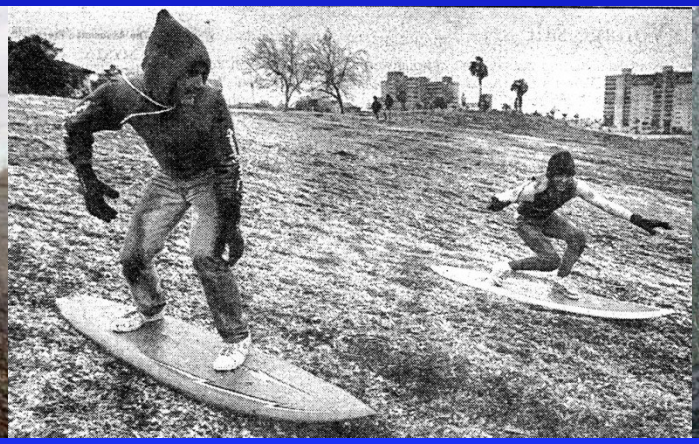




# Significant Ice Storms Affecting Corpus Christi, Texas


Michael Buchanan

Science & Operations Officer

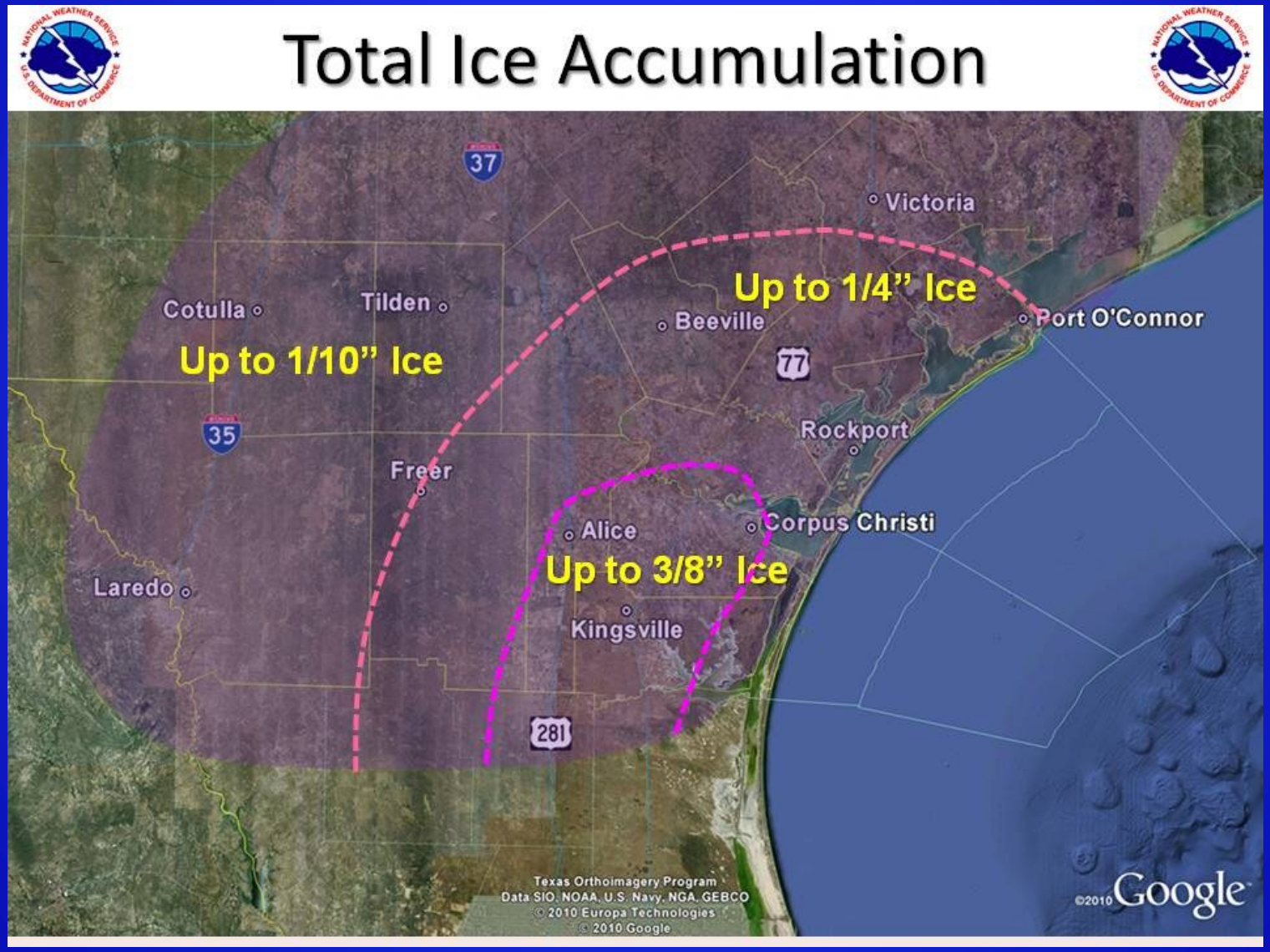
WFO Corpus Christi


# Why do an ice storm study for Corpus Christi?

- The impetus was the Feb 3-4, 2011 ice storm.
- Was this the "worst" ice storm to affect Corpus Christi?
- Would it be possible to quantify the "severity" of past ice storms?

Feb 3-4, 2011

# Feb 3-4, 2011


Total Ice Accumulation
37
Victoria
Up to 1/4" Ice
Cotulla
Tilden
Beeville
Port O'Connor
Up to 1/10" Ice
77
35
Rockport
Freer
Alice
Corpus Christi
Up to 3/8" Ice
Laredo
Kingsville
281
Texas Orthoimagery Program
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2010 Europa Technologies
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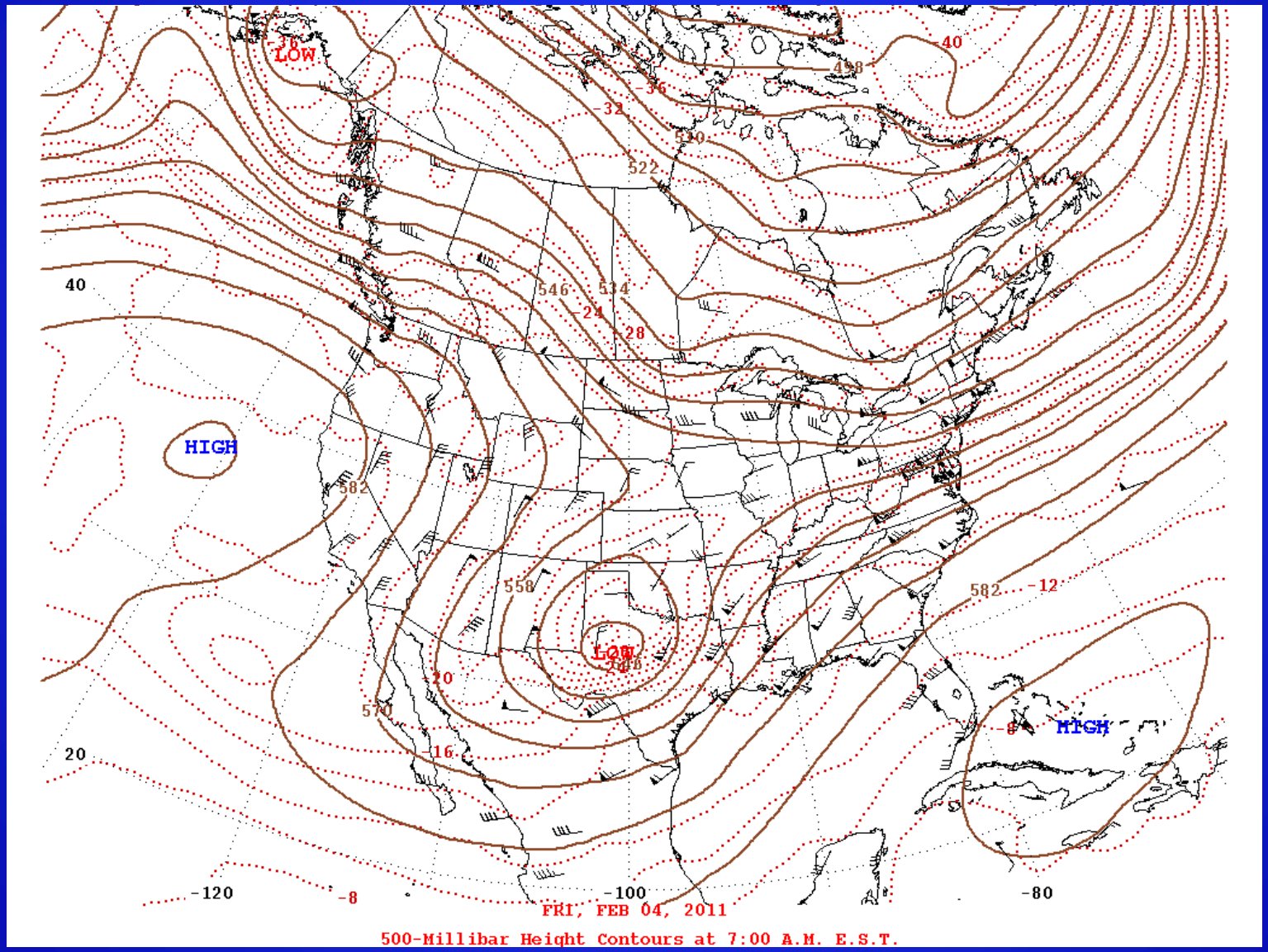
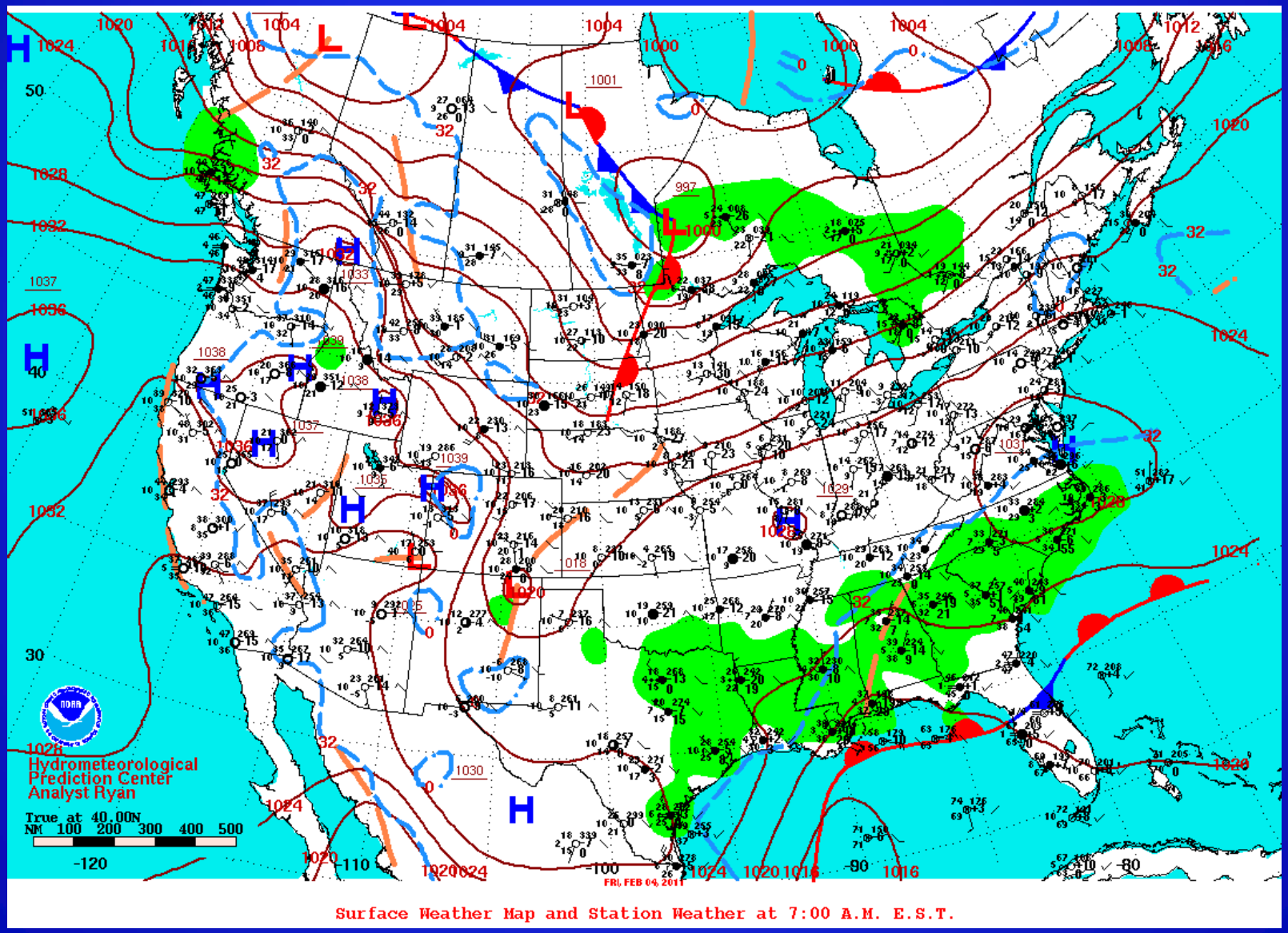
©2010 Google

