NATS 101
Section 13: Lecture 3

Weather vs. Climate

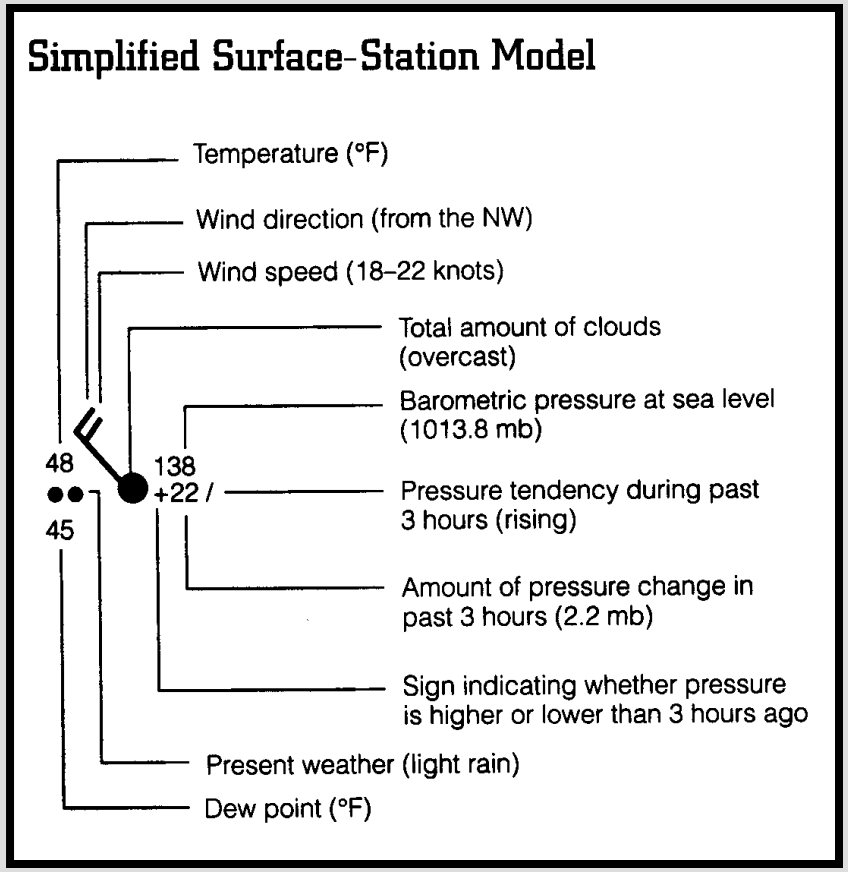
Definition of Weather

Weather: Condition of the atmosphere at a particular time and place.

Comprised of:

Air temperature: Degree of hotness or coldness
Air pressure: Force of the air above
Humidity: Amount of water vapor in the air
Clouds: Water droplets (liquid) or ice crystals (solid) above the surface
Precipitation: Water that falls clouds and reaches ground
Visibility: Farthest distance one can see.
Wind: Horizontal movement of air

Surface Station Model (U.S.)

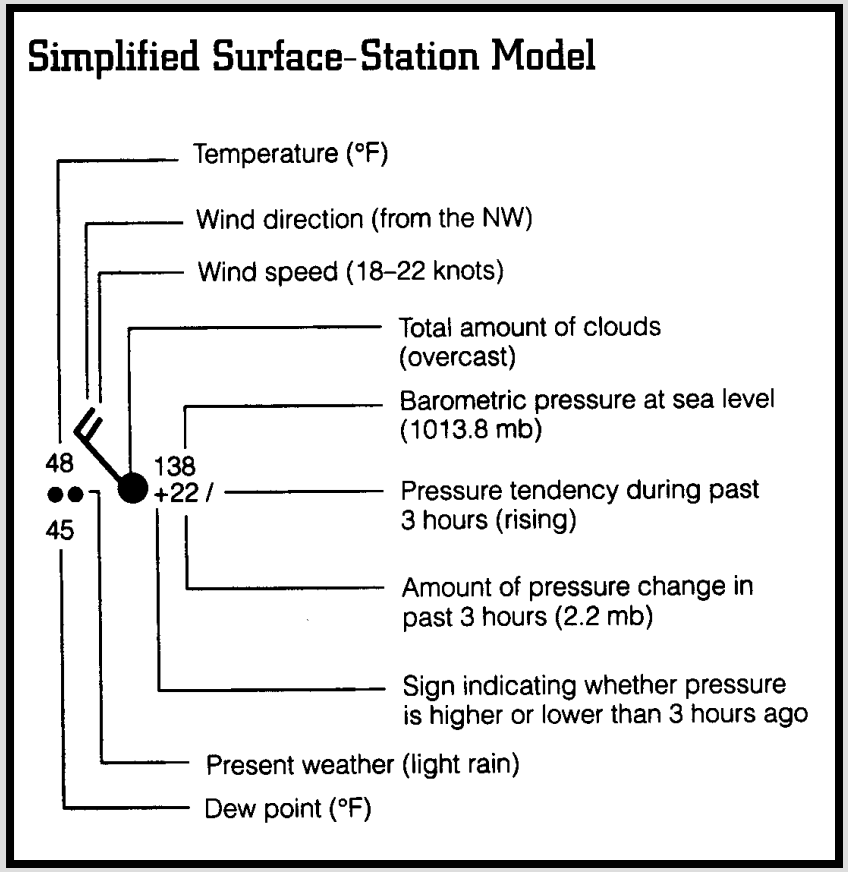


Notes: Temperature and Wind

Stations outside U.S. use degrees Celsius for temperature

Wind barb direction reverses in southern hemisphere.

Surface Station Model (U.S.)



Notes: Pressure

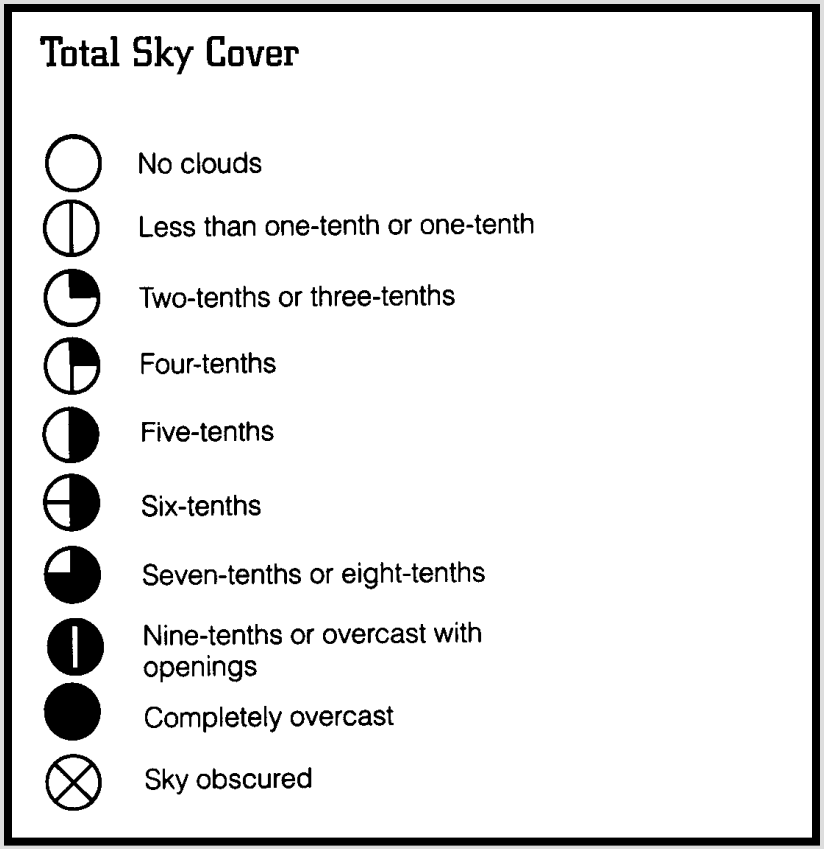
Leading 10 or 9 is not plotted for surface pressure

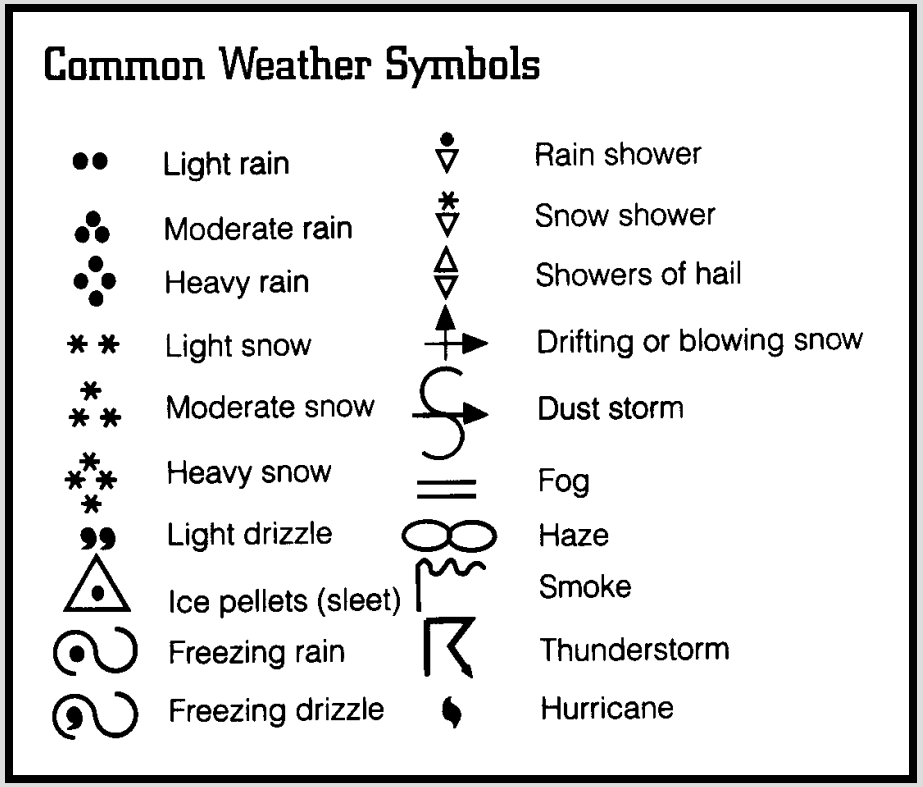
Greater than 500 = 950 to 999 mb

Less than 500 = 1000 to 1050 mb

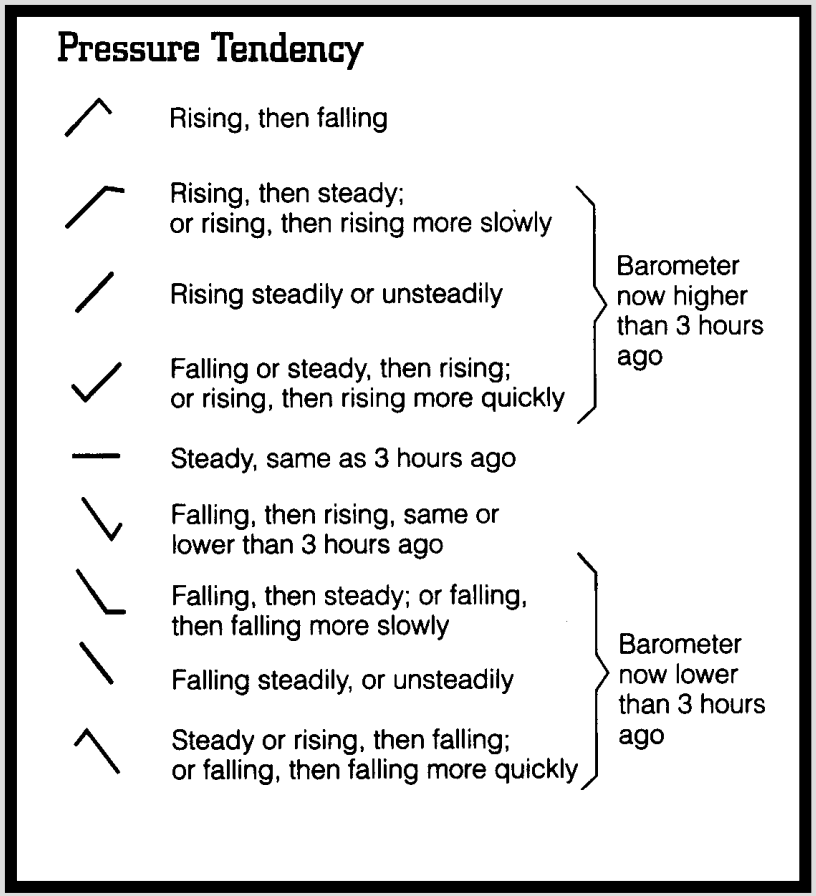
988 → 998.8 mb
200 → 1020.0 mb

Sky Cover, Weather Symbols on a Surface Station Model





Surface Pressure Tendency



Wind Speed

Wind Entries

	Miles (statute) per hour	Knots	Kilometers per Hour
	Calm	Calm	Calm
	1–2	1–2	1–3
	3–8	3–7	4–13
	9–14	8–12	14–19
	15–20	13–17	20–32
	21–25	18–22	33–40
	26–31	23–27	41–50
	32–37	28–32	51–60
	38–43	33–37	61–69
	44–49	38–42	70–79
	50–54	43–47	80–87
	55–60	48–52	88–96
	61–66	53–57	97–106
	67–71	58–62	107–114
	72–77	63–67	115–124
	78–83	68–72	125–134
	84–89	73–77	135–143
	119–123	103–107	144–198

