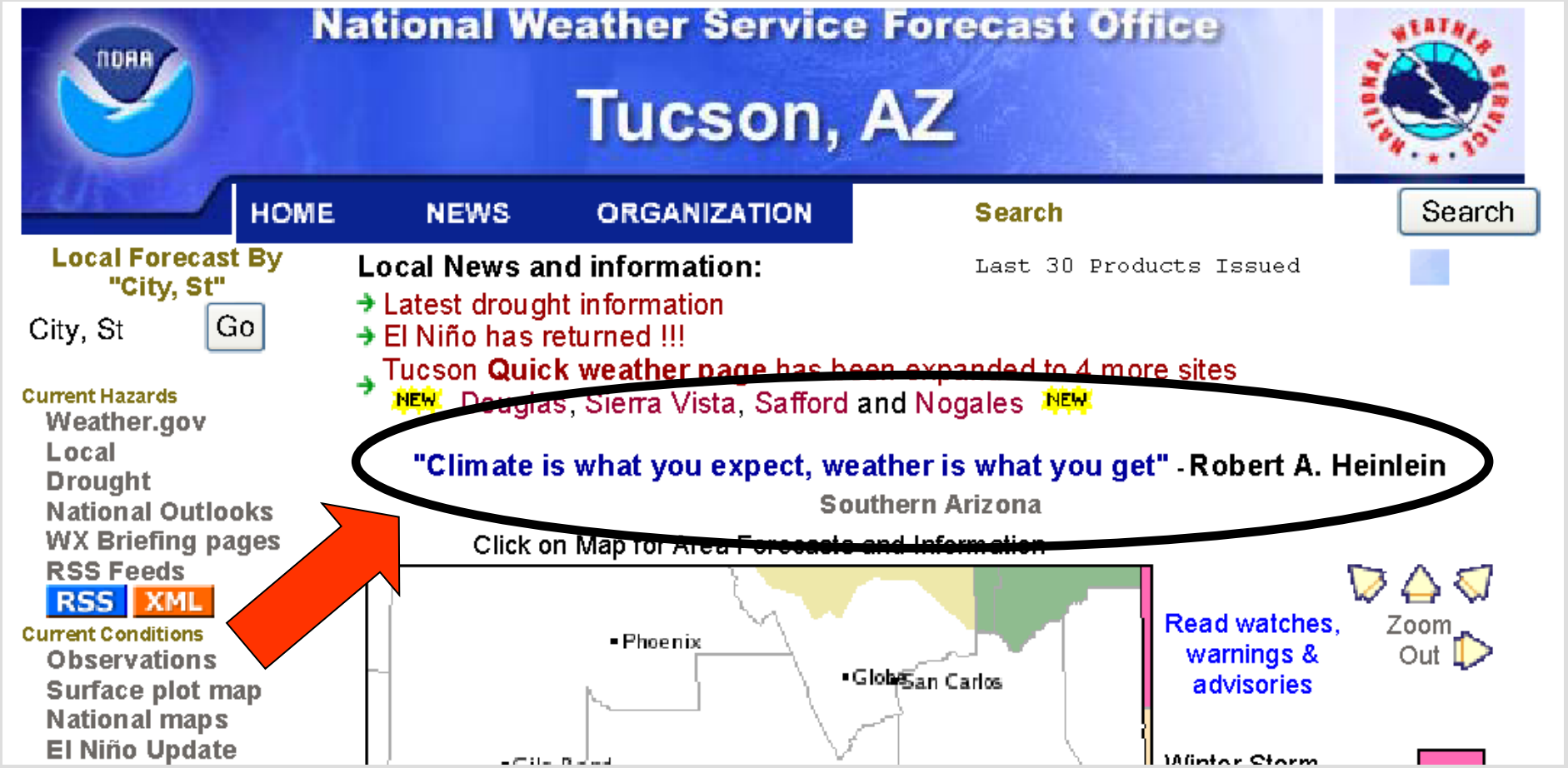
Weather vs. Climate



Tucson NWS homepage: www.nws.noaa.gov/twc/


OPEN

Definition of Weather

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

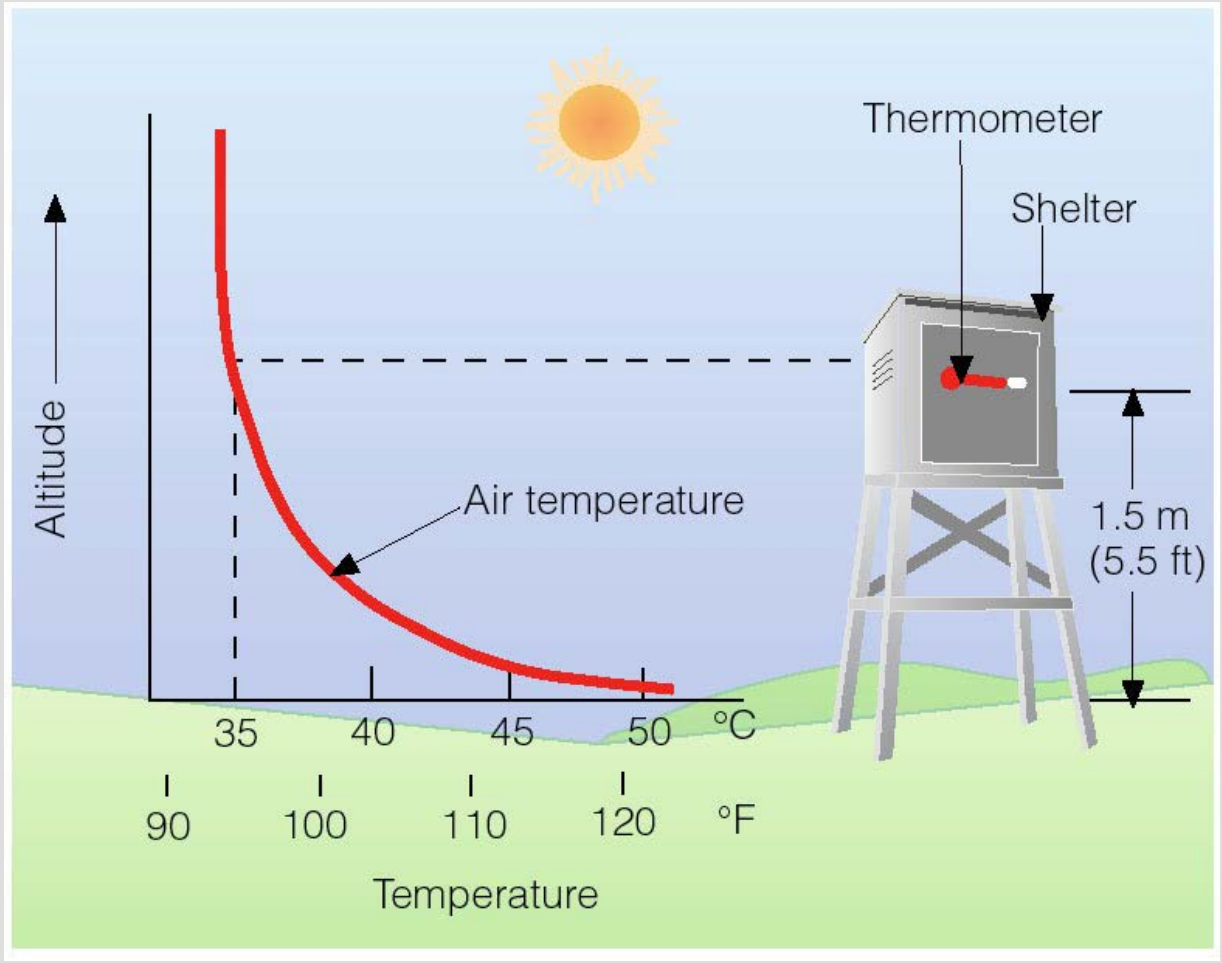
Comprised of:

