

# Cold Waves

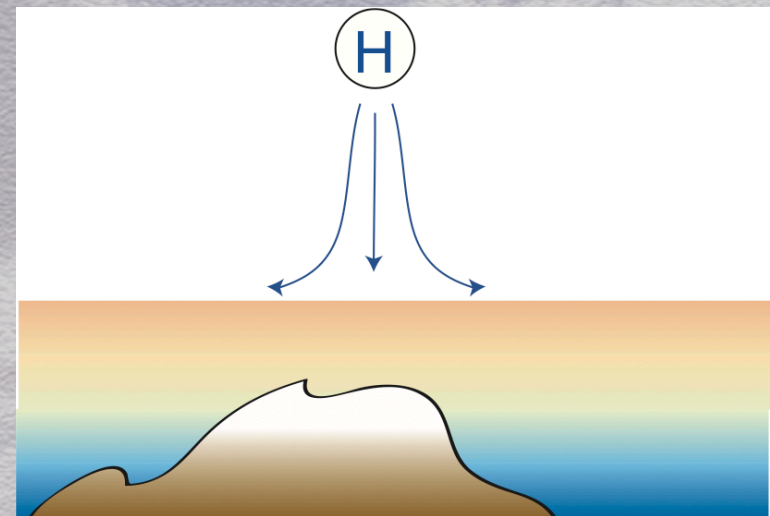
- usually at height of winter season (Jan/Feb)
- strong, stable H
- Arctic air reaching unusually far south
- fair weather but cold
- often T inversion -> smog

Smog in Nowa Ruda, Poland 2017



source: Wikipedia

Temperature Inversion



# Cold Storms

## “Great Blizzard of 1899”

also known as:

“Great Arctic Outbreak of 1899”

10-14 Feb 1899

- ✧ many T records still stand today
- ✧ Washington DC  $-15^{\circ}\text{F}$
- ✧ Tallahassee  $-2^{\circ}\text{F}$
- ✧ snow in New Orleans,  $6^{\circ}\text{F}$
- ✧ Houston,  $6^{\circ}\text{F}$  (2<sup>nd</sup> lowest ever)
- ✧ ice floes into Gulf of Mexico
- ✧ > 100 fatalities
- ✧ devastation to crops, birds

*Feb 1899 U.S. second coldest  
2<sup>nd</sup> only to 1936*

- greatest cold wave in U.S.
- arctic air spreads unusually far south
- strong H (Saskatchewan 1064 mbar)

## Snowball fight at Tallahassee Capitol



source: Wikipedia

# More Recent Cold Waves

## “The 2014 Polar Vortex”

Dec 1 – Apr 10

- \$5 billion damage
- 21 fatalities
- 200 M people affected (transportation/electricity)

## “The 2019 Arctic Blast”

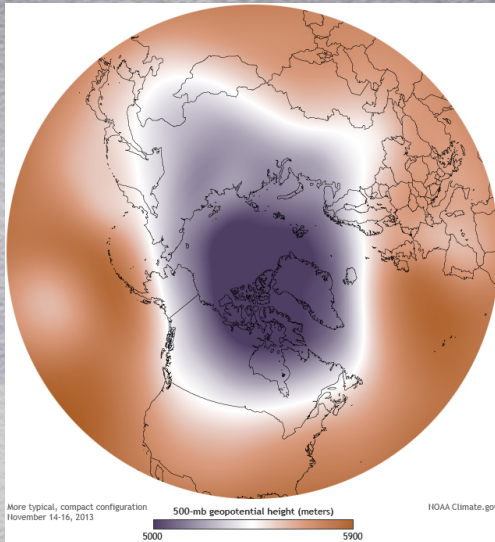
Nov 13

- 100s schools closed in northern New England
- Arctic air from Siberia more typical of mid-Jan