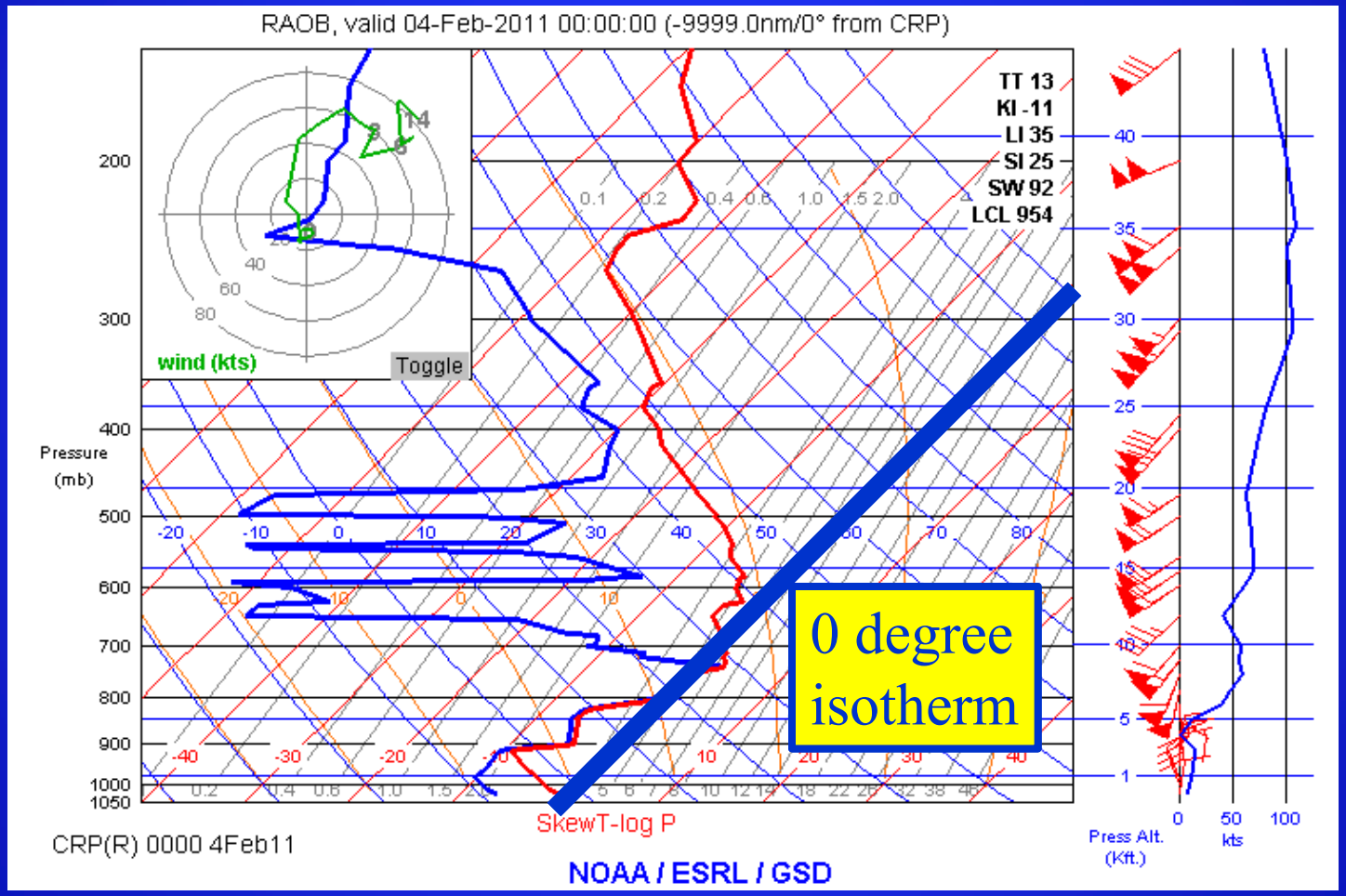
# Feb 3-4, 2011 – 500 mb



# Feb 1-4, 2011 – Surface Map



# Feb 3-4, 2011


RAOB, valid 04-Feb-2011 00:00:00 (-9999.0nm/0° from CRP)
TT 13
KI -11
LI 35
SI 25
SW 92
LCL 954
wind (kts)
Toggle
Pressure (mb)
200
300
400
500
600
700
800
900
1000
1050
0 degree isotherm
SkewT-log P
CRP(R) 0000 4Feb11
NOAA / ESRL / GSD
Press Alt. (Kft.)
kts

# Feb 3-4, 2011

- 14 hours of freezing drizzle (2/3 eve thru 2/4 morn).
- 0.05” total pcpn.
- **1/4-3/8”** ice accumulation.
- Arctic front on morning of 2/1.
  - 1054 mb High over Montana.
  - 5th coldest 3-day stretch Max Temp in Feb.
  - 1 record low.
  - 37 hours of freezing temps!
- 60 hours after fropa…freezing pcpn began.

# Feb 3-4, 2011

- Roads, bridges, schools & city offices closed.
- At least 200 car accidents.
- Multiple injuries.
- Ice melted by the aftn on 4th.
- Caller Times reported that a long-time resident said it was ***"not as disruptive as other winter storms in the 1950s and '60s".***

# “Other” factors

- Does ice thickness tell the whole story?
- Are there are other “factors” which complete the picture?
- Can these be quantified?
- Or do we simply qualitatively rank past storms using this “non-meteorological data”?

# What about ice thickness?

Jan 9-10, 1973

- Little to no official record except for recent events!!!
- So, how can one compare historical ice storms without ice thickness data?
- Must use socio-economic data in addition to the surface observations.

# Socio-economic Data from Caller Times

Jan 29-31, 1951

- Fatalities
- Injuries
- Damage
- Traffic Accidents
- Airport Closures
- Road Closures
- Businesses Closed
- Schools Closed
- Communication Disruption

# NCDC Hourly Global Surface Data

- Since 1924, Freezing rain/drizzle has been observed on average once every **3-4** years in Corpus Christi.
- At least one report of freezing rain/drizzle in **24** separate years since 1924.

Jan 12-14, 1985

# All Freezing Rain/Drizzle Events

- 1924, 1940, 1946, 1947, 1948, 1949, 1951, 1956, 1961, 1962, 1963, 1964, 1973, 1978, 1982, 1983, 1985, 1989, 1990, 1994, 1996, 1997, 2007, 2011.

- Questionable years in which freezing rain/drizzle **MAY** have occurred:
  - 1896, 1897, 1918, 1925, 1929, 1932.
  - Sleet and/or snow recorded in these years.

# Other supplemental Met Data

- Total Precipitation
  - More Pcpn = More Ice?
- How long did Freezing Rain/Freezing Drizzle occur?
- How long was it below freezing?
- "How cold did it get?"
  - Was it record cold?
  - Less chance of melting.