Definition of Weather

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

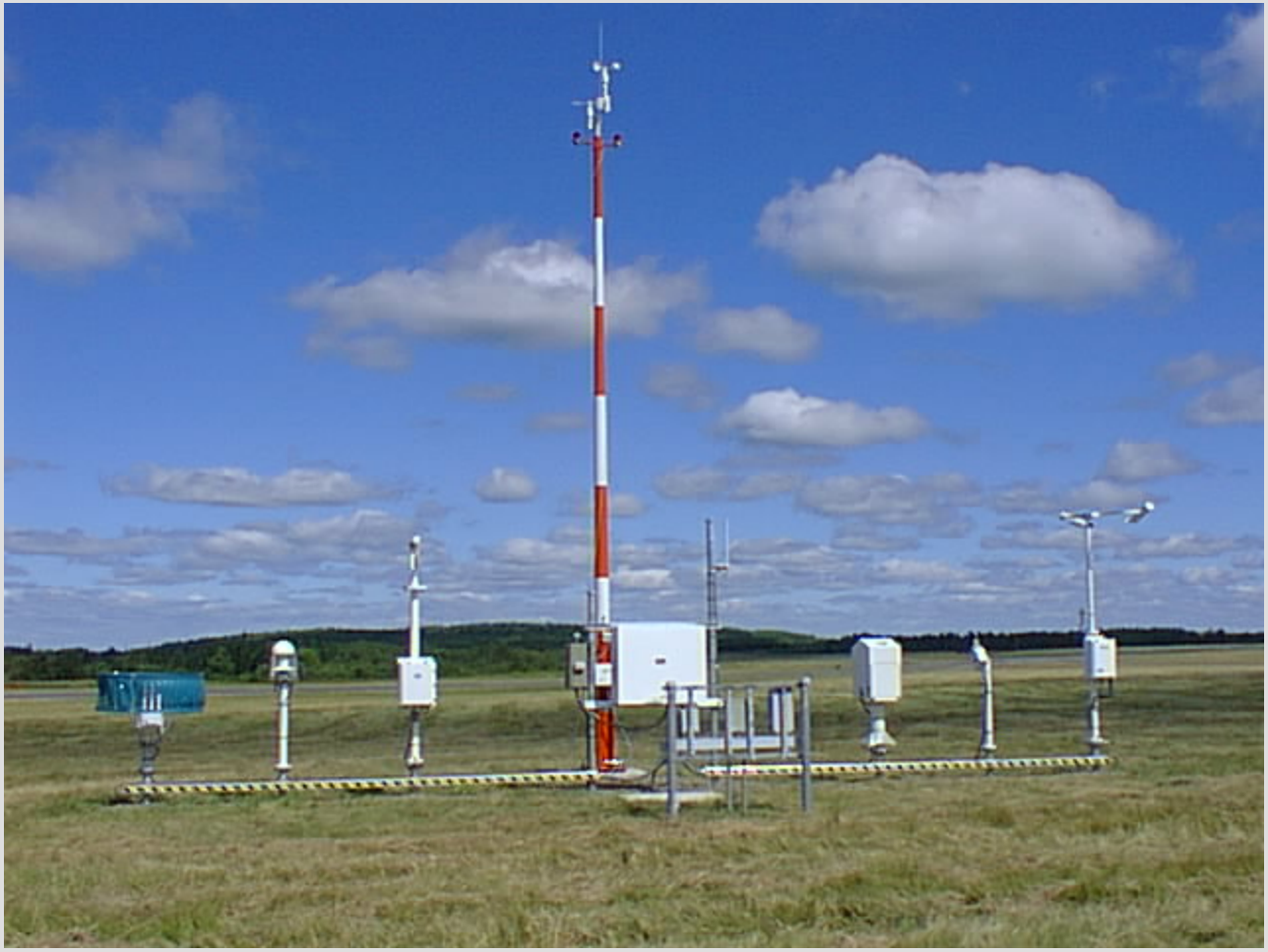
Comprised of:

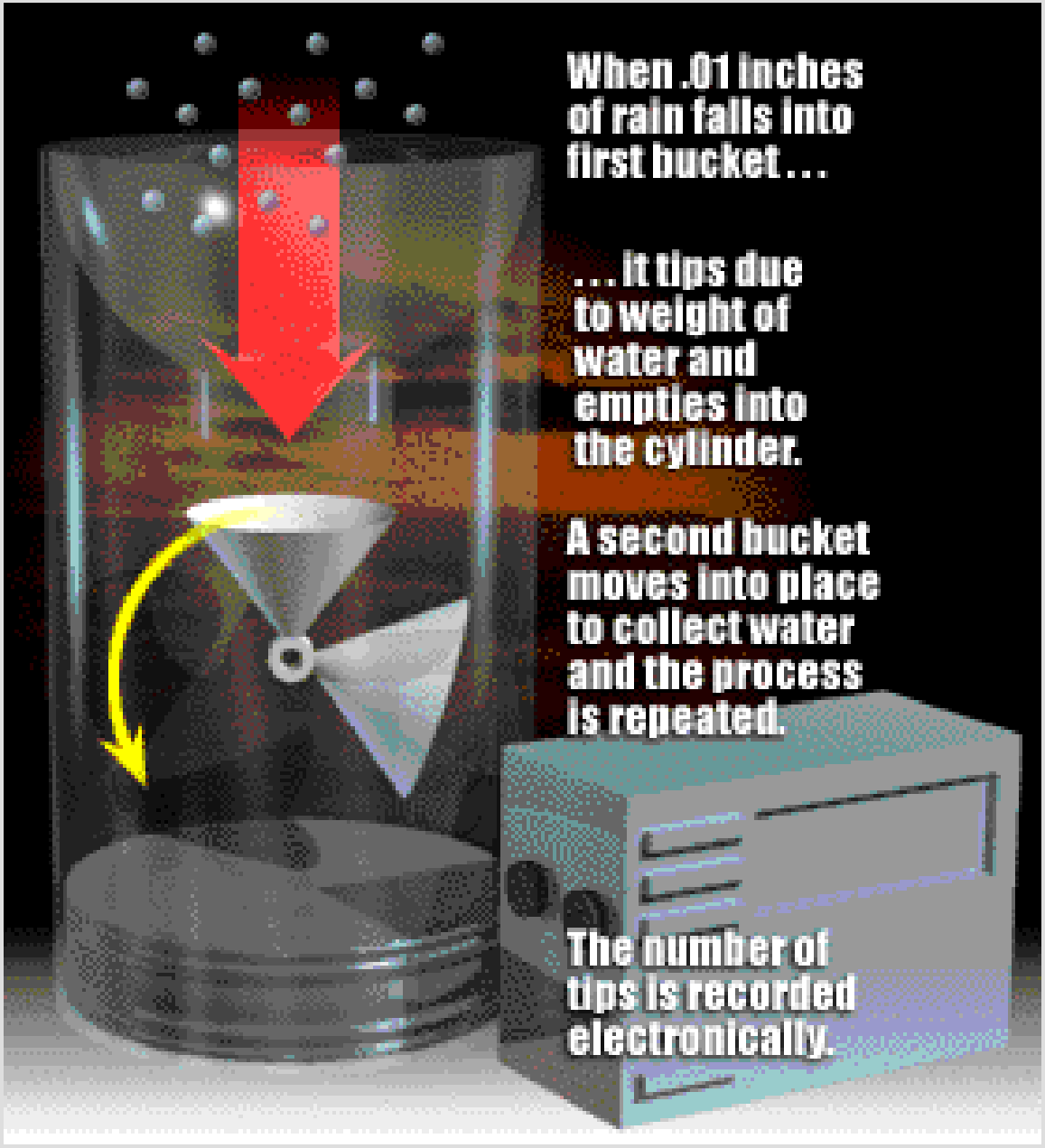
Air temperature: Degree of hotness or coldness
Air pressure: Force of the air above
Humidity: Amount of water vapor in the air
Sky conditions: Clouds, water droplets (liquid) or ice crystals (solid) above the surface; but also report haze, smoke, dust, etc.
Precipitation: Water that falls clouds and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

