

# The Lake Breeze

## The Newsletter of the Buffalo Forecast Office

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### 2008 Sees Fifth Largest Ozone Hole

The ozone hole over Antarctica, which fluctuates in response to temperature and sunlight, grew to the size of North America in a one-day maximum in September that was the fifth largest on record, since NOAA satellite records began in 1979.

NOAA scientists, who have monitored the ozone layer since 1962, have determined that this year's ozone hole has passed its seasonal peak for 2008. Data is available at [http://www.esrl.noaa.gov/gmd/dv/spo\\_oz/](http://www.esrl.noaa.gov/gmd/dv/spo_oz/).

The primary cause of the ozone hole is human-produced compounds called chlorofluorocarbons, or CFCs, which release ozone-destroying chlorine and bromine into the atmosphere. Earth's protective ozone layer acts like a giant umbrella, blocking the sun's ultraviolet-B rays. Though banned for the past 21 years to reduce their harmful build up, CFCs still take many decades to dissipate from the atmosphere.

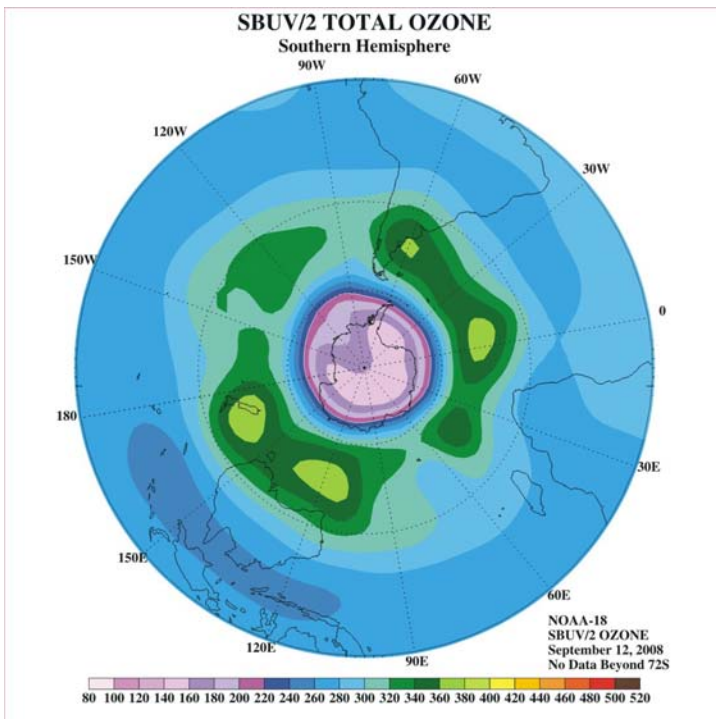
According to NOAA scientists, colder than average temperatures in the stratosphere may have helped play a part in allowing the ozone hole to develop more fully this year.

"Weather is the most important factor in the fluctuation of the size of the ozone hole from year-to-year," said Bryan Johnson, a scientist at NOAA's Earth System Research Laboratory in Boulder, which monitors ozone, ozone-depleting chemicals, and greenhouse gases around the globe. "How cold the stratosphere is and what the winds do determine how powerfully the chemicals can perform their dirty work."

NASA satellites measured the maximum area of this year's ozone hole at 10.5 million square miles and four miles deep, on Sept. 12. Balloon-borne sensors released from NOAA's South Pole site showed the total column of atmospheric ozone dropped to its lowest count of 107 Dobson units on Sept. 28. Dobson units are a measure of total ozone in a vertical column of air.

In 2006, record-breaking ozone loss occurred as ozone thickness plunged to 93 Dobson units on Oct. 9 and sprawled over 11.4 million square miles at its peak. Scientists blamed colder-than-usual temperatures in the strato-

(Continued on page 2)



### INSIDE THIS ISSUE:

Winter Weather Awareness	2
Winter Weather Product Simplification	3
SKYWARN Recognition Day	4
Assessment of Beach Closures	4
Great Lakes-St. Lawrence River Basin Water Resources Compact	5
NOAA at the South Pole	5
A "Snaky" Winter	6
A Lake Effect Primer	7
NOHRSC	8

## 5th Largest Ozone Hole (continued)

sphere for its unusually large size. Last year's ozone hole was average in size and depth.