Feb 4-7, 1989

# Worst Ice Storms

- 1924
- 1940
- 1951
- 1973
- 1982
- 1985
- 1989
- 2011

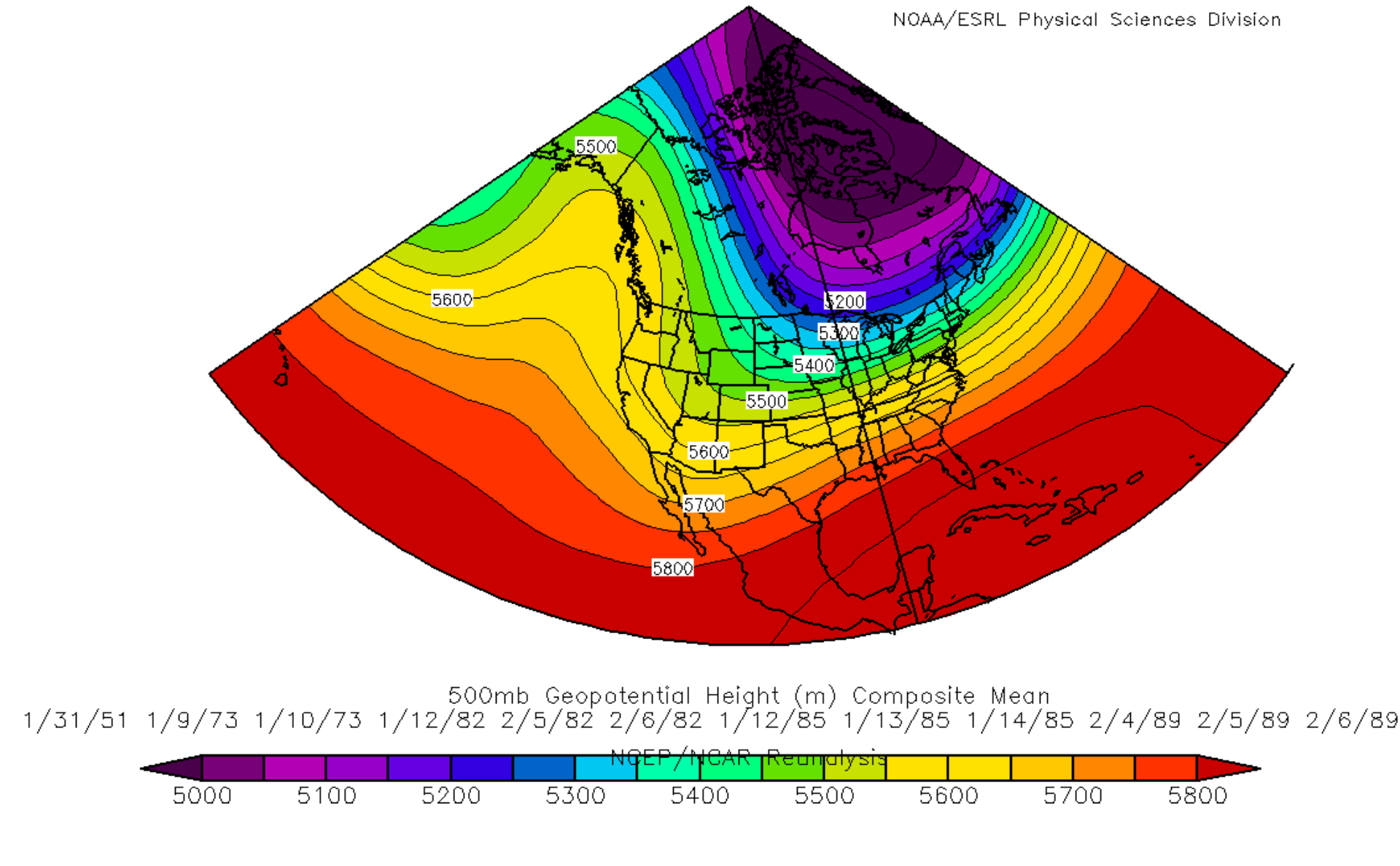
Feb 3-4, 2011

Jan 29-31, 1951

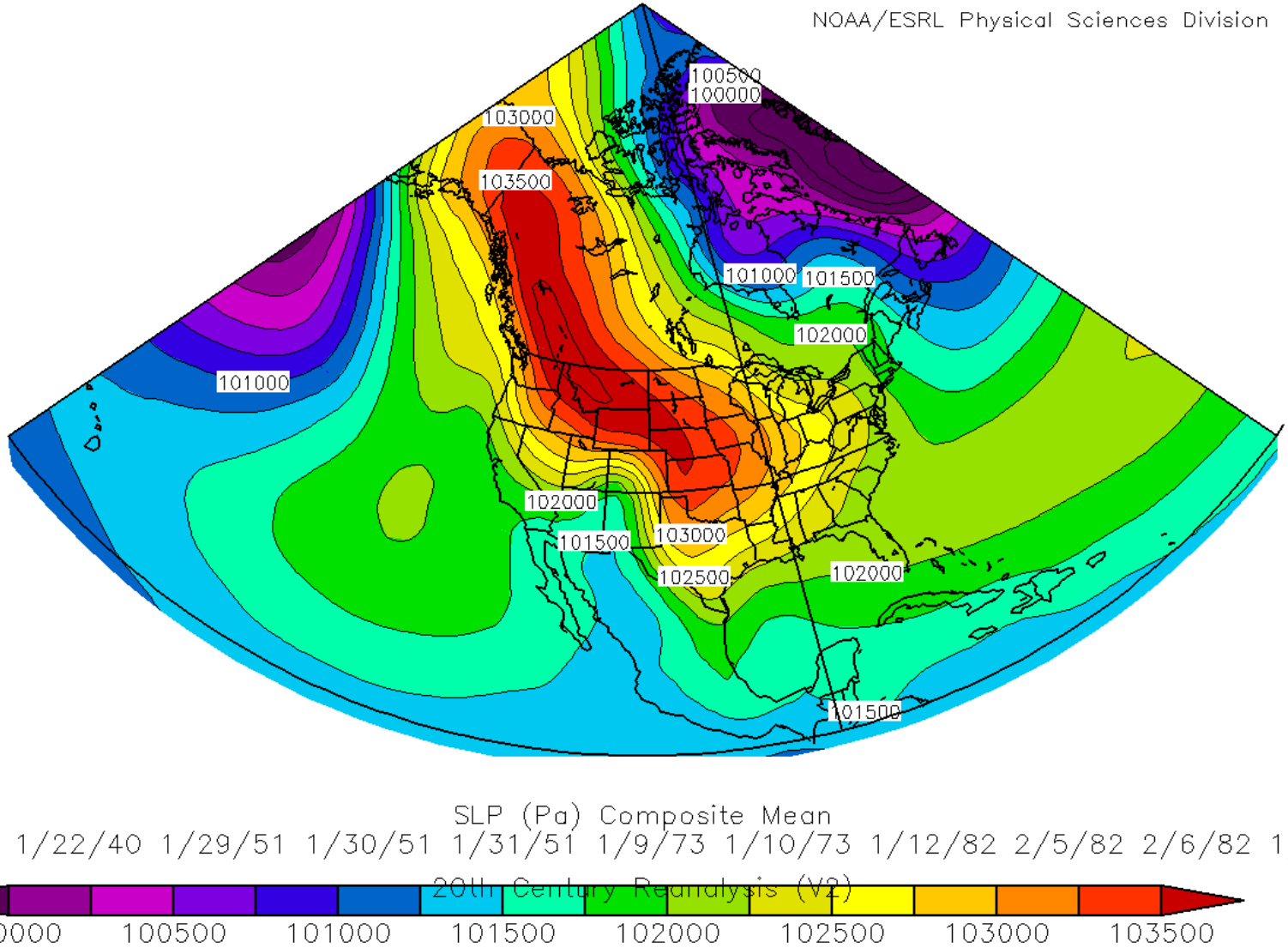
# Worst Ice Storms

- Highly amplified synoptic regime:
  - **Strong Ridge aloft across Alaska & West Coast.**
  - **Deep Low Pressure in NE Canada & Greenland.**
- The net result is Arctic air is driven very far southward across most of the United States.
- Shortwave trough axis evident in subtropical branch moving through Desert Southwest and Northern Mexico.

# 500 mb Composite

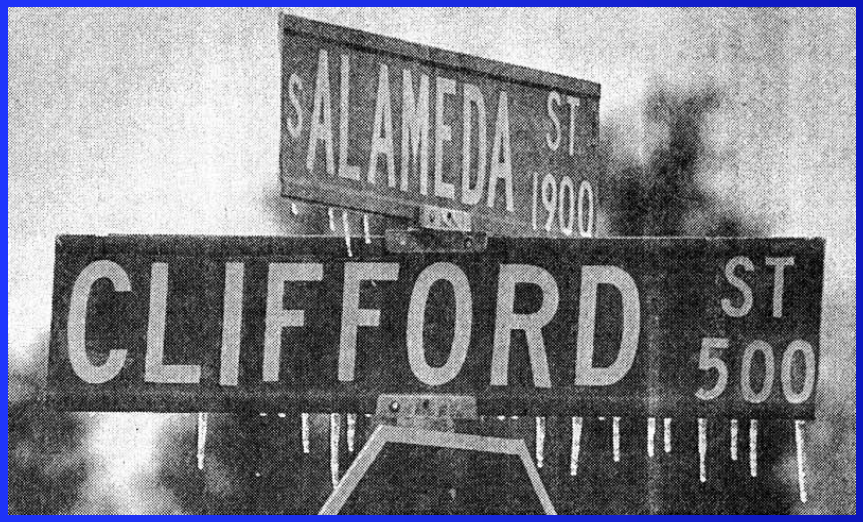


# Surface Composite



# Worst Ice Storms

- Associated behind Arctic cold front.
- Observed in all cases.
- This is consistent with Changnon 2002 & Rauber et al. 2001.




