

Winter Storms

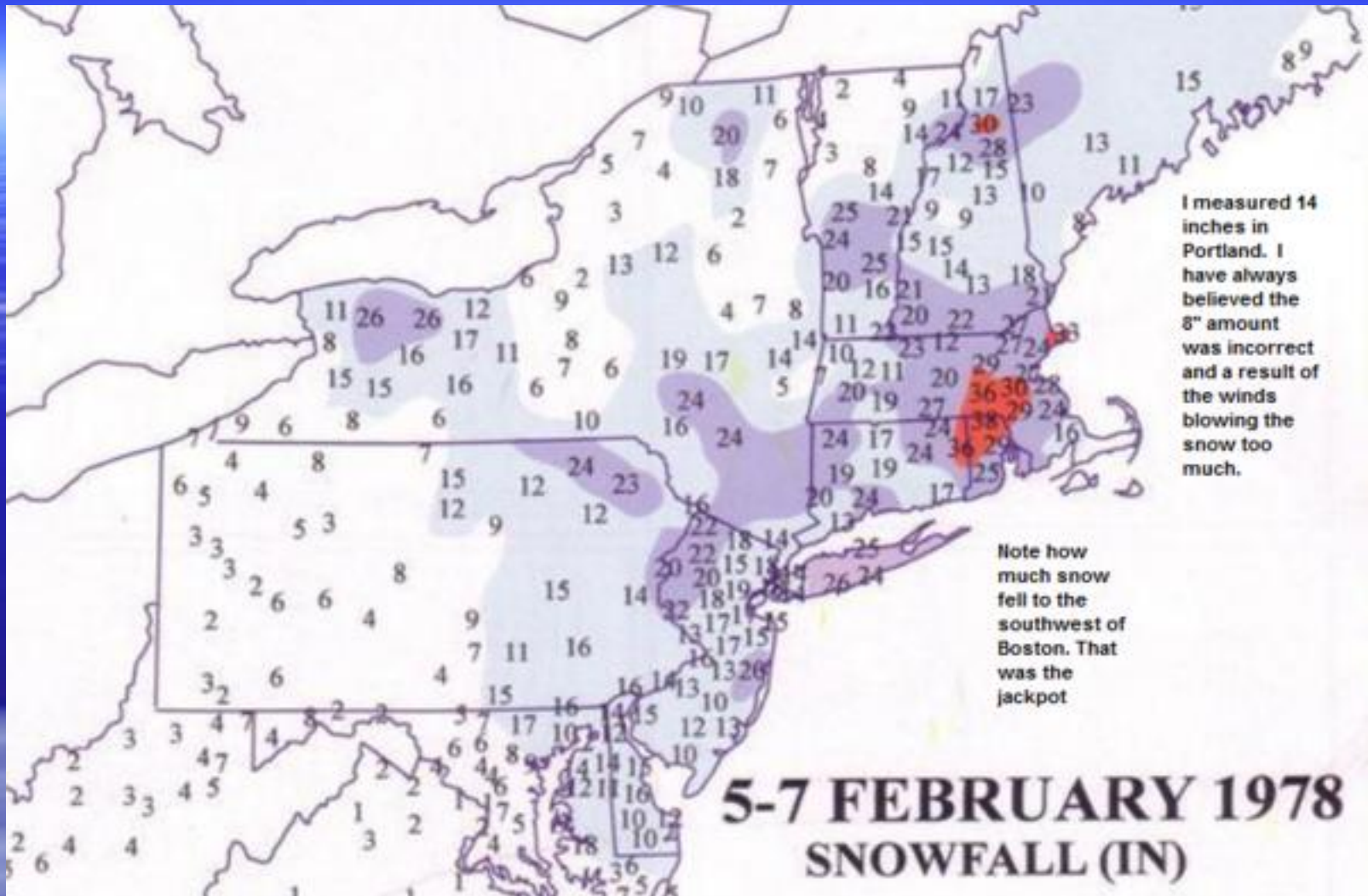
American Meteorological Society
Project ATMOSPHERE

Why do I love the weather?



Blizzard of '78





✦ Blizzard: winds 35 mph; visibility 0.25 mi

EXIT 64N
138 NORTH
Milton
↑



Needs for Snow

✦ Moisture

✦ Cold Air

✦ Lift

Sources of Moisture?

Sources of Cold?

Sources of Lift?