Starting in May, as Antarctica moves into a period of 24-hour-a-day darkness, rotating winds the size of the continent create a vortex of cold, stable air centered near the South Pole that isolates CFCs over the continent. When spring sunshine returns in August, the sun's ultraviolet light sets off a series of chemical reactions inside the vortex that consume the ozone. The colder and more isolated the air inside the vortex, the more destructive the chemistry. By late December the southern summer is in full swing, the vortex has crumbled, and the ozone has returned—until the process begins anew the following winter.

The 1987 Montreal Protocol and other regulations banning CFCs reversed the buildup of chlorine and

bromine, first noticed in the 1980s.

“These chemicals—and signs of their reduction—take several years to rise from the lower atmosphere into the stratosphere and then migrate to the poles,” said NOAA's Craig Long, a research meteorologist at NOAA's National Centers for Environmental Prediction. “The chemicals also typically last 40 to 100 years in the atmosphere. For these reasons, stratospheric CFC levels have dropped only a few percent below their peak in the early 2000s.”

“The decline of these harmful substances to their pre-ozone hole levels in the Antarctic stratosphere will take decades,” said NOAA atmospheric chemist Stephen Montzka of the Earth System Research Laboratory. “We don't expect a full recovery of Antarctic ozone until the second half of the century.”

## Winter Weather Awareness

The National Weather Service and state and local governments want you to know that now is the time to prepare for the severe winter weather our area can experience. It's never too early to think safety. While winter “officially” begins on December 21<sup>st</sup>, you know that winter weather arrives much earlier.

By taking a few simple steps, you can protect yourself and your family from the harsh effects of winter.

**STEP 1:** Be aware of local weather conditions by listening to broadcasts of NOAA Weather Radio All Hazards, the National Weather Service, and local television and radio stations. During major winter storms, it's usually best to remain at home rather than venturing outdoors. However, if you must, before going out on the road, listen to the local media reports for the latest road conditions.

**STEP 2:** Be prepared to ride out any adverse weather. Your primary concerns at home include the possible loss of heat, electricity, and telephone service. You may also run out of supplies if the storm persists for several days. You should keep a three-day supply of non-perishable food that requires no cooking or refrigeration. Have a non-electric can opener available. Store one gallon of water per person, per day. Your disaster supplies for the home should also include a first aid kit along with essential prescription medication (a minimum one-week supply of essential medicines), a portable radio with extra batteries, a NOAA weather radio, flashlights with extra batteries, and several blankets.

**STEP 3:** Make sure you have a supply of heating fuel. Fuel carriers may not reach you for days after a severe

winter storm. Since most furnaces are controlled by electric thermostats, if the power goes out, residents should have some kind of emergency heating equipment and fuel available to keep at least one room of the house warm enough to be livable. Common examples of emergency heating equipment are kerosene heaters or a supply of wood if you have a fireplace or woodstove. Learn to use equipment properly to prevent a fire. Have proper ventilation. If necessary, conserve fuel by keeping the house cooler than usual, or by “closing off” some rooms temporarily. Never operate a generator indoors.

**STEP 4:** Give your home a safety check. Have a professional check out your furnace, woodstove and chimney. Make certain they are in good working condition. Replace the batteries in your smoke, heat and carbon monoxide detectors. It's also a good idea to make certain your snow blower is ready to go to work.

**STEP 5:** Be sure your vehicle is ready for the winter driving season. Have your engine tuned up, your battery checked, and your engine coolant or antifreeze tested to see if it can withstand the extreme cold. Also, you can increase your visibility by installing new windshield wipers. Finally, be sure your snow tires or all season tires are properly inflated and have enough tread to grip the road. You should consider a survival kit for your car, especially if you drive in rural areas. Have a blanket or sleeping bag on hand along with a supply of non-perishable food, a first aid kit with prescription medication if necessary, and bottles of drinking water or juice. If you become stuck or stranded, your chances of survival will be greater. Also include a shovel, sand or cat litter, booster cables, an ice scraper, and a snowbrush.

## National Weather Service Winter Weather Products Simplification

The National Weather Service has restructured its winter weather products by combining a number of previous seasons' advisory and warning products into categories associated with similar impacts. For example, conditions that would have prompted the issuance of separate winter weather headlines—Snow, Snow and Blowing Snow, Sleet, and or Blowing Snow Advisories—will be issued as Winter Weather Advisories. Similarly, conditions that would have prompted the issuance of Winter Storm, Heavy Snow, and/or Sleet Warnings, will be issued as Winter Storm Warnings. In addition, advisories and warnings for both lake effect snow and the combination of lake effect and blowing snow will be issued as Lake Effect Snow Advisories/Warnings.