How to read:

Half barb = 5 knots

Full barb = 10 knots

Flag = 50 knots

1 knot = 1 nautical mile per hour = 1.15 mph

 **= _____ knots**

Wind direction

NORTHERLY
From the north

360°

270°

90°

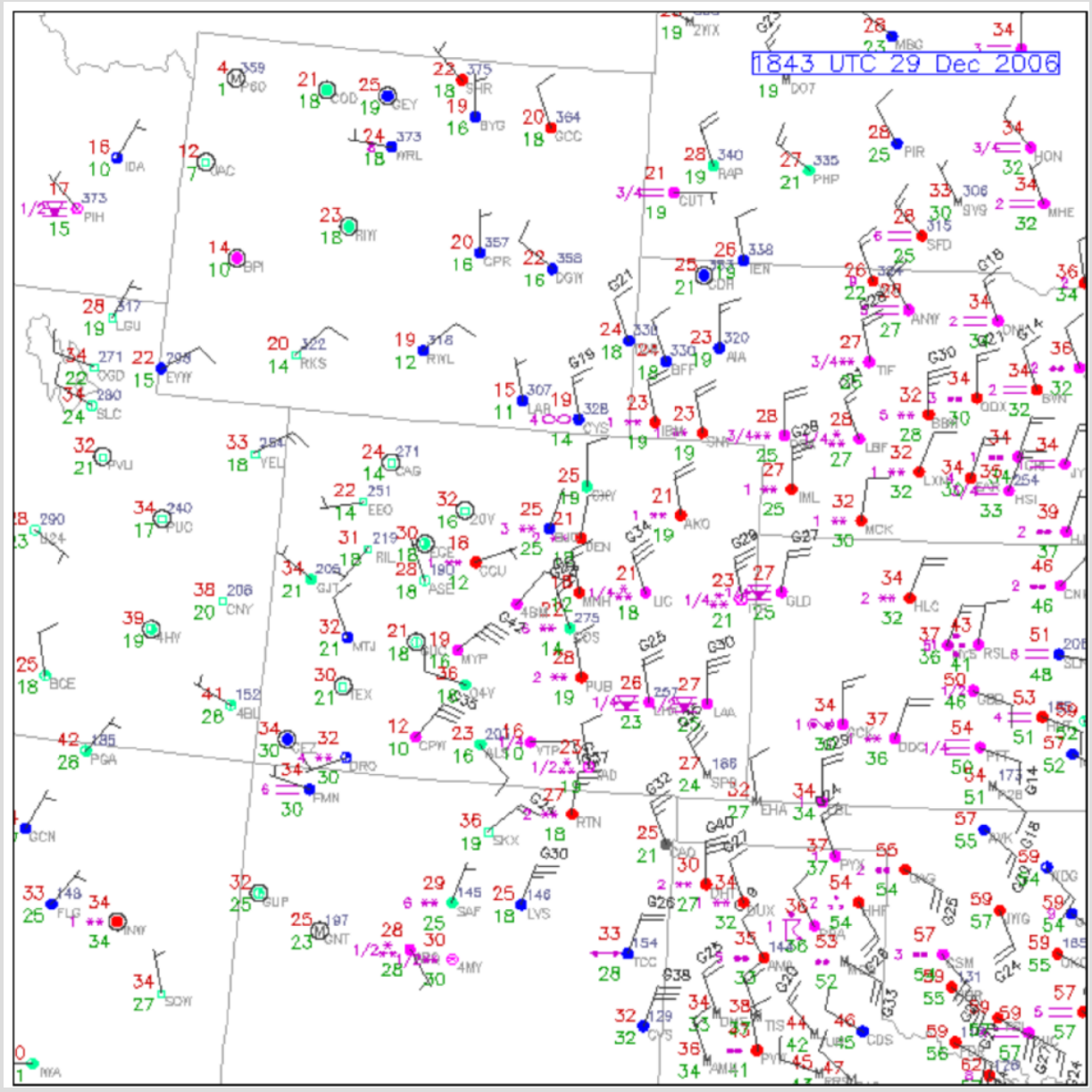
180°

WESTERLY
From the west

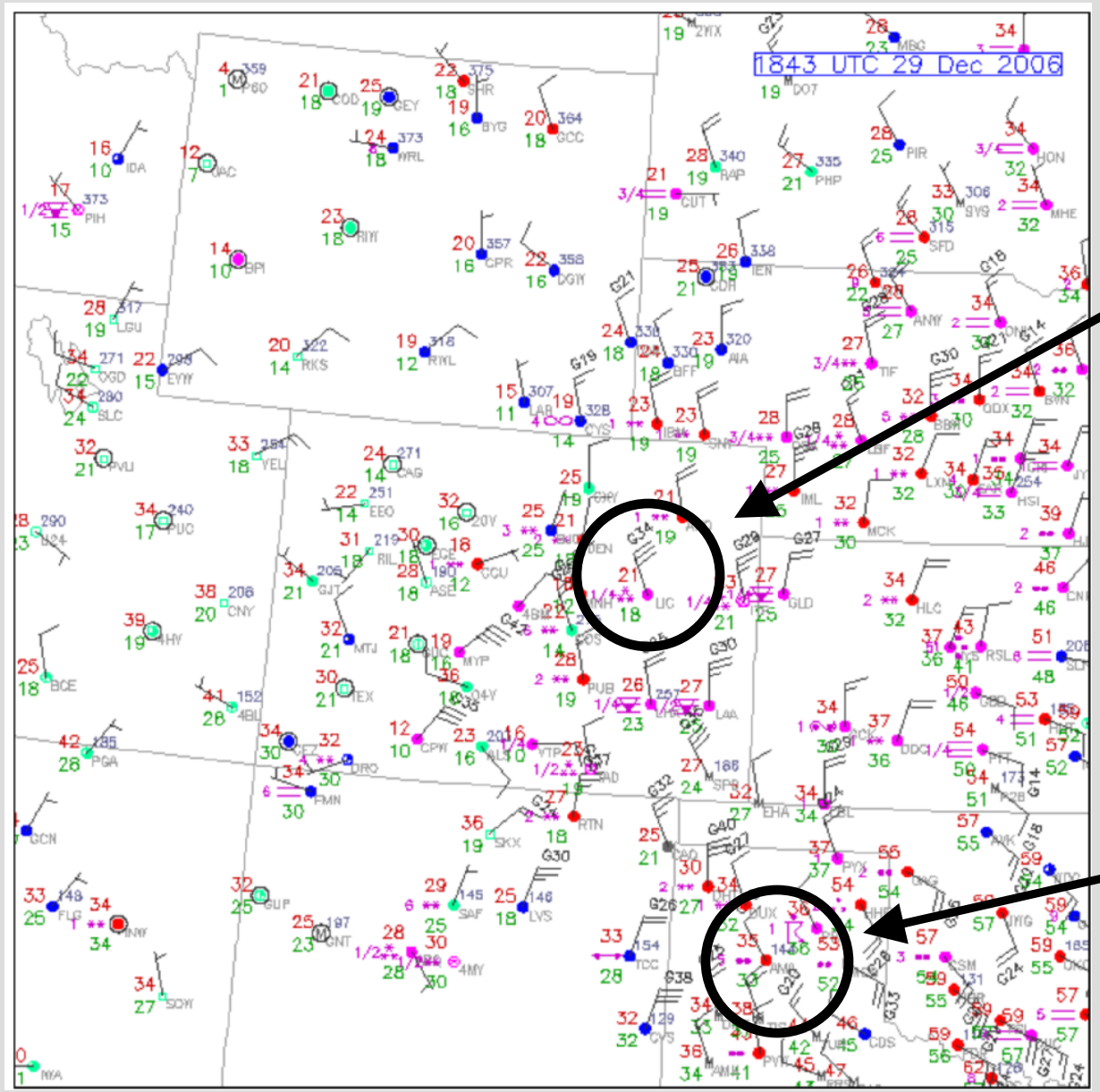
EASTERLY
From the east

SOUTHERLY
From the south

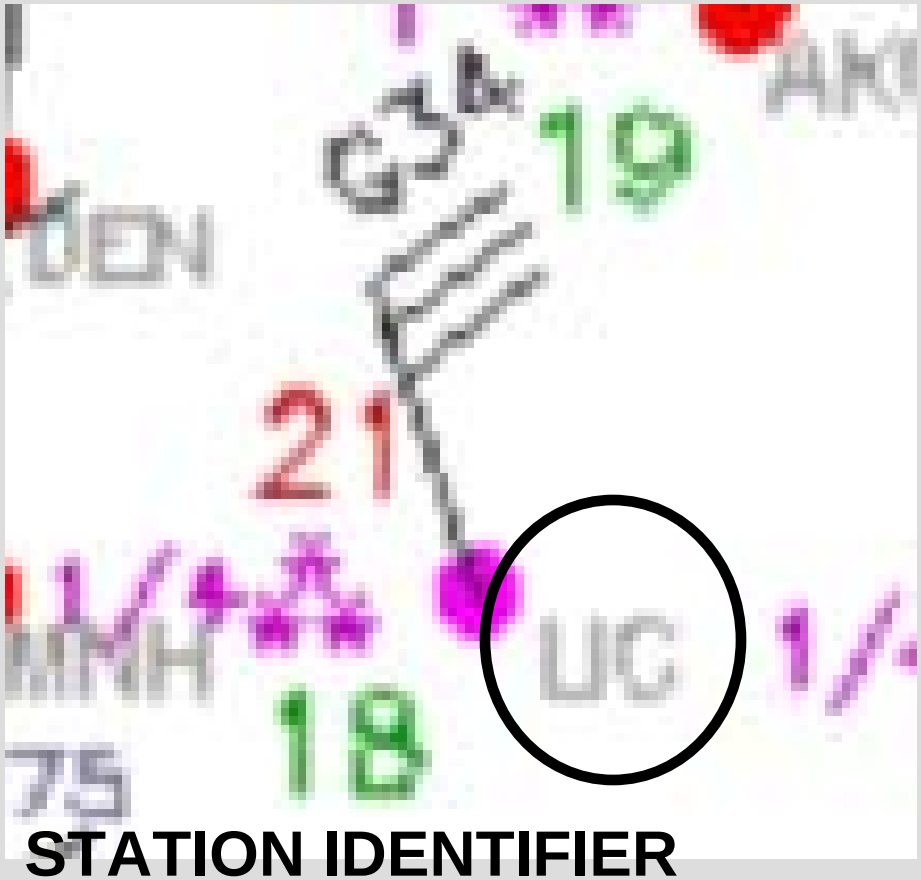
Eastern Colorado Snowstorm 12-29-06



(From UCAR RAP website)