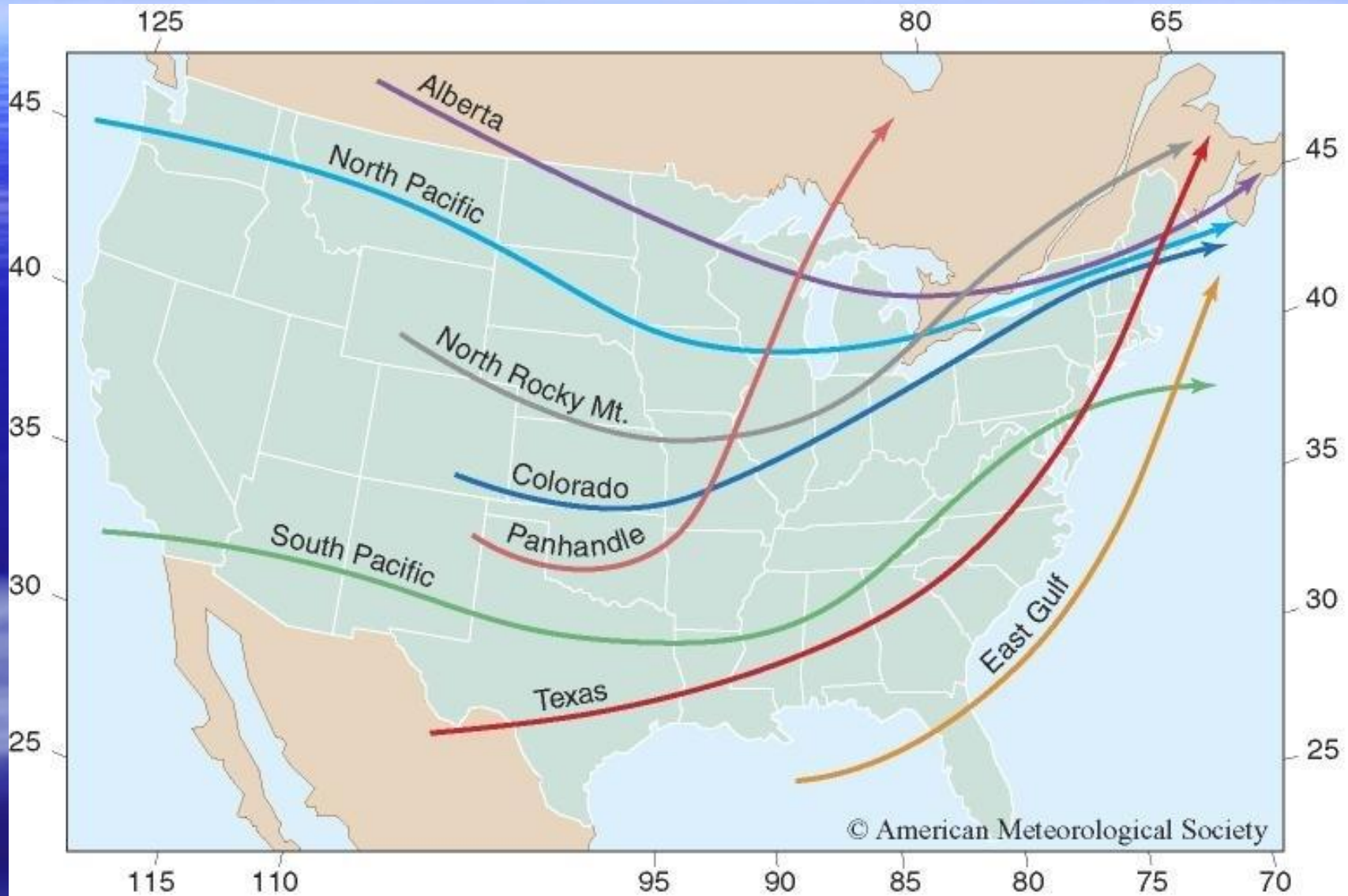
Extratropical Cyclones

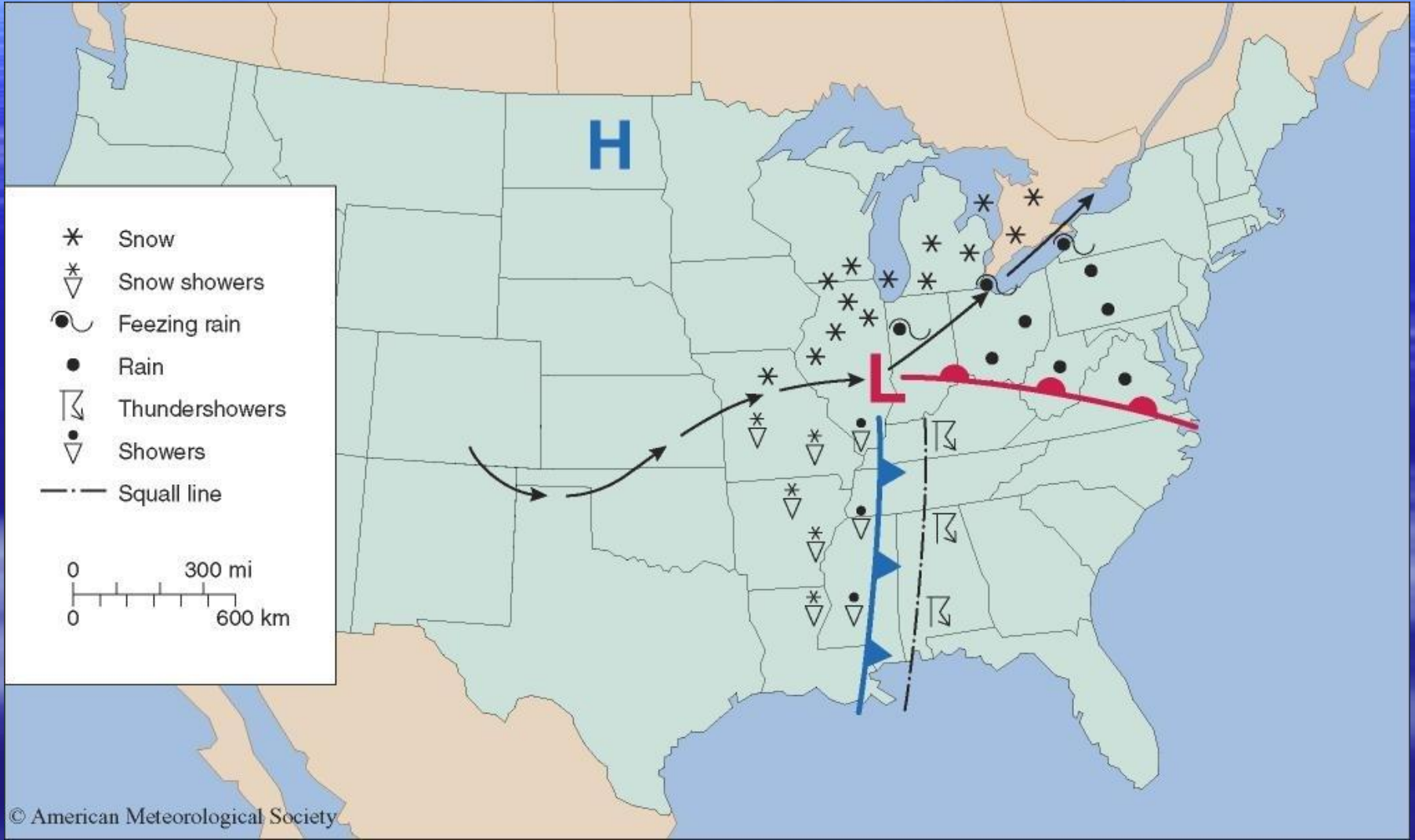
- ✦ Principal tracks

- ✦ Warm side versus cold side

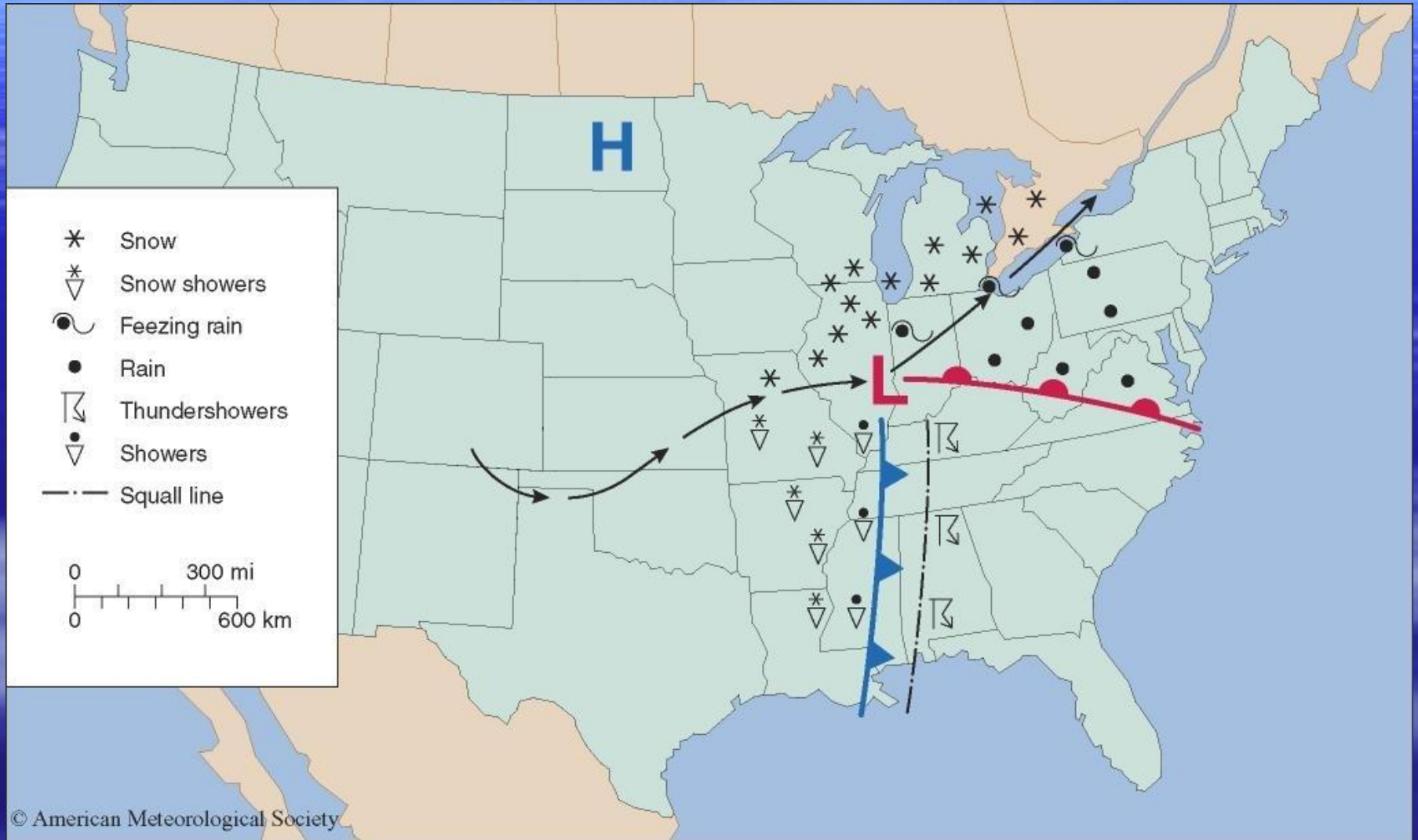
- ✦ Upper-air support

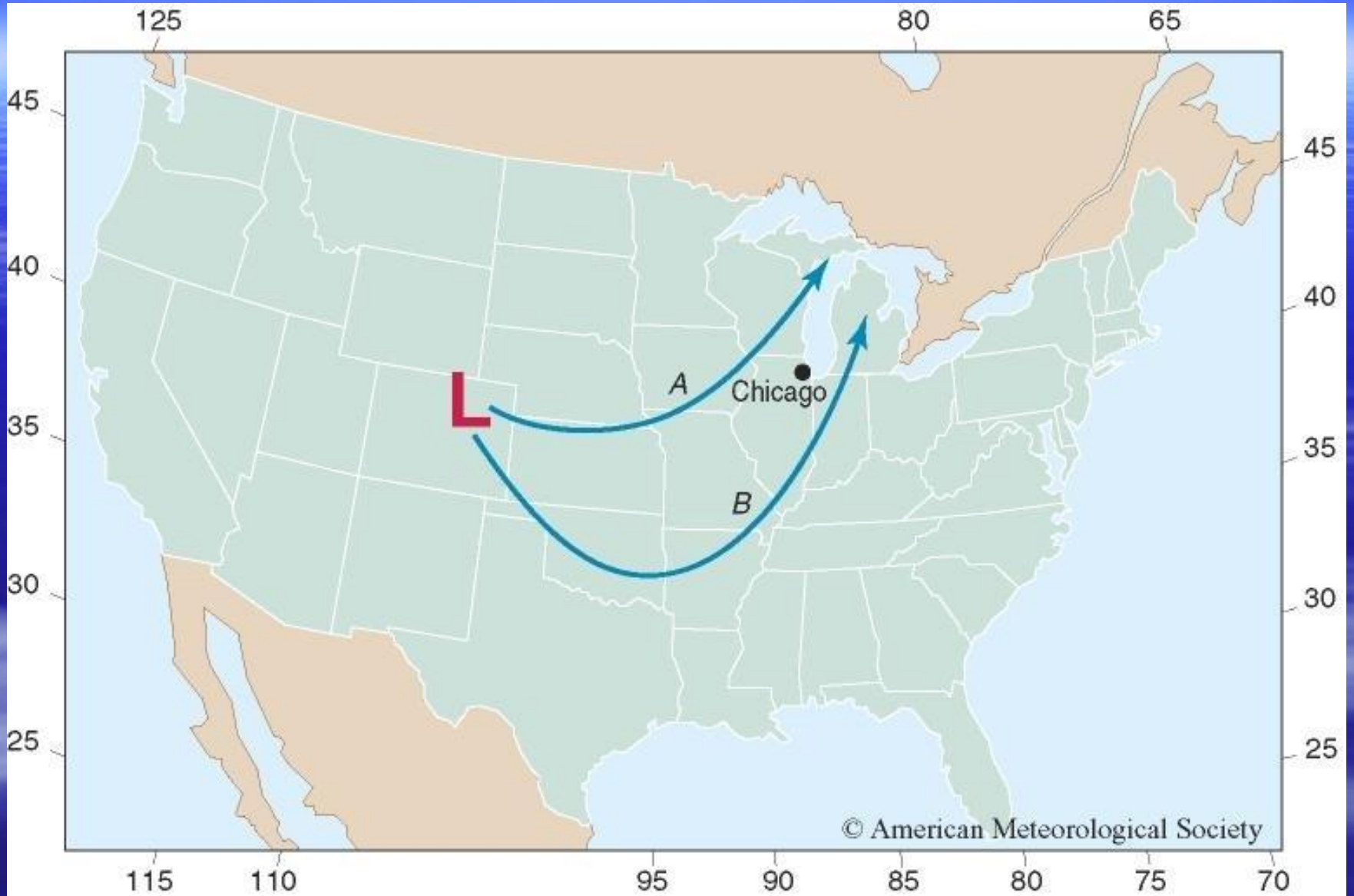
Named for where they form

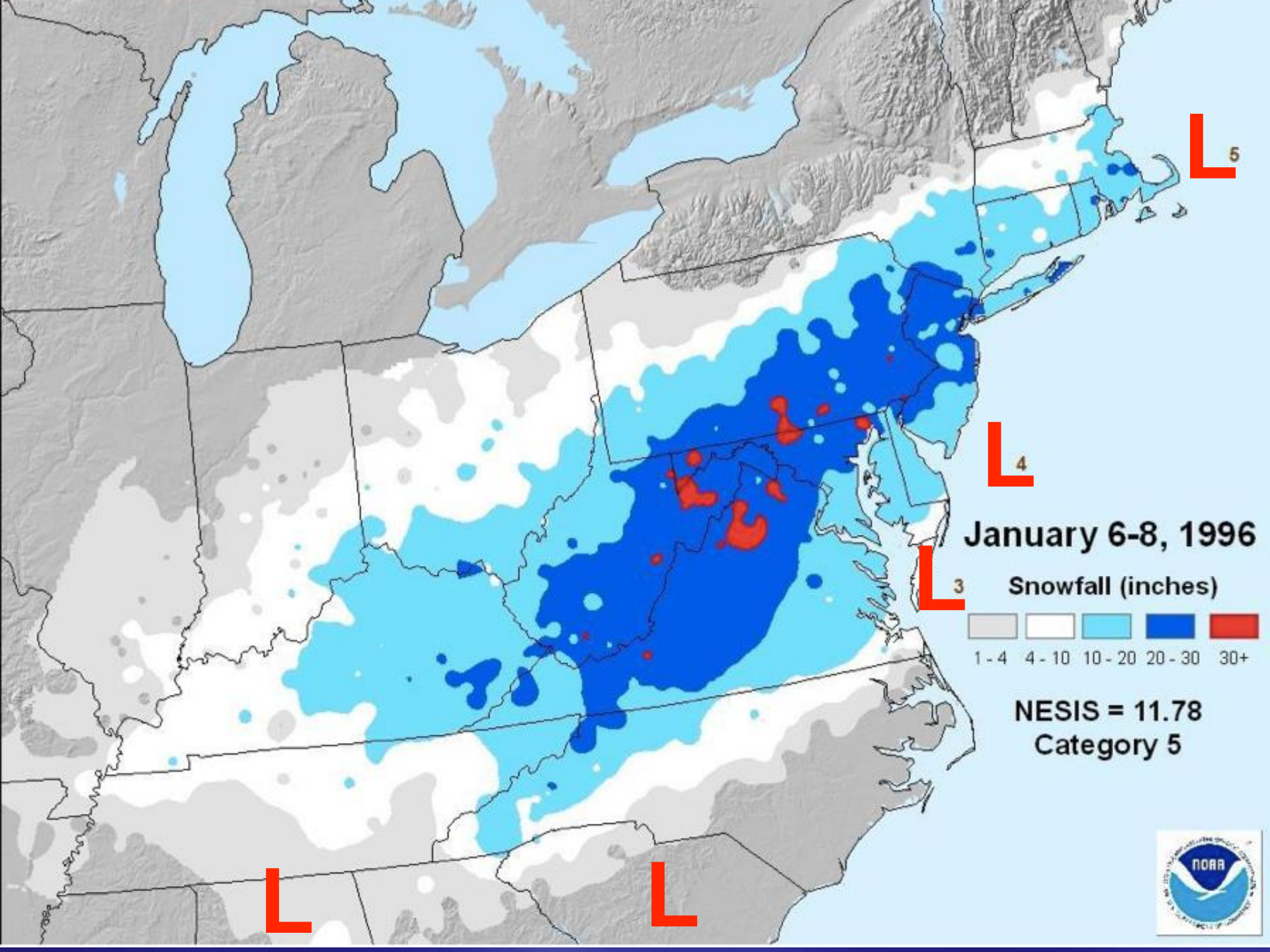




What are the air masses?