This change is the result of public comments received by the National Weather Service. The significant majority of comments about the change strongly supported moving forward. The comments are consistent with feedback received from many of our partners and public users as well as feedback received from NWS field managers and forecasters over the past three years.

Freezing Rain and Wind Chill Advisories will still be issued as separate products due to the uniqueness of their impacts. Similarly, Blizzard, Ice Storm and Wind Chill Warnings will continue to be issued as separate products.

In all cases, the specific hazard information associated with the discontinued products will be clearly depicted in the first line of the body of the advisory or warning product. These changes will reduce the number of specific winter weather warning and advisory products and enhance their clarity and consistency among adjoining NWS Forecast Offices during winter weather events.

To review what winter weather products are issued by the National Weather Service and when.

The potential for a Winter Storm is included in the Hazardous Weather Outlook issued daily when there is a chance of a major winter storm from 3 to 7 days in the future. This is meant to assist people with their long range plans. However, since the outlook is issued so far in advance, the accuracy of the prediction may be limited.

As the event gets closer in time, a **WATCH** may be issued. A watch is issued when there is a 50% or greater chance of a hazardous winter weather event occurring. Although a watch indicates the risk of a hazardous winter weather event has increased, the occurrence, location, and/or timing is still uncertain. Specifically...



A **WINTER STORM WATCH** is issued when there may be hazardous winter weather due to various elements such as heavy snow, sleet, or ice accumulation from freezing rain. In our region, heavy snow means 7" or more of accumulation in 12 hours or less, or 9" or more of accumulation in 24 hours or less.

A **LAKE EFFECT SNOW WATCH** is issued when there is a possibility of heavy lake effect snow (accumulating 7" or more within a 12 hour period or 9" or more within a 24 hour period). Lake effect snow usually occurs in narrow bands over limited areas.

A **BLIZZARD WATCH** is issued when conditions are favorable for a blizzard event within the next 12 to 48 hours.

Finally, a **WARNING** is issued when there is an 80% or greater likelihood of a hazardous winter weather event meeting or exceeding the warning criteria within the next 36 hours.

A **WINTER STORM WARNING** is issued when severe winter weather of heavy snow, sleet, or a combination of heavy snow and blowing snow, snow and ice, or combination of heavy snow, sleet, and/or freezing rain) is expected within the next 12 hours.

A **LAKE EFFECT SNOW WARNING**: Issued when heavy lake effect snow is occurring, is imminent, or has a very high probability of occurring within the next 12 hours. The snow is expected to accumulate 7" or more within a 12 hour period or 9" or more within a 24 hour period. Lake induced squalls/showers occur

in narrow bands and over limited areas. They can occur quite suddenly and cause blizzard-like conditions.

An **ICE STORM WARNING** is issued when ice accumulation of ½ inch or greater (enough to bring down power lines) is expected within the next 12 hours.

A **BLIZZARD WARNING** is issued for severe winter conditions including a combination of strong winds averaging or frequently gusting to or above 35 mph and very low visibility due to blowing or falling snow. These are the most dangerous winter storms.

**ADVISORIES**, in general, are issued for weather conditions that are expected to cause significant inconveniences and may be hazardous. These situations are normally not life threatening if caution is exercised.

**FREEZING RAIN ADVISORY**: Light ice accumulation is expected either from freezing rain or freezing drizzle.

**WINTER WEATHER ADVISORY**: is issued for snowfall accumulation of 4" to 7" of snow within a 12 hour period; sustained wind or frequent gusts of 25 to 34 mph accompanied by falling and blow snow, occasionally reducing visibility to less than ¼ mile; or a combination of any of the above.

**LAKE EFFECT SNOW ADVISORY** is issued for lake induced snowfall in western and central New York totaling

*(Continued on page 4)*

## 2008 SKYWARN Recognition Day

The 2008 Special Event for amateur radio operators is approaching. It will take place on December 6th from 0000 UTC – 2400 UTC... that's Friday December 5th 7PM EST through Saturday December 6 7PM EST.