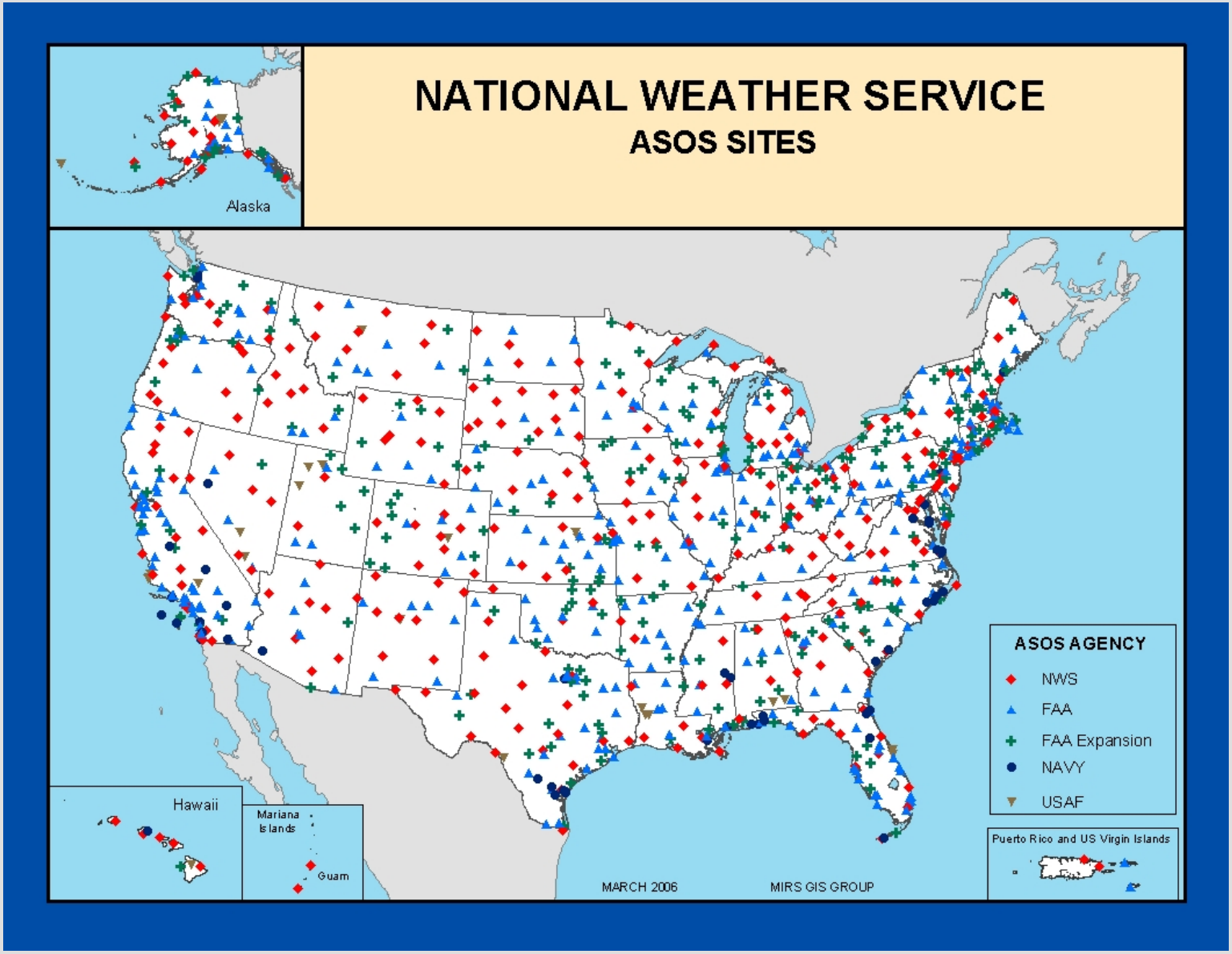


COTTON REGION SHELTER

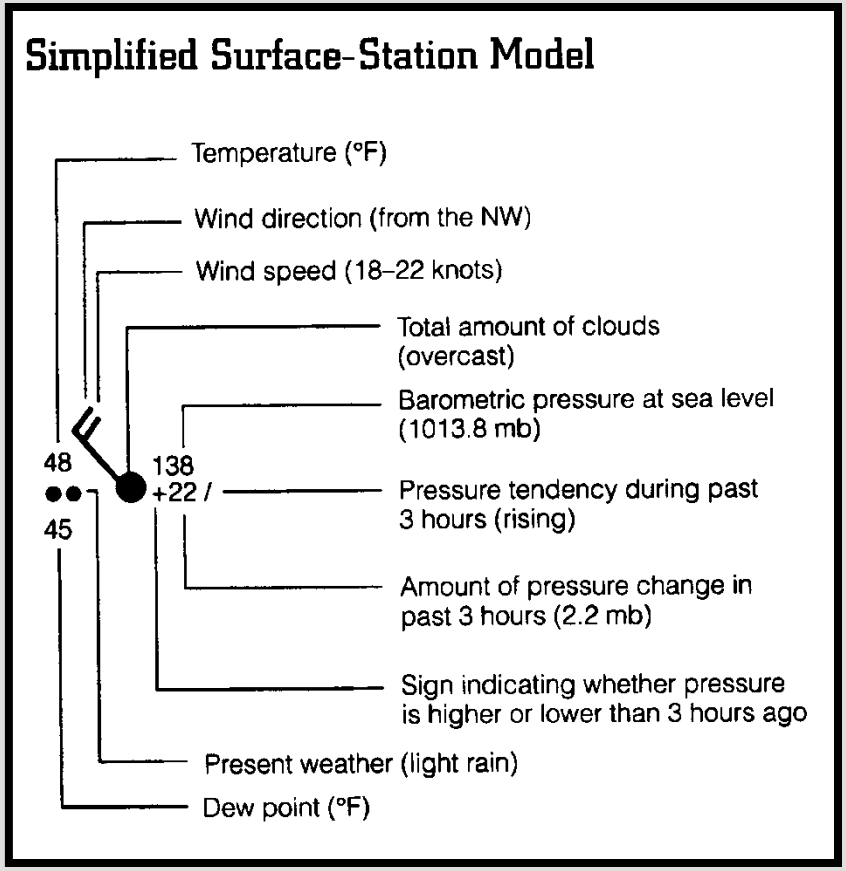
Automated Surface Observing System (ASOS)




When .01 inches of rain falls into first bucket . . .
. . . it tips due to weight of water and empties into the cylinder.
A second bucket moves into place to collect water and the process is repeated.
The number of tips is recorded electronically.


NATIONAL WEATHER SERVICE
ASOS SITES
Alaska
Hawaii
Mariana Islands
Guam
Puerto Rico and US Virgin Islands
ASOS AGENCY
NWS
FAA
FAA Expansion
NAVY
USAF
MARCH 2006
MIRS GIS GROUP

Surface Station Model (U.S.)



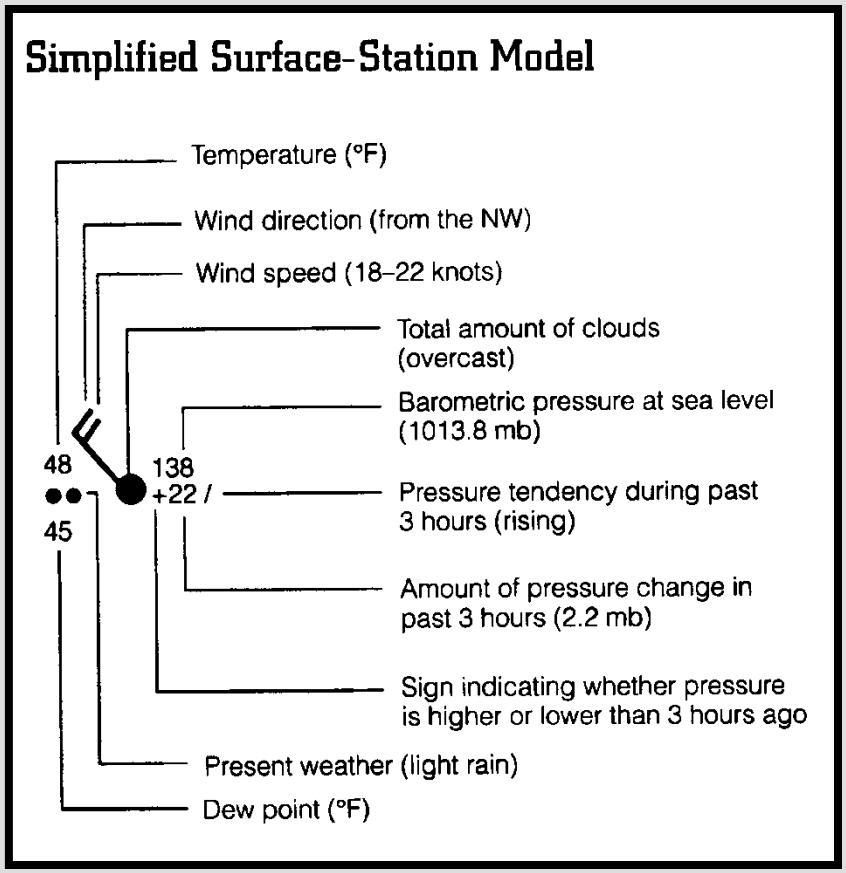
Notes: Temperature and Wind

Stations outside U.S. use degrees Celsius for temperature

Wind barb direction reverses in southern hemisphere.

Surface observations typically reported *every three to six hours* in U.S. at designated observing sites with a three letter identifier (e.g. NWS offices, airports).

Surface Station Model (U.S.)