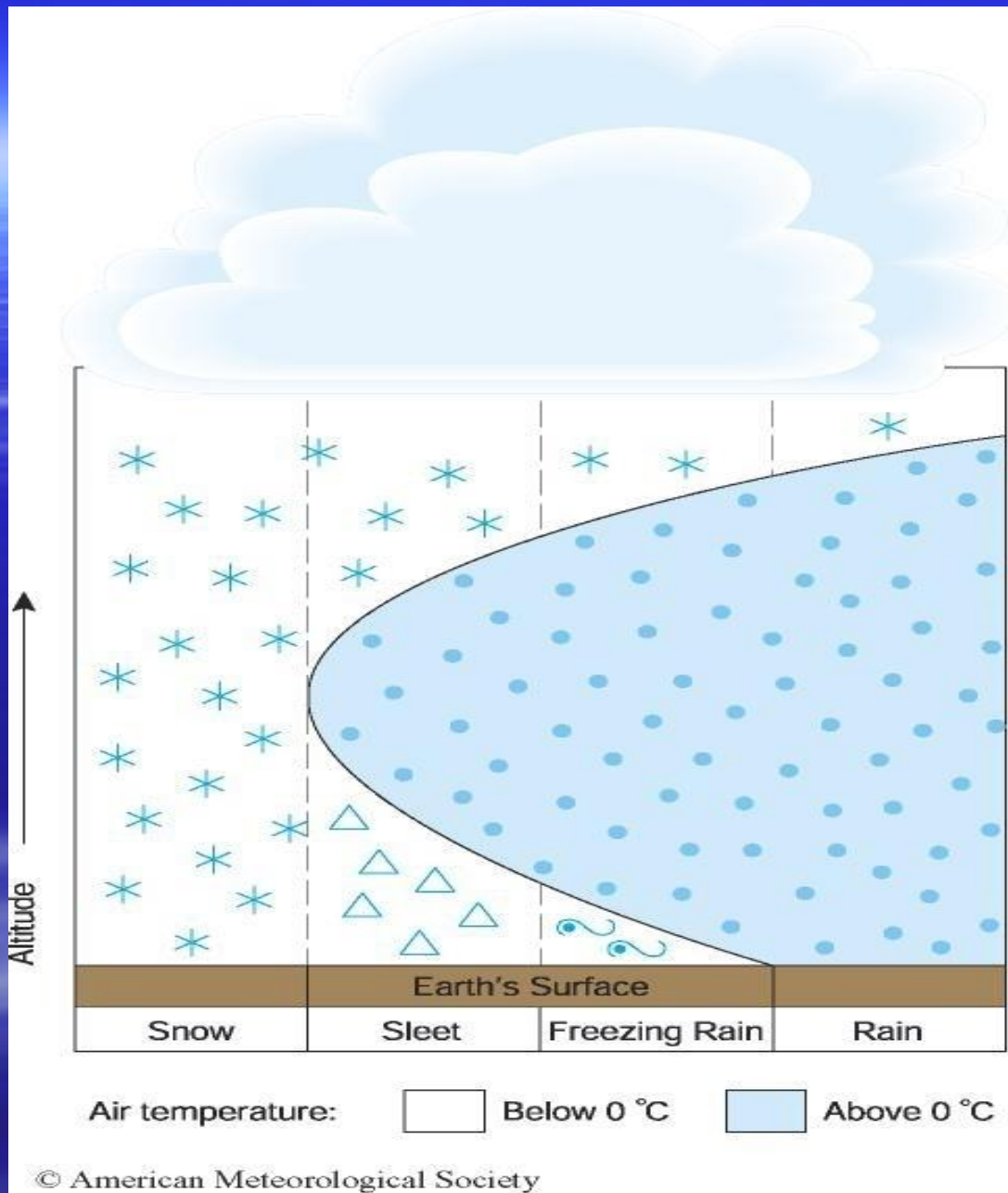


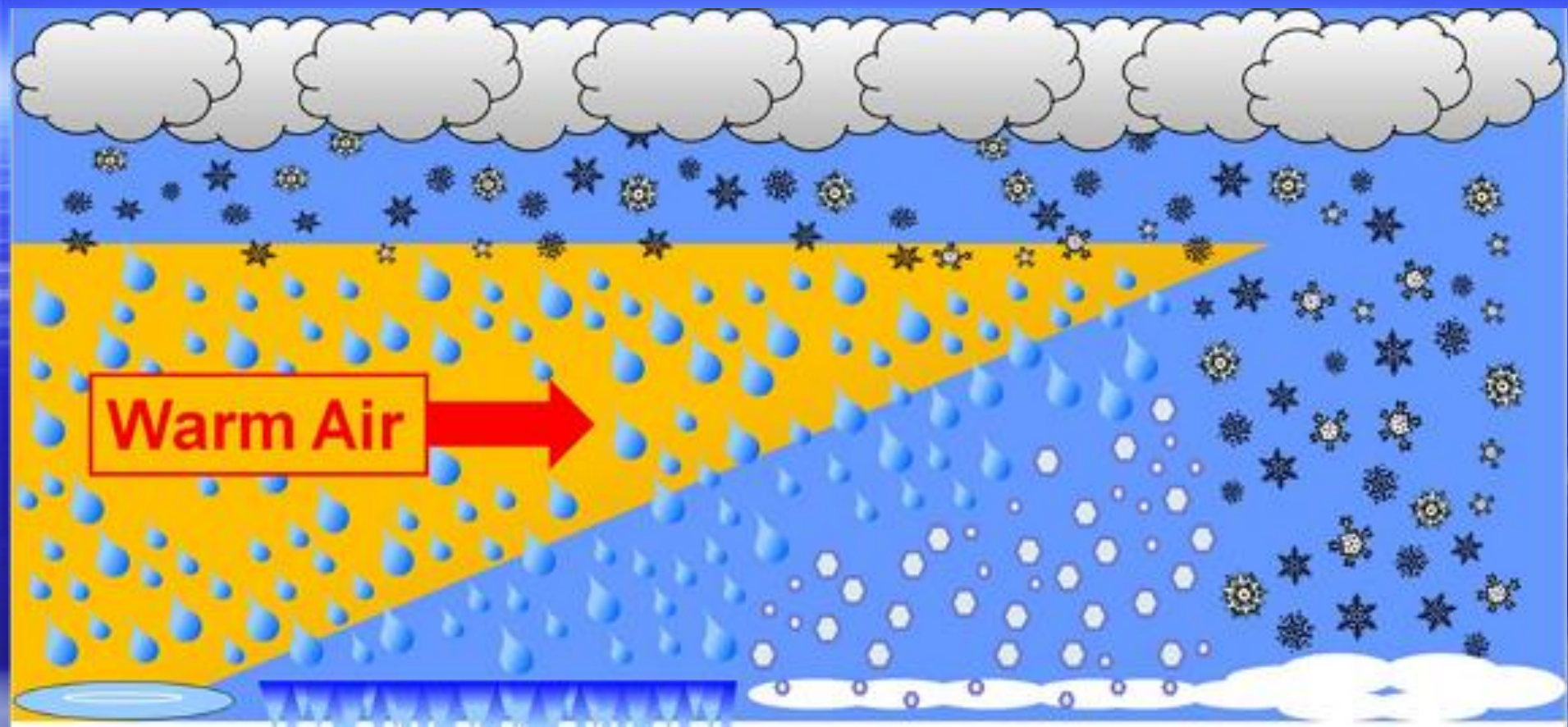


Precipitation Types

- ✦ Rain, drizzle
- ✦ Snow
- ✦ Sleet (ice pellets)
- ✦ Freezing rain
- ✦ freezing drizzle
- ✦ Hail

			Rain (light,moderate,heavy)
			Snow (light,moderate,heavy)
			Thunder (with rain,snow,no precipitation)
			Shower (rain,snow)
			Drizzle
			Freezing rain, Freezing drizzle
			Ice pellets/Sleet
			Fog (thin,thick)
			Haze





Warm Air →

Rain

Frozen precipitation melts and reaches the ground as rain.

Freezing Rain

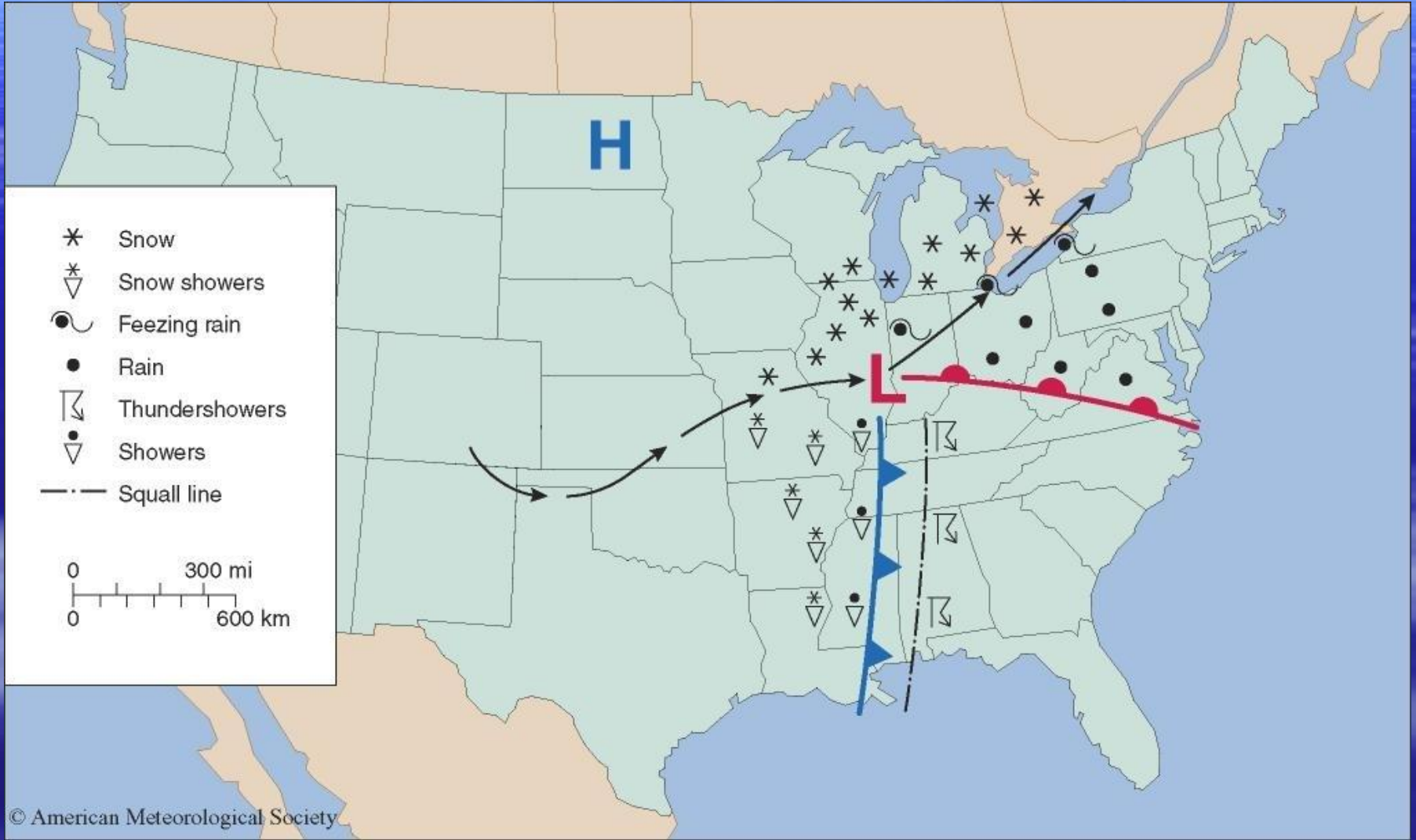
Frozen precipitation melts in warm air. Rain falls and freezes on cold surfaces.

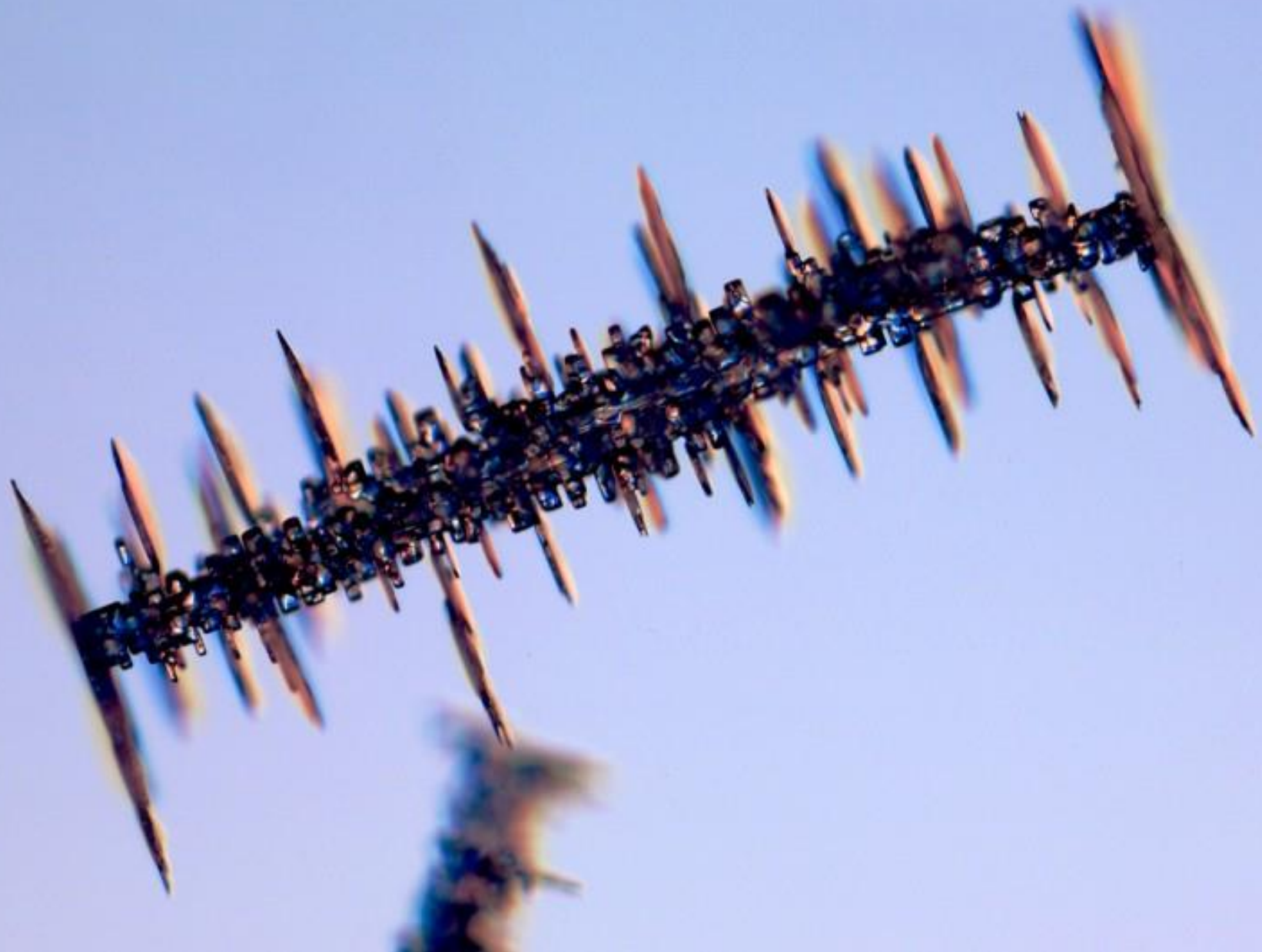
Sleet

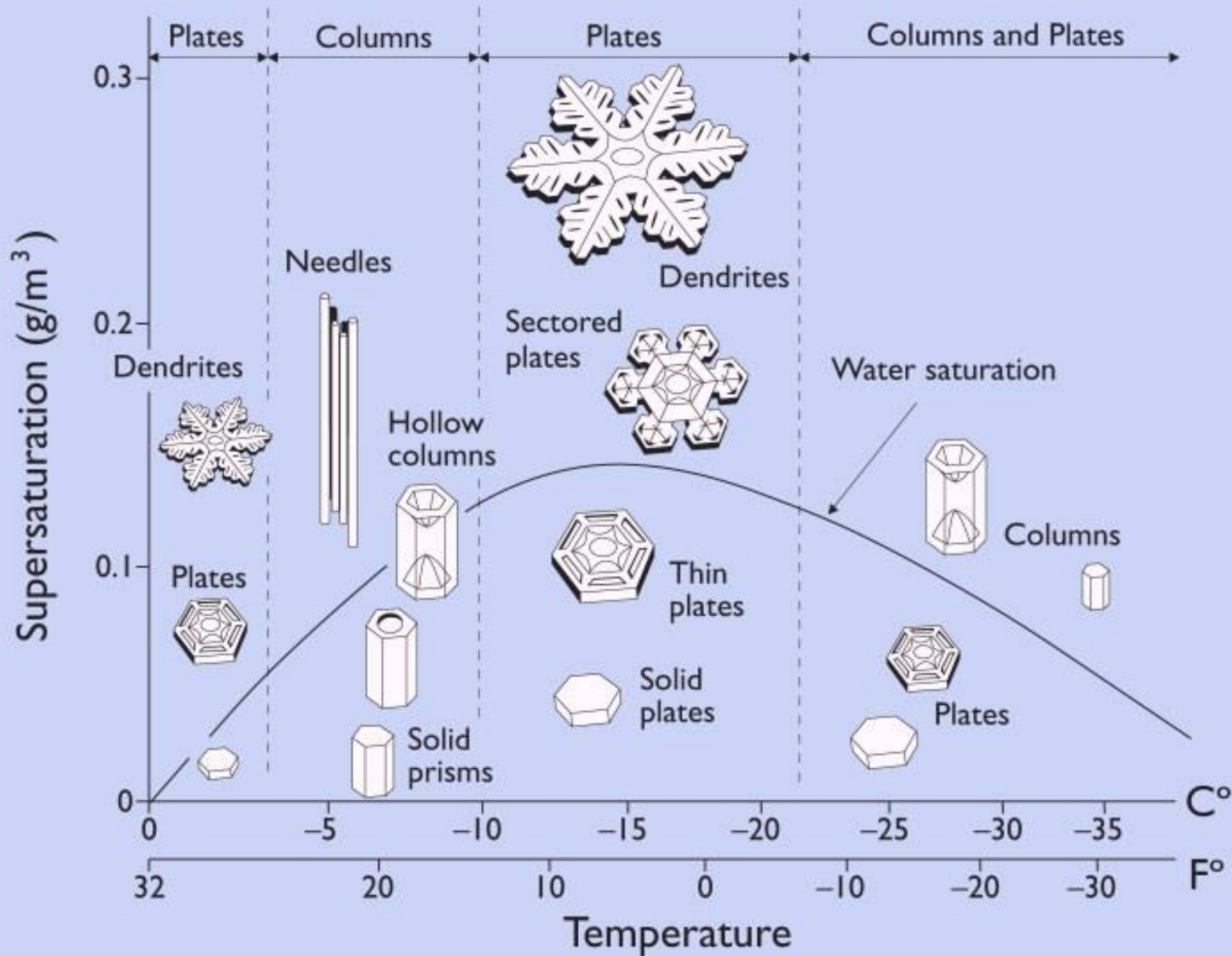
Frozen precipitation melts in shallow warm air. Then refreezes into sleet before reaching the surface.