SKYWARN Recognition Day was developed in 1999 by the National Weather Service and the American Radio Relay League. It celebrates the contributions that volunteer SKYWARN amateur radio operators make to the National Weather Service. During the day, SKYWARN operators visit NWS offices and contact other radio operators across the world. The NWS and the ARRL both recognize the importance that amateur radio provides during severe weather. Many NWS offices acquire real time weather information from amateur radio operators in the field. These operators, for example, may

report the position of a tornado, the height of flood waters, or damaging wind speeds during hurricanes. All of this information is critical to the mission of the NWS which is to preserve life and property. The special event celebrates the special contribution by amateur radio operators.

Last year, base operators here at the Buffalo office made 326 contacts in 38 states, including contact with 34 other NWS offices across the nation. If you're interested in being a base operator here at the Buffalo Office for this year's event, you can contact Judy N2TEZ at [judith.levan@noaa.gov](mailto:judith.levan@noaa.gov).

More information about the Special event and a list of participating NWS offices can be found at on the Special Event website at <http://hamradio.noaa.gov>

## Assessment of Beach Closures Attributed to Rainfall Using Archived Radar

Thomas Niziol, Meteorologist-In-Charge of the Buffalo Weather Forecast Office, and collaborator Dr. Stephen Vermette of Buffalo State College, reconstructed past rain events using archived radar data on GIS maps to examine the relationship between beach closings, bacterial count, and rainfall. Ultimately they are seeking to find out whether a scientifically-based rainfall threshold can be established for beach closures. This project was supported by NOAA's Great Lakes Environmental Research



Laboratory and the Center of Excellence for Great Lakes and Human Health.

One result of the study was a suggestion to build a local network of rain gauges in the vicinity of the beaches affected along Lake Erie near Buffalo. The Erie County Health Department recently obtained grant money to begin development of the local network, eventually planning to deploy eight weather stations in the study area to provide real-time high resolution rainfall reports.

## Winter Weather Products (cont.)

*(Continued from page 3)*  
greater than 4", but less than 7" in a 12 hour period. Blowing and drifting snow is also common in relatively limited areas and in narrow bands

The National Weather Service also issues several "non-precipitation" winter weather watches, warnings and advisories:

- A **HIGH WIND WATCH** is issued when conditions are favorable for damaging winds within 12 to 48 hours.
- HIGH WIND WARNING:** Expected winds will average 40 mph or more for at least 1 hour or winds gusts will be greater than 58 mph. Trees and power lines can be blown down
- WIND ADVISORY:** Issued for average wind speeds between 31 and 39 mph, or for frequent wind gusts between 46 and 57 mph.

A **WIND CHILL WATCH** is issued when there is a possibility of dangerous wind chill values.

**WIND CHILL WARNING:** Life threatening cold with wind chill temperatures computed to be -25 degrees or less (-30 degrees or less in Jefferson and Lewis counties) for at least 3 hours. Exposure to this combination of strong winds and low temperatures without protective clothing will quickly lead to frostbite and/or hypothermia. Longer exposures can be fatal.

**WIND CHILL ADVISORY:** Issued for cold temperatures and winds, with wind chill temperatures computed to be -15 degrees or less (-20 degrees or less for Jefferson and Lewis counties) for at least 3 hours. Exposure to this combination of strong winds and low temperatures without protective clothing can lead to frostbite and/or hypothermia. Prolonged exposure may be fatal.



## Great Lakes—St. Lawrence River Basin Water Resources Compact

On October 3, 2008, President Bush signed the “Great Lakes—St. Lawrence River Basin Water Resources Compact,” which provides approval for an interstate compact to protect the water resources of the Great Lakes-St. Lawrence River Basin. The purpose of the compact is to ensure sustainable use and responsible management of waters from the Great Lakes Basin and preserve the Great Lakes for the benefit and enjoyment of present and future generations.



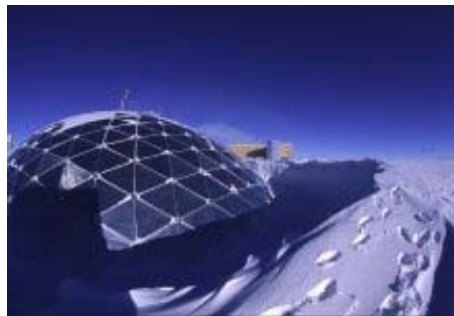
Great Lakes are a national treasure. They were vital to the exploration of this continent and have long supported commerce. Today, more than 33 million people live in the States and Provinces bordering the lakes, and the lakes provide an efficient means to transport food and other commodities destined for global markets. The Great Lakes provide a wide variety of recreational opportunities and serve as a source of drinking water for more than 30 million people.”

