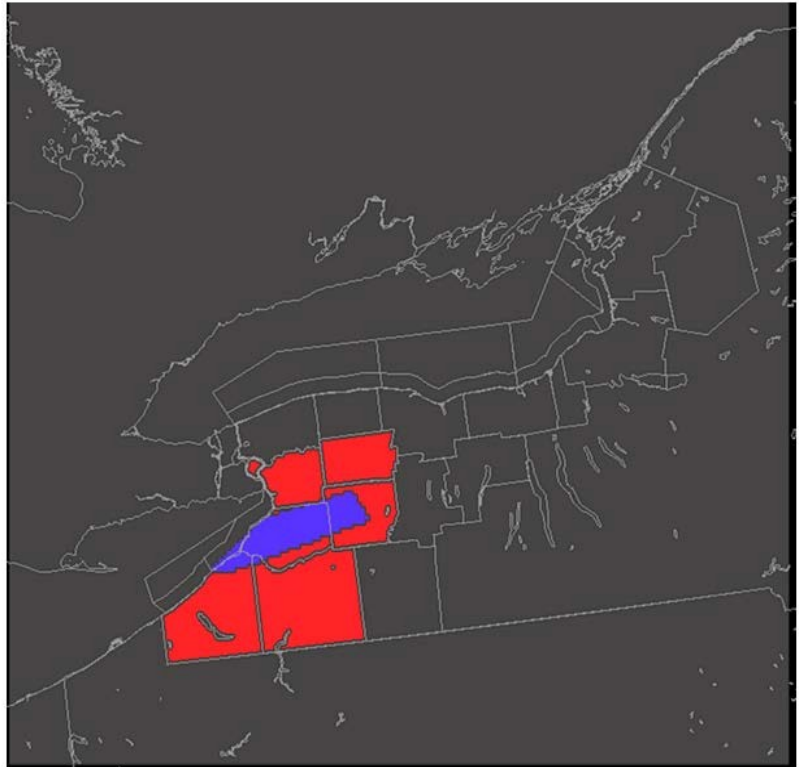
\$\$

Example of Graphical Display: Five Counties in a sample warning without polygons: Erie, Genesee, Wyoming, Chautauqua and Cattaraugus.



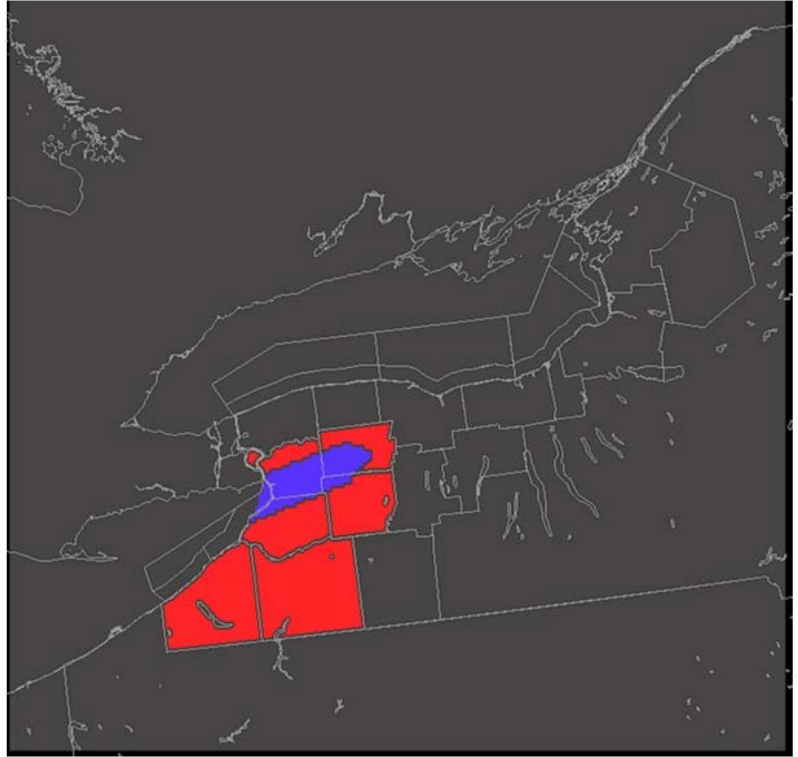
2100-0000Z:

All five counties are in the warning, but only a tiny portion of Chautauqua and Cattaraugus County are expected to be affected during this period. Southern Erie is nearly covered along with western Wyoming County. Northern Erie and all of Genesee county are not forecast to be under the lake band during this time, despite being under the warning.