Snow

Snow falls through cold air and reaches the surface

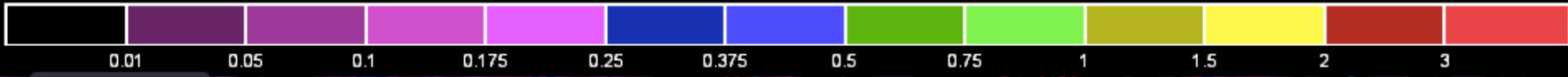
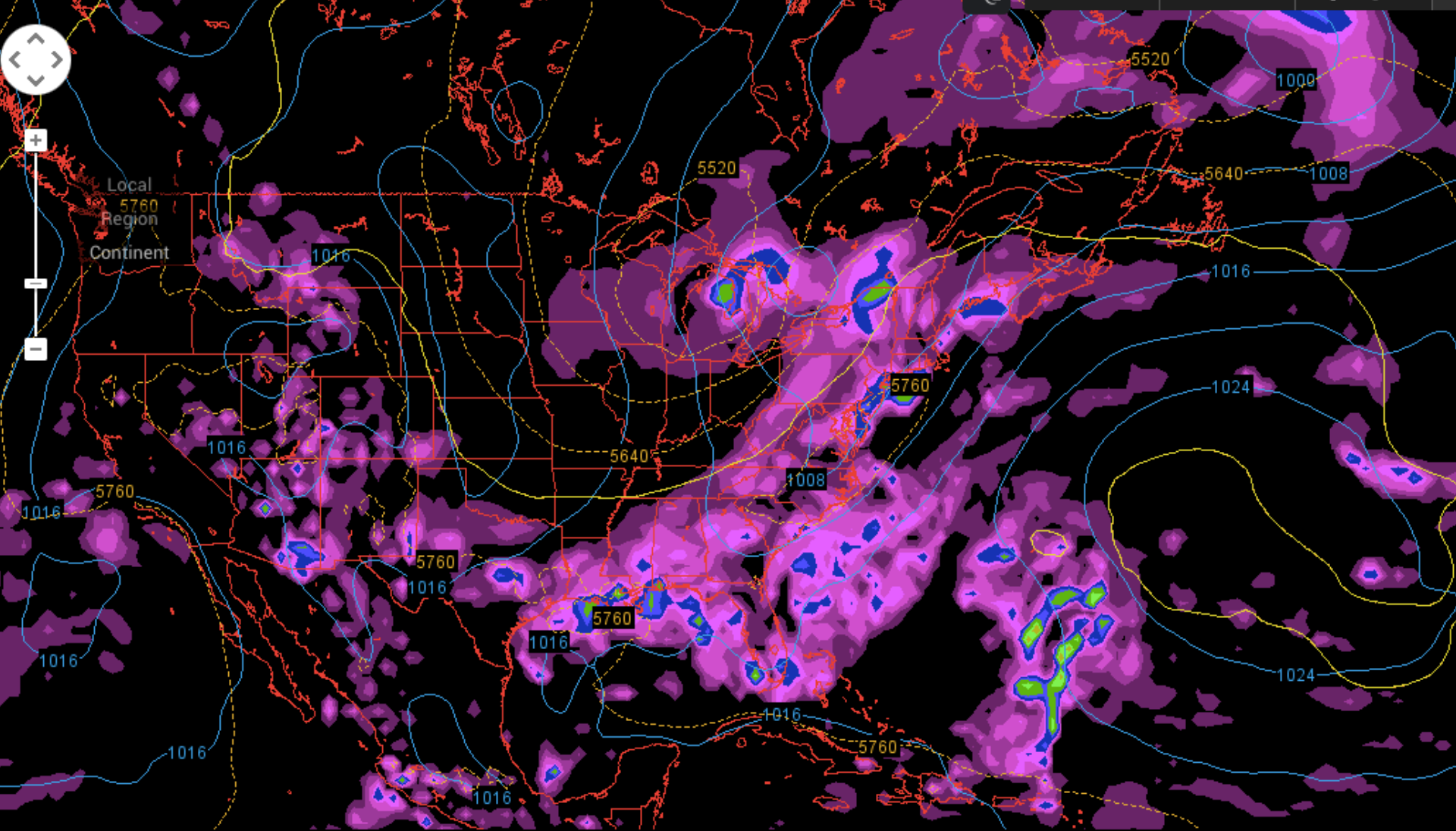






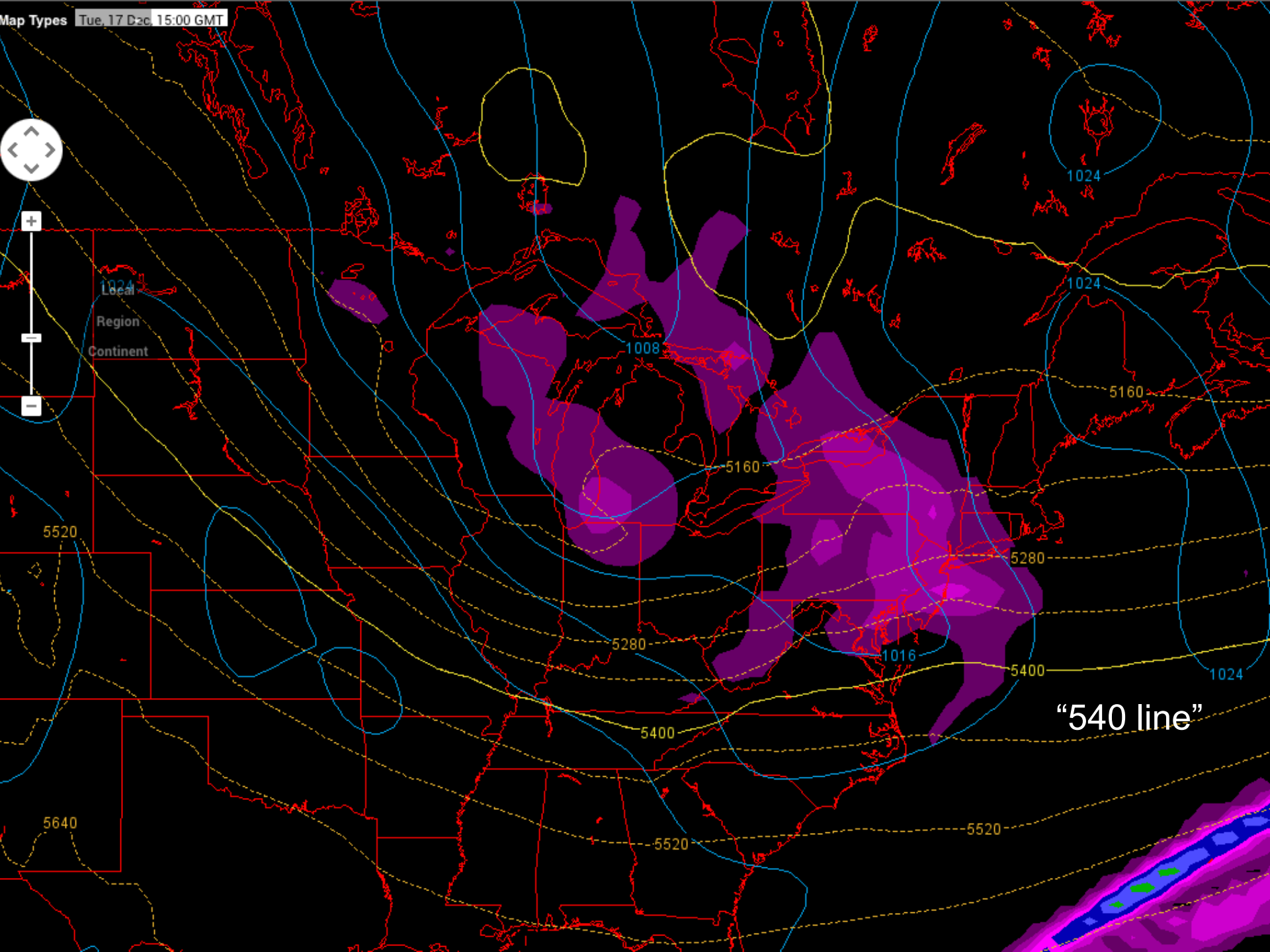
Connection to 500 mb Charts

- ✦ Describe contours as heights or thicknesses
- ✦ Ideal Gas Law ($pV=nRT$)
- ✦ Volume increases with temperature
- ✦ Higher 500 mb heights = warmer air
- ✦ Good way to evaluate temperature throughout the layer
- ✦ “540 line” is a good estimate of rain/snow line





Local
Region
Continent



Air Temperature and Snow

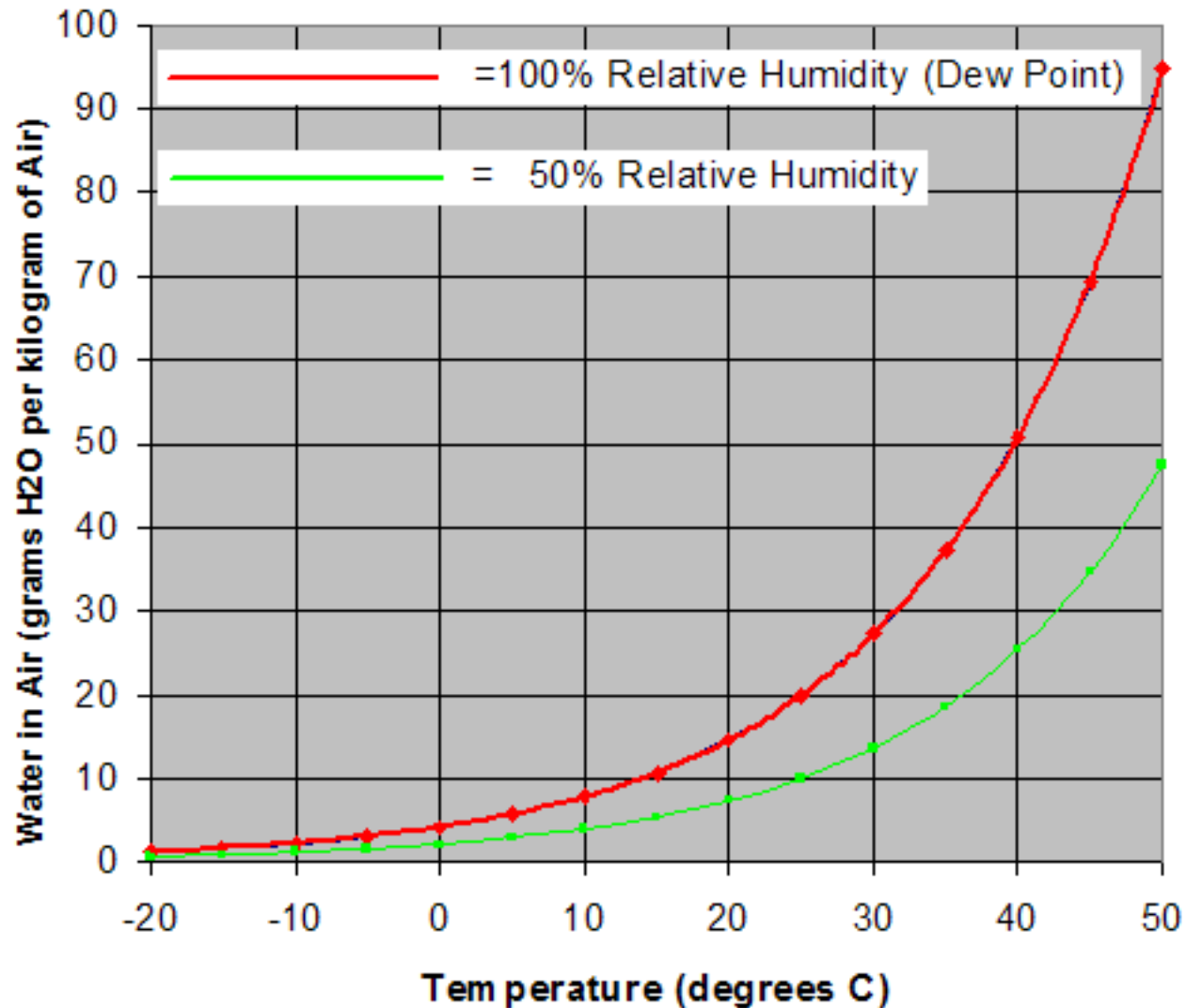
- ✦ When is it too warm to snow?
- ✦ Is it ever too cold to snow?
- ✦ How does a snow cover influence the air temperature during daylight?
- ✦ How does a snow cover influence the air temperature at night?