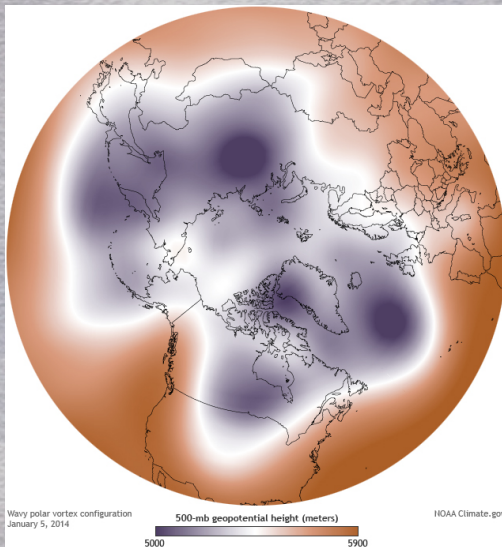
record T broken 5-7 Jan:  
(7 Jan, > 49 record lows across country)  
Green Bay, WI -18°F (1979)  
Chicago O'Hare, -16°F (1984/1988)  
Babbitt, MN -37°F coldest in U.S. 6 Jan  
Atlanta, GA 6°F (1970)  
Dallas, TX 16°F (??)

Chicago 7°F (for date, 1986)  
St. Louis 11°F (for date, 1911)  
Snowfall records in Buffalo, Detroit  
Dust of snow in Memphis  
Early frozen lakes in MN

# The Polar Vortex .... happens every winter!



normal/strong polar vortex:  
upper level low pressure -> vortex (air goes W->E)  
stable over long time  
large mass of cold air beneath  
jet stream around restricts cold air toward N



weak polar vortex (**the media's "Polar Vortex"**):  
warming in stratosphere  
-> low pressure disorganized  
jet stream undulates  
cold Arctic air allowed to reach far S

**BIG QUESTION:**  
global warming -> more weather extremes  
first evidence points to warming Arctic

Source: Wikipedia

# Ice Storms

- rain falls at same time when ground below freezing

5 Dec 2002, North Carolina



source: Wikipedia/NOAA



source: Wikipedia/NOAA

# Ice Storms

- rain falls at same time when ground below freezing

1910s Elora, Ontario

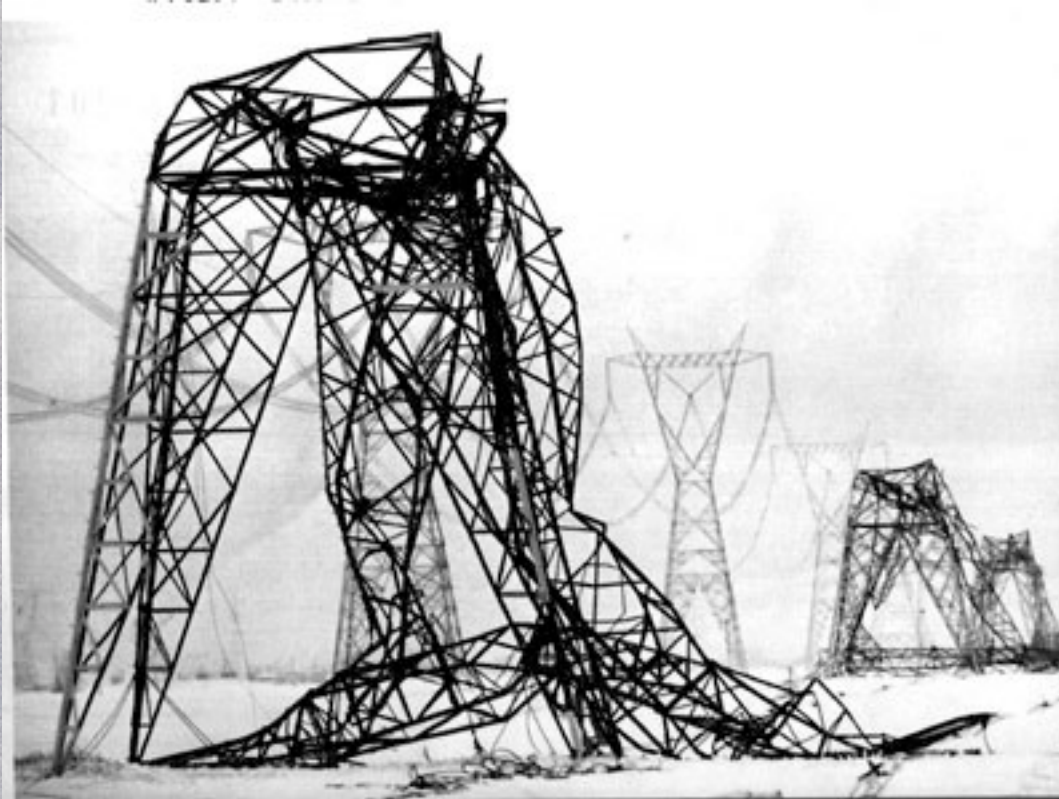


source: Wikipedia/NOAA

# Ice Storms

## January 1998 North American Ice Storm

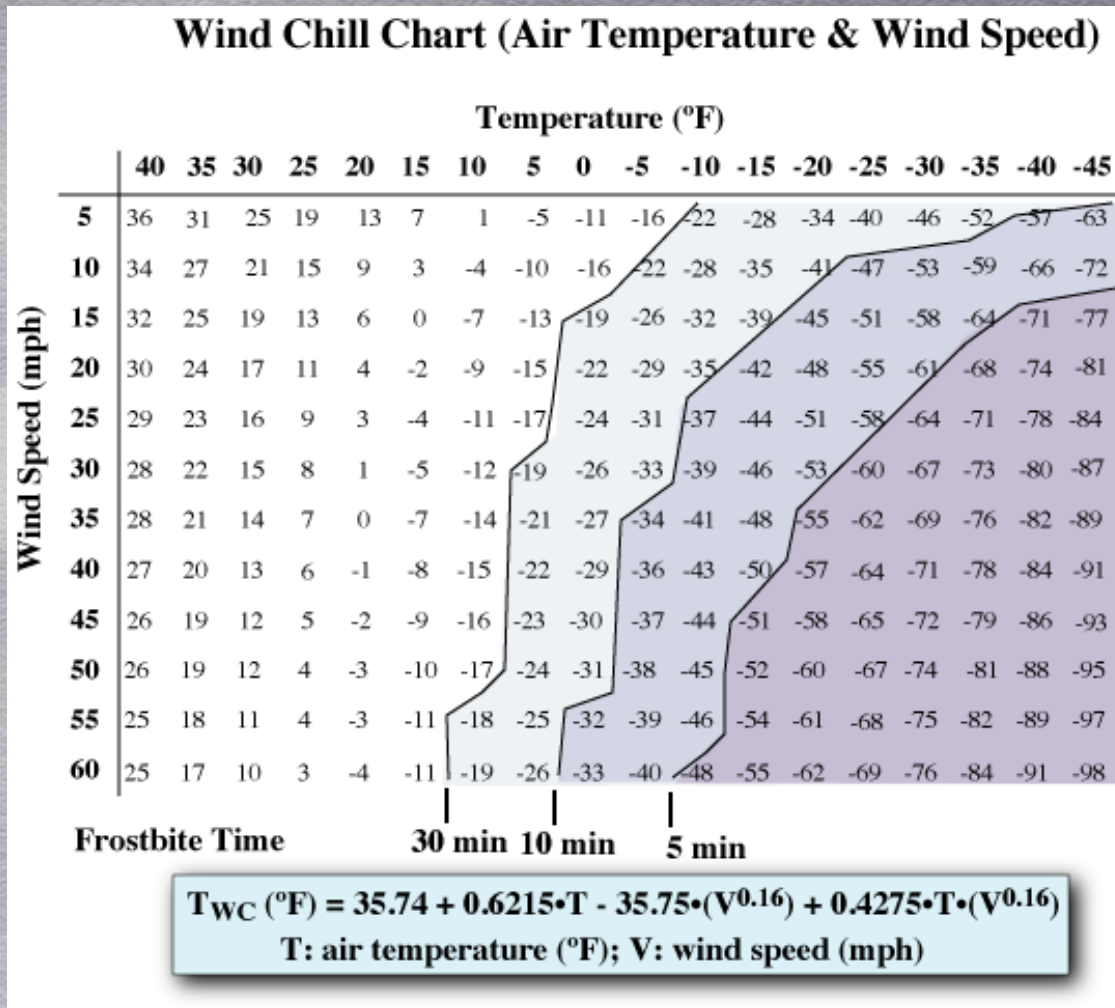
damages: \$6 billion  
fatalities: 35



- massive damage to trees and electrical infrastructure
- 1000 pylons collapsed  
-> 4 million left in dark for weeks, even months (700,000 in Maine)

Cleanup: largest deployment of Canadian forces since Korean war

# The Wind Chill



- wind chill factor:  
winds blow away  
warm air around skin  
-> feels colder

- effect stronger at  
lower temperature

Fig 13.19

# Blizzards

criteria vary by country

in U.S.:

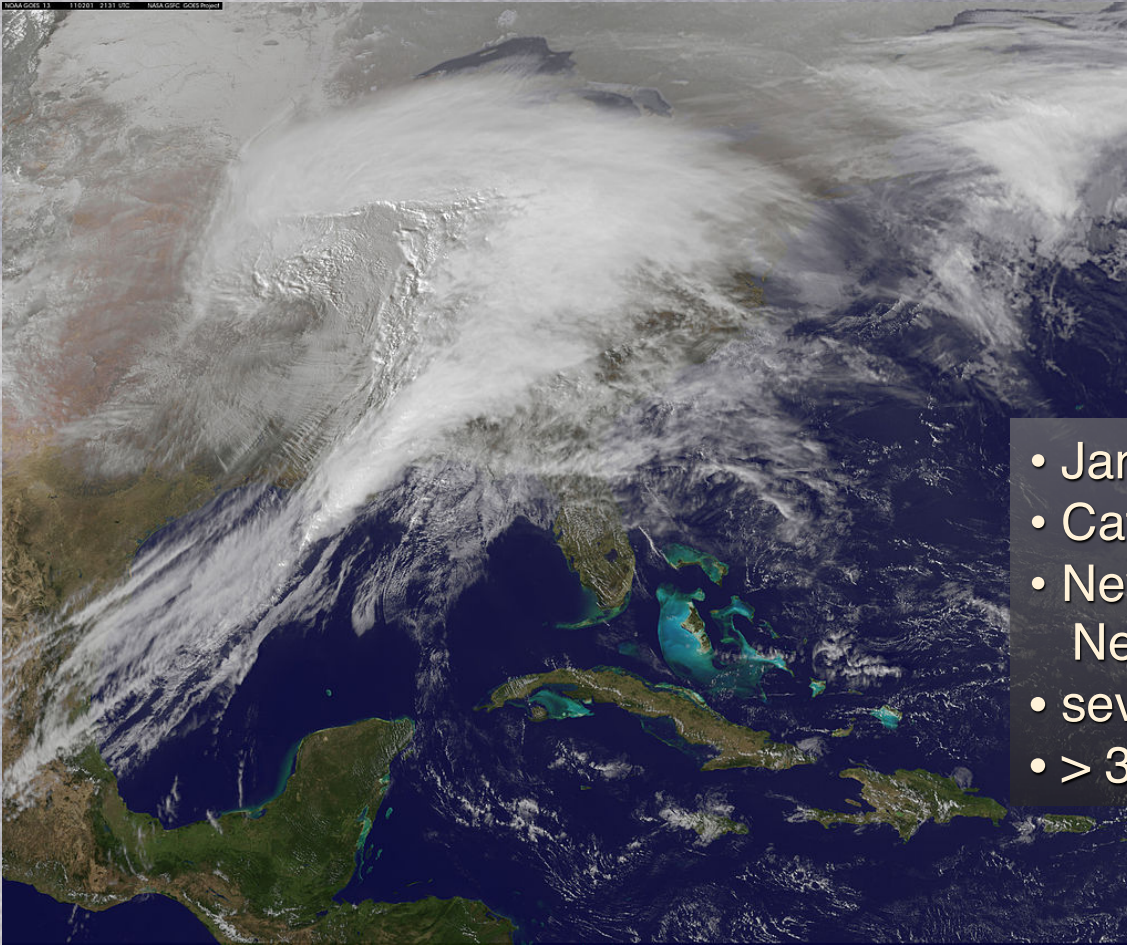
- sustained winds  $> 35$  mph (56 km/h)
- duration:  $> 3$ h
- blowing snow
- visibility  $< 0.25$  mi

3-9 Feb 1972 Iran blizzard:

- deadliest in recorded history
- 6 m snow in south
- 4000 fatalities
- unusually long cold period in Feb

# Blizzards

## Groundhog Day Blizzard 2011



- Jan 31 – Feb 2
- Category 5 “Extreme”
- New Mexico/Texas to New England/ Eastern Canada
- several tornadoes in TX
- > 36 casualties; \$2 billion damage

source: Wikipedia/NASA

# Blizzards

## Groundhog Day Blizzard 2011

- 20-28 “ snow in Illinois
- thundersnow in Chicago



Chicago's Fullerton Harbor



... normally ...

# Blizzards

- ORD cancelled 1300 flights

Groundhog Day Blizzard 2011; Chicago's Lake Shore Dr.