1843 UTC 29 Dec 2006
LIMON, COLORADO
AMARILLO, TEXAS

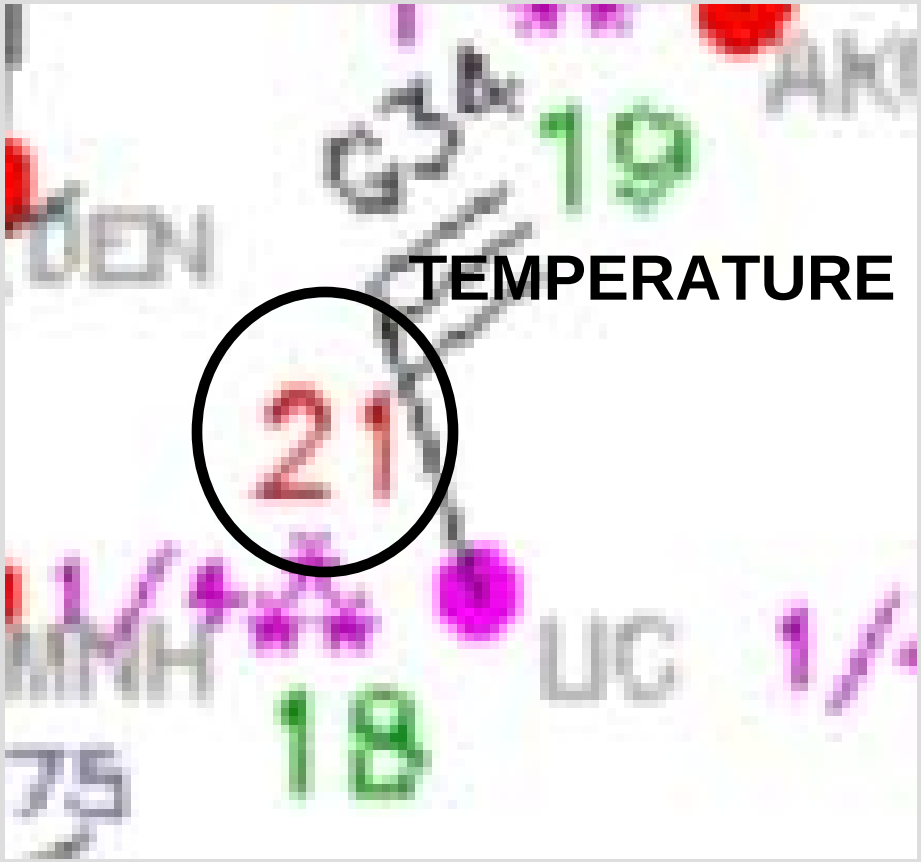
Limon, Colorado (LIC)



STATION IDENTIFIER

Weather conditions

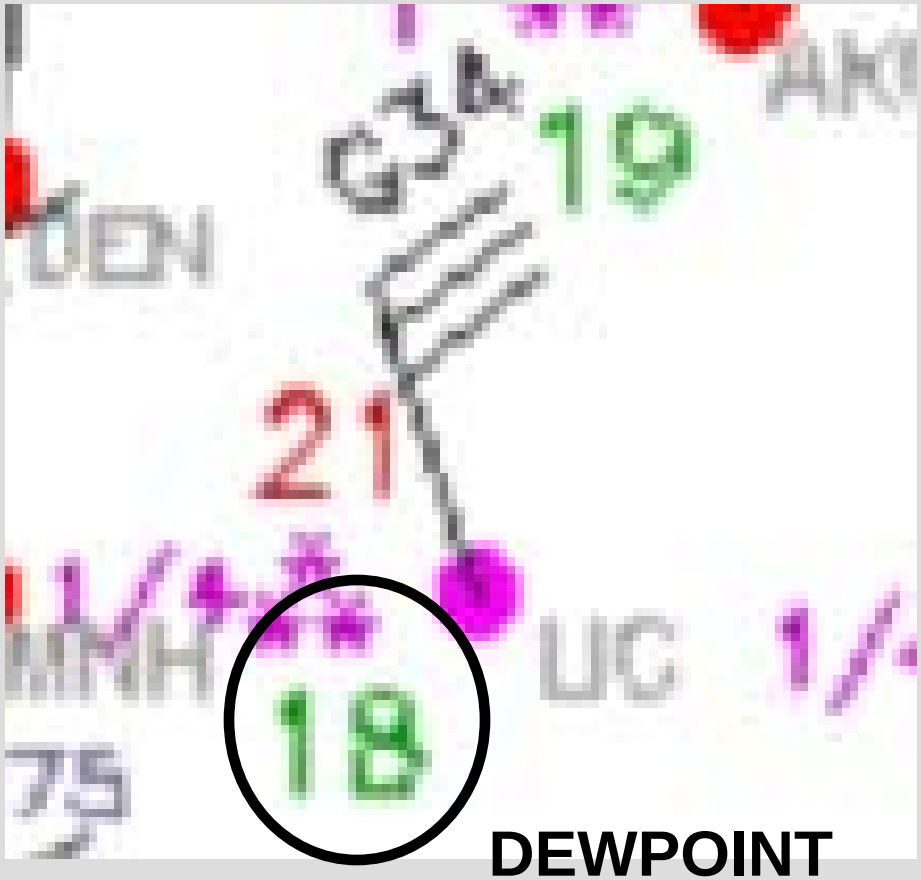
Limon, Colorado (LIC)



Weather conditions

Temperature: 21°F

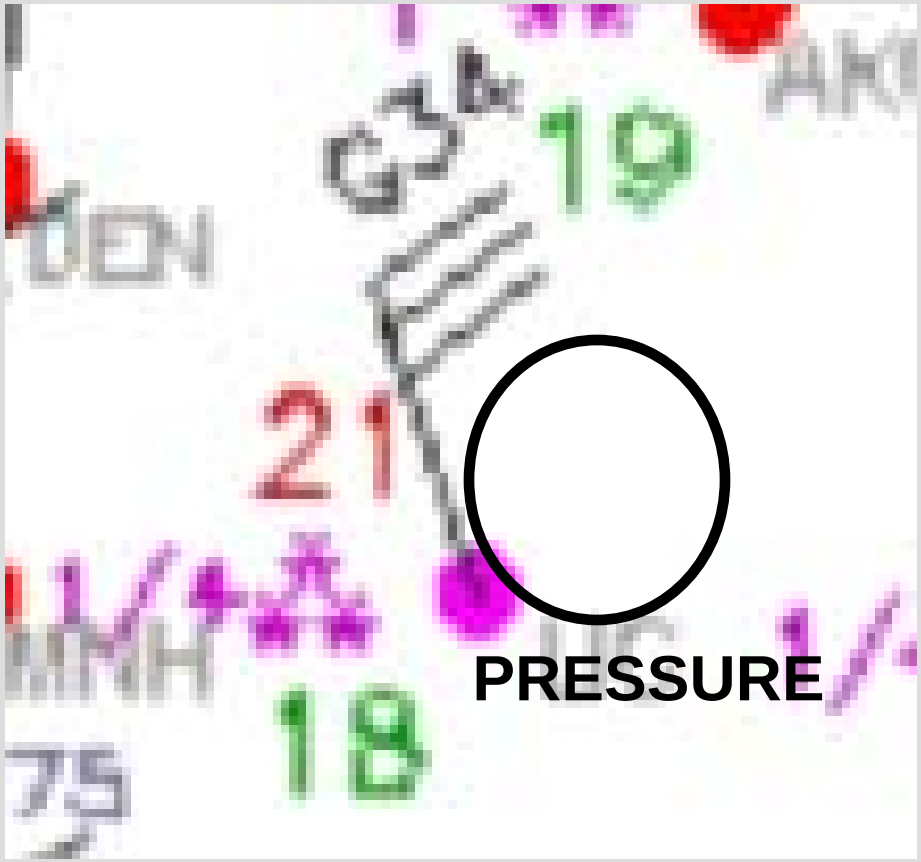
Limon, Colorado (LIC)



Weather conditions

Temperature: 21°F
Dewpoint: 18°F

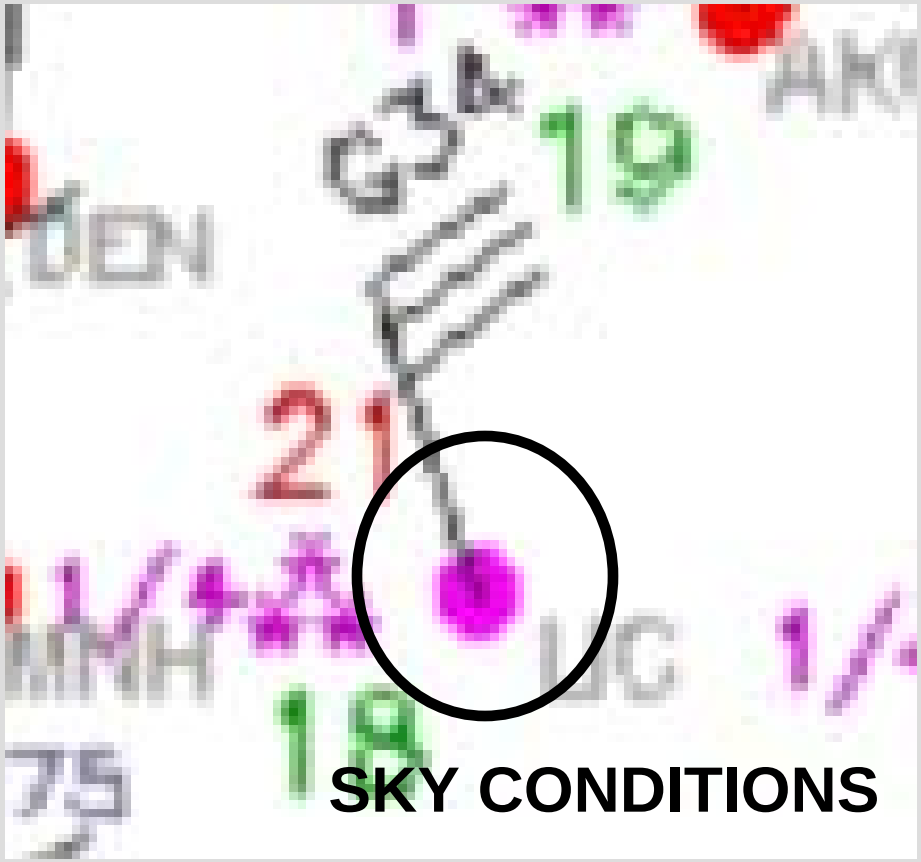
Limon, Colorado (LIC)



Weather conditions

Temperature: 21°F
Dewpoint: 18°F
Pressure: *Not available*

Limon, Colorado (LIC)



Weather conditions

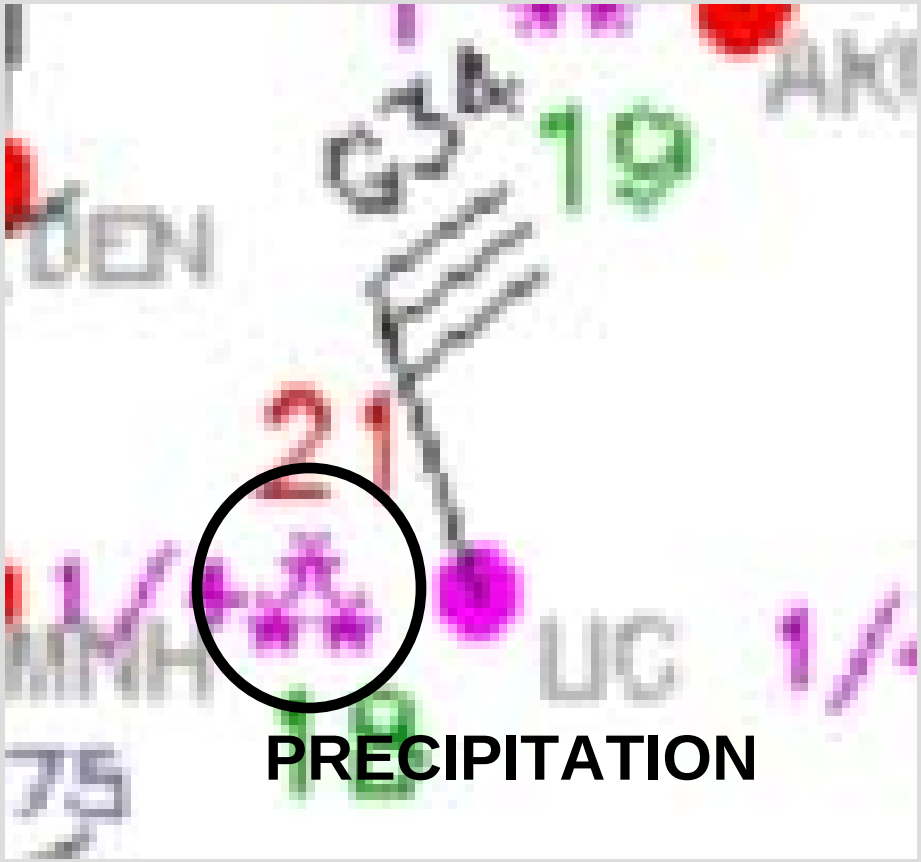
Temperature: 21°F
Dewpoint: 18°F
Pressure: Not available
Sky conditions: Overcast

Limon, Colorado (LIC)

Weather conditions

Temperature: 21°F
Dewpoint: 18°F
Pressure: Not available
Sky conditions: Overcast
Wind: North-northwesterly at 30 knots, gusting to 34 knots.