Too Cold to Snow?

- ✦ Available Moisture vs. Temperature
- ✦ Capacity vs. Temperature
- ✦ Air does not “hold” water
- ✦ Warmer air has the potential for more available moisture

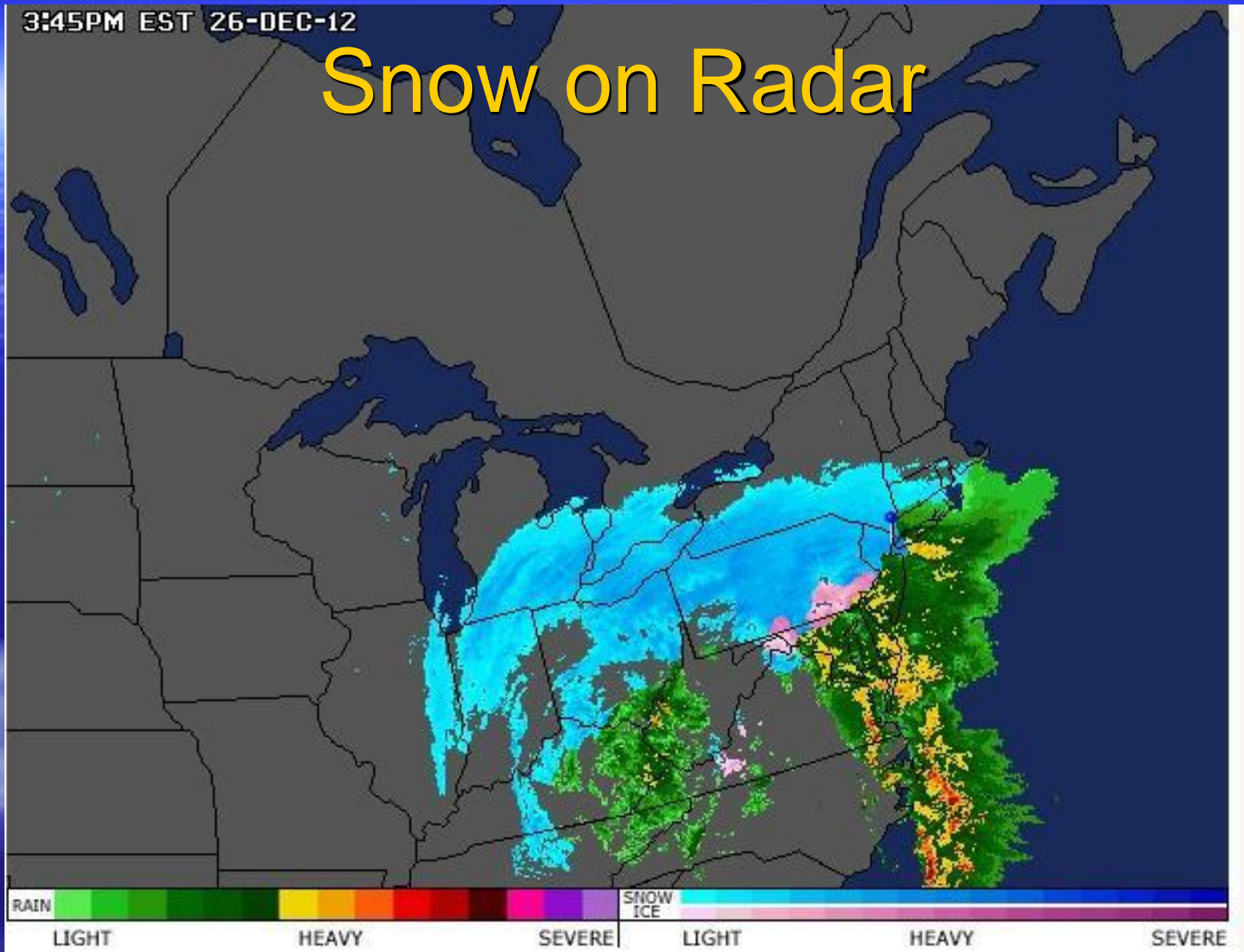
Amount of Water in Air at 100% Relative Humidity Across a Range of Temperatures

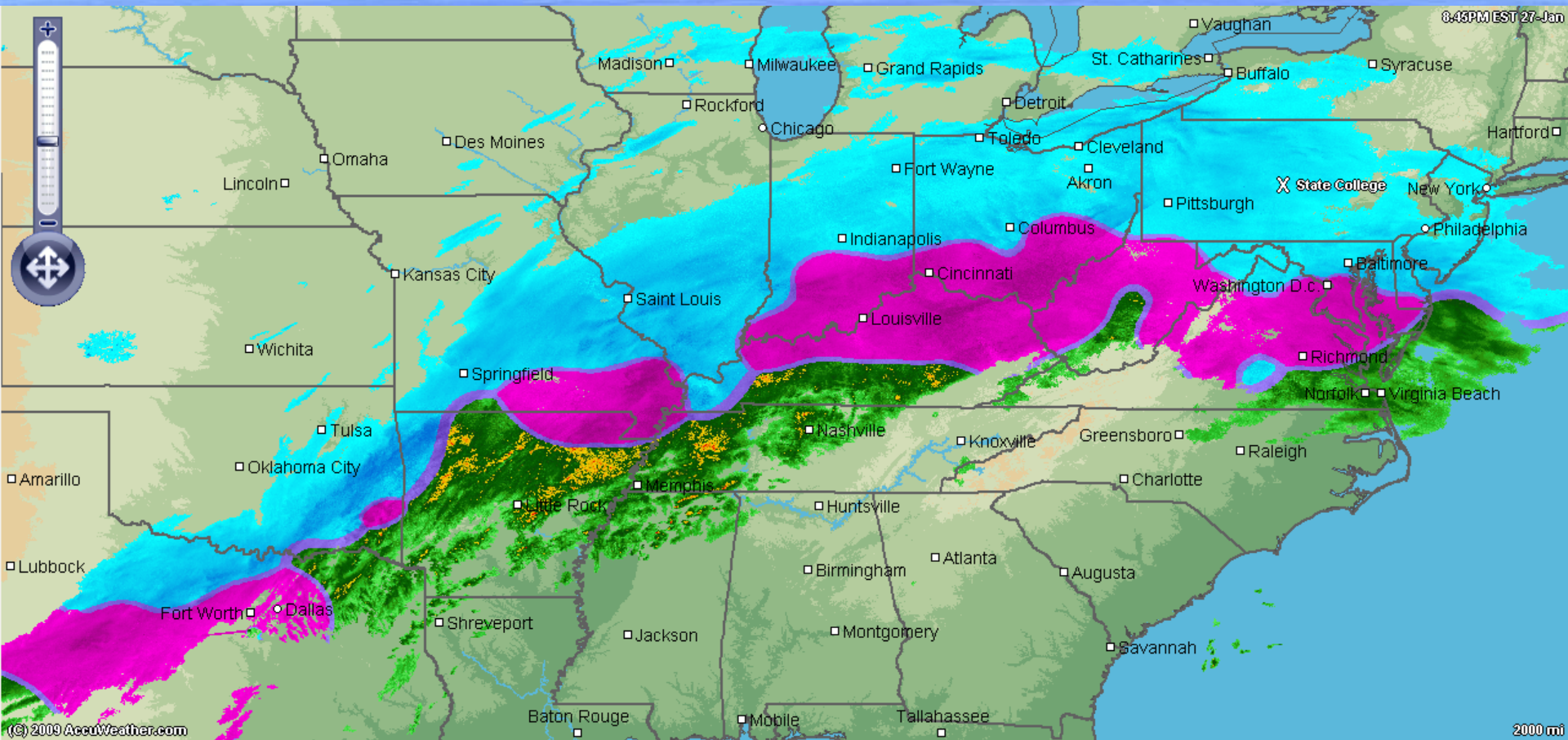
Calculated with tool at <http://www.lennetch.com/calculators/relative-humidity.htm>