Jan 12-14, 1985

# Is the Feb 3-4, 2011 ice storm the worst?

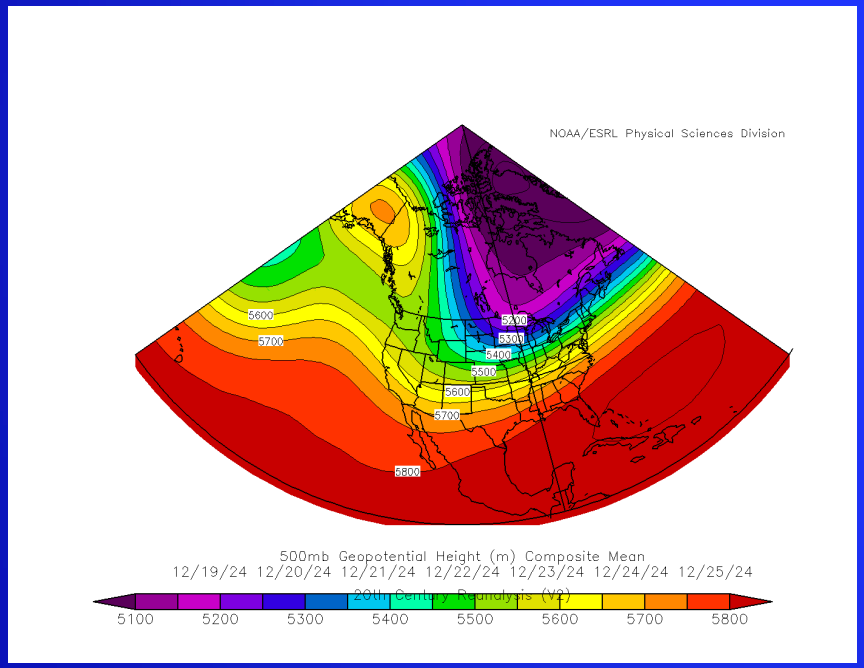
- In one word…NO!
- Why not?
- Then which storms are the worst of the worst and why?

# Why are the 1924, 1951 & 1985 ice storms worse than the Feb 3-4, 2011 ice storm?

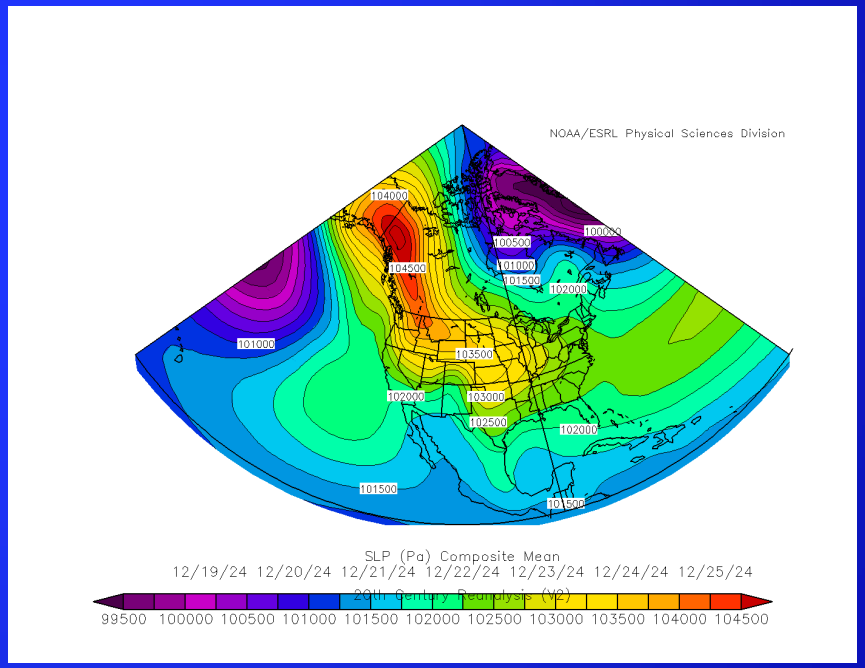
- More fatalities.
- Thicker ice.
- Longer period of freezing rain/freezing drizzle.
- Greater amount of pcpn.
- Longer period of below freezing temps.
- Greater amount of damage and disruption.

# Dec 19-25 1924*

## 500 mb Composite



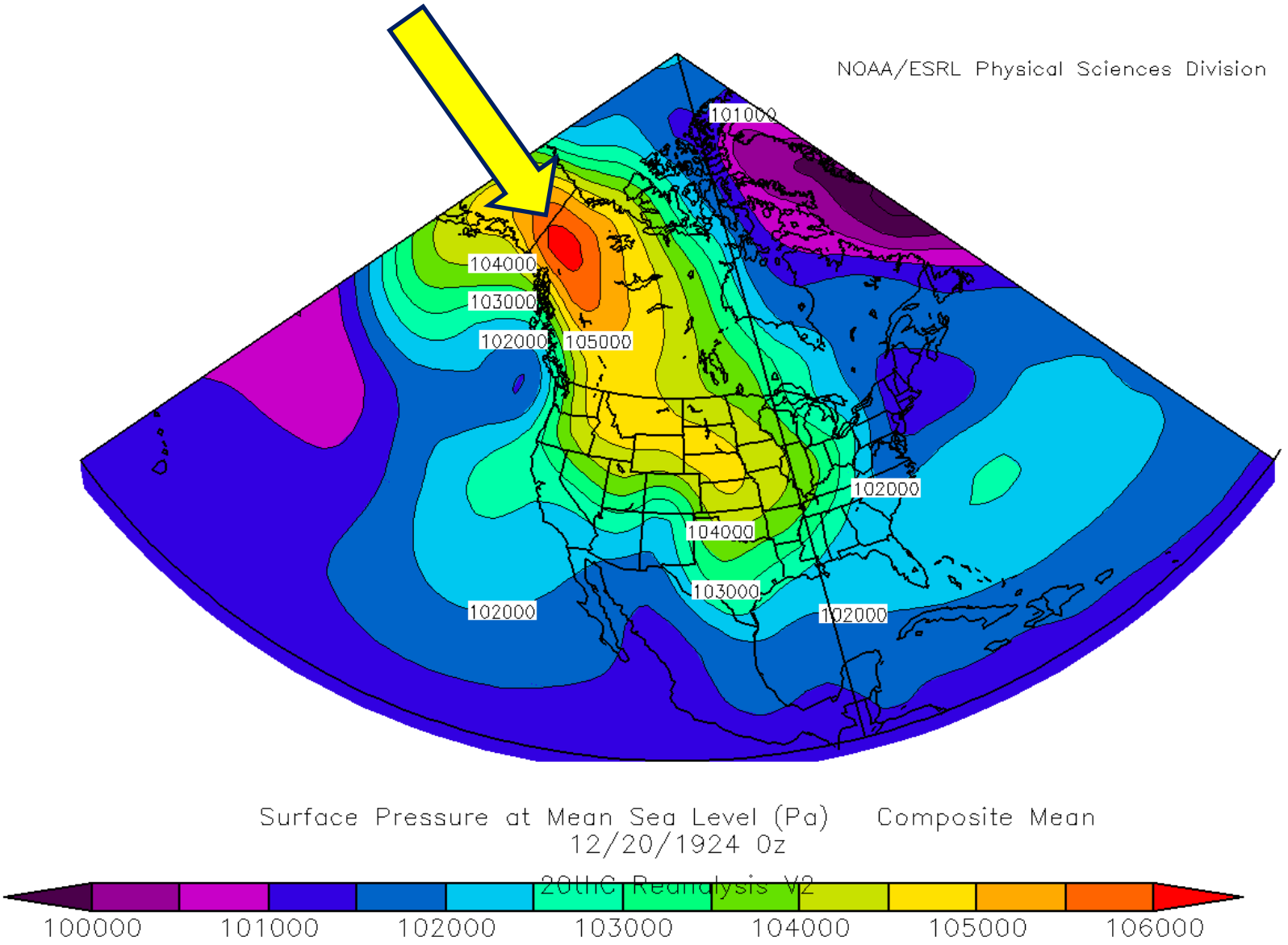

## Surface Composite



# Dec 19-25 1924*

- ~4 days (19,20,21,25) of freezing pcpn.
- Approx. 1.45 inches total pcpn (Mix of freezing rain, sleet & snow).
- 2 Arctic cold fronts (19th morning and 24th morning):
  - 1060 mb anticyclone center in the Yukon.
  - Tied 2nd all-time for 2 consecutive days with max temp <= 32 degs.
  - ~72 hours below freezing.
  - 1 record low and 2 record low maxes still exist.
- 9 hours after first fropa…freezing pcpn began.

# 1060 mb high centered over Yukon



# Dec 19-25 1924*

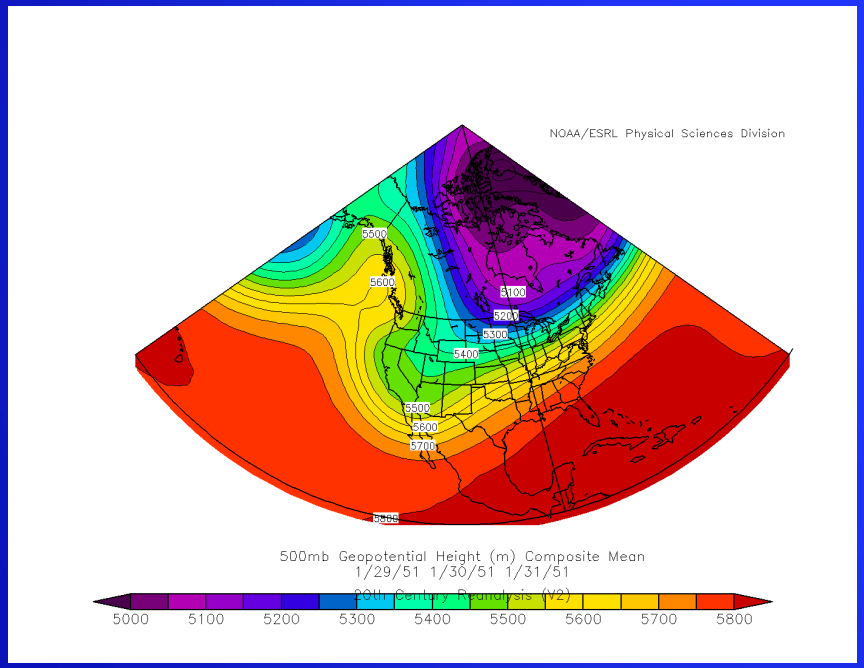
- J.P. McAuliffe, former MIC WSO CRP (1922-1946) wrote:
  - *"heavy coating of glaze making travel of all sorts difficult and dangerous"*
  - *"The coating on the wires and trees soon became so heavy as to cause the wires to break and branches of trees to collapse."*
  - *"ice caused telephonic communication to cease"*