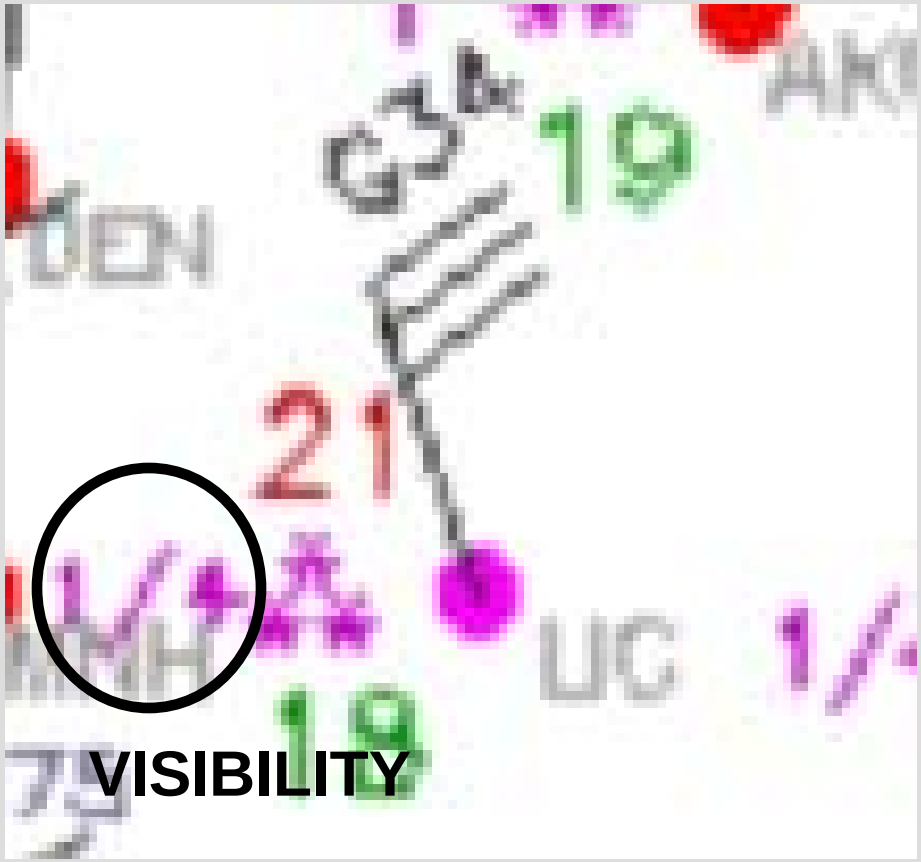
Limon, Colorado (LIC)



Weather conditions

Temperature: 21°F
Dewpoint: 18°F
Pressure: Not available
Sky conditions: Overcast
Wind: North-northwesterly at 30 knots, gusting to 34 knots.
Precipitation: Moderate Snow

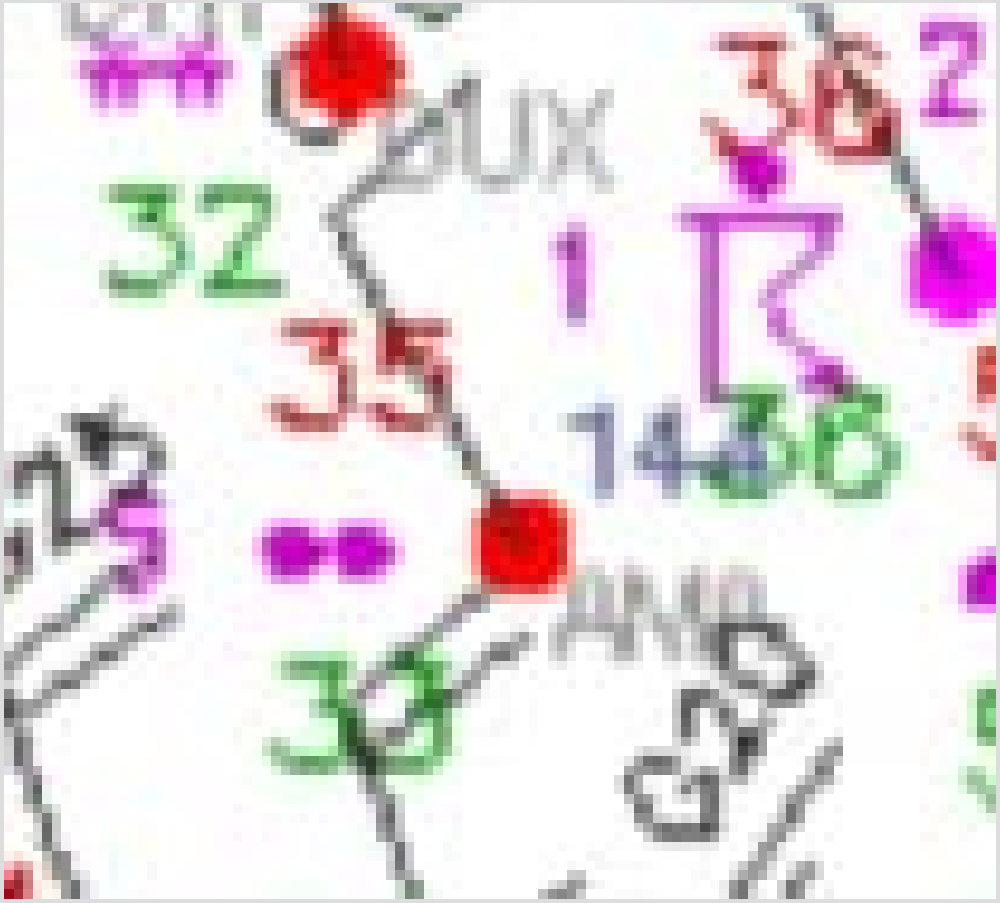
Limon, Colorado (LIC)



Weather conditions

Temperature: 21°F
Dewpoint: 18°F
Pressure: Not available
Sky conditions: Overcast
Wind: North-northwesterly at 30 knots
Precipitation: Moderate Snow
Visibility: Quarter mile

Amarillo, Texas (AMA)



Weather conditions

Temperature:

Dewpoint:

Pressure:

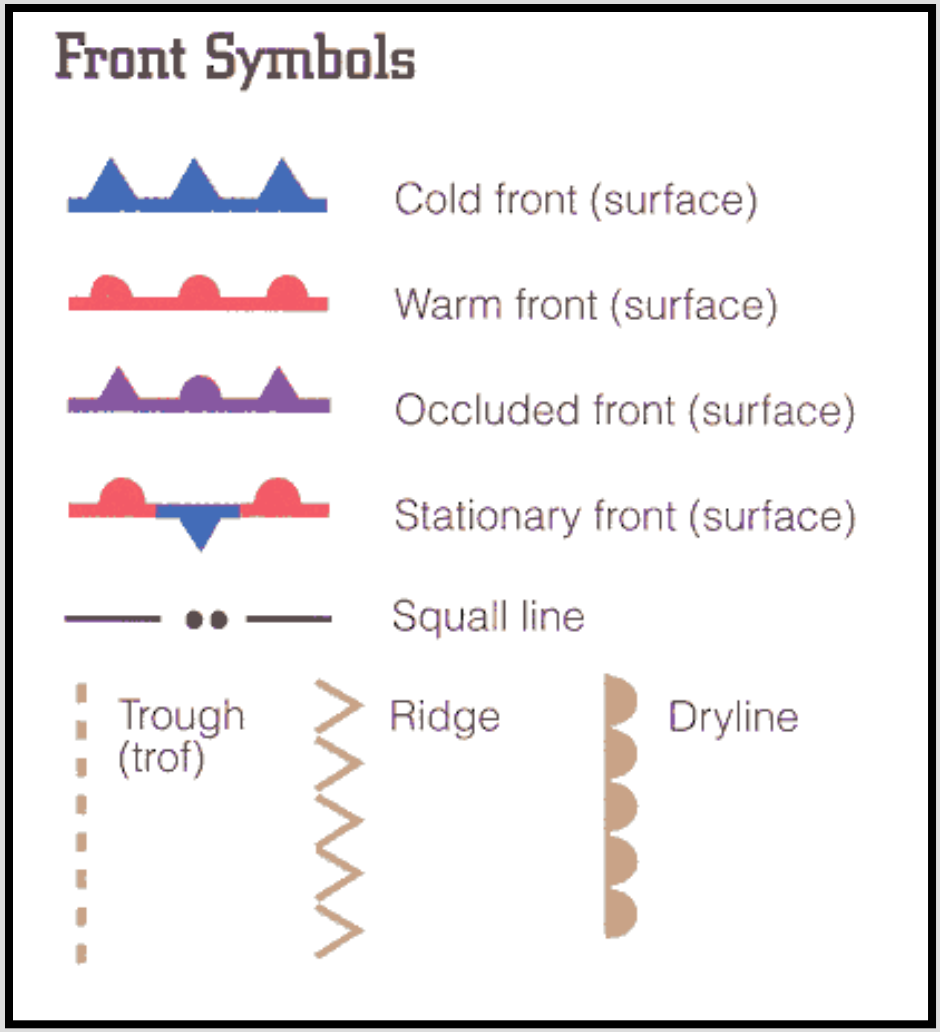
Sky conditions:

Wind:

Precipitation:

Visibility:

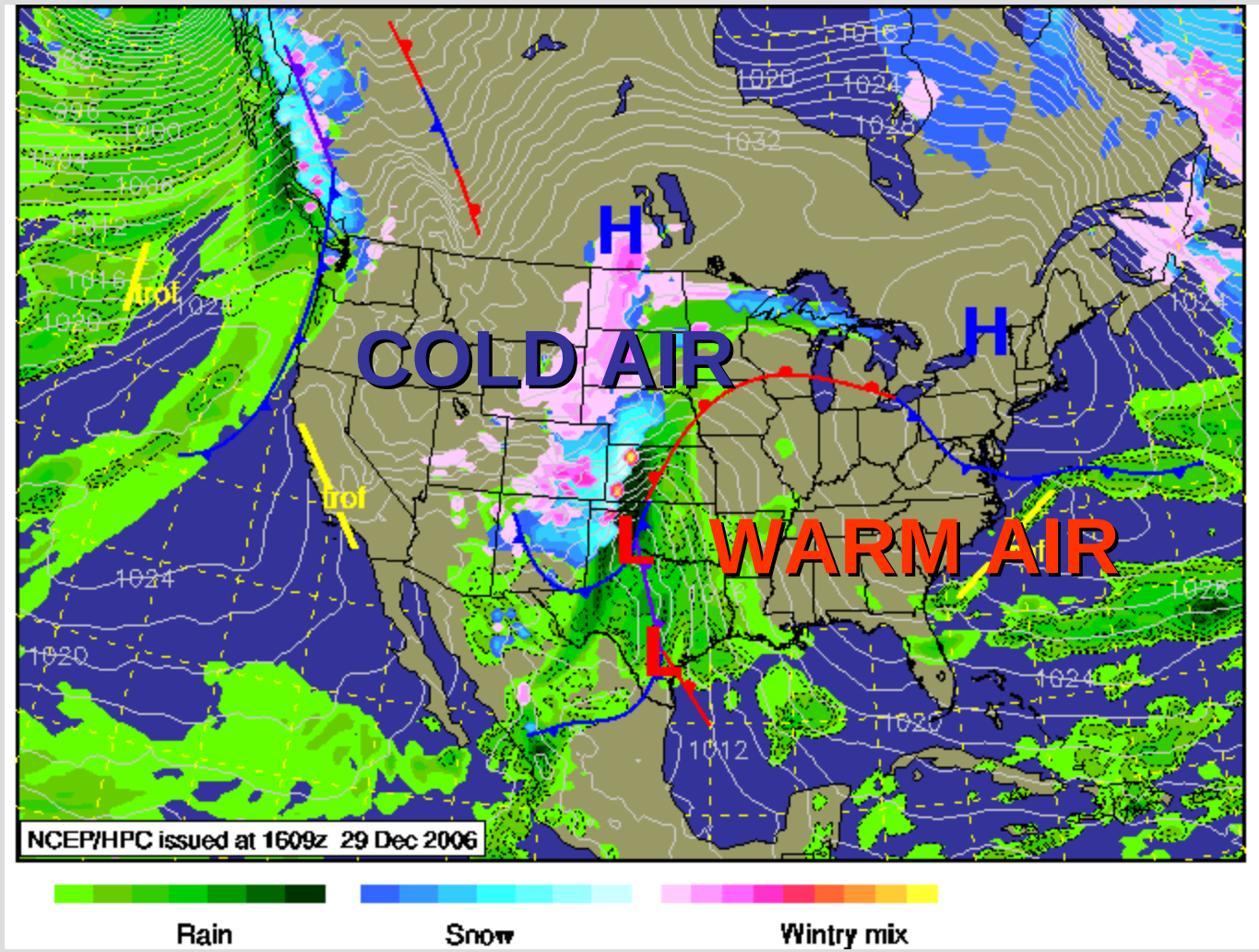
Weather symbols



Fronts mark the boundary between air masses with different characteristics.

Typically where “interesting” weather happens.

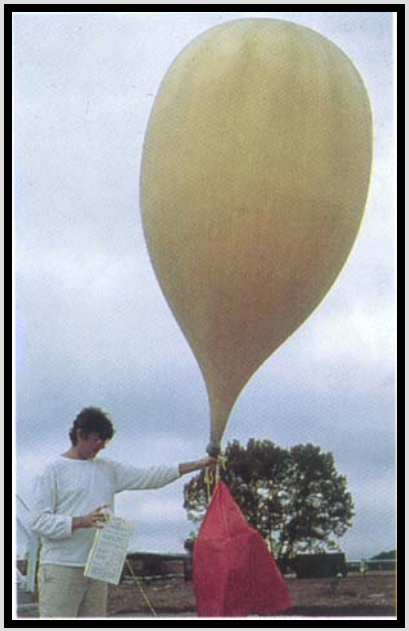
Weather Map: 12-29-06



(UCAR RAP website)

What about what is happening above the ground?

Upper Air Measurements

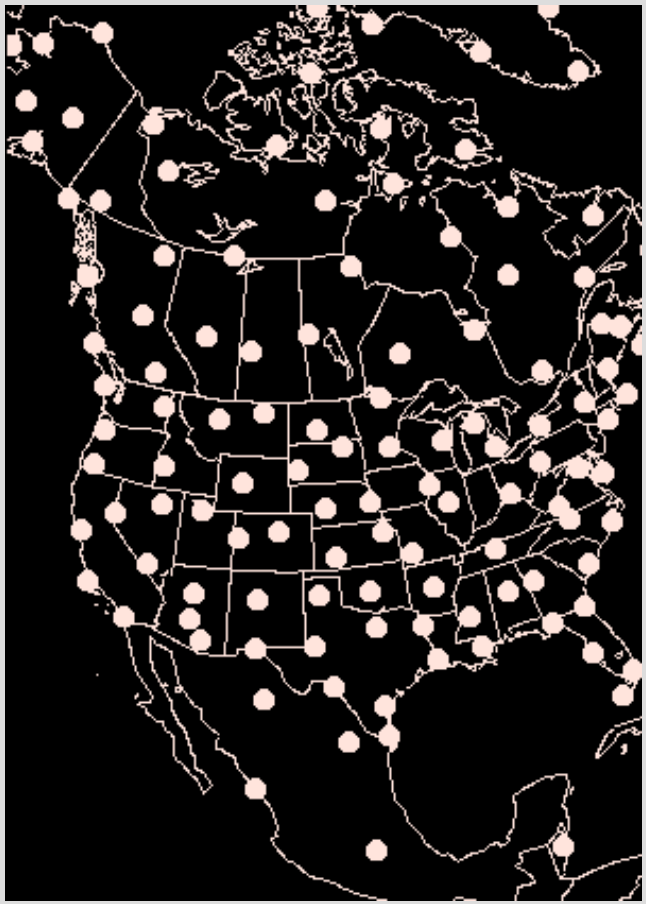


Weather balloons, or *radiosondes*, sample atmosphere up to 10 mb.

They measure:
- **Temperature**
- **Moisture**
- **Pressure**

They are tracked to get winds using global positioning satellites (GPS)

North American Upper Air Network

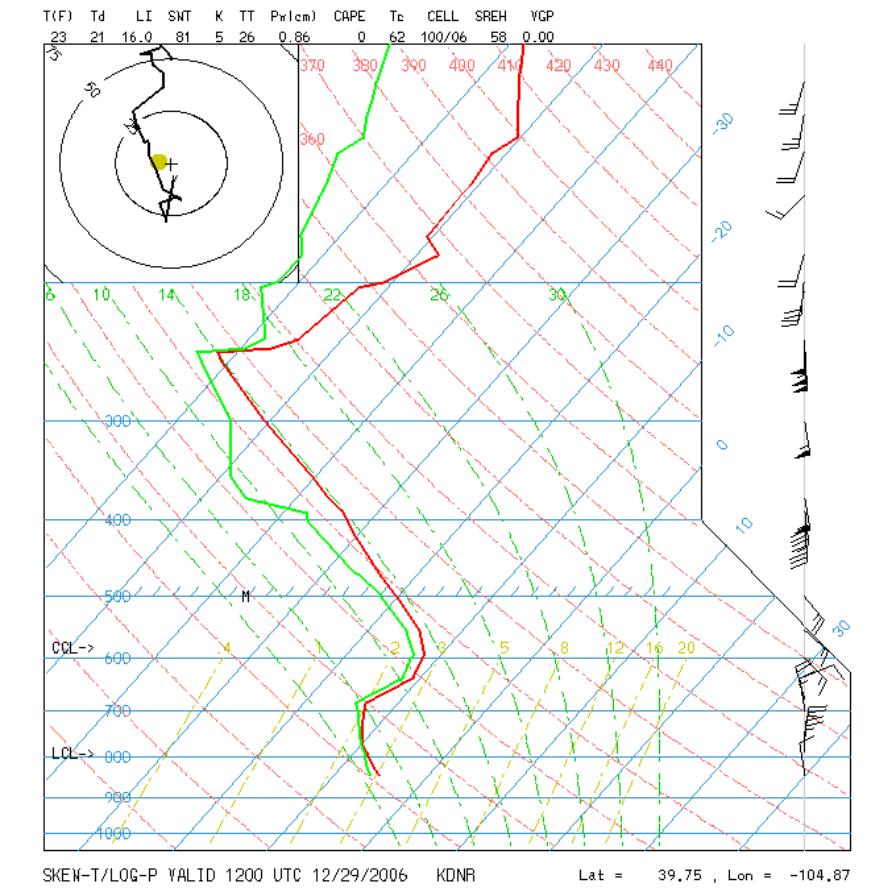


Observations typically taken twice per day at the same time (00 and 12 GMT)

Note the scarcity of observations over Mexico—and the Mexican government may even cut these!

Upper Air Sounding
(Skew T Log P Diagram)

Denver Sounding on 12-29-06



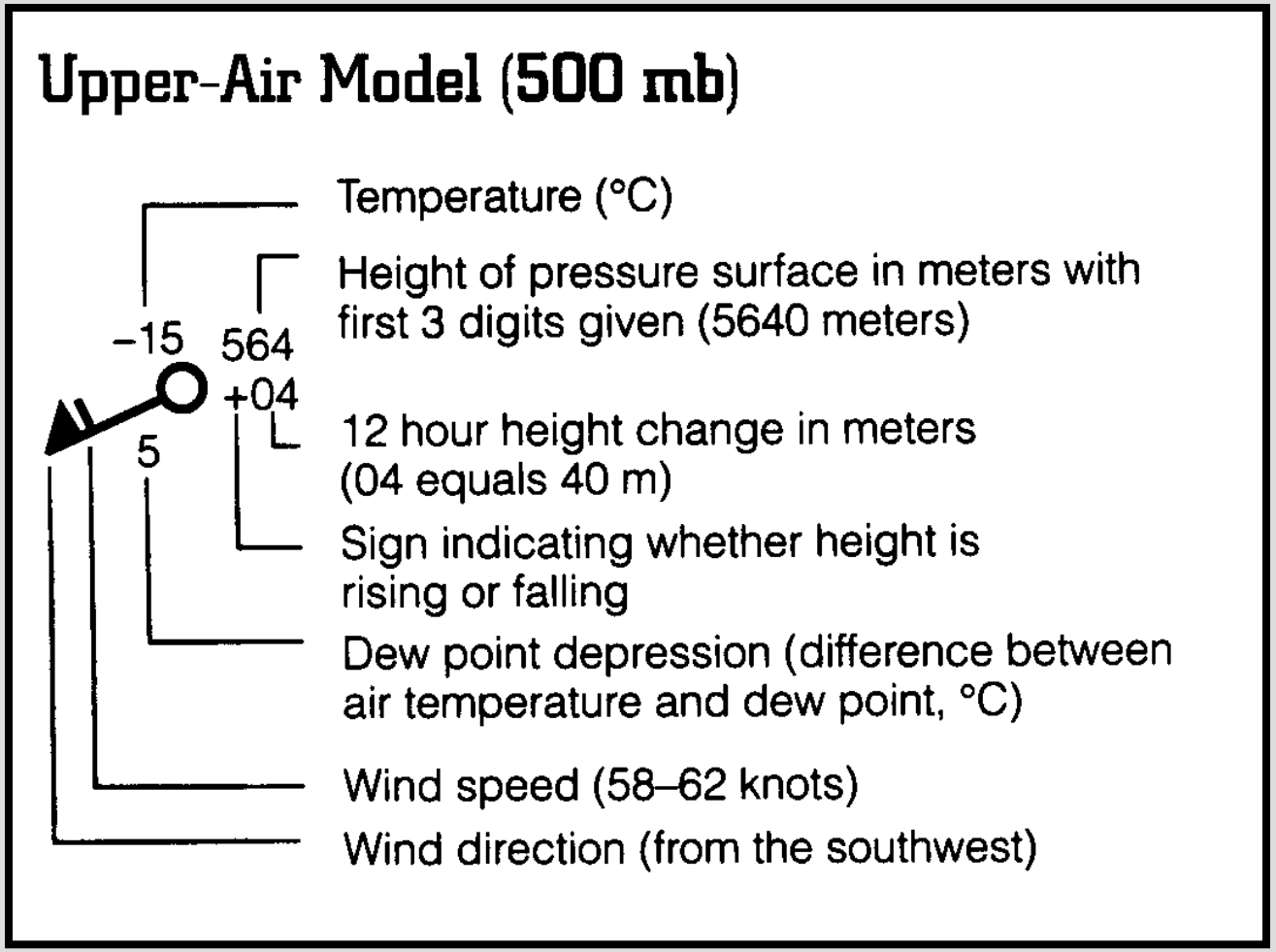
UCAR RAP website

Gives a graphical display of information from the radiosonde:

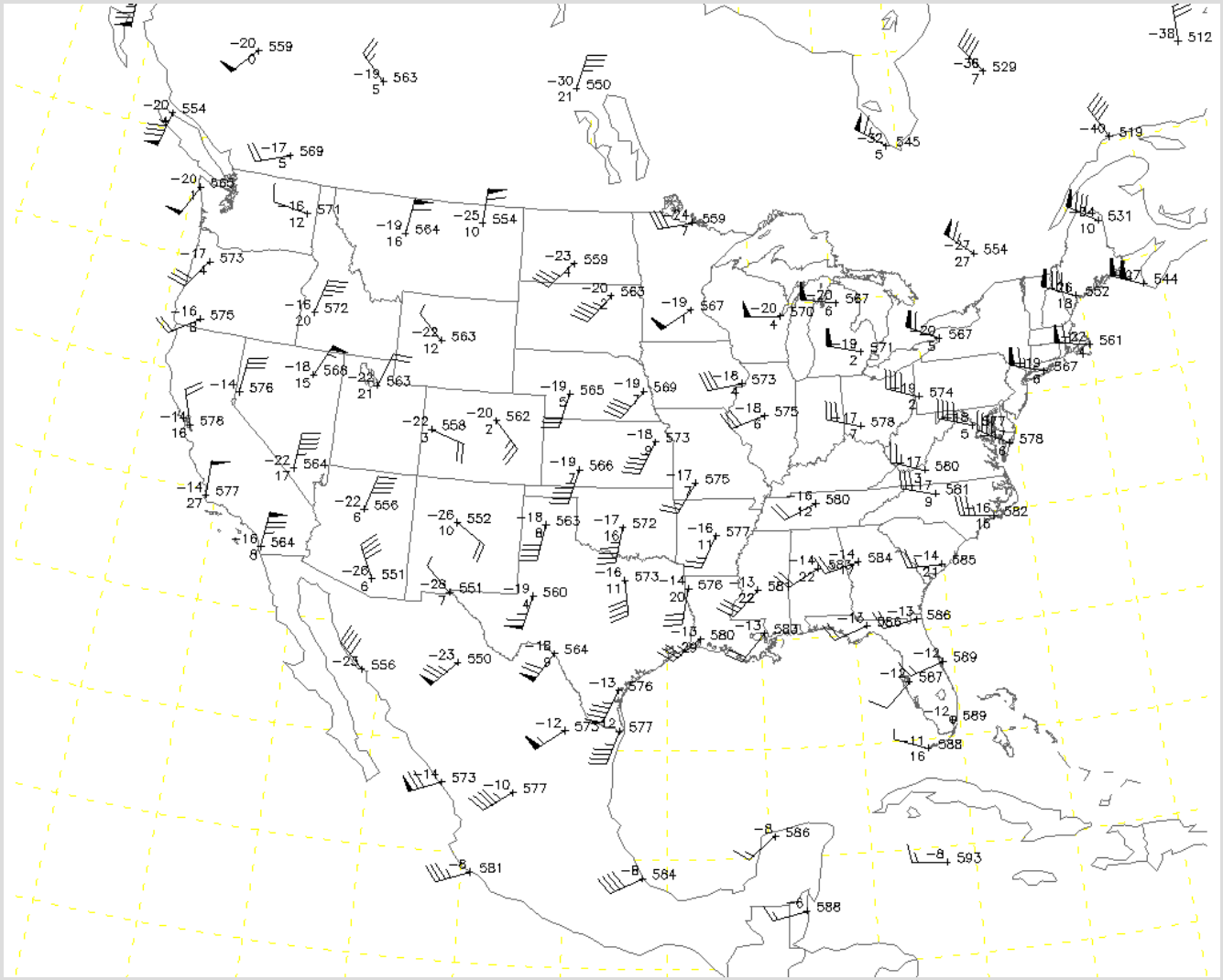
Temperature (Red)
Dewpoint (Green)
Winds (right side)

Note the changes in temperature and moisture with height.

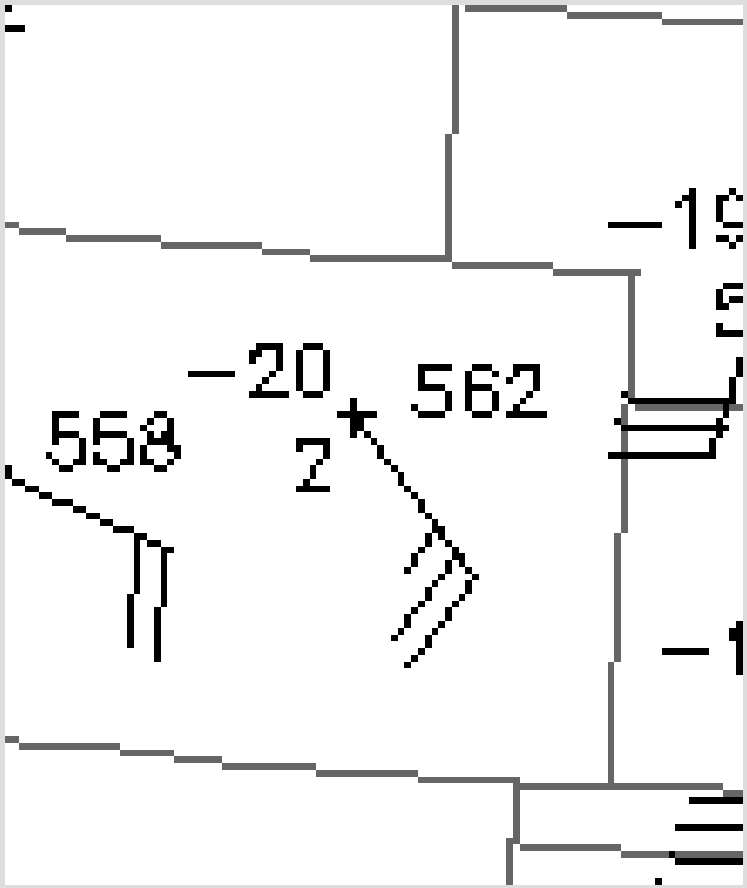
Upper Air Station Model
(At specific pressure level)



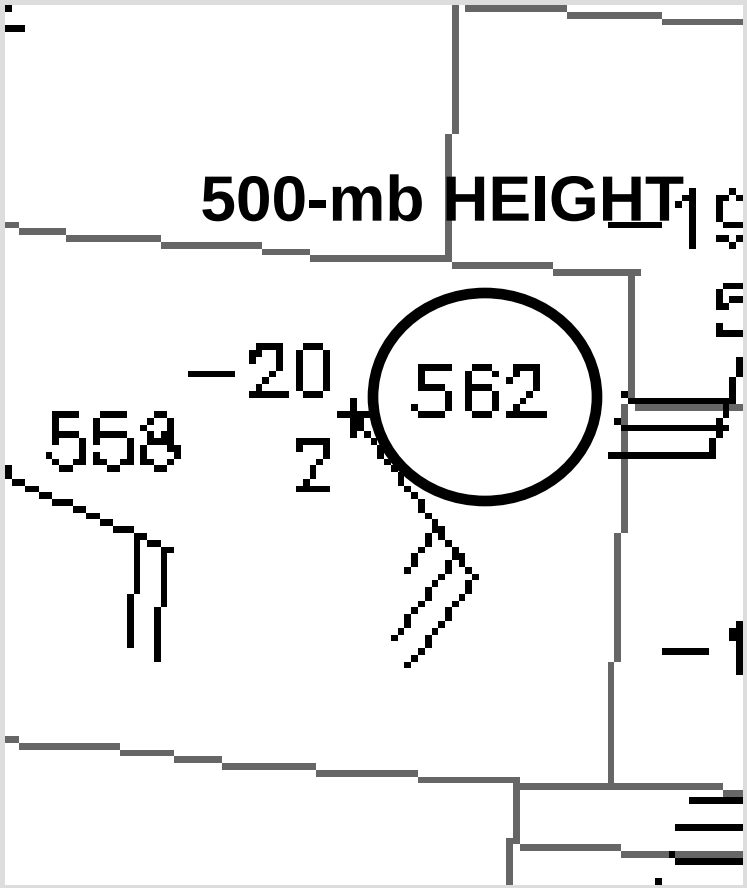
500-mb Map: 12-29-06



500-mb Conditions at Denver (DEN)

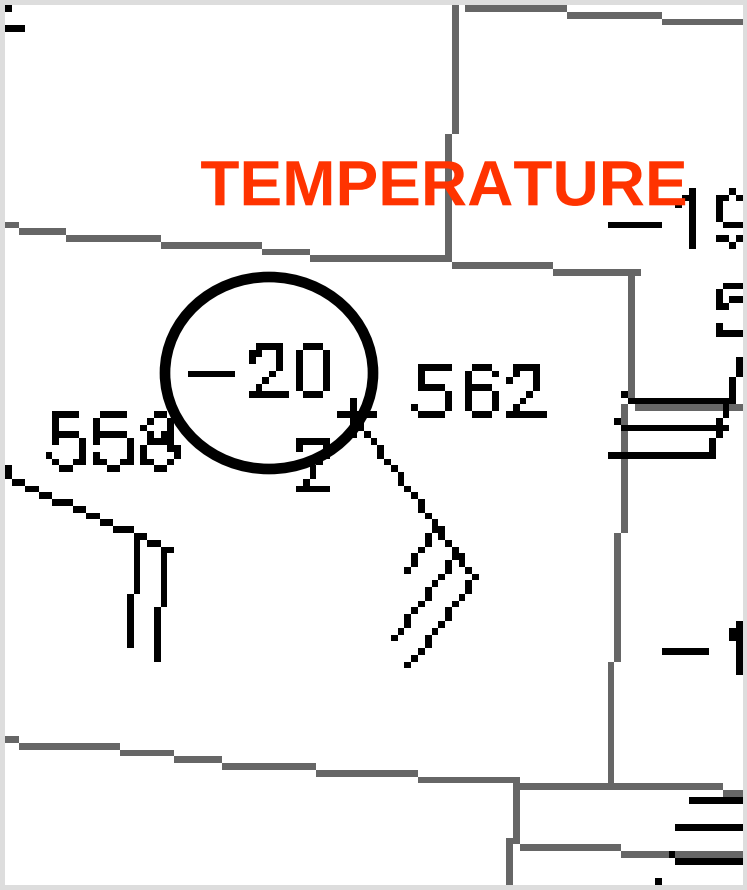


500-mb Conditions at Denver (DEN)



Height of 500-mb Surface:
5620 m

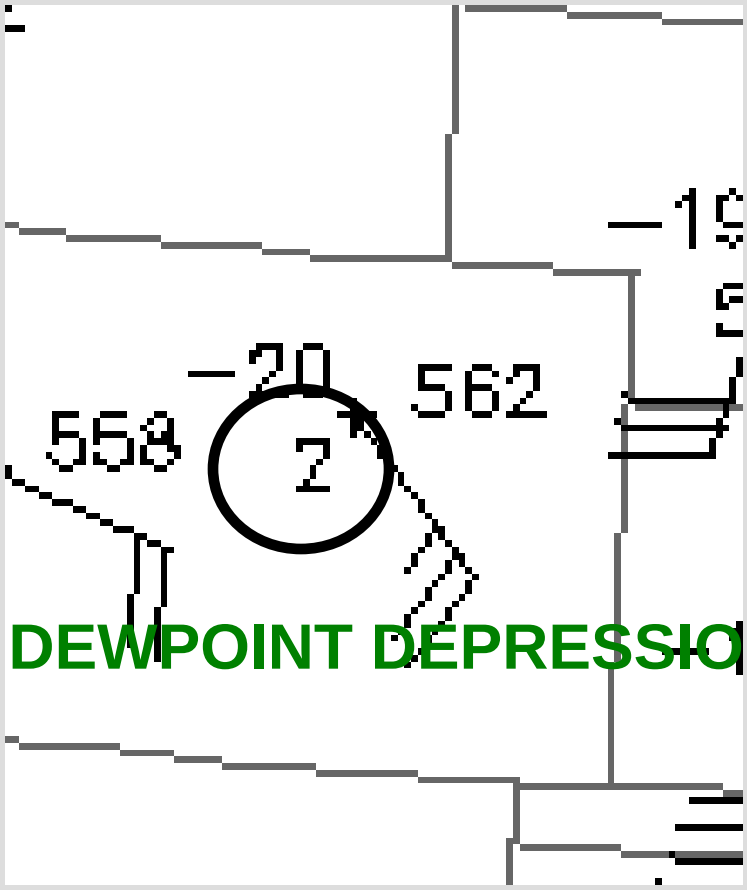
500-mb Conditions at Denver (DEN)