The Great Lakes contain more than 90 percent of the fresh surface water in the United States. In a statement issued by the White House, the President said: “The

compact has been approved by the legislatures of the affected Great Lakes States: Minnesota, Wisconsin, Illinois, Michigan, Indiana, New York and Pennsylvania.

## NOAA at the South Pole

The South Pole Observatory is one of four atmospheric baseline observatories for NOAA’s Earth System Research Laboratory.



*The South Pole Geodesic Dome at twilight.*

Americans have occupied the geographic South Pole continuously since November 1956 as part of the International Geophysical Year of 1957. The original South Pole station was constructed by a United States Navy crew during 1956-1957. As interest in polar research increased, it became evident that a new design and a larger station was necessary.

In 1975 the central area of the station was rebuilt as a geodesic dome 50 meters wide and 16 meters high. Large steel archways covered modular buildings, fuel bladders, and equipment. Detached buildings housed instruments for monitoring the upper and lower atmosphere and for numerous projects in astronomy and astrophysics.

The dome facility was designed to house 18 science and support personnel during the winter and 33 during the austral summer. However, over the years, the facility’s infrastructure and technology exceeded its design and operational life. In 1997, a redevelopment plan to upgrade the station began. The new station is one connected, elevated facility. The new station is constructed in sections with Science, Medical, Administration, Communications, Multipurpose Room, and additional living quarters. To accommodate changes in population from winter to summer, certain areas can be closed.

Remote science facilities, such as the Atmospheric Research Observatory (ARO) are being developed with small one- to two-story elevated buildings and are located away from the main station to minimize interference between necessary operations and science.

Some 50 scientists and support personnel winter at the station, and up to 150 people work there during the summer. The station’s winter personnel are isolated between mid-February and late October.



*The new Amundsen-Scott South Pole Station*

## Watch out for a “Snaky” Winter!

At NWS Buffalo, we name our lake effect snow events after they end so it is easier to refer back to them for archiving and research. It's very unofficial, but each winter, the staff of NWS Buffalo votes on the theme of that year's lake effect events. This year, the theme is snakes.

Previous years have had themes of: Insects, Dogs, Cats, Fruits, Minerals, Scientists, Birds, Trees, Native American Nations and Leaders, and Heavenly Bodies.

In addition to giving the storm a name, we assign a “flake scale”. We subjectively rank the events from 1-flake (\*) for minor (wimpy) events to 5-flakes (\*\*\*\*\*) for epic mega-storms, based not only on snowfall amounts but the impact on population centers as well.

Check out our soon to be posted Lake Effect Page for the 2008-2009 season at <http://www.weather.gov/buf/lakeeffect/08-09.html>

## A Lake Effect Primer

Barney Wiggin, former Meteorologist-In-Charge at the NWS Office in Buffalo was quoted as saying that the weather often "clears up stormy" to the lee of the Great Lakes during the winter. In particular, long after the passage of cold fronts across the region, the relatively warm waters of the Great Lakes often create convective instability in an otherwise stable, arctic or polar continental airmass. So while other parts of the northeastern U.S. are clearing up after a recent cold frontal passage, Great Lakes communities wait for the lake effect snow machine to fire up!

### How Does it Form?

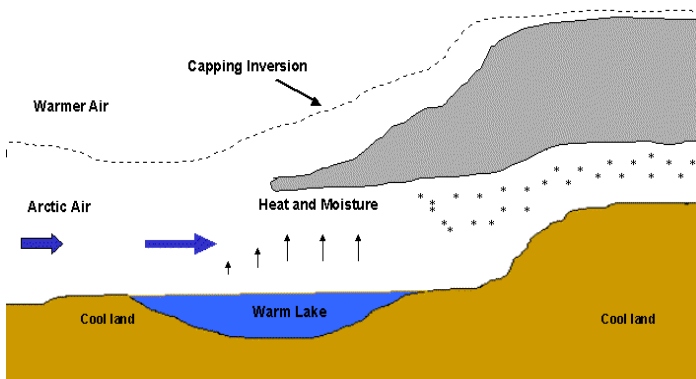
Basically there are a couple of main ingredients that you need to produce lake effect snow. The first is a relatively warm body of water (for example, a Great Lake). The second ingredient is a source of cold air. In the Great Lakes Region, that source comes from the high latitudes of North America where arctic airmasses often "spill southward" over those warm bodies of water. Heat and moisture from the warm lakes rises into the "modified" arctic air where it then cools and condenses into snow clouds.