# Dec 19-25 1924*

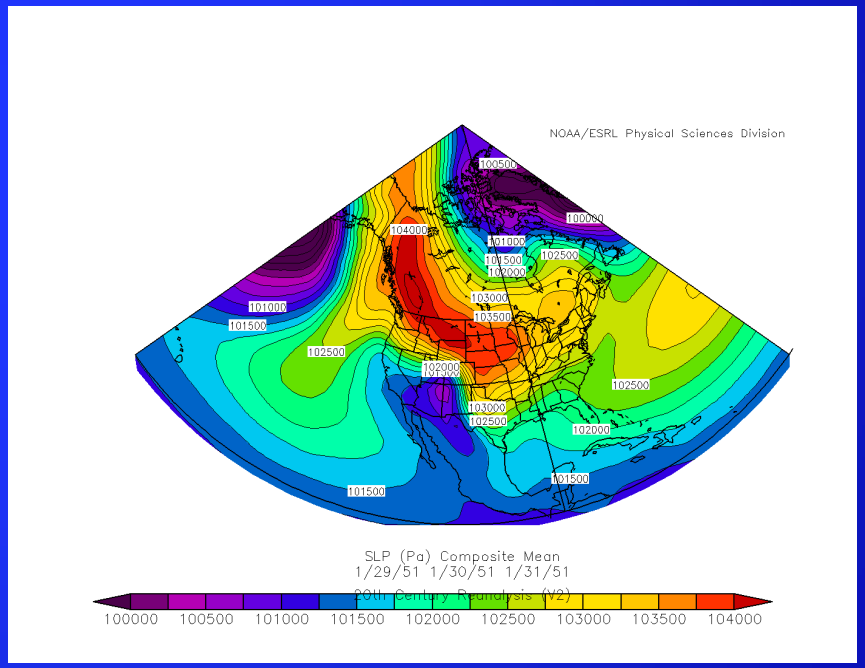
- **Telephone lines down for as long as 4 months!**
- Most communication down for days.
- Extensive damage to crops and vegetation.

# Jan 29-31, 1951*

## 500 mb Composite




## Surface Composite

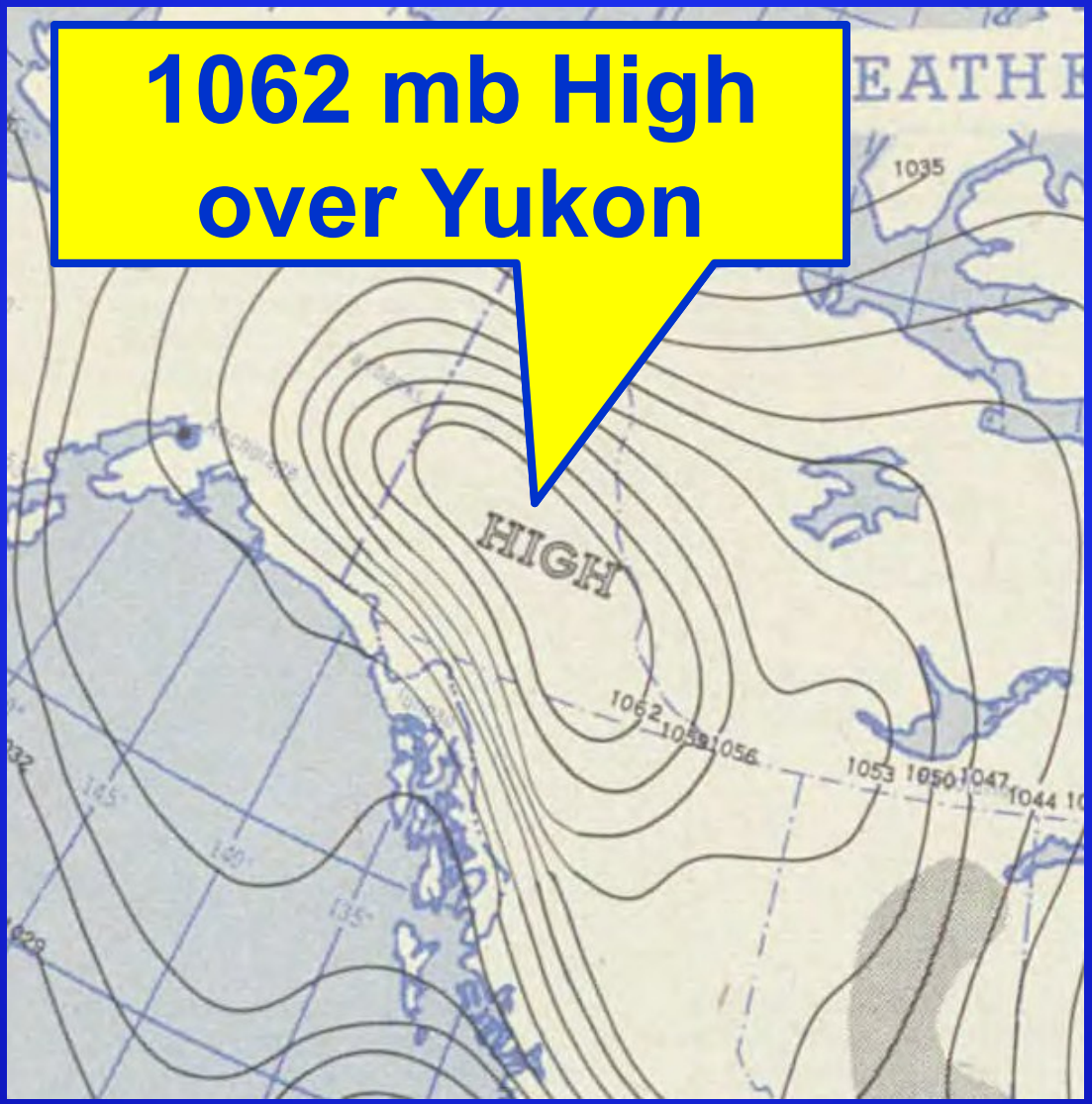


# Jan 29-31, 1951*

- ~42 hours of freezing pcpn.
- 0.10 inches total pcpn.
- Arctic cold front on the 28th (evening).
  - 1062 mb anticyclone center in the Yukon.
  - Coldest 6 day stretch (ending Feb 3rd) in history!!!
  - 96 consecutive hours at or below freezing is the all-time record!!!
  - 5 record lows for the 29th, 30th, 1st, 2nd & 3rd.
  - More than 10000 broken pipes!
  - Killed countless fish.
- Strong shortwave in southern stream.
  - Induces surface low in NW Gulf.
- 19 hours after fropa…freezing pcpn began.

Jan 29-31, 1951

# Jan 28, 1951 1930Z Surface Map



# Jan 29-31, 1951*

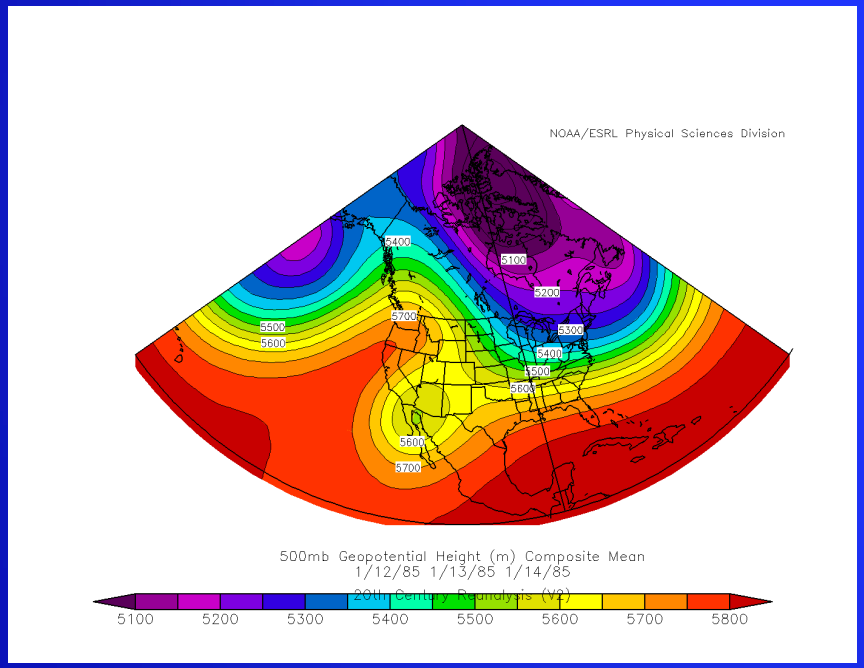
- 2 Fatalities.
- “Hospitals filled to overflow” due to many injuries.
- 3800 wire breaks.
- 1200 circuit breaks.
- 2100 poles down.
- More than 100 poles leaning.
- 240 miles of wire had to be restrung at a cost of $450K.

# Jan 29-31, 1951*

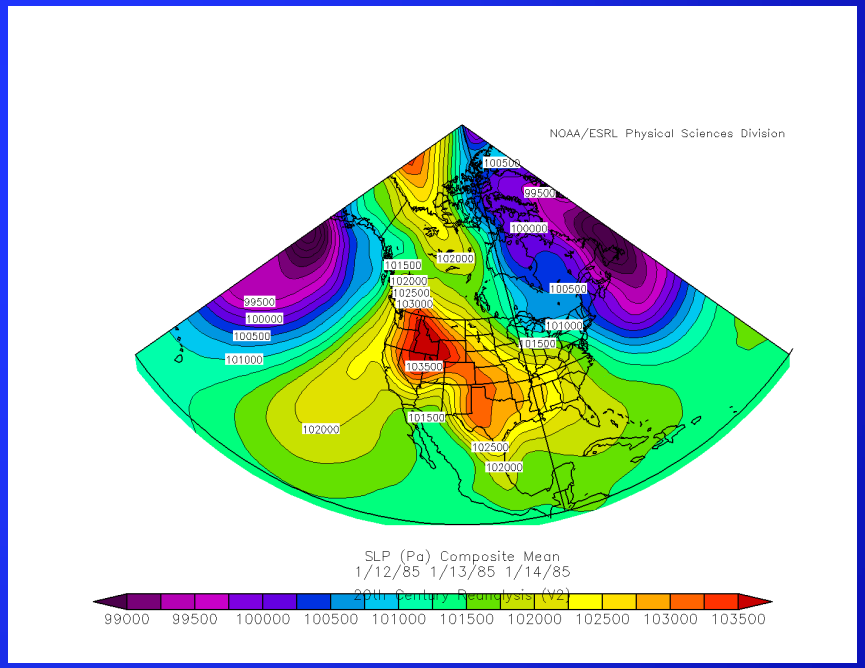
- All flights cancelled.
- Buses stopped for the first time.
- Most schools and businesses closed.
- Roads closed.
- No mail deliveries.
- Caller Times stated:
  - *"Not within the memory of any city official has an ice storm caused such widespread damage."*
  - *"Another coating of ice on top of 1/10 of an inch that had already accumulated".*

# Jan 12-14, 1985*

## 500 mb Composite




## Surface Composite



# Jan 12-14, 1985*

- 30 hours of freezing pcpn.
- 0.57” total pcpn.
- ***“A solid inch of ice”*** reported on the Nueces Bay Causeway.
- Arctic front 1/10 morning.
  - 1048 mb High in Montana.
  - 32 hours below freezing.
- 49 hours after fropa… freezing pcpn began.