3:45PM EST 26-DEC-12

Snow on Radar

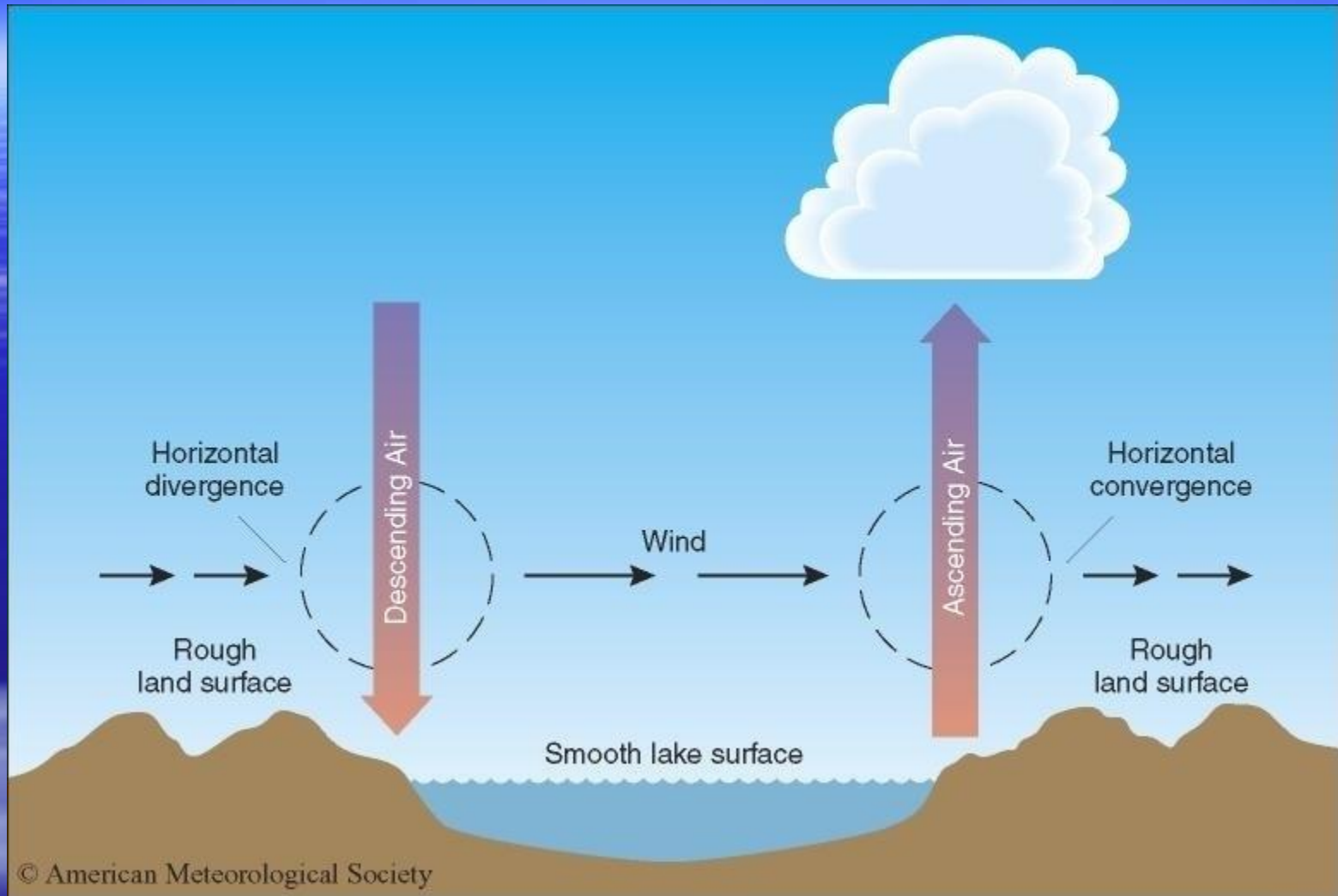




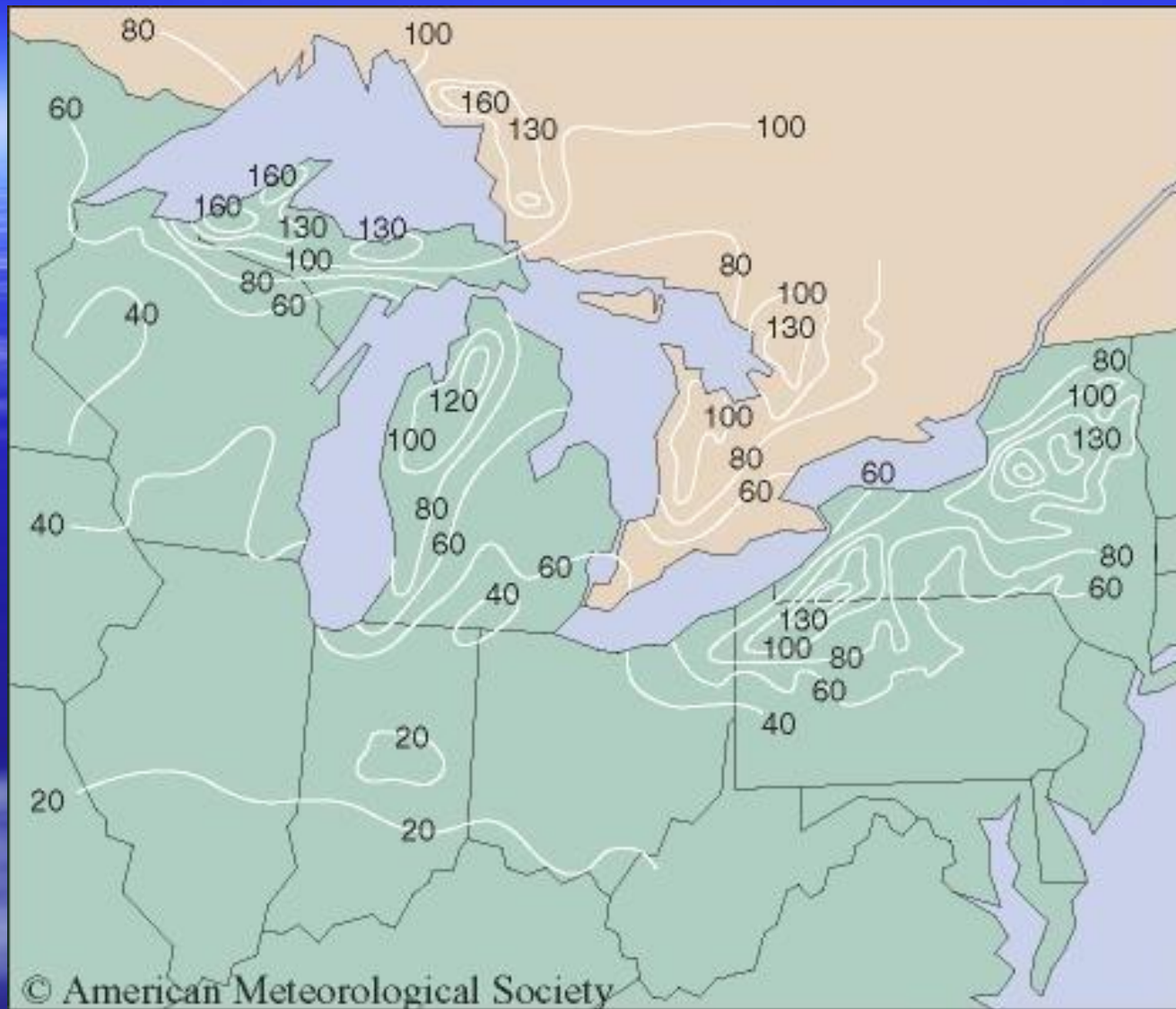
Lake-Effect Snow

- ✦ Favorable conditions
- ✦ Great Lakes
- ✦ Lake-enhanced snow
- ✦ Great Salt Lake
- ✦ Ocean-effect snow

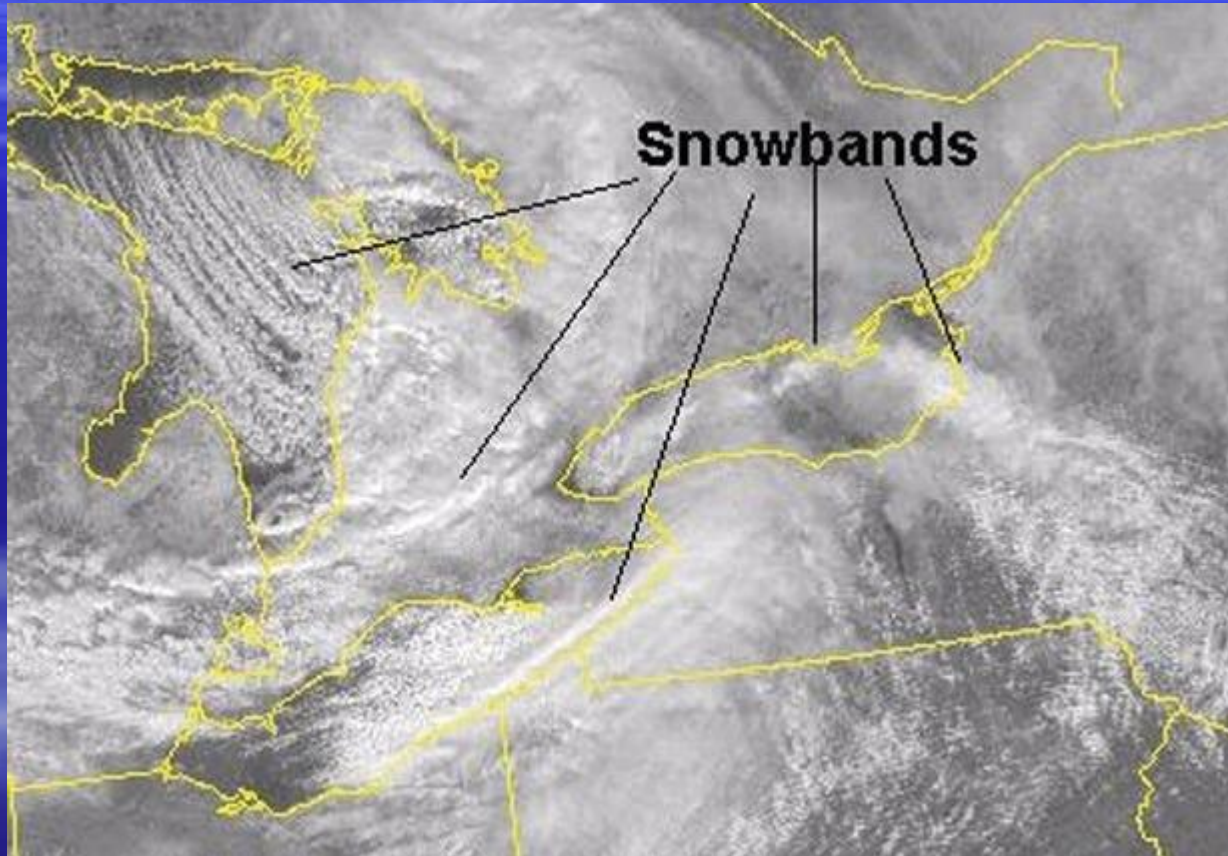




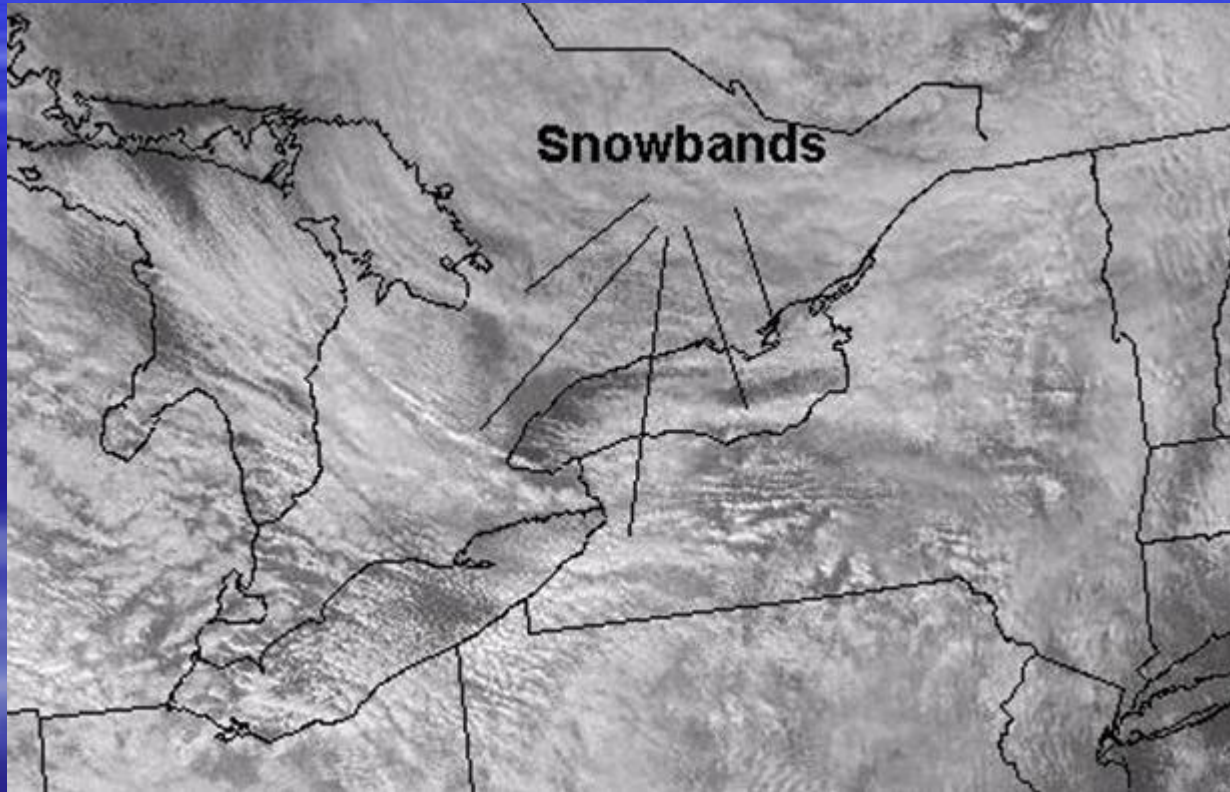
See the “toll booths”?



Shore Parallel Snow Bands



Wind Parallel Snow Bands



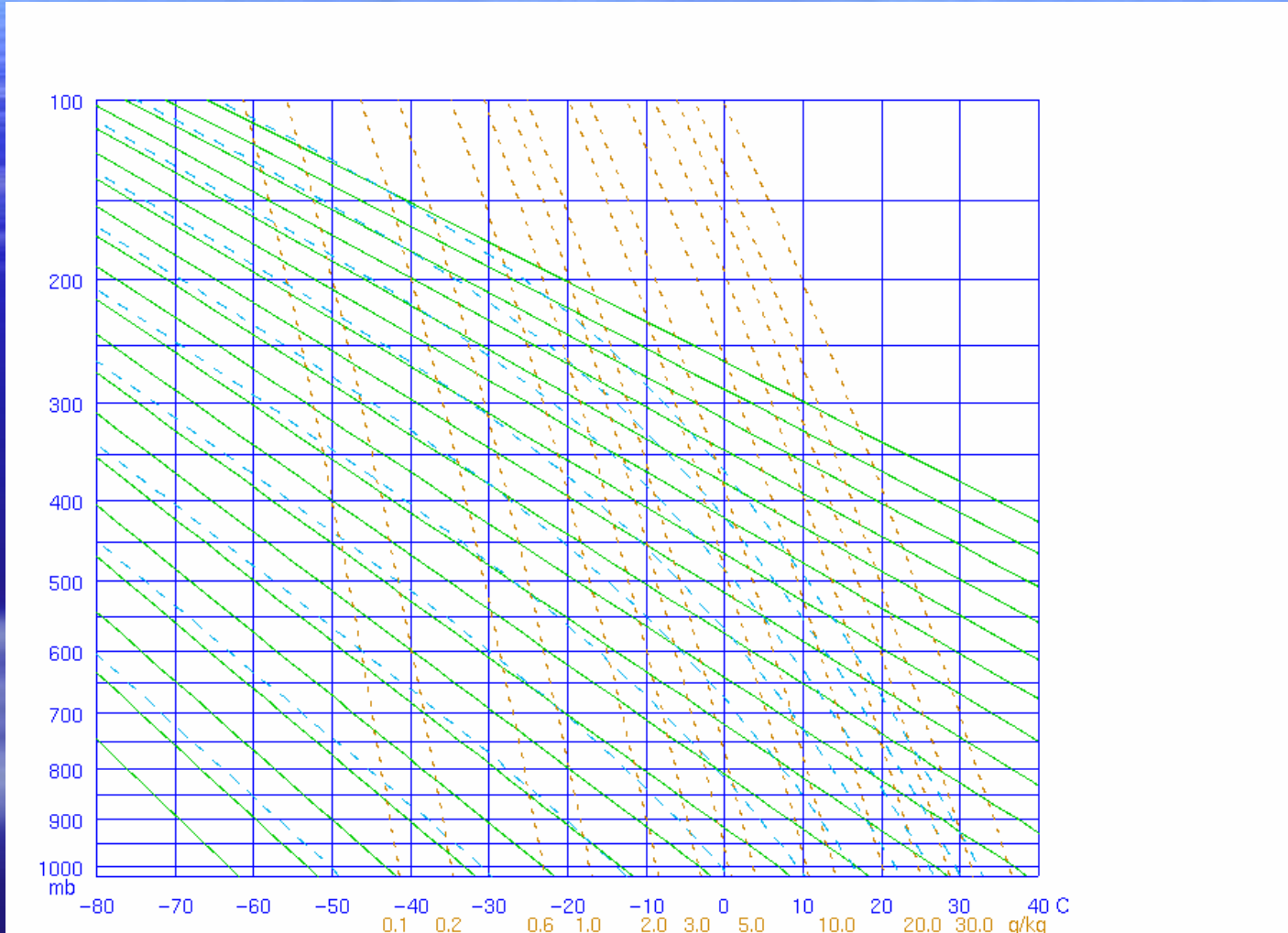
A satellite image of Earth's surface, showing a large area of white cloud cover over the ocean. The landmasses are visible in shades of brown and green. A white rounded rectangle with a blue border is overlaid on the image, containing the URL.