to which the snow clouds can grow. The addition of heat and moisture from the warm lake modifies the airmass and modified air rises and cools allowing moisture to condense into snow clouds. It also causes the inversion to rise, allowing snow clouds to grow in height. After moving easily across the "smooth" lake surface, the modified air slows down and "piles up" as it approaches the downwind shore. The convergence produces additional lift, which is further enhanced by orographic features (hills, mountains) downwind of the body of water. The result is lake effect snow, though during early Fall, lake effect rain can occur

### Where Can it Occur?

The prevailing wind direction through the depth of the snow clouds determines where the snow will occur. Lake Effect snows don't only occur on the Great lakes, but are common in other parts of the country as well. One prime example is across Cape Cod on the New England Coast. In that scenario, a huge High centered over the province of Quebec, pumps a northeast to east flow of arctic air across the ocean, including the warmer waters of the Gulf Stream. Although not as common, this same type of snow can occur when east winds channel up Long Island Sound, or southeast winds channel up Chesapeake Bay. Finally, lake effect snows often occur off the Great Salt Lake in Utah (don't worry though, the snow isn't salty!).

Lake Effect Snow Formation



Arctic or polar continental air masses cross the warm lake. The cold airmass is usually only a few thousand feet thick, and is "capped" by a layer of warmer air, called a temperature inversion. This inversion limits the extent

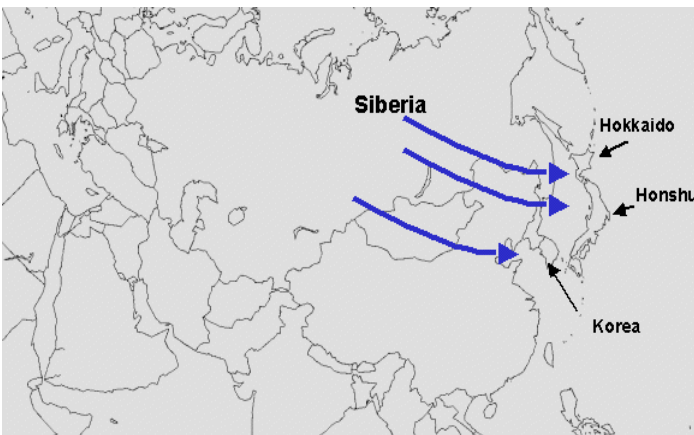


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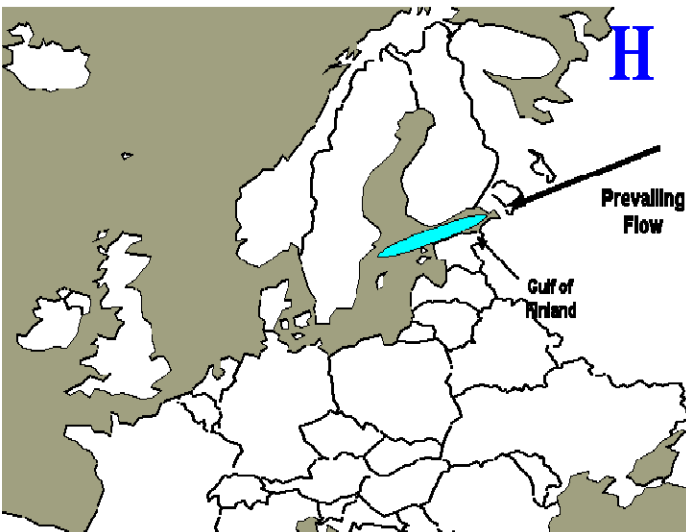
## A Lake Effect Primer (cont.)

(Continued from page 6)

Japanese meteorologists have done extensive research on convective snows that develop off the Sea of Japan and affect the western coasts Honshu and Hokkaido Islands. Three main ingredients are responsible for these types of snows, arctic air off the Siberian continent, the warm waters of the Sea of Japan, and the higher elevations on the west coast of these islands. It is also interesting to note that the same type of phenomenon has been reported off the Yellow Sea across portions of Korea.