Height of 500-mb Surface: 5620 m

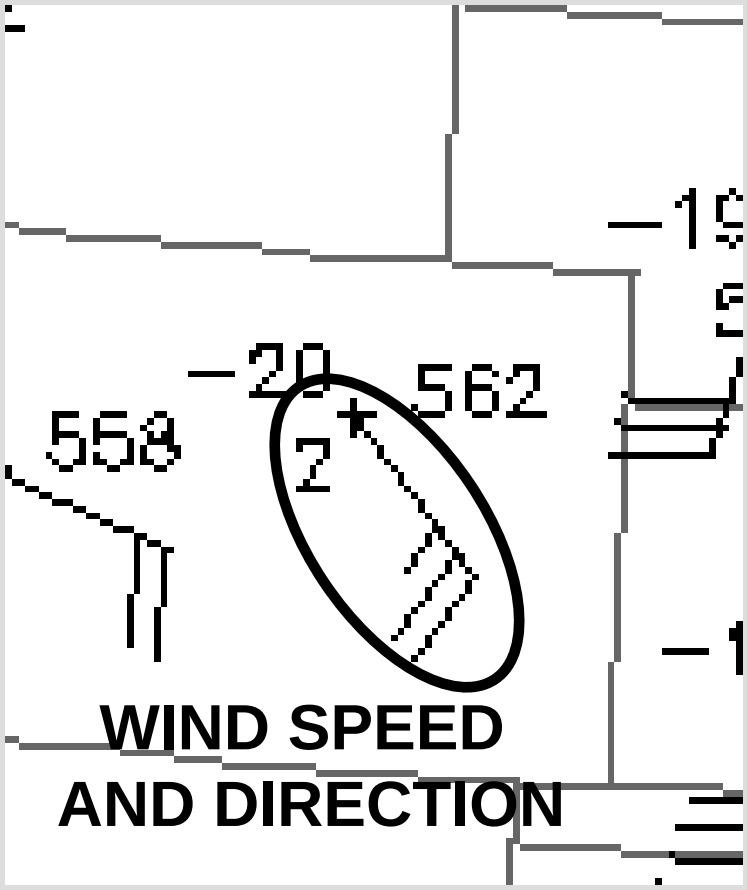
Temperature: -20° C

500-mb Conditions at Denver (DEN)



Height of 500-mb Surface: 5620 m
Temperature: -20° C
Dewpoint: -22° C

500-mb Conditions at Denver (DEN)



Height of 500-mb Surface: 5620 m
Temperature: -20° C
Dewpoint: -22° C
Winds: Southeasterly at 25 knots

Practice it yourself for today's weather using the UCAR RAP website…

www.rap.ucar.edu/weather

Definition of Climate

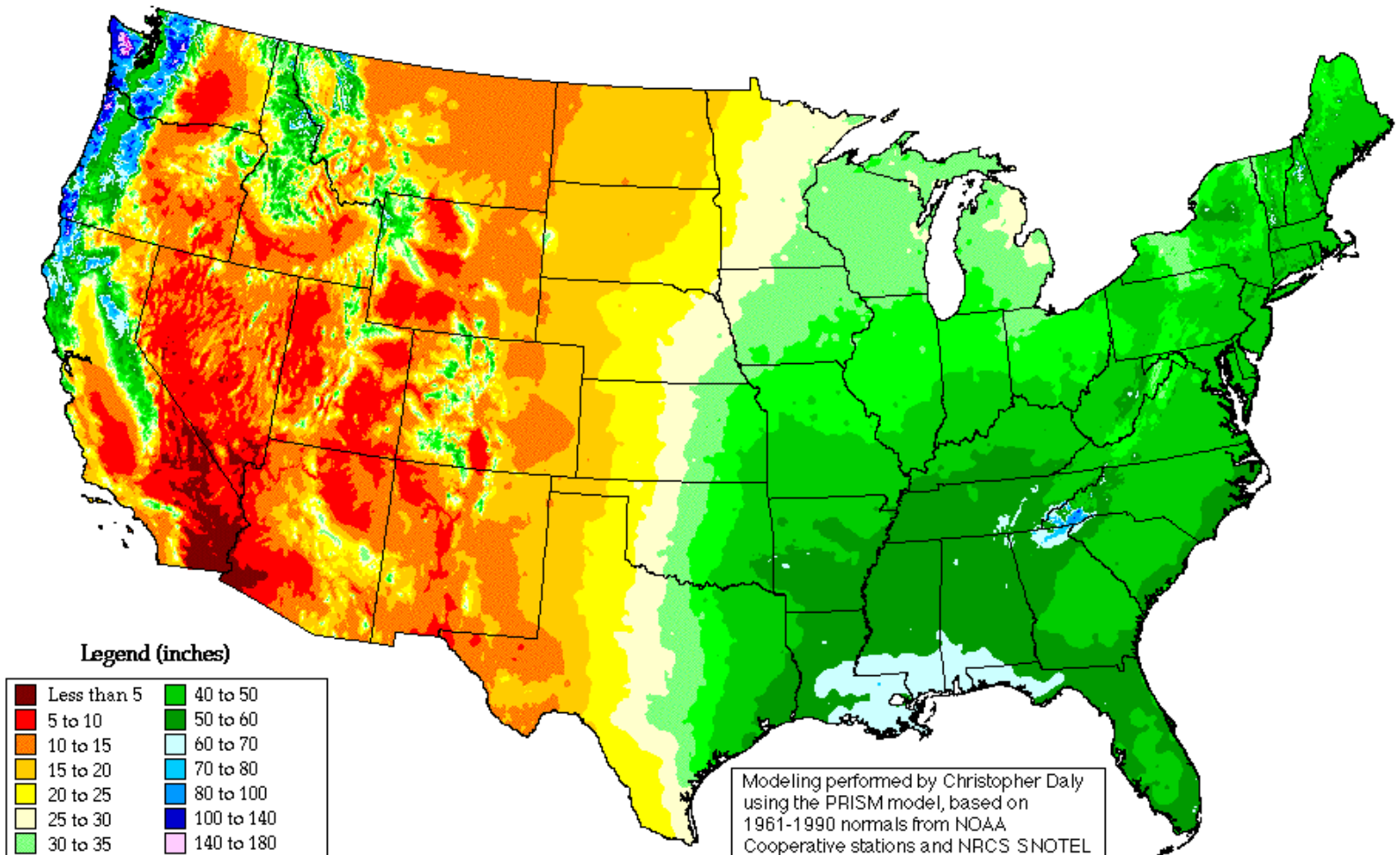
<u>Climate</u>: The statistical characteristics of weather elements over a given period of time.

Some examples:

- Seasonal or yearly average rainfall in the U.S.
- Dominant patterns of sea surface temperatures (e.g. El Niño)
- Daily average temperature at a weather station
- Variability of snowfall

Annual Average Precipitation

United States of America



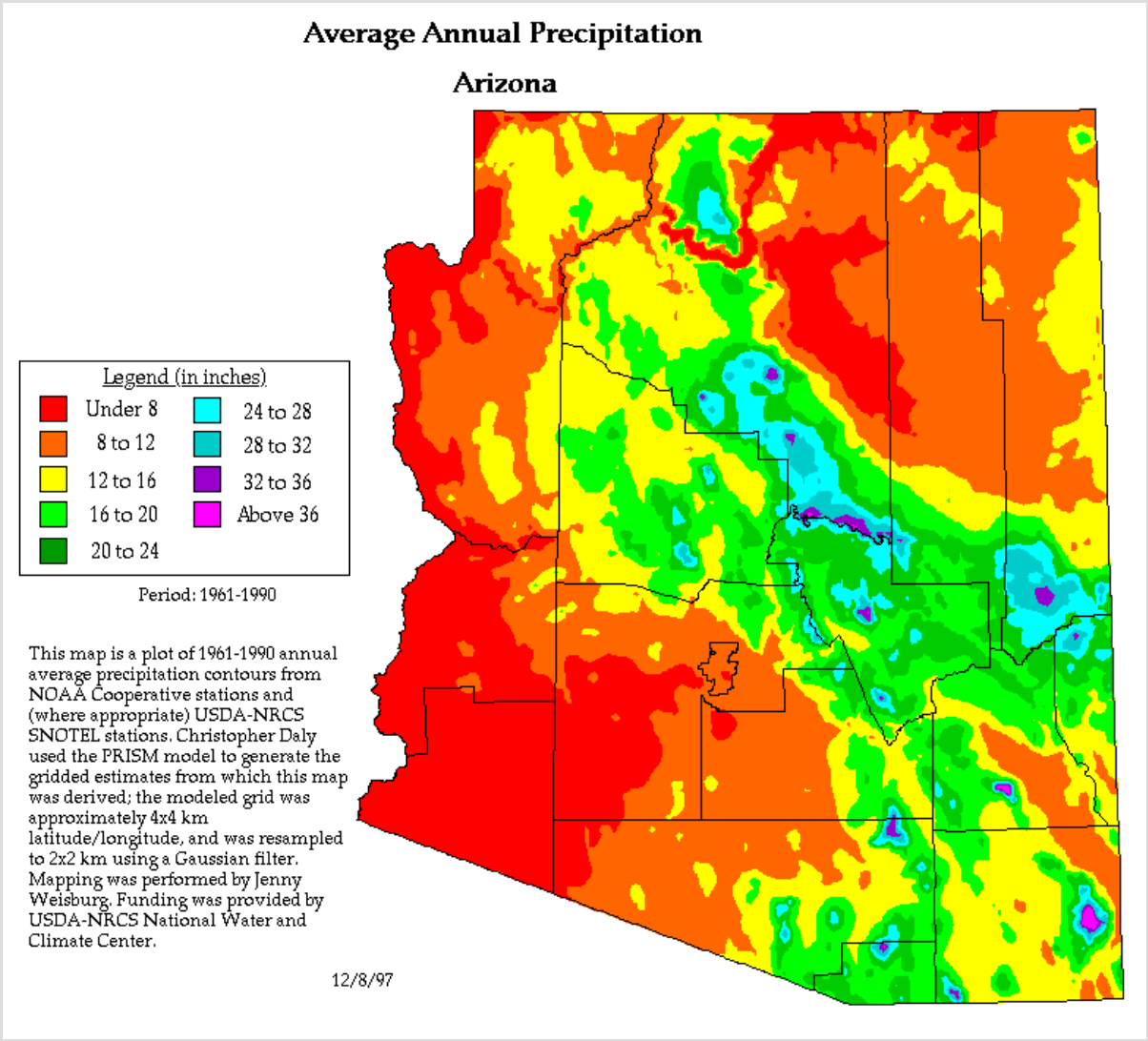
Legend (inches)

Less than 5	40 to 50
5 to 10	50 to 60
10 to 15	60 to 70
15 to 20	70 to 80
20 to 25	80 to 100
25 to 30	100 to 140
30 to 35	140 to 180
35 to 40	More than 180

Period: 1961-1990

Modeling performed by Christopher Daly using the PRISM model, based on 1961-1990 normals from NOAA Cooperative stations and NRCS SNOTEL sites. Sponsored by USDA-NRCS Water and Climate Center, Portland, Oregon.