<http://earthobservatory.nasa.gov>

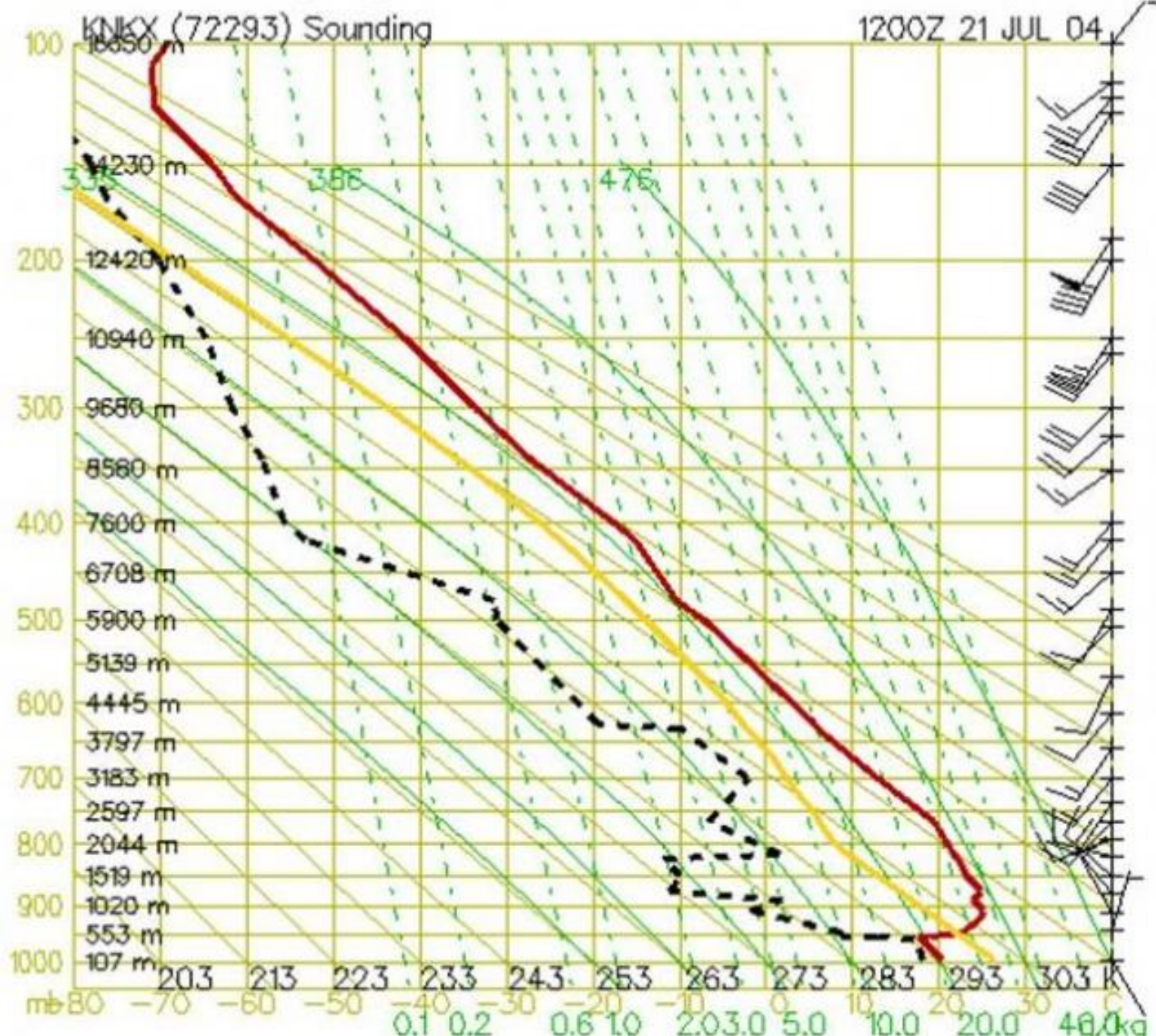
Ocean Effect Snow



Stüve Diagram



Plymouth State Weather Center



WMO:72293
 TP:124
 FRZ:572
 WB0:645
 PW:0.78
 RH:24.9
 MAXT 37.2
 TH:5793
 L57:7.3
 LCL:966
 Lt6.7
 S:10.8
 TT:28
 K:6
 SW:29
 EI:2.0
 -PARCEL-
 CAPE:72
 CNH:60174
 LCL:800
 CAP:13.1
 LFC:-1
 -WIND-
 STM 261/7
 HEL:-49
 SHR+:0.0
 SRDS:91
 EH:0.0
 BRN:2.9
 BSHR:24

Plymouth State Weather Center

KNKX (72293) Sounding

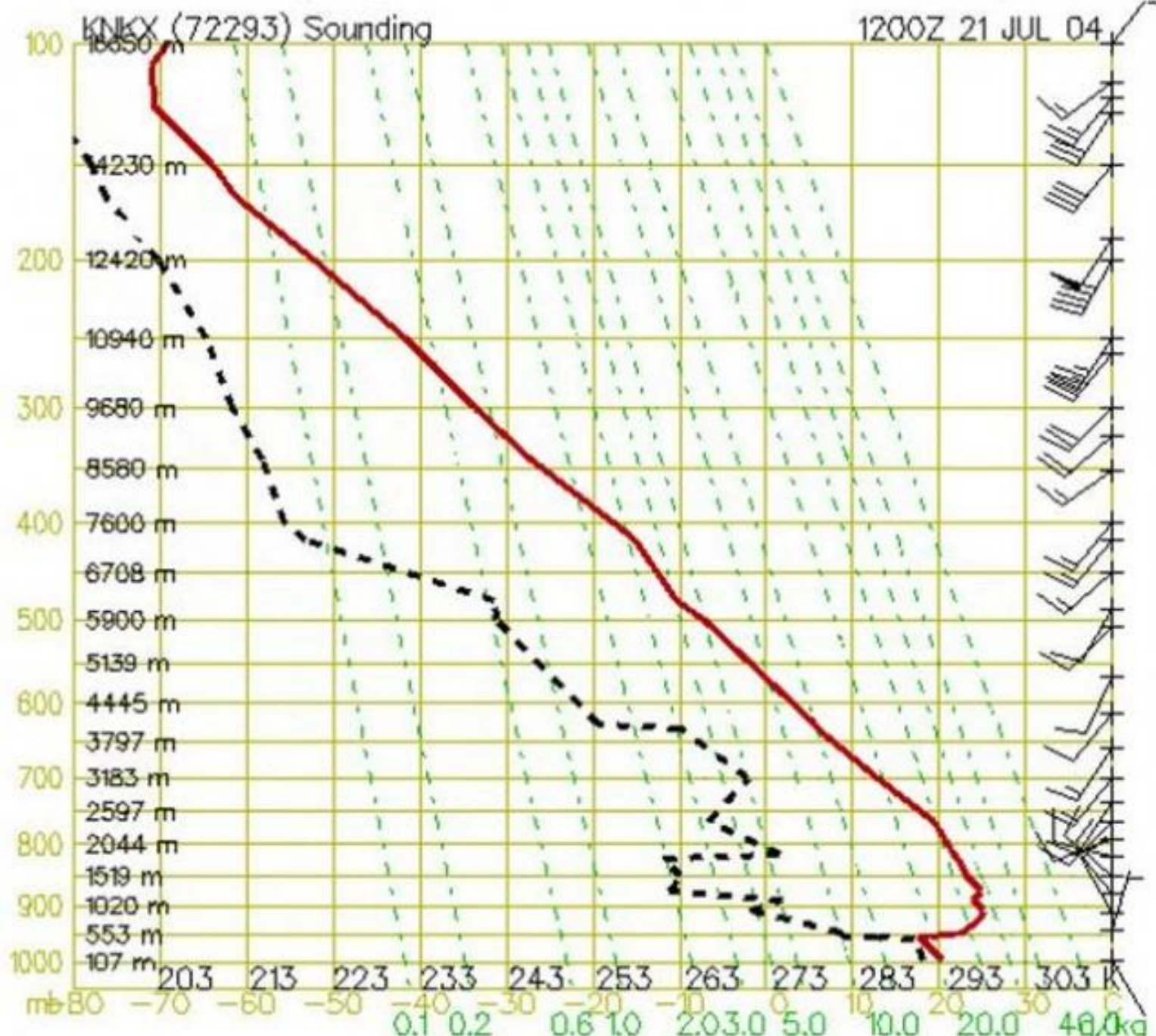
1200Z 21 JUL 04



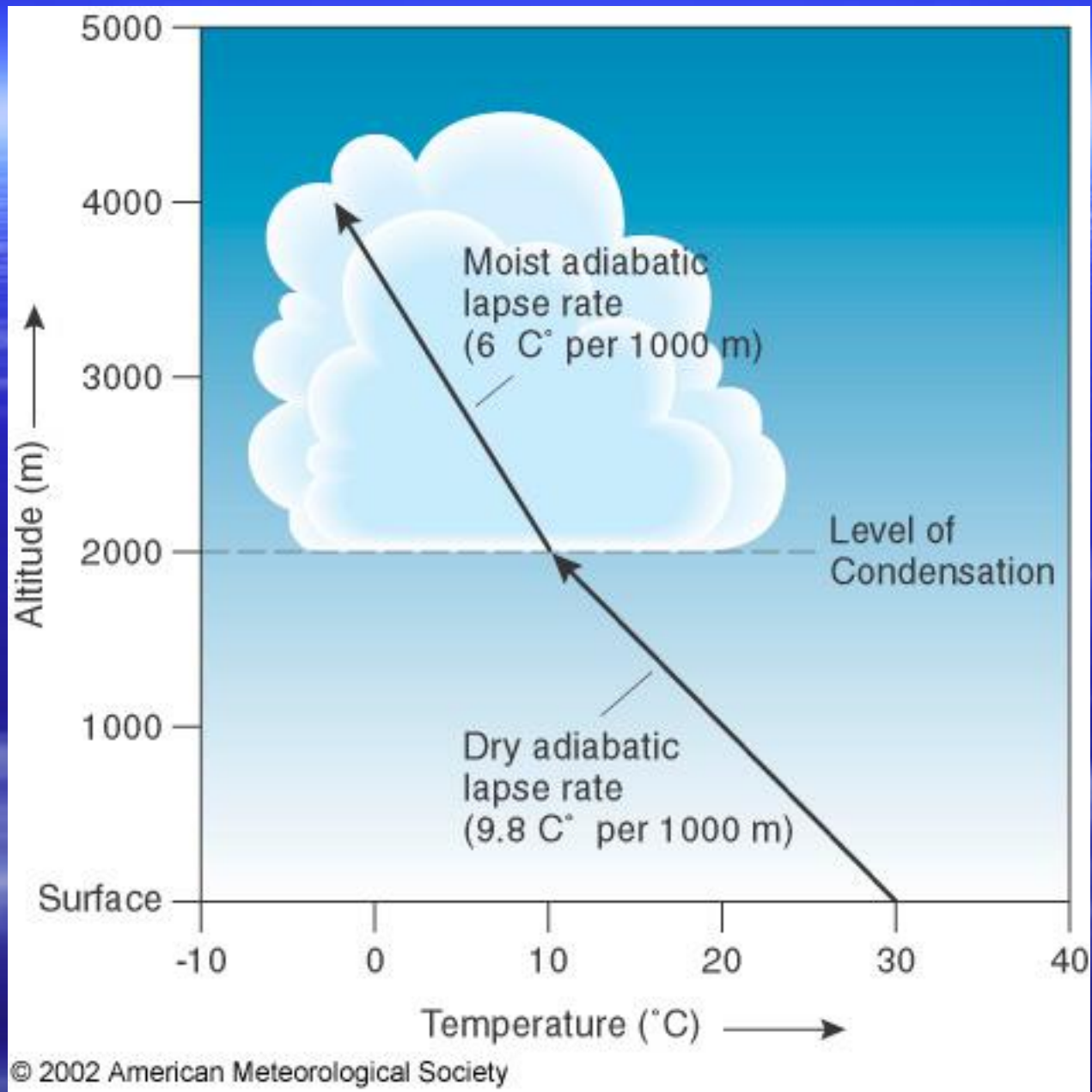
WMO:72293
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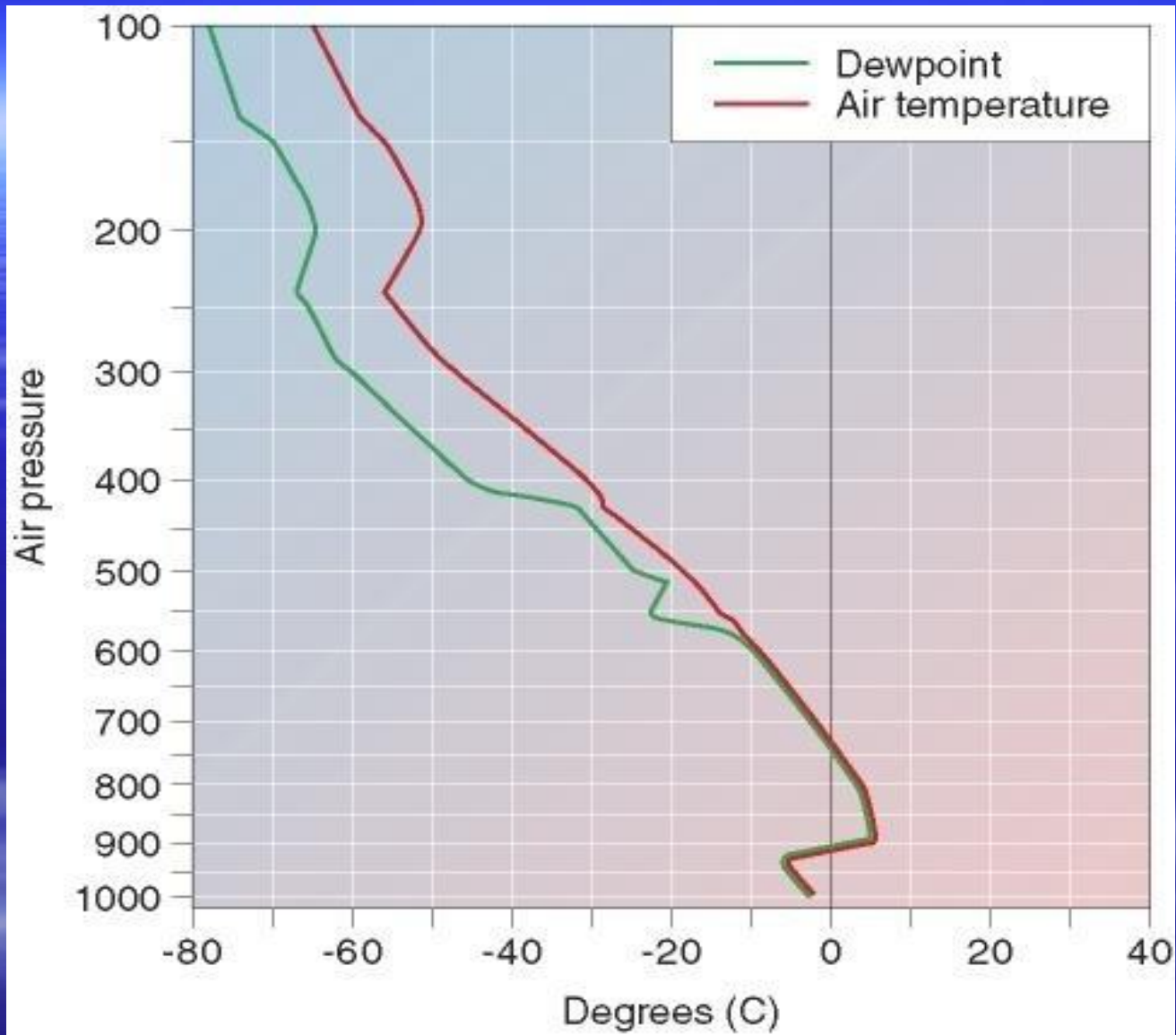
mb 80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 C