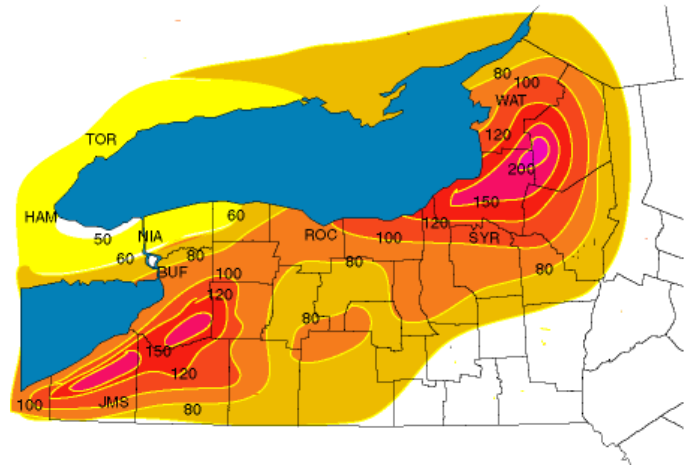


Arctic air is funneled down the Gulf of Finland as a huge High over Siberia produces low level easterly flow.



The result is the development of the same type of convective snowbands that occur in the Great Lakes, the west coast of Japan and other locations around the world.

## AVERAGE SEASON SNOWFALL



### Annual Snowfall: Eastern Great Lakes

Lake Effect Snow contributes significantly to the total seasonal snowfall in Western and Central New York. In fact, the higher elevations east of Lake Ontario get over 200 inches of snow annually, making that area the snowiest populated region to the east of the Rocky Mountains!

You can clearly see the snowbelts to the lee of Lakes Erie and Ontario on the map. To the east of Lake Erie, annual snowfall exceeds 150 inches, which is great news for the numerous ski resorts south of Buffalo, NY. The area east of Lake Ontario however is the "snow capital" of the east. The higher elevations between Watertown and Syracuse, commonly known as the Tug Hill Plateau, receives of more than 200 inches a year. In fact, the town of Hooker, located in Lewis county, recorded 466 inches of snow during the winter of 1976-77! It is no coincidence that the greatest snowfall also occurs across the highest elevations to the lee of the lakes. Orographic features tend to enhance snowfall rates by providing additional lift as the air crosses the region.

In contrast to the tremendous snowfall amounts to the lee of the lakes is the lack of snow parts of Niagara and Orleans counties which are located to the north of Buffalo. This area does not normally get much snow off Lake Erie or Lake Ontario, mainly because it is not downwind of the longer fetch across each body of water.

The wide range of snowfall across Western and Central New York points out the tremendous challenge that faces the operational forecaster. In Erie county, including the city of Buffalo, annual snowfall ranges from less than 80 inches to more than 160 inches over a 15 mile wide area that is inhabited by nearly 500,000 people!

## NOAA's National Operational Hydrologic Remote Sensing Center

The National Operational Hydrologic Remote Sensing Center provides comprehensive snow observations, analyses, data sets and map products for the Nation.

- National Snow Observation Database
- Airborne Snow Surveys
- Satellite Snow Cover Mapping
- Snow Modeling and Data Assimilation
- Analyses, Maps, and Interactive Visualization Tools
- Integrated Snow Datasets for Geospatial Applications
- Applied Snow Research

NOHRSC products and services support a wide variety of government and private-sector applications in water resource management, disaster emergency preparedness, weather and flood forecasting, agriculture, transportation and commerce.

The National Snow Analysis webpage at <http://www.nohrsc.noaa.gov/nsa/> provides a variety of snow-related observations, including: snowfall, snow depth, snowpack temperatures, snow water equivalent, snow melt, and blowing snow and surface sublimation (the change from solid to gas with no liquid phase). This data is available in daily, weekly, and seasonal maps and animations.

If it's snow information you're looking for, this is the site to check out!



NOAA's  
National  
Weather Service



**We're on the Web!**  
**[weather.gov/buf](http://weather.gov/buf)**

National Weather Service Forecast Office  
587 Aero Drive  
Cheektowaga, NY 14225  
Phone: 716-565-0204  
Fax: 716-565-9002

### EDITORS NOTE:

Published quarterly, each of issue of "The Lake Breeze" contain articles about our operations, products and services, and interesting weather submitted by various members of our staff and NOAA Headquarters. If you have a comment about our programs, or an idea for something you'd like to see included in an upcoming issue, we'd like to hear from you. You can email me at [judith.levan@noaa.gov](mailto:judith.levan@noaa.gov).

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