Notes: Pressure

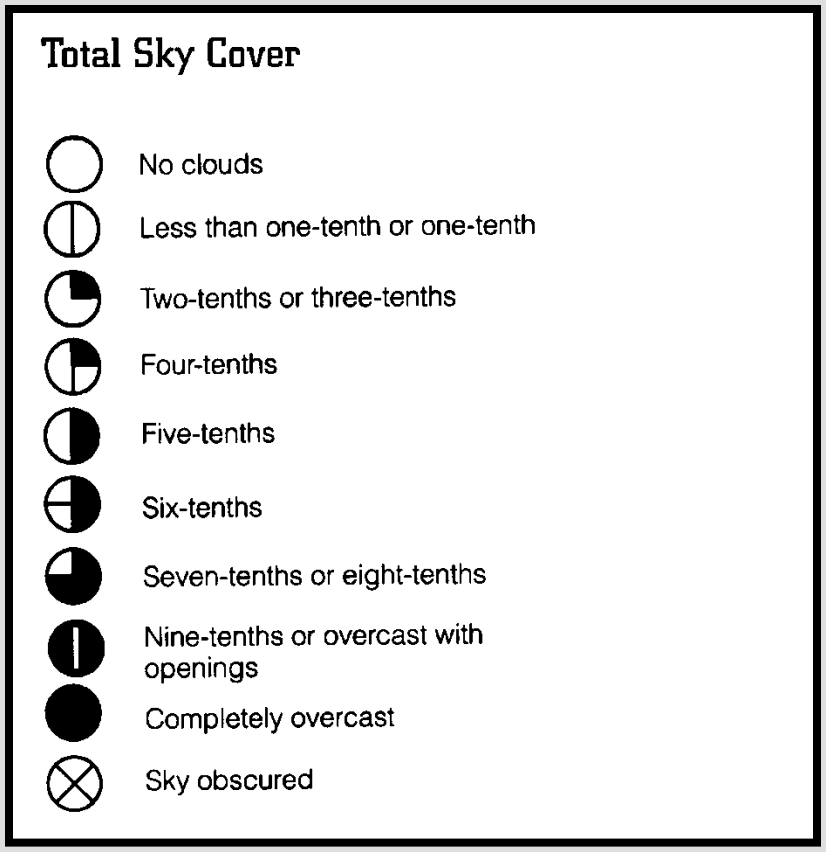
Leading 10 or 9 is <u>not</u> plotted for surface pressure

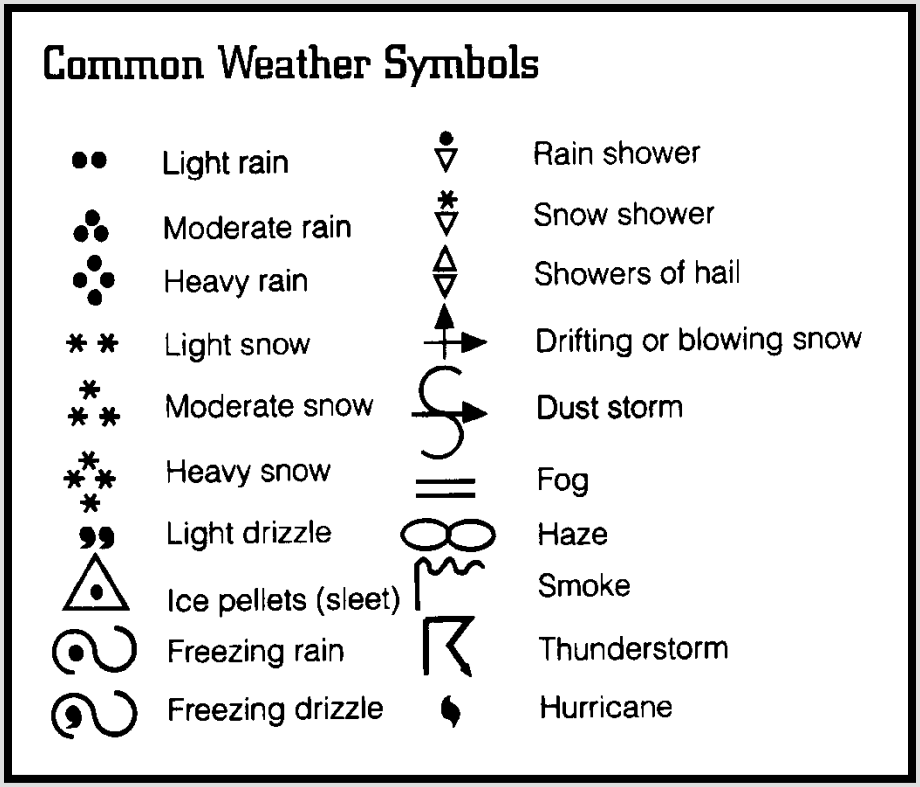
Greater than 500 = 950 to 999 mb

Less than 500 = 1000 to 1050 mb

988 → 998.8 mb
200 → 1020.0 mb

Sky Cover, Weather Symbols on a Surface Station Model



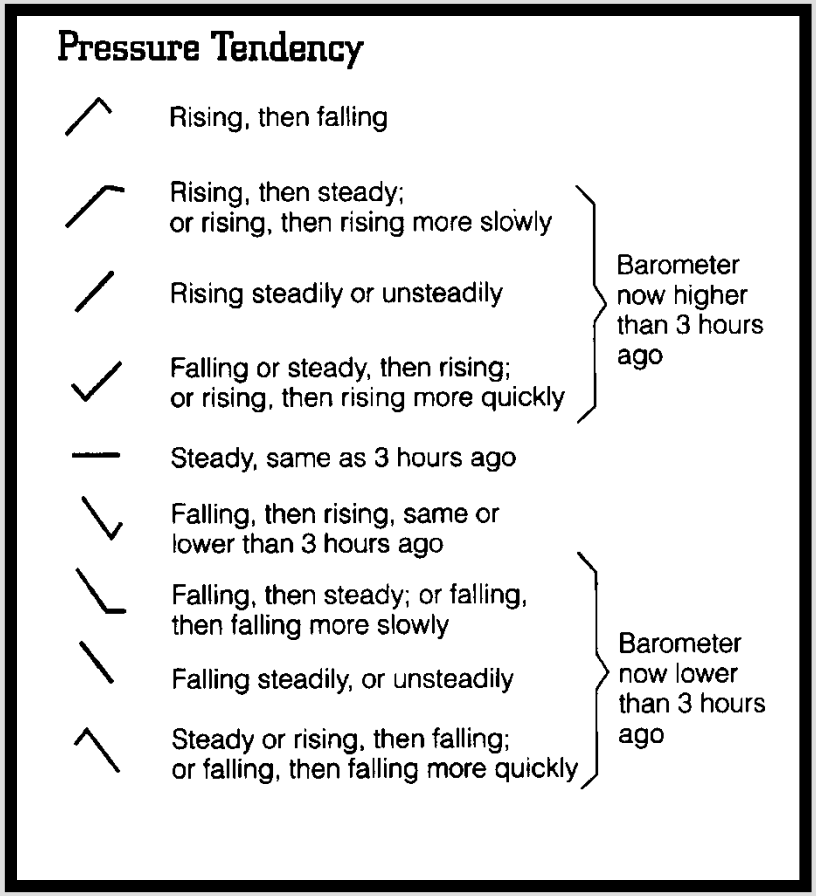


WEATHER SYMBOLS

Numbers indicate the weather code as used in synoptic weather reports (**ww**, present weather reported from a manned weather station, as defined in WMO Pub. No. 306-A).

00  Cloud development not observed/observable during past hour.	01  Clouds generally dissolving during past hour.	02  State of sky unchanged during past hour.	03  Clouds generally forming or developing during past hour.	04  Visibility reduced by smoke.	05  Haze.	06  Dust suspended in the air, but not raised by wind.	07  Dust or sand raised by wind.	08  Dust devils now or within past hour.	09  Duststorm or sandstorm not at station but within sight.
10  Mist.	11  Patches of shallow fog at station, not deeper than 2 m (10 m at sea).	12  Continuous shallow fog at station, not deeper than 2 m (10 m at sea).	13  Lightning visible, but no thunder heard.	14  Precipitation visible but not reaching ground at station.	15  Precipitation reaching the ground not at or near the station but at a distance.	16  Precipitation reaching the ground not at the station but nearby.	17  Thunder heard but no precipitation at the station.	18  Wind squall now or during the past hour.	19  Tornado, waterspout, or funnel cloud observed now or during past hour.
20  Recent drizzle (not freezing, not showers) during past hour.	21  Recent rain (not freezing, not showers) during past hour.	22  Recent snow (not showers) during past hour.	23  Recent rain and snow (not showers) during past hour.	24  Freezing drizzle or rain (not showers), not now but during past hour.	25  Rain showers, not now but during past hour.	26  Snow showers, not now but during past hour.	27  Hail or hail and rain, not now but during past hour.	28  Fog, not now but during past hour.	29  Thunderstorm, with or without precipitation, not now but during past hour.
30  Slight/moderate duststorm or sandstorm, decreased during hour.	31  Slight/moderate duststorm or sandstorm, no change during hour.	32  Slight/moderate duststorm or sandstorm, increased during hour.	33  Severe duststorm or sandstorm, which has decreased during hour.	34  Severe duststorm or sandstorm, no change during past hour.	35  Duststorm or sandstorm, severe, has increased during past hour.	36  Drifting snow, slight or moderate.	37  Drifting snow, heavy.	38  Blowing snow, slight or moderate.	39  Blowing snow, heavy.
40 Fog at a distance but not at station during past hour.	41 Patchy fog.	42 Fog, sky discernable, and has become thinner during past hour.	43 Fog, sky not discernable, and has become thinner during past hour.	44 Fog, sky discernable, no change during past hour.	45 Fog, sky not visible, no change during past hour.	46 Fog, sky visible, has begun or become thicker during past hour.	47 Fog, sky not visible, has begun or become thicker during past hour.	48 Freezing fog, sky visible.	49 Freezing fog, sky not visible.
50 Drizzle, light, intermittent, not freezing.	51 Drizzle, light, continous, not freezing.	52 Drizzle, moderate, intermittent, not freezing.	53 Drizzle, moderate, continuous, not freezing.	54 Drizzle, heavy, intermittent, not freezing.	55 Drizzle, heavy, continous, not freezing.	56 Freezing drizzle, light.	57 Freezing drizzle, moderate or heavy.	58 Drizzle and rain mixed, light.	59 Drizzle and rain mixed, moderate or heavy.
60 Rain, light, intermittent, not freezing.	61 Rain, light, continous, not freezing.	62 Rain, moderate, intermittent, not freezing.	63 Rain, moderate, continuous, not freezing.	64 Rain, heavy, intermittent, not freezing.	65 Rain, heavy, continous, not freezing.	66 Freezing rain, light.	67 Freezing rain, moderate or heavy.	68 Rain and snow mixed, light.	69 Rain and snow mixed, moderate or heavy.
70 Snow, light, intermittent.	71 Snow, light, continous.	72 Snow, moderate, intermittent.	73 Snow, moderate, continous.	74 Snow, heavy, intermittent.	75 Snow, heavy, continous.	76 Ice needles, with or without fog.	77 Snow grains, with or without fog.	78 Snow crystals, with or without fog.	79 Ice pellets (sleet).
80 Rain showers, light.	81 Rain showers, moderate or heavy.	82 Rain showers, torrential.	83 Rain/snow showers mixed, light.	84 Rain/snow showers mixed, moderate or heavy.	85 Snow showers, light.	86 Snow showers, moderate or heavy.	87 Ice pellet showers, light.	88 Ice pellet showers, moderate or heavy.	89 Hail, light, not associated with thunder.
90 Hail, moderate or heavy, not associated with thunder.	91 Rain, light. Thunder heard during past hour but not now.	92 Rain, moderate or heavy. Thunder heard during past hour but not now.	93 Light snow or rain/snow mixed with hail. Thunder heard during past hour.	94 Moderate or heavy snow or rain/snow with hail. Thunder in past hour.	95 Thunderstorm, light or moderate. Rain or snow, but no hail.	96 Thunderstorm, light or moderate, with hail.	97 Thunderstorm, severe. Rain or snow, but no hail.	98 Thunderstorm, with duststorm or sandstorm.	99 Thunderstorm, severe, with hail.