Plymouth State Weather Center



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Satellite

Infrared - Latest	Latest IR Animation	Infrared - 00Z	Infrared - 12Z
Visible - Latest		Visible - 18Z	
Water Vapor - Latest	Latest WV Animation		GOES Satellite Server

Additional Satellite Links

Upper Air

850 mb - Contours, Isotherms, & Data	00Z - 500 mb - Analysis
700 mb - Contours, Isotherms, & Data	12Z - 500 mb - Analysis
500 mb - Contours, Isotherms, & Data	500 mb - Data
300 mb - Contours, Isotachs (wind speed) & Data	300 mb - Data
Stüves for Selected Cities	Upper Air Data - Text
Available Upper Air Stations	

Additional Upper Air Links

Watches, Warnings, Advisories and Forecasts

Current NWS Weather Watches and Warnings	Weather-Ready Nation
NWS Short-Range Forecast Maps	Quantitative Precipitation Estimates

Additional Severe Weather/Forecast Links

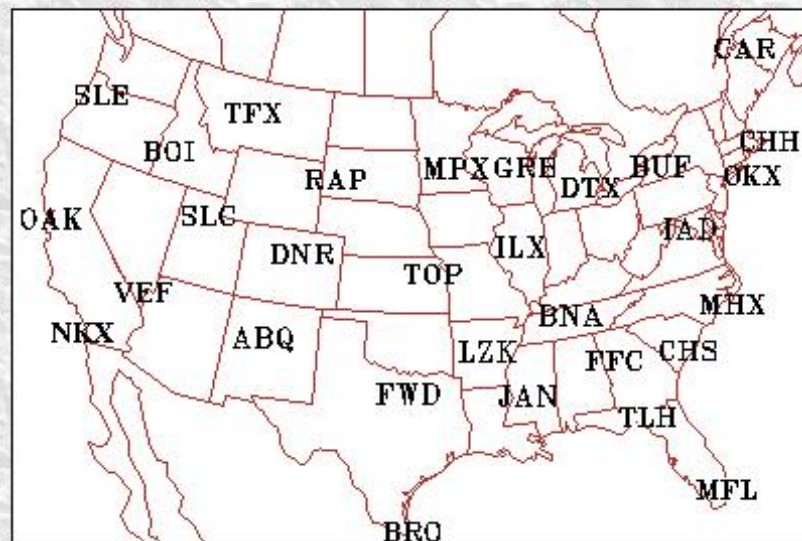
Alaska	Hawaii and Pacific	Puerto Rico and Caribbean
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Additional International Links

Climate

National Temps/Precip.	NOAA Climate Services	U.S. Climatology
Local NWS Offices	NNDC Climate Data Online	Drought Monitor
World Climate		

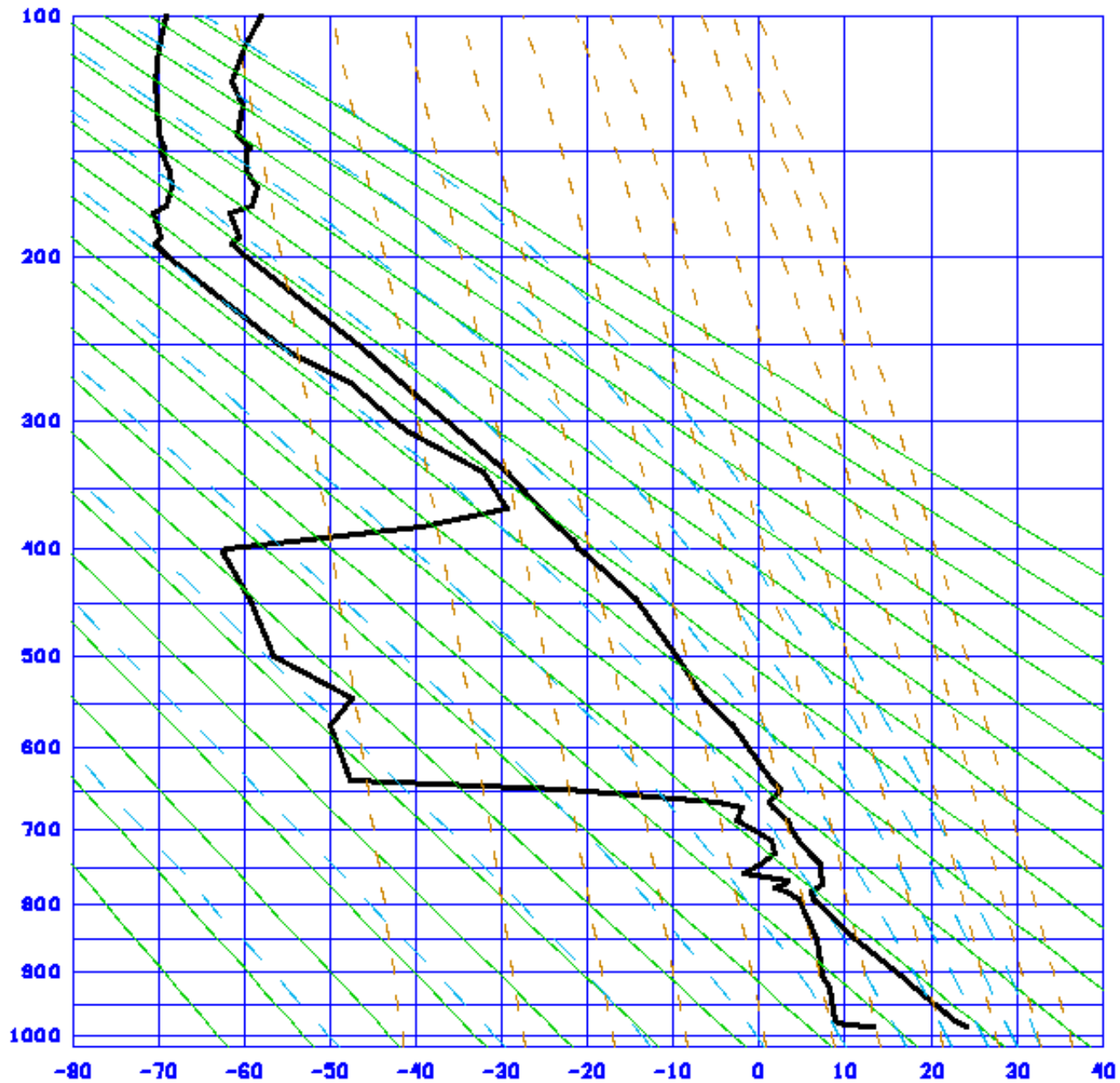
Stüves for Selected Cities in the US



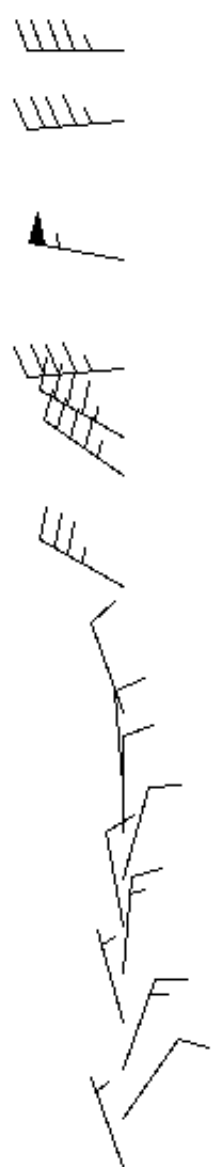
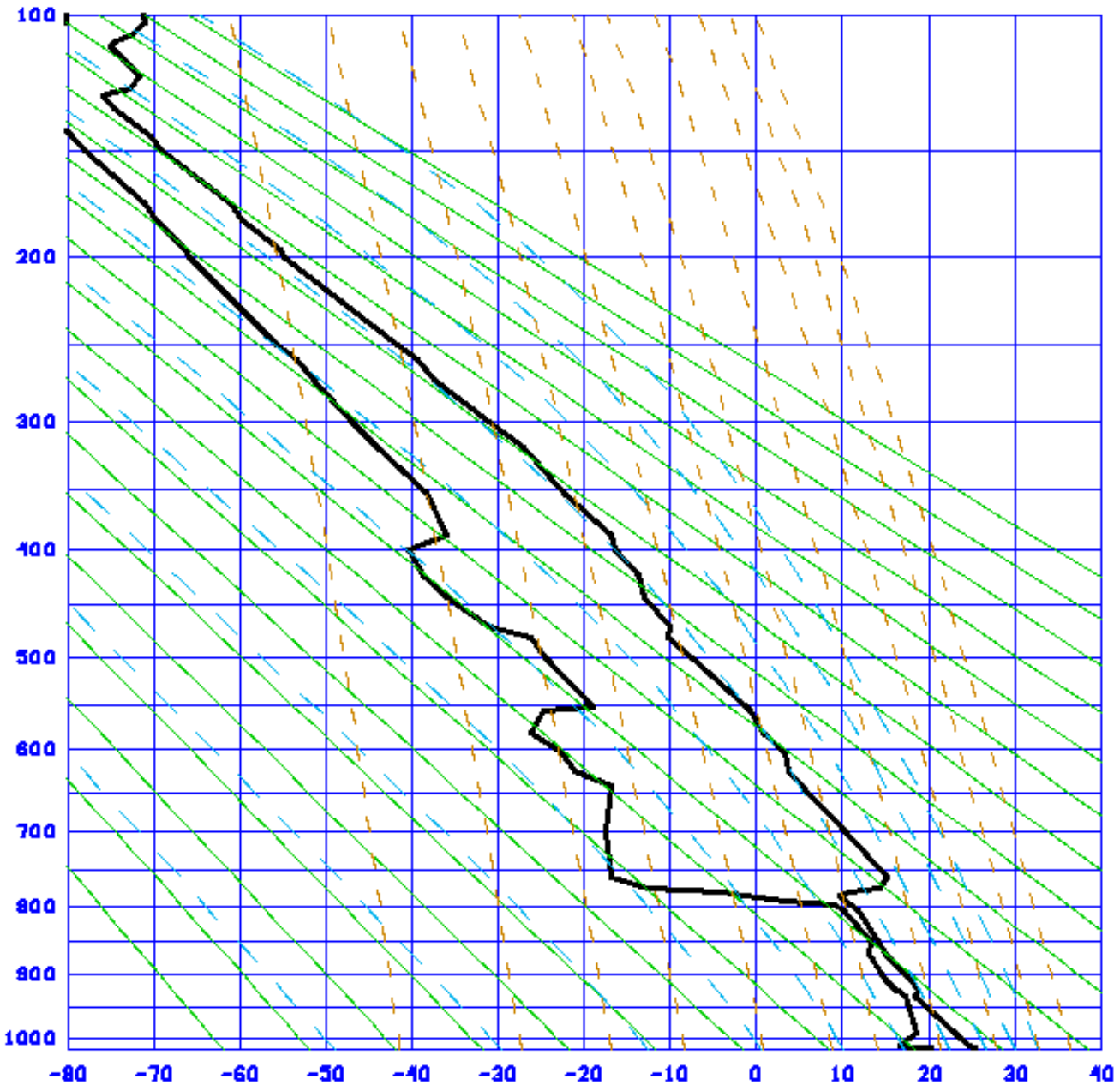
Click on a city listed below to get the current Stüve diagram for that city.

The list is sorted alphabetically by station ID.

PANC - Anchorage, AK		PHTO - Hilo, HI
ABQ - Albuquerque, NM	BNA - Nashville, TN	BOI - Boise, ID
BRO - Brownsville, TX	BUF - Buffalo, NY	CAR - Caribou, ME
CHH - Chatham, MA	CHS - Charleston, SC	DNR - Denver, CO
DTX - Detroit, MI	FFC - Peachtree City, GA	FWD - Dallas, TX
GRB - Green Bay, WI	IAD - Washington, DC	ILX - Lincoln, IL
JAN - Jackson, MS	LZX - Little Rock, AR	MFL - Miami, FL
MHX - Morehead City, NC	MPX - Minneapolis, MN	NKX - San Diego, CA
OAK - Oakland, CA	OKX - Brookhaven, NY	RAP - Rapid City, SD
SLC - Salt Lake City, UT	SLE - Salem, OR	TFX - Great Falls, MT
TLH - Tallahassee, FL	TOP - Topeka, KS	VEF - Las Vegas, NV



Handwritten notes on the right side of the plot, including a large bracket and several arrows pointing upwards.



Questions?