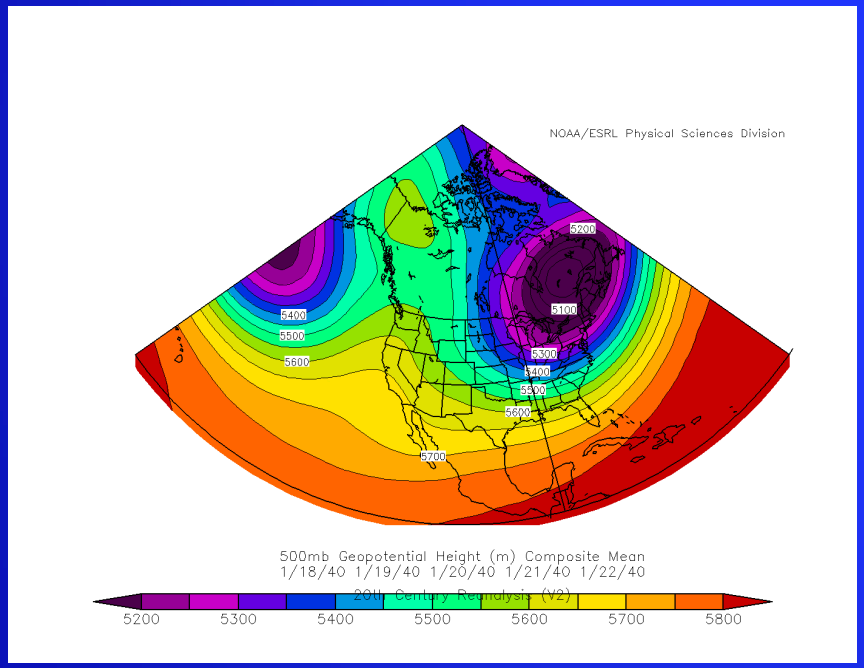
# Jan 12-14, 1985*

- 1 fatality and 1 injury in San Patricio county
  - A second fatality due to CO poisoning.
- At least 27 traffic accidents with injuries.
- Closed bridges and roads (up to several days) to allow sanding.
- Cancelled airline flights.
- Schools closed.

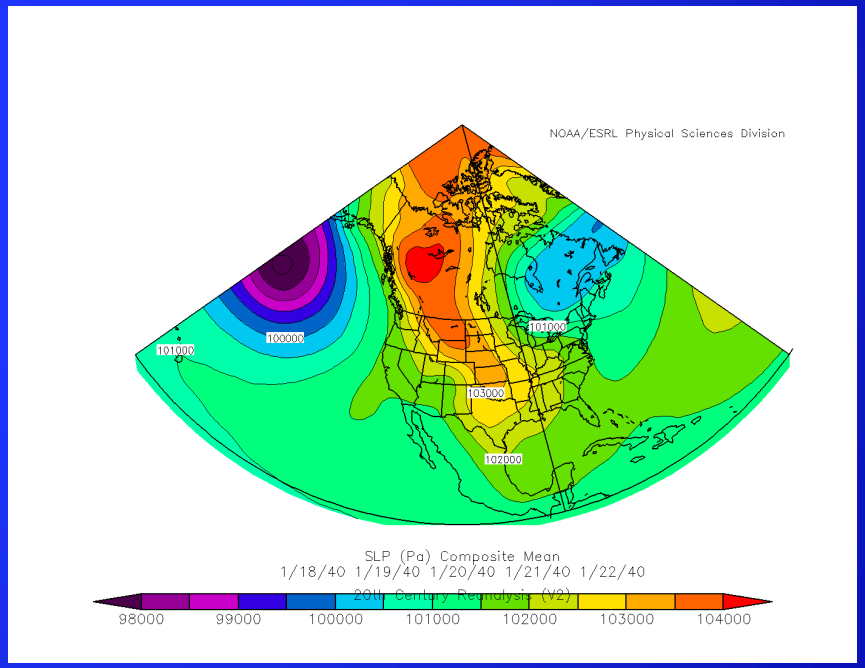
| | 12/19-25, 1924 |
|---|---|
| **Ice Thickness** | Unknown |
| **Total Liquid Equivalent** | 1.45" |
| **Duration of Event** | ~4 days |
| **Duration of Freezing Temps** | ~72 hours |
| **Fatalities** | Unknown |
| **Injuries** | Unknown |
| **Socio-economic** | Telephone lines down 4 months, Extensive damage to crops and vegetation, Most communication down for days |
| **Notable Quotes** | “Heavy coating of glaze", “Telephonic communication to cease”, “The coating on the wires and trees soon became so heavy as to cause the wires to break and branches of trees to collapse." |

# Jan 18-22 1940

## 500 mb Composite




## Surface Composite



# Jan 18-22 1940

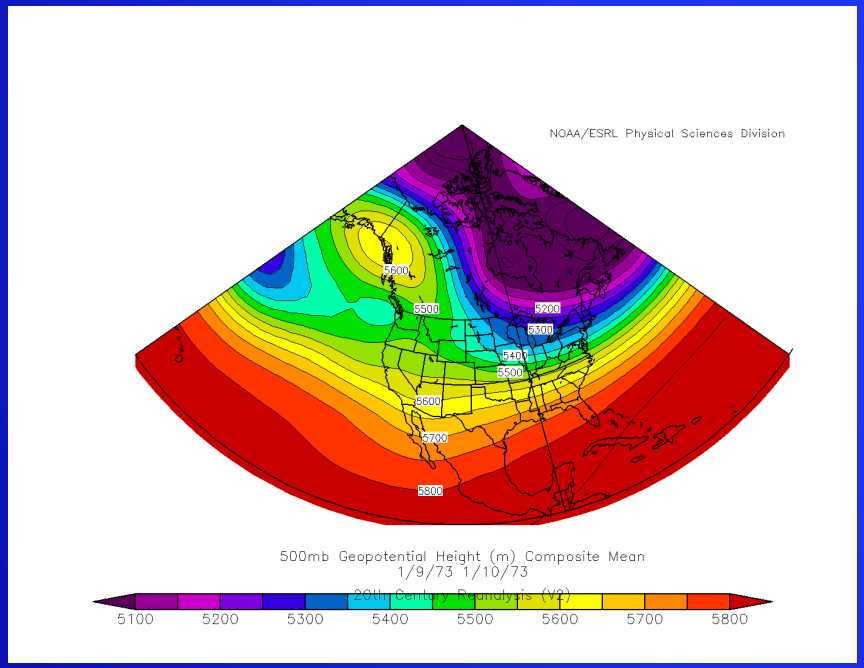
- 6 hours of freezing pcpn.
- Amount unknown.
- Began 5 hours after fropa.
- Arctic front 1/18 noon.
  - 1047 mb High across the NW Territories into Montana.
  - 3rd coldest January period (19-23rd) ever!
  - 2 record lows.
  - 23 hours below freezing.
- Secondary surge along with surface low in NW Gulf (SE of Brownsville) on 1/22.

# Jan 18-22 1940

- “Utility lines damaged”.
- Heavy crop damage.
- Hazardous driving conditions.

# Jan 9-10 1973

## 500 mb Composite

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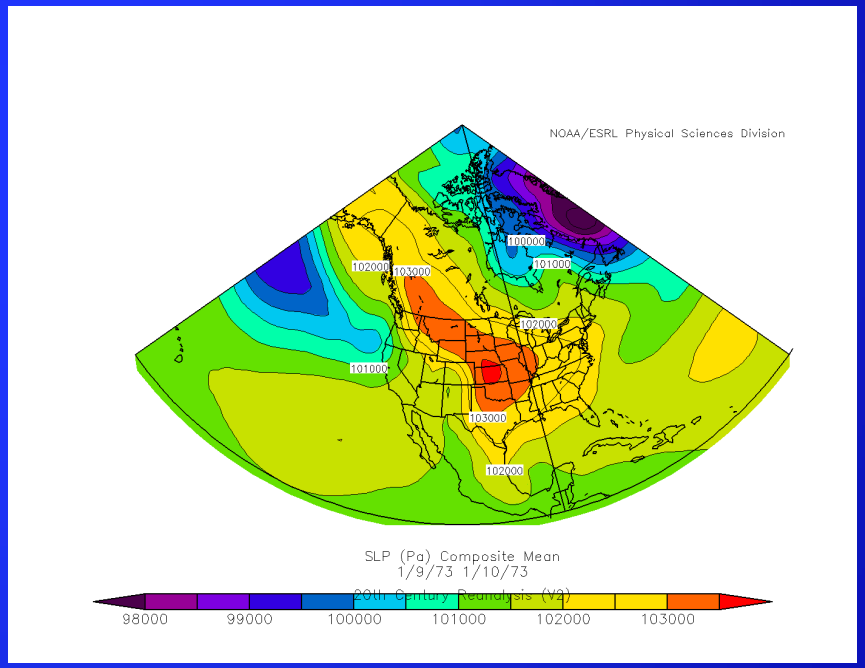
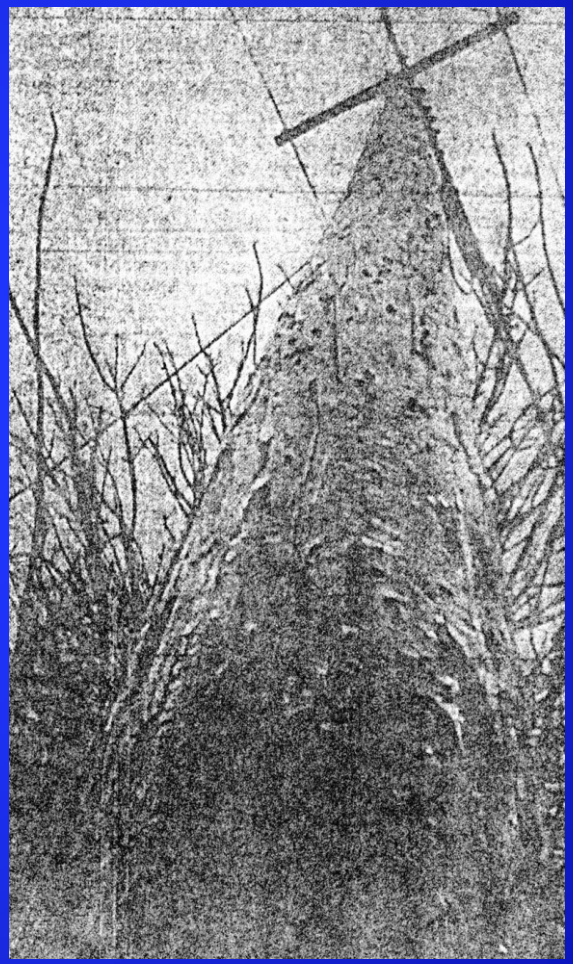