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

= 65 knots

Wind direction

The direction of the barb reflects which way the wind is coming *from*

NORTHERLY
From the north

360°

270°

90°

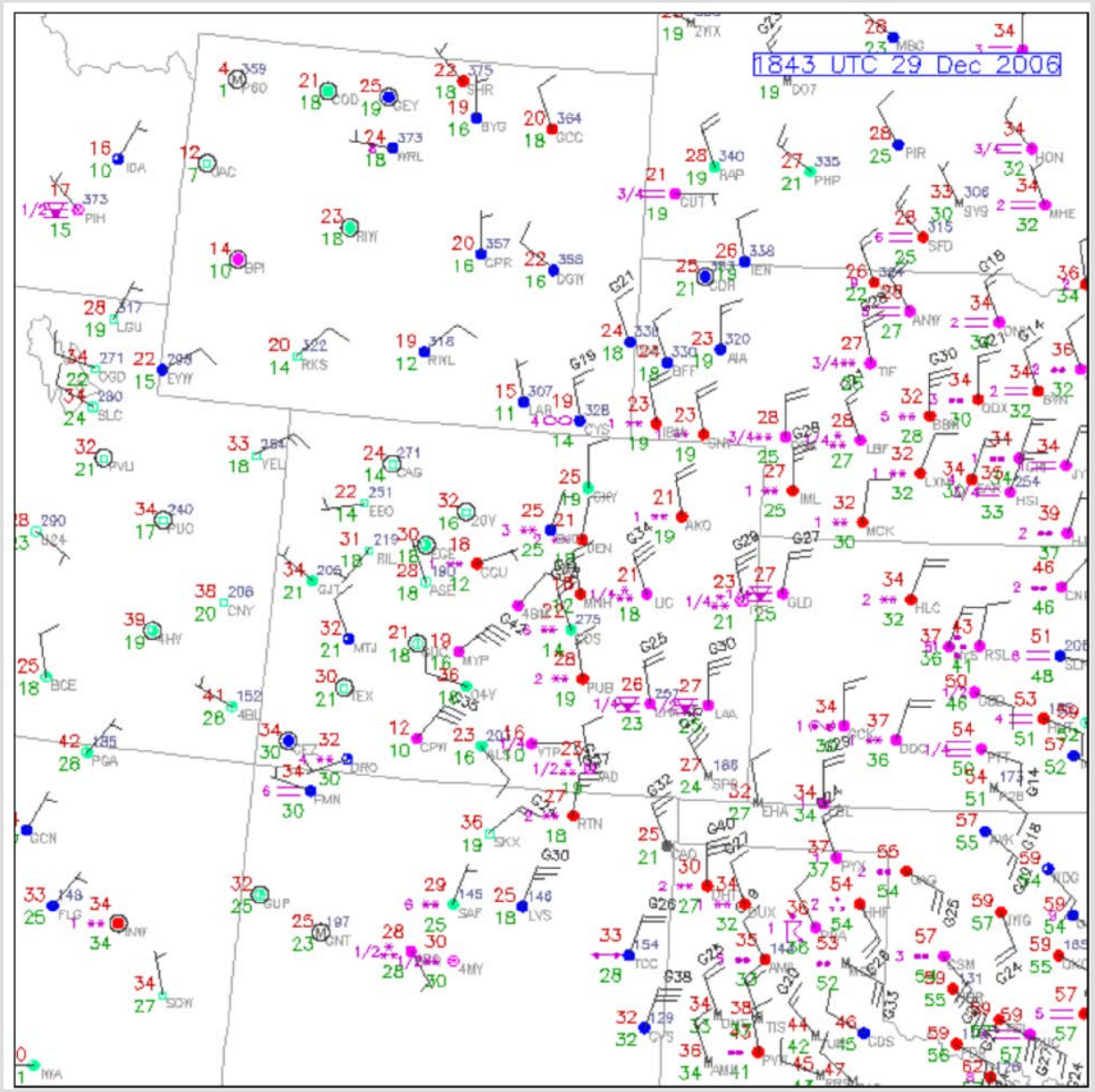
180°

WESTERLY
From the west

EASTERLY
From the east

SOUTHERLY
From the south

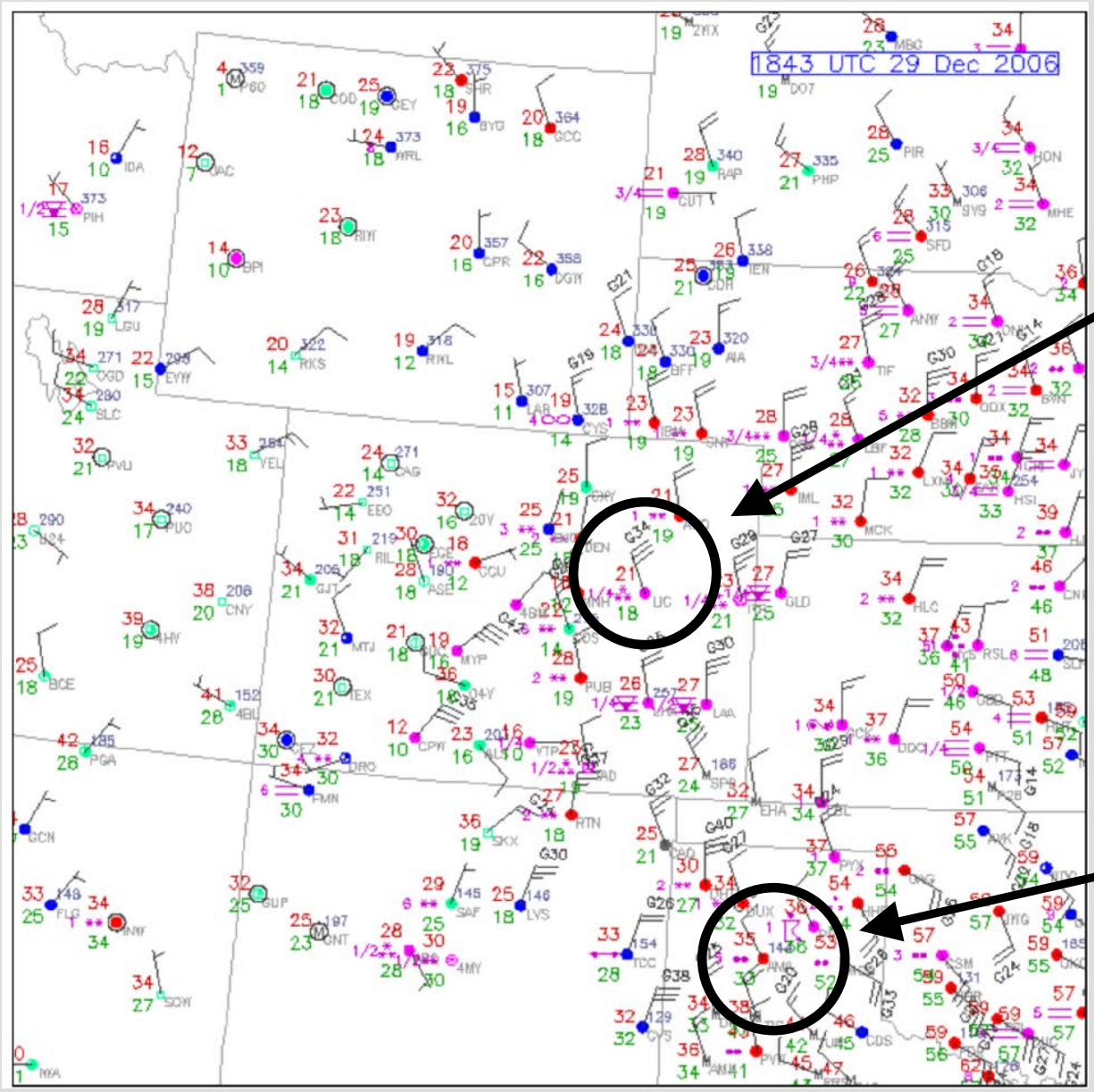