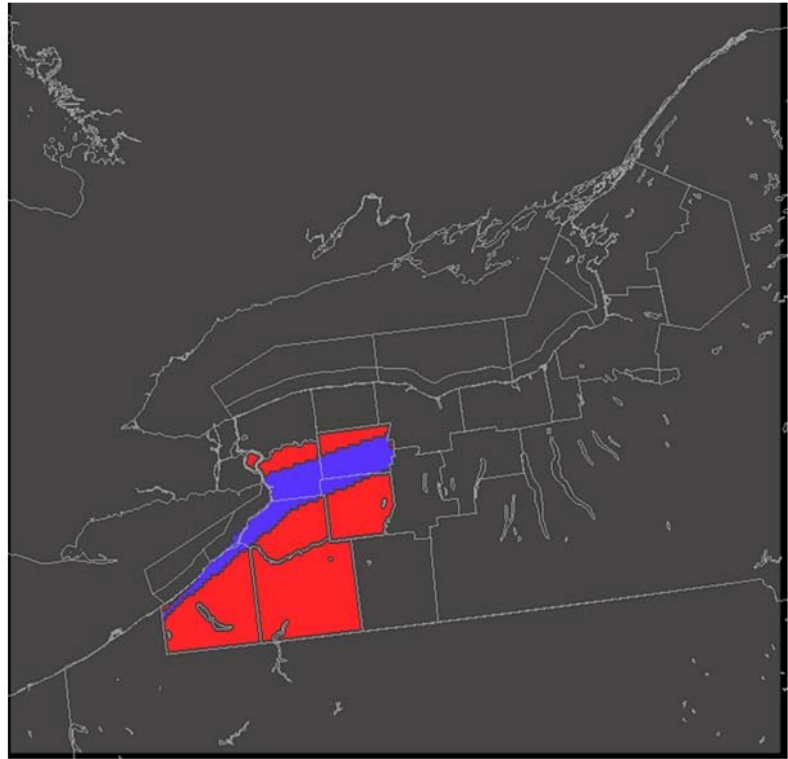
0000-1200Z:

All five counties are in the warning, but the band is not expected to be over any portion of Chautauqua and Cattaraugus Counties during this period. The forecast LE band is expected to sit squarely across Erie County, but missing far northern and southern sections. Meanwhile the forecast only shows far northwestern Wyoming County and roughly the southwest half of Genesee County under the lake band.



1200-0000Z:

All five counties are in the warning, but the band is not expected to be over any portion of Cattaraugus County during this period. The band is forecast to intensify and hug the Lake Erie shoreline by this time and extend further inland as well. Thus, section of Chautauqua County is once again seen being affected by a lake band. A sizeable section of Erie is under the band. Only a small section of Wyoming County is still under the band, while nearly all of southern Genesee County is under the band.



In addition to the text output and a graphic display on NWS webpages, KML/KMZ data should also be available.

Similarly, other short-fused warnings issued currently via long-fused products (such as dust storms and snow squalls away from lake effect areas) would follow the same procedure for issuance.

Availability

The text portion of the polygons will be available experimentally via the WSW using an already familiar LAT...LON/TIME format. Graphical products and links to GIS files should be available via the Internet. The graphical products are intended to be easy to interpret and will provide users with simple navigation capabilities similar to looping radar.

Additional Technical Information

The text output will be created using software provided by GSD and locally modified to fit into the existing WSW format. This software will simplify polygons to a user choice of 3-20 vertices. Short-fetch (multibanded) lake effect events will require wide polygons with lower snow rate thresholds. However, even multibanded lake effect events should show some movement with time and therefore show reduced areal extent when compared to static county-based warnings.