Oregon Climate Service
George Taylor, State Climatologist
(541) 737-5705



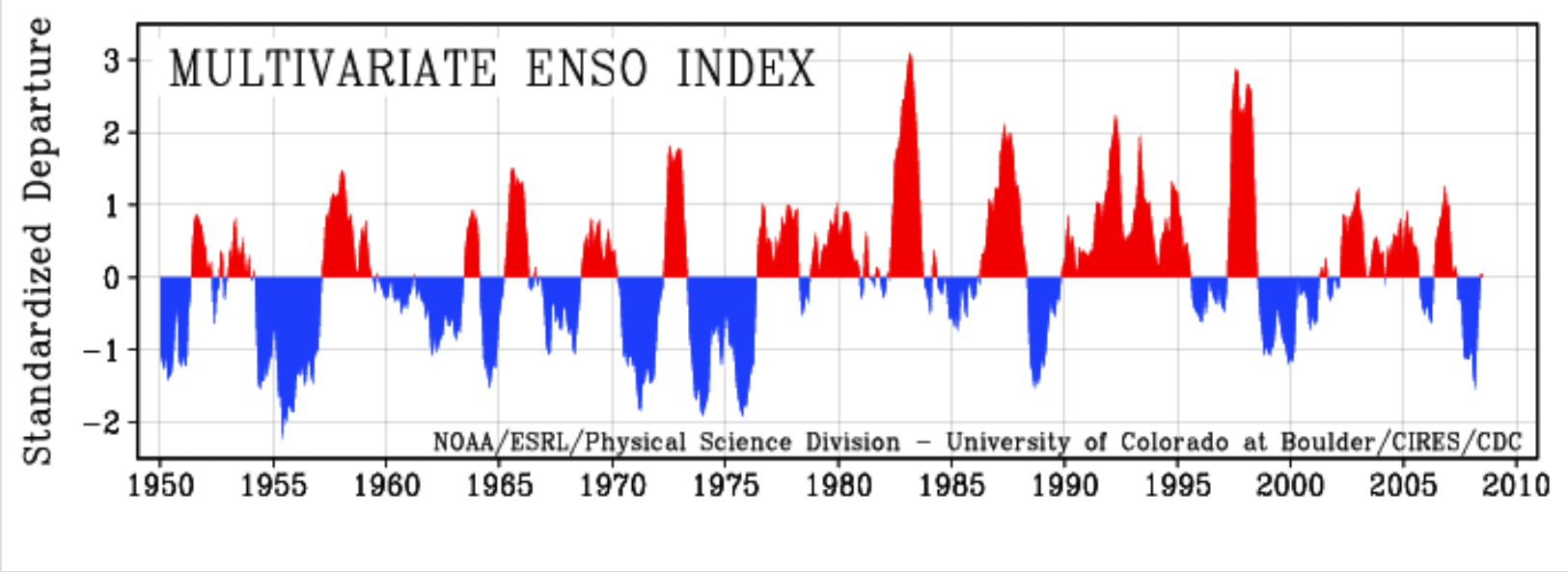
Major factors for AZ:

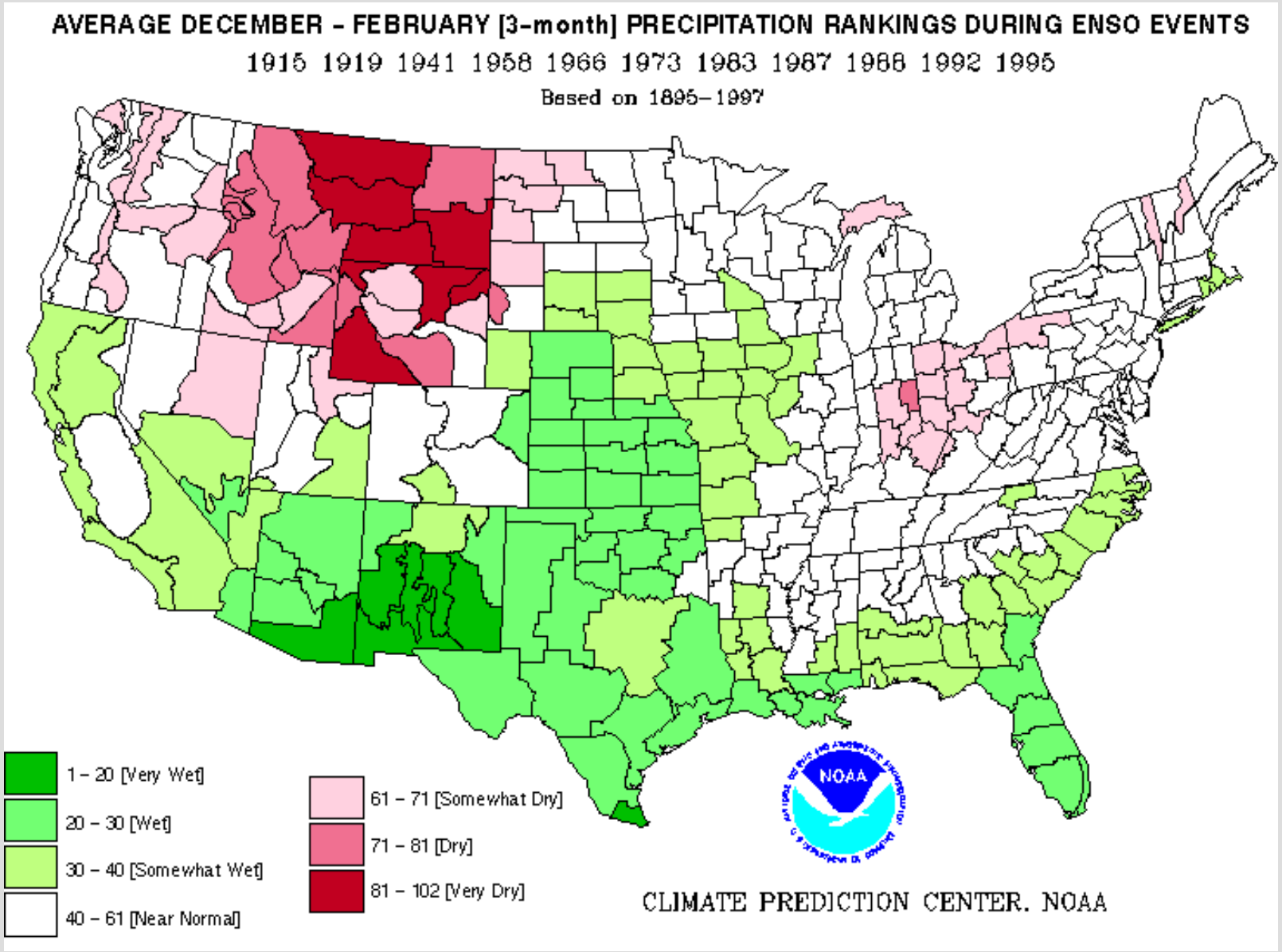
1. _____

2. _____

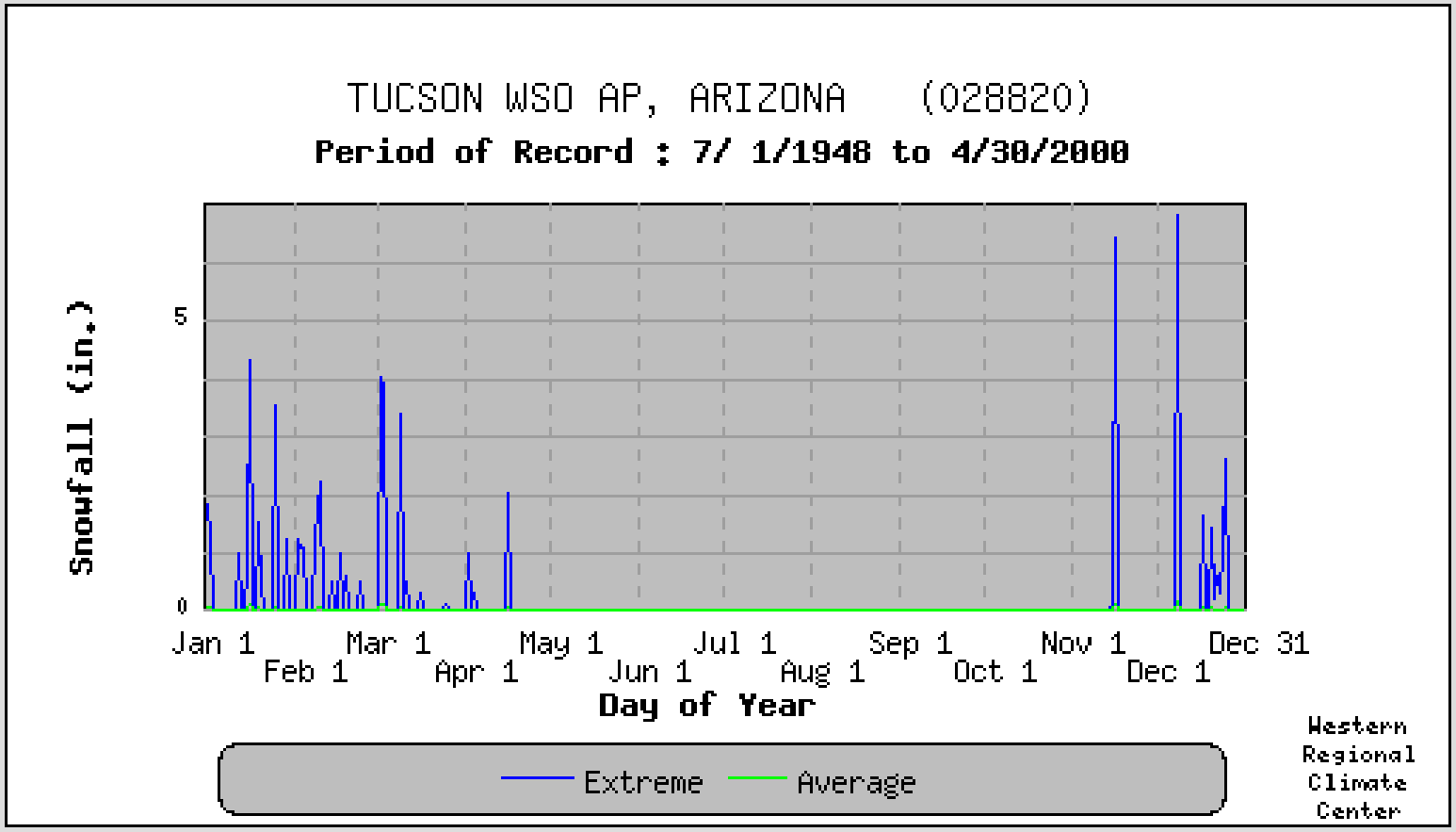
Note the dependence of rainfall with elevation

El Niño Southern Oscillation (ENSO)




AVERAGE DECEMBER - FEBRUARY [3-month] PRECIPITATION RANKINGS DURING ENSO EVENTS
1915 1919 1941 1958 1966 1973 1983 1987 1988 1992 1995
Based on 1895-1997
1 - 20 [Very Wet]
20 - 30 [Wet]
30 - 40 [Somewhat Wet]
40 - 61 [Near Normal]
61 - 71 [Somewhat Dry]
71 - 81 [Dry]
81 - 102 [Very Dry]
NOAA
CLIMATE PREDICTION CENTER, NOAA

Tucson Snowfall



Some Good Places on the Web for Climate Information

National Weather Service
www.nws.noaa.gov

Climate Diagnostics Center, Boulder, CO
www.cdc.noaa.gov

Climate Prediction Center, NCEP, Camp Springs, MD
www.cpc.noaa.gov

Western Regional Climate Center, Reno, NV
www.wrcc.dri.edu

National Climate Data Center, Asheville, NC
www.ncdc.noaa.gov

Summary of Lecture 3

Defined the difference between weather and climate.

***Weather* is the condition of the atmosphere at a particular time and place: temperature, pressure, humidity, clouds, precipitation, visibility and wind. Be familiar with how each of these is defined.**

Looked at surface and upper air station models (as well as weather symbols) and how to interpret them to diagnose the weather. Went through an example of a snowstorm in Colorado in late December.

***Climate* is the statistical characteristics of weather elements over a given period of time. Several examples of climate data were presented for various time and space scales.**

Reading Assignment

Ahrens, Chapter 2, pp. 27-35 (8th ed.)
pp. 29-37 (9th ed.)