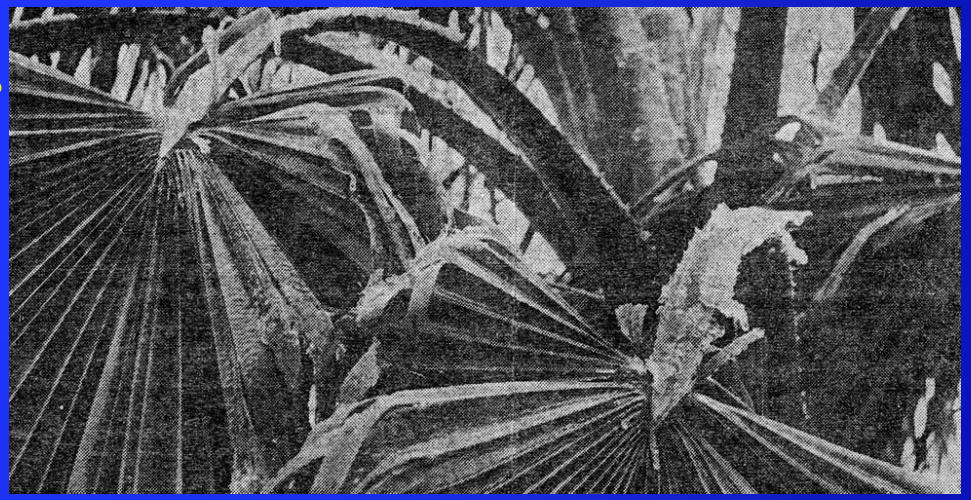
# Jan 9-10 1973

- 16 hours of freezing pcpn.
- 0.39” total pcpn.
- **“Ice a quarter to half an inch”.**
- Modified arctic front on 1/5 evening.
  - 1045 mb High in Southern Canada.
  - 14 hours at or below freezing.
  - 4th coldest 3-day Max Jan Temp through the 11th.
- Freezing pcpn began 82 hours after fropa.



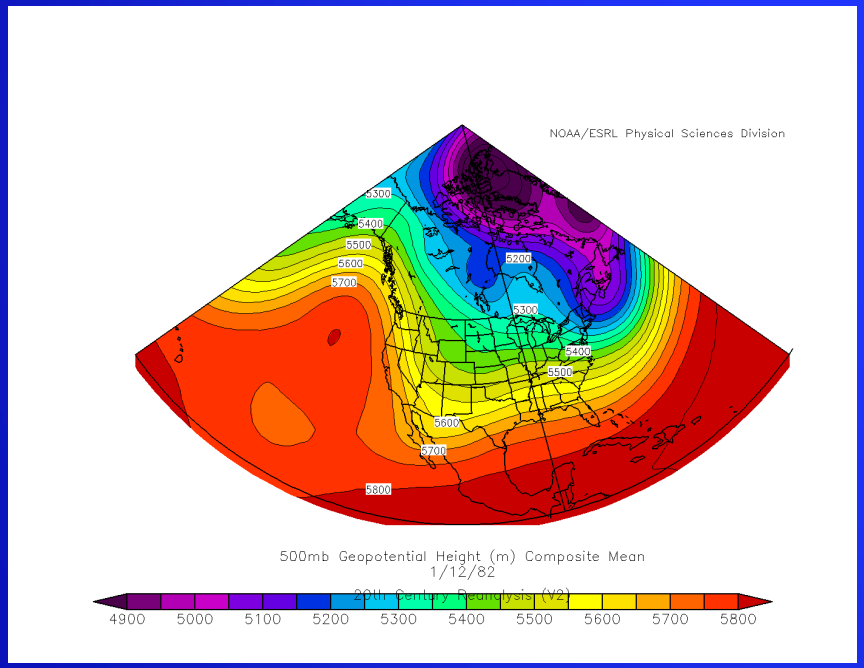
# Jan 9-10 1973

- 10 people injured.
- Several dozen auto accidents.
- More than 100 lines down and 30 poles lost.
- Some highways, roads, bridges and businesses closed.
- No airline interruption.
- “Limbs breaking off trees”.
- “Worst winter disaster ever to hit the Nueces Electric Cooperative”.
- Similar to 2011 ice storm.



# Jan 12, 1982

## 500 mb Composite

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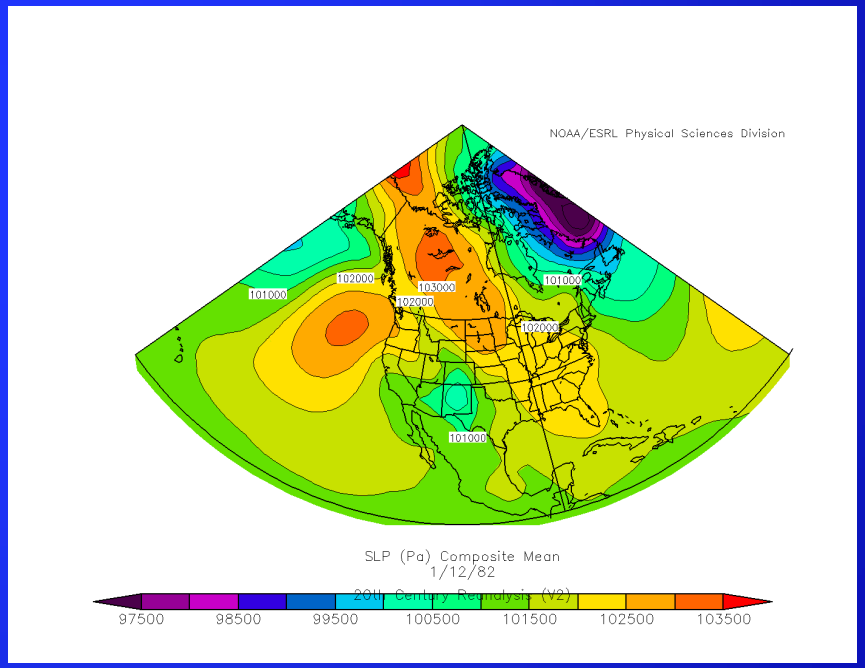


# Jan 12, 1982

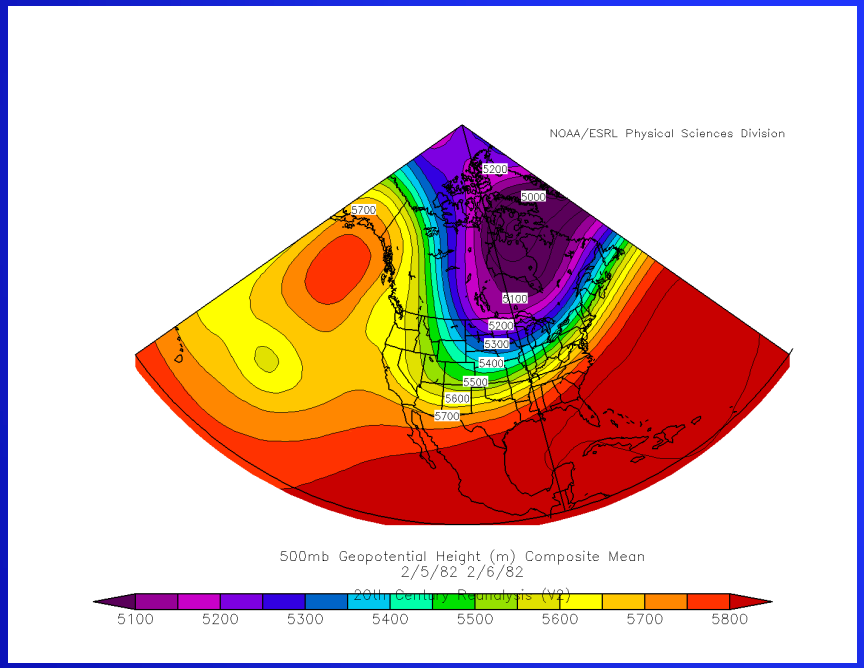
- 2 hours of freezing pcpn (Most likely more).
- 0.05” total pcpn (Not all freezing).
- Arctic front 1/10 morning.
  - 1056 mb High in Southern Canada on 1/10.
  - 31 hours below Freezing.
- Freezing pcpn began 39 hours after fropa.

# Jan 12, 1982

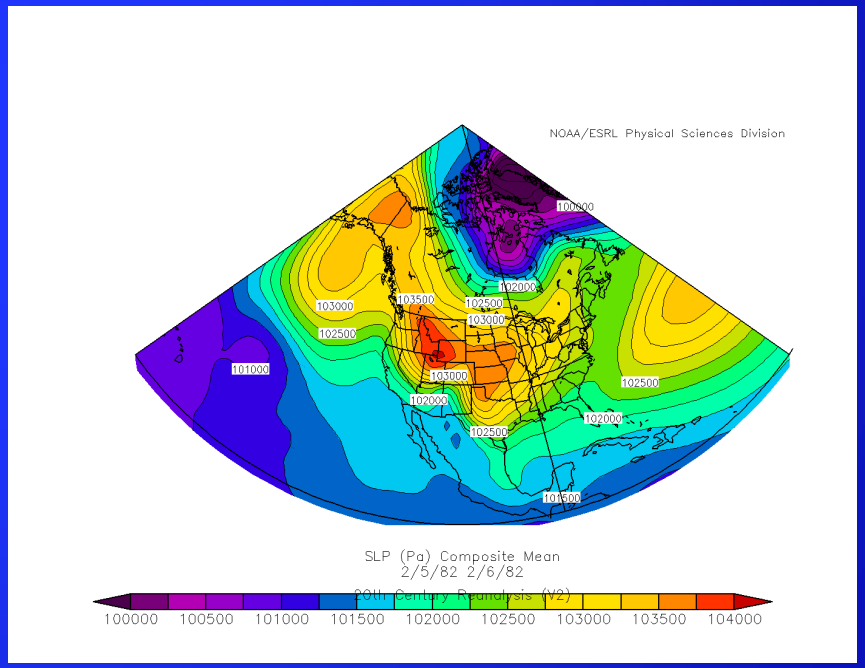
- “Travel disruption due to ice coated expressways, overpasses, and bridges”.
- “Numerous accidents”.
- “Significant glazing” north of Corpus Christi.