Eastern Colorado Snowstorm 12-29-06



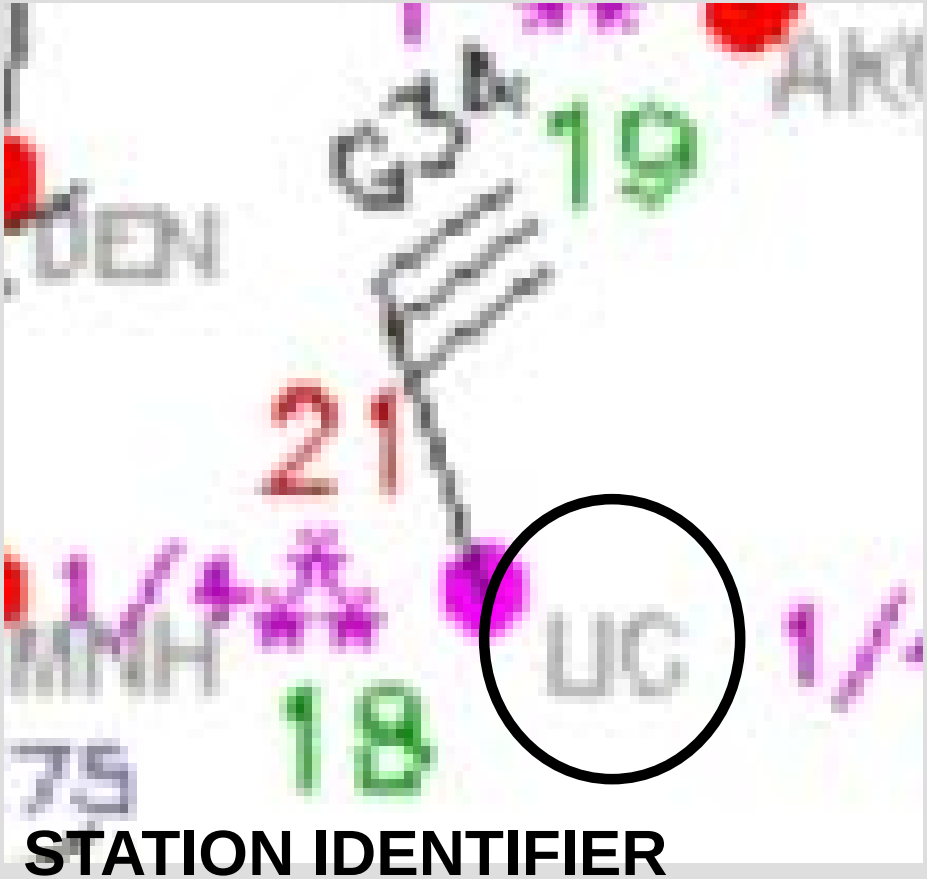
(From UCAR RAP website)

What was happening in Colorado?

(CNN images)


1843 UTC 29 Dec 2006
LIMON, COLORADO
AMARILLO, TEXAS

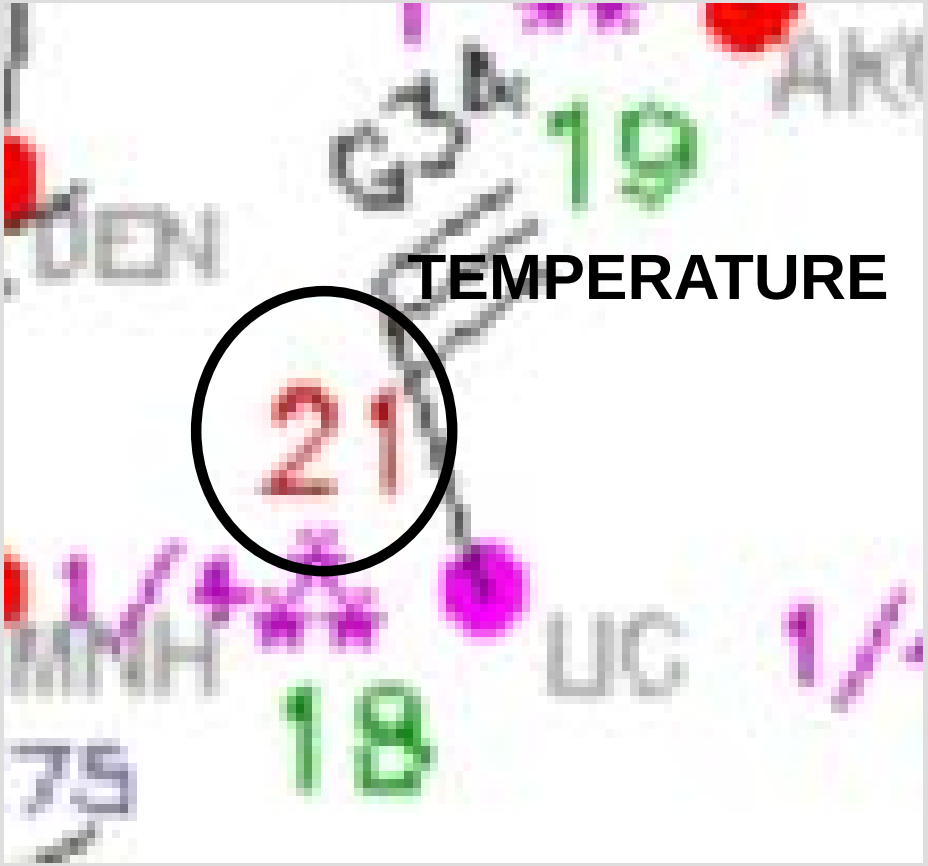
Limon, Colorado (LIC)



STATION IDENTIFIER

Weather conditions

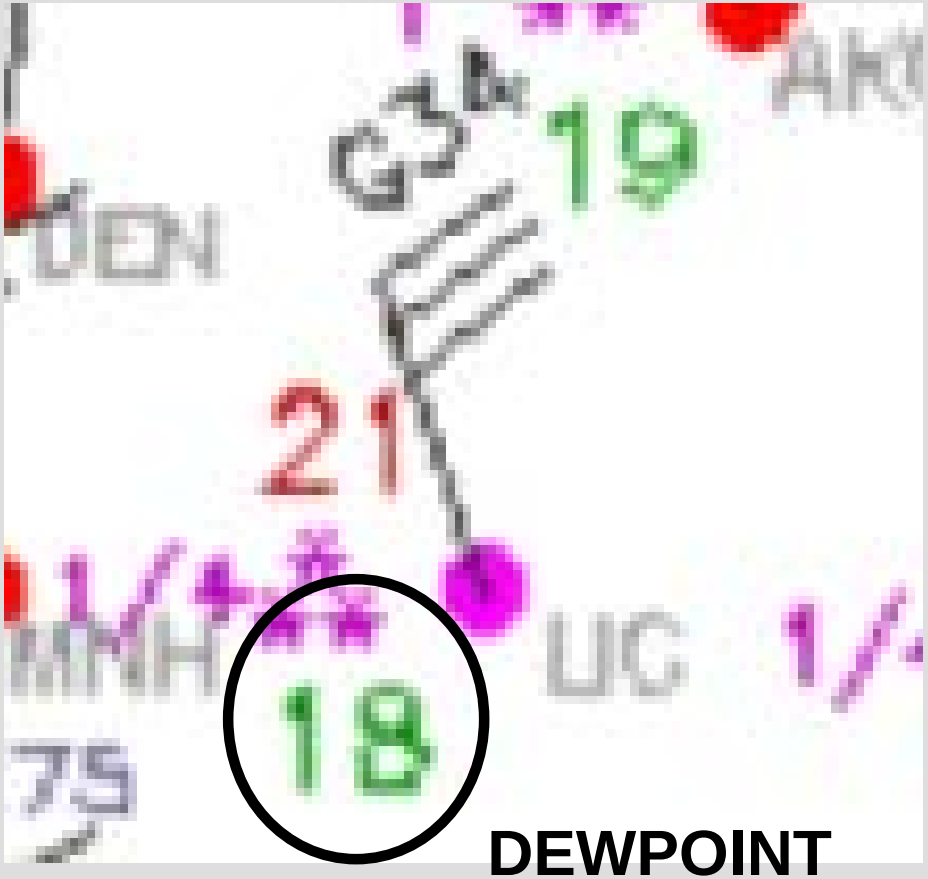
Limon, Colorado (LIC)



Weather conditions

Temperature: 21°F

Limon, Colorado (LIC)

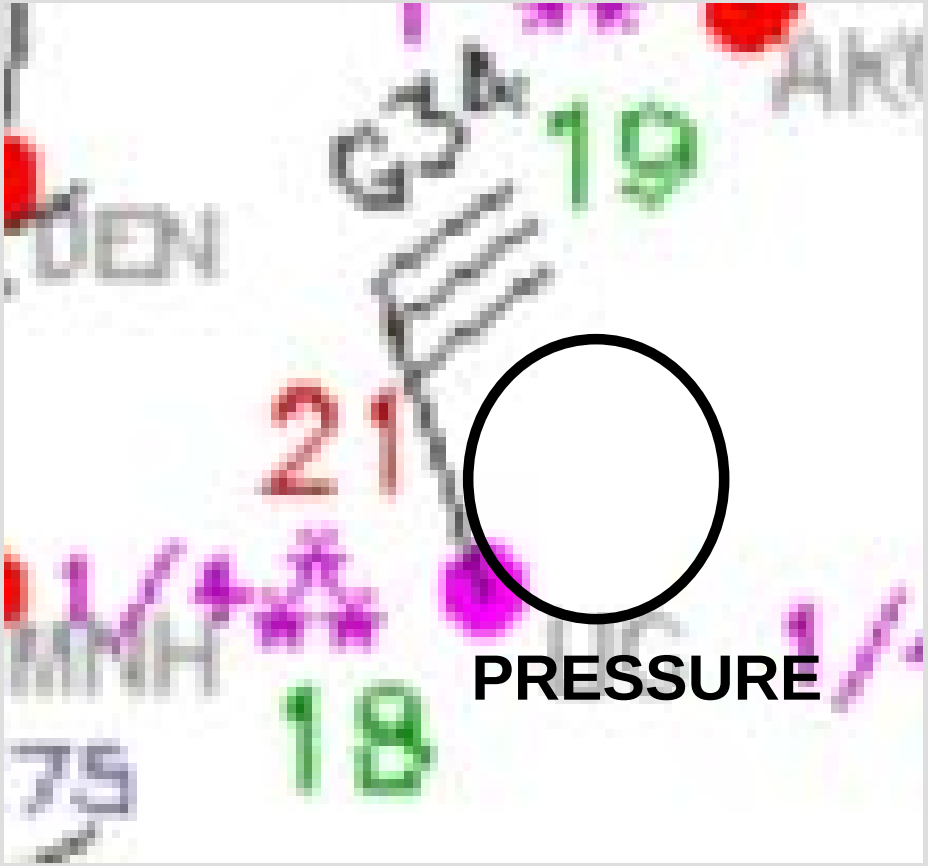


DEWPOINT

Weather conditions

Temperature: 21°F
Dewpoint: 18°F

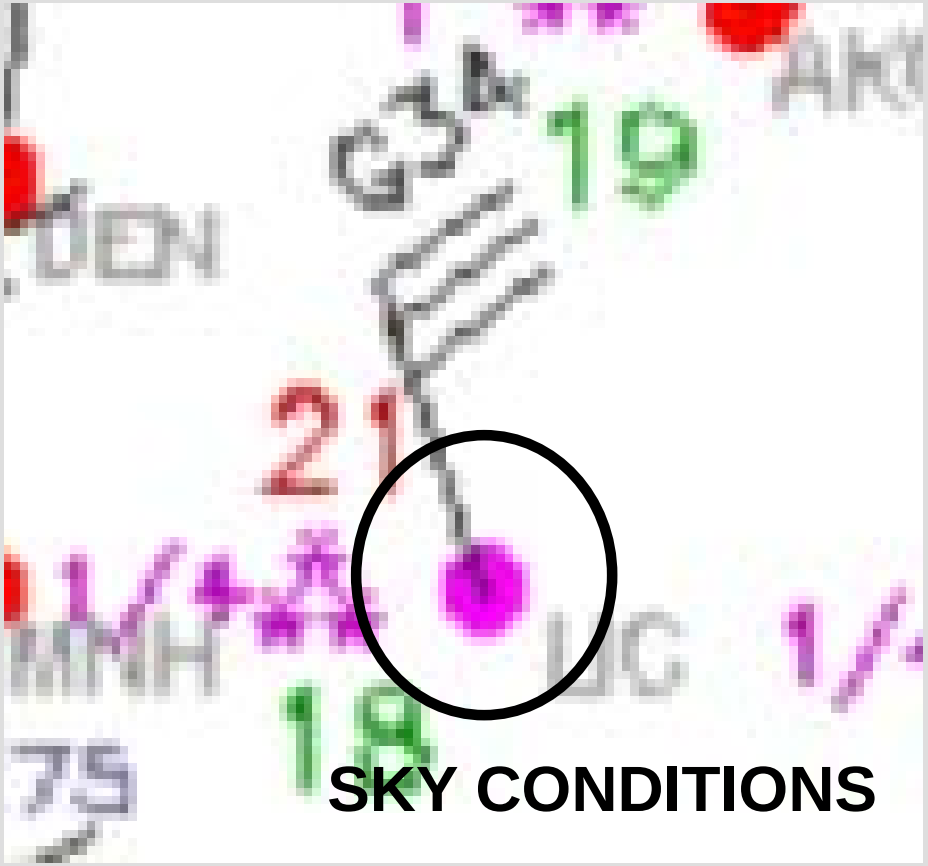
Limon, Colorado (LIC)



Weather conditions

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

Limon, Colorado (LIC)



Weather conditions

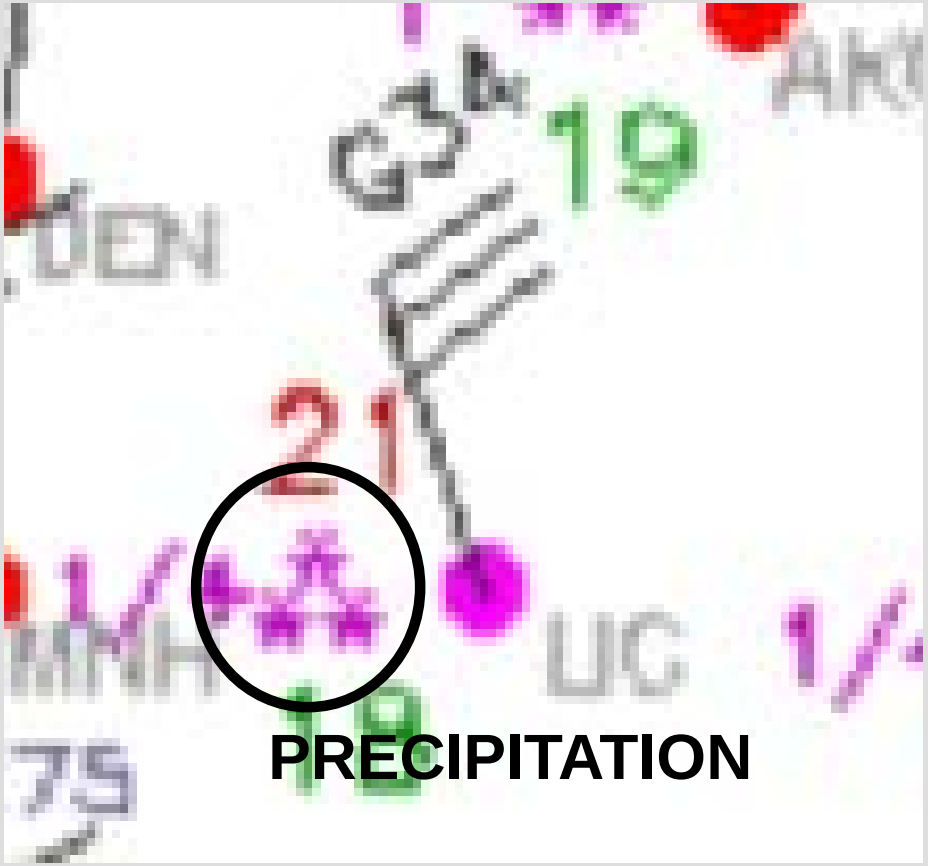
Temperature: 21°F
Dewpoint: 18°F
Pressure: Not available
Sky conditions: Overcast

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.

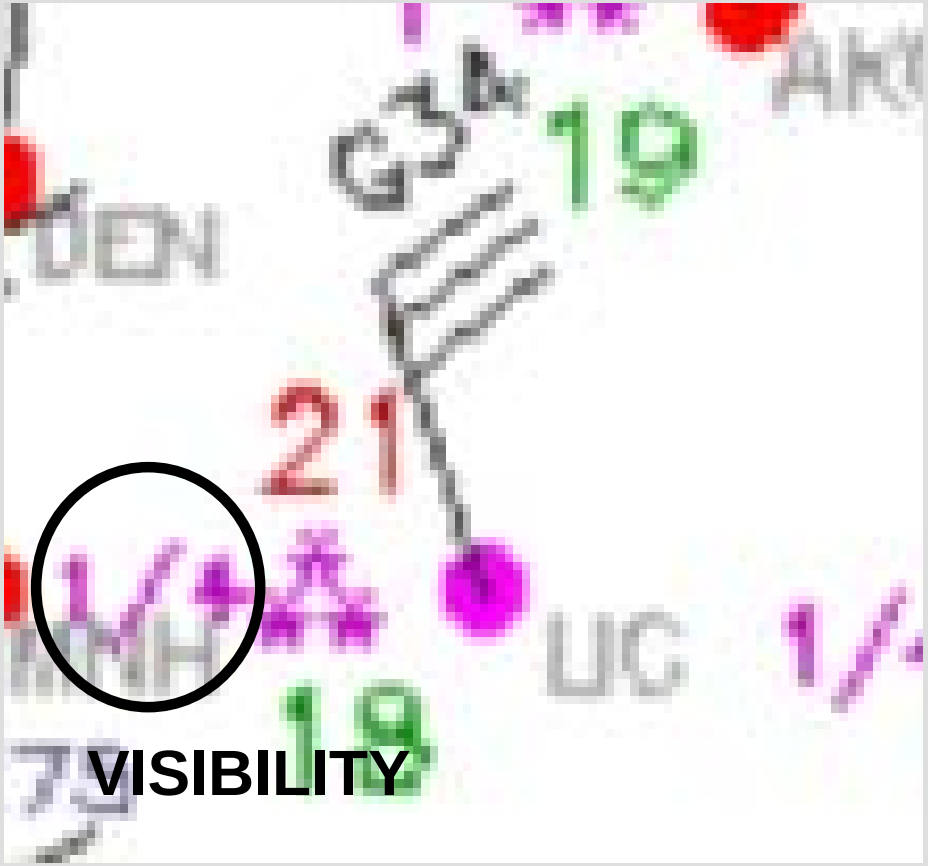
Limon, Colorado (LIC)



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

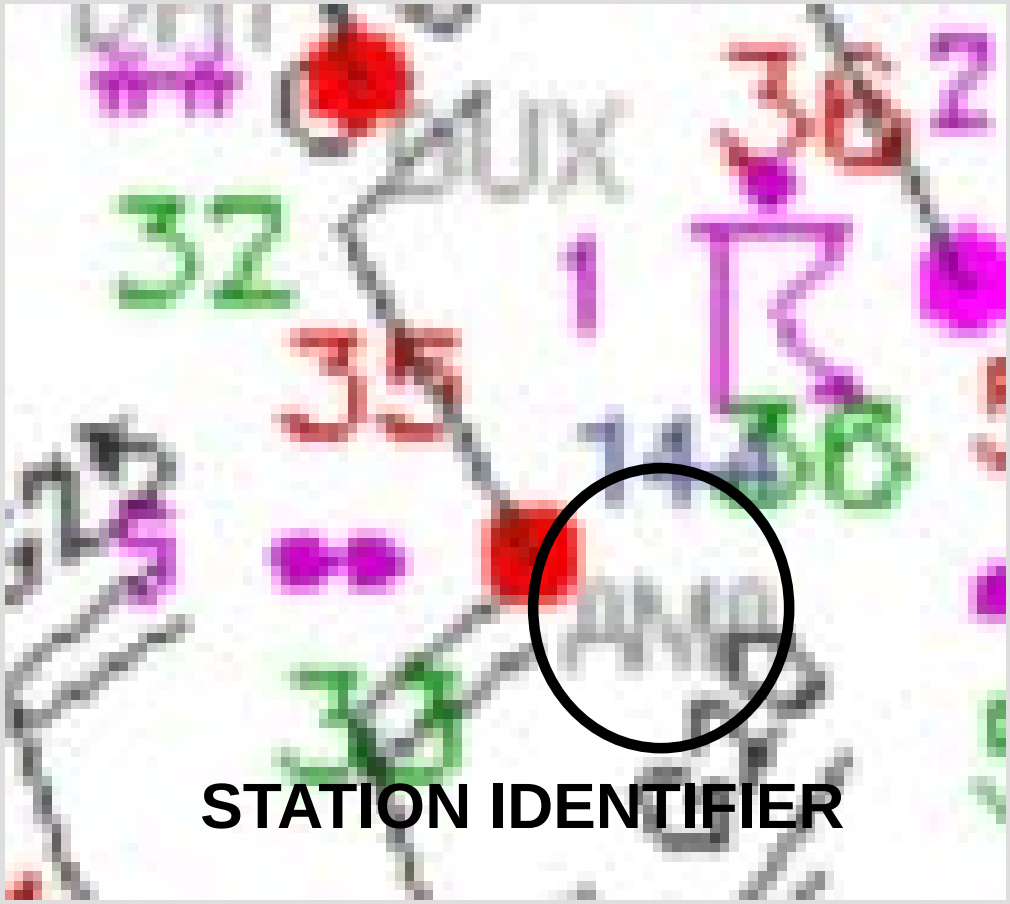
Limon, Colorado (LIC)



Weather conditions

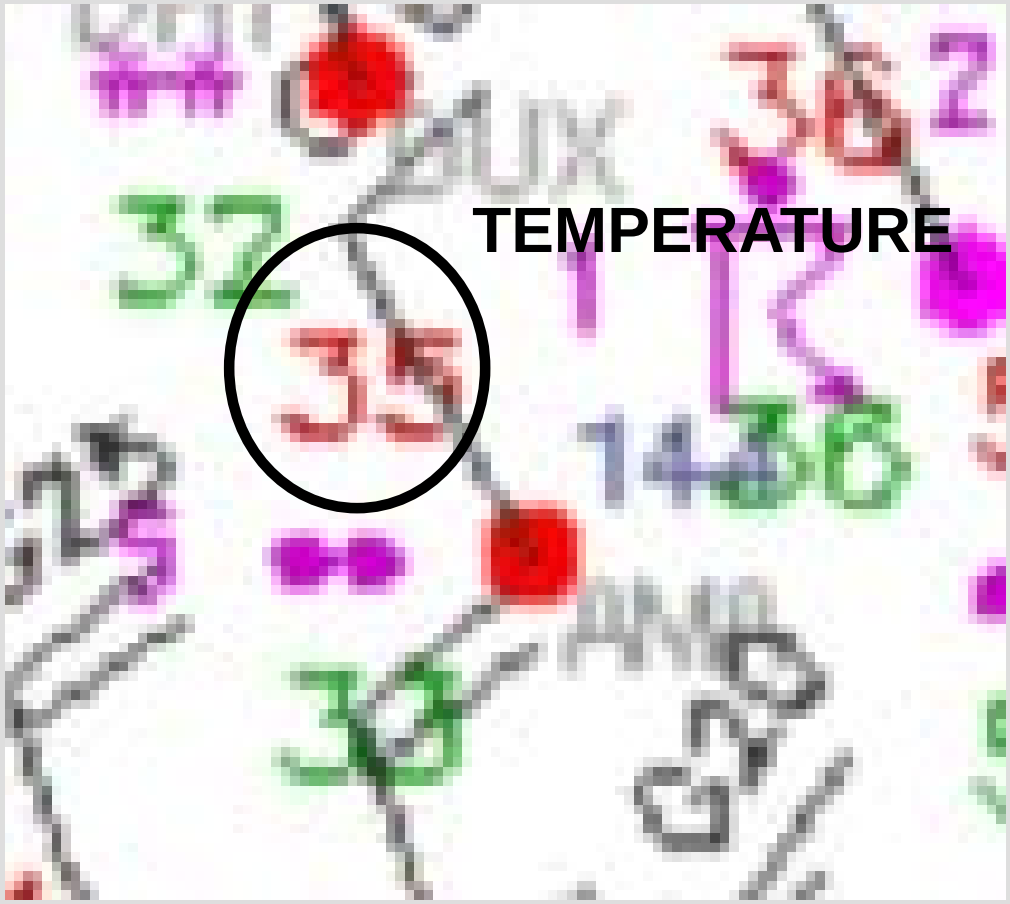
Temperature: 21°F
Dewpoint: 18°F
Pressure: Not available
Sky conditions: Overcast
Wind: North-northwesterly at 30 knots
Precipitation: Moderate Snow
Visibility: Quarter mile

Amarillo, Texas (AMA)



Weather conditions