# Feb 5-6, 1982

## 500 mb Composite




## Surface Composite



# Feb 5-6, 1982

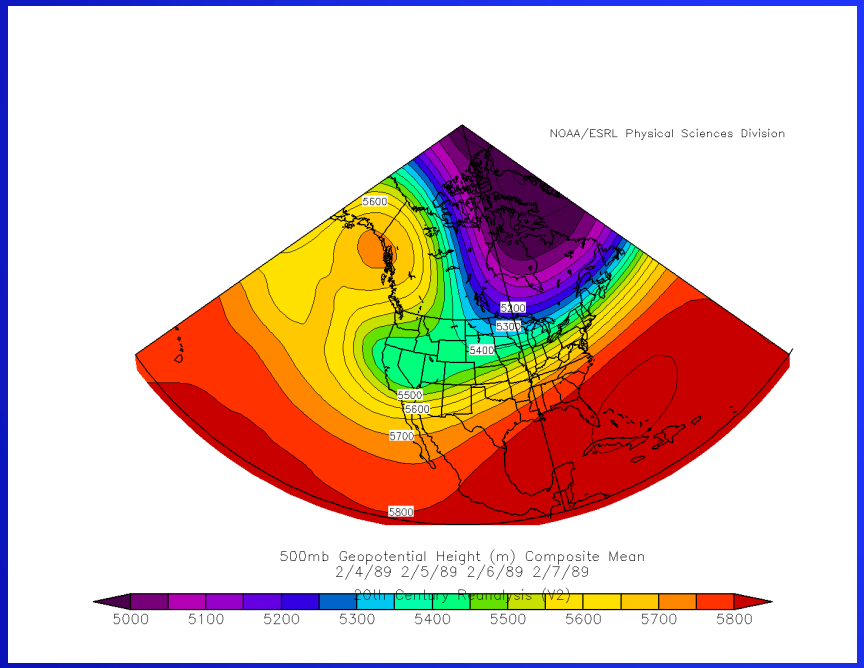
- 5 hours of freezing pcpn.
- 0.04” total pcpn.
- Arctic front 2/2 aftn.
  - 1044 mb High across Southern Canada into the Northern Plains.
  - 17 hours below freezing.
- 84 hours after fropa…freezing pcpn began.

# Feb 5-6, 1982

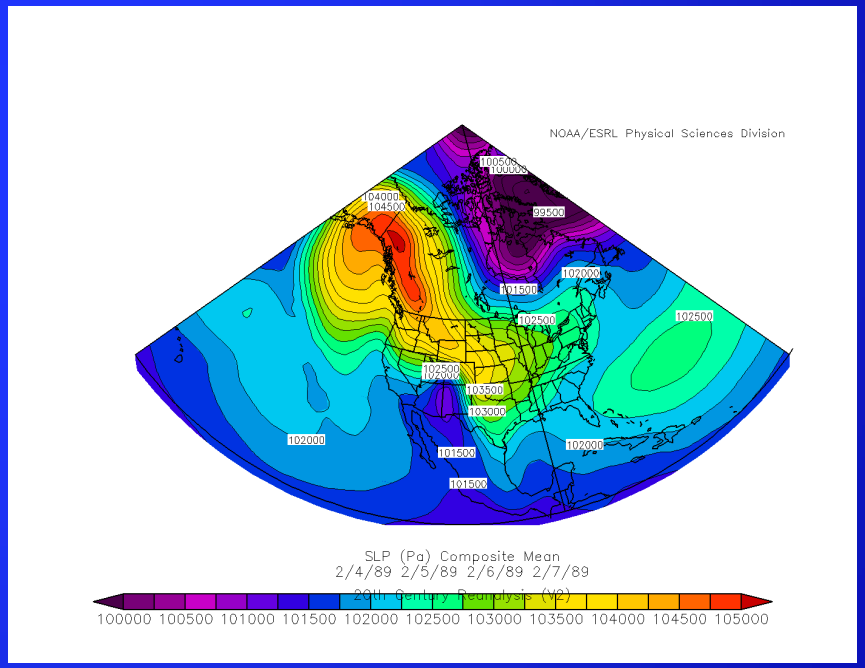
- 1 fatality in George West (north of Corpus Christi).
- Dozens of injuries.
- Lots of traffic accidents.
- Harbor Bridge closed to allow sanding.

# Feb 4-7, 1989

## 500 mb Composite




## Surface Composite



# Feb 4-7, 1989

- 39 hours of freezing pcpn.
- 0.09” total pcpn.
- 1/3-1/4” ice accumulation.
- Arctic front 2/3 morning.
  - 1060 mb High in the Yukon.
  - 7th coldest 3-day stretch Max Temp (ending 2/6).
  - 1 record low.
  - 38 hours below freezing.
- 23 hours after fropa... freezing pcpn began.

# Feb 4-7, 1989

- Many injuries.
- Several traffic accidents.
- Roads, bridges, schools and businesses closed.
- Some flights cancelled.
- Disruption in mail service.

# So…in summary

| | 12/19-25 1924 | 1/18-22 1940 | 1/29-31 1951 | 1/9-10 1973 | 1/12 1982 | 2/5-6 1982 | 1/12-14 1985 | 2/4-7 1989 | 2/3-4 2011 |
|---|---|---|---|---|---|---|---|---|---|
| **Ice Thickness** | Unknown | Unknown | >1/10" | 1/4-1/2" | Unknown | Unknown | 1" | 1/3-1/4" | 1/4-3/8" |
| **Total Liquid** | 1.45" | Unknown | 0.10" | 0.39" | 0.05" | 0.04" | 0.57" | 0.09" | 0.05" |
| **Event Duration** | ~4 days | 6 hours | ~42 hours | 16 hours | 2 hours | 5 hours | 30 hours | 39 hours | 14 hours |
| **Freezing Duration** | ~72 hours | 23 hours | 96 hours | 14 hours | 31 hours | 17 hours | 32 hours | 38 hours | 37 hours |
| **Fatalities** | Unknown | Unknown | 2 | None | None | 1* | 2 | None | None |
| **Injuries** | Unknown | Unknown | Multiple | >=10 | Unknown | Dozens | >=27 | Multiple | Multiple |

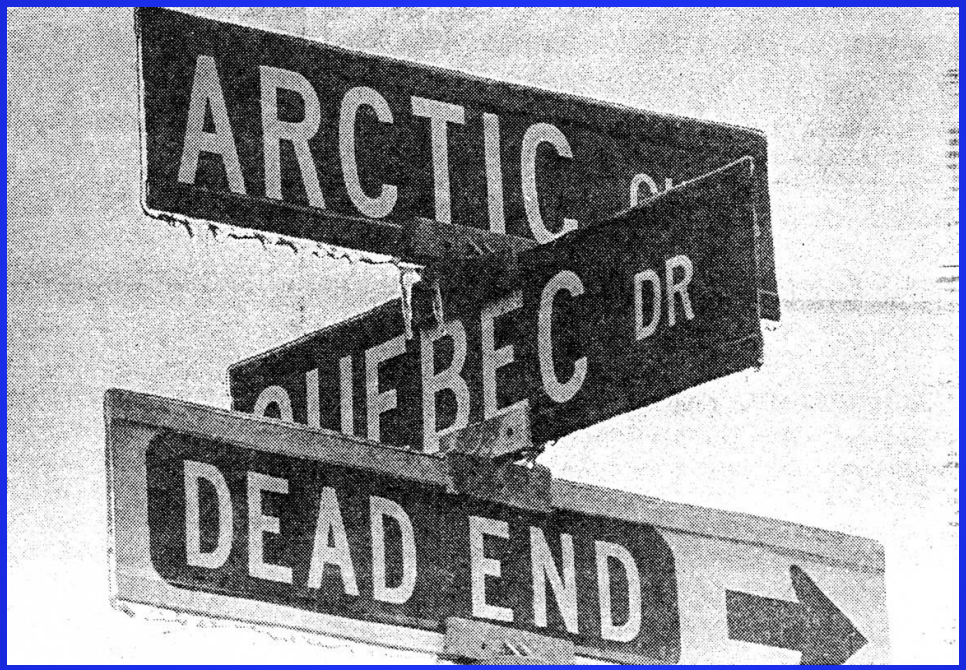
| **Worst storms** | **1924 Storm** | **1951 Storm** | **1985 Storm** |
|---|---|---|---|
| **Socio-economic** | **Telephone lines down 4 months, Extensive damage to crops and vegetation** | **3800 wire breaks, 2100 poles down, $450k wire damage, Flights & buses cancelled, Schools, businesses & roads closed, No mail** | **At least 27 auto accidents, Bridges and roads closed for days to allow sanding, Schools closed, Airline flights cancelled** |
| **Notable Quotes** | **“Heavy coating of glaze", “The coating on the wires and trees soon became so heavy…”** | **"Hospitals filled to overflow", "Not…has an ice storm caused such widespread damage"** | **"Very hazardous driving conditions", "Solid inch of ice"** |

# References


- Changnon, Stanley A., 2003: Characteristics of Ice Storms in the United States. *J. Appl. Meteor.*, **42**, 630–639.

- Rauber, Robert M., Larry S. Olthoff, Mohan K. Ramamurthy, Dianne Miller, Kenneth E. Kunkel, 2001: A Synoptic Weather Pattern and Sounding-Based Climatology of Freezing Precipitation in the United States East of the Rocky Mountains. *J. Appl. Meteor.*, **40**, 1724–1747.

# Questions




Jan 12-14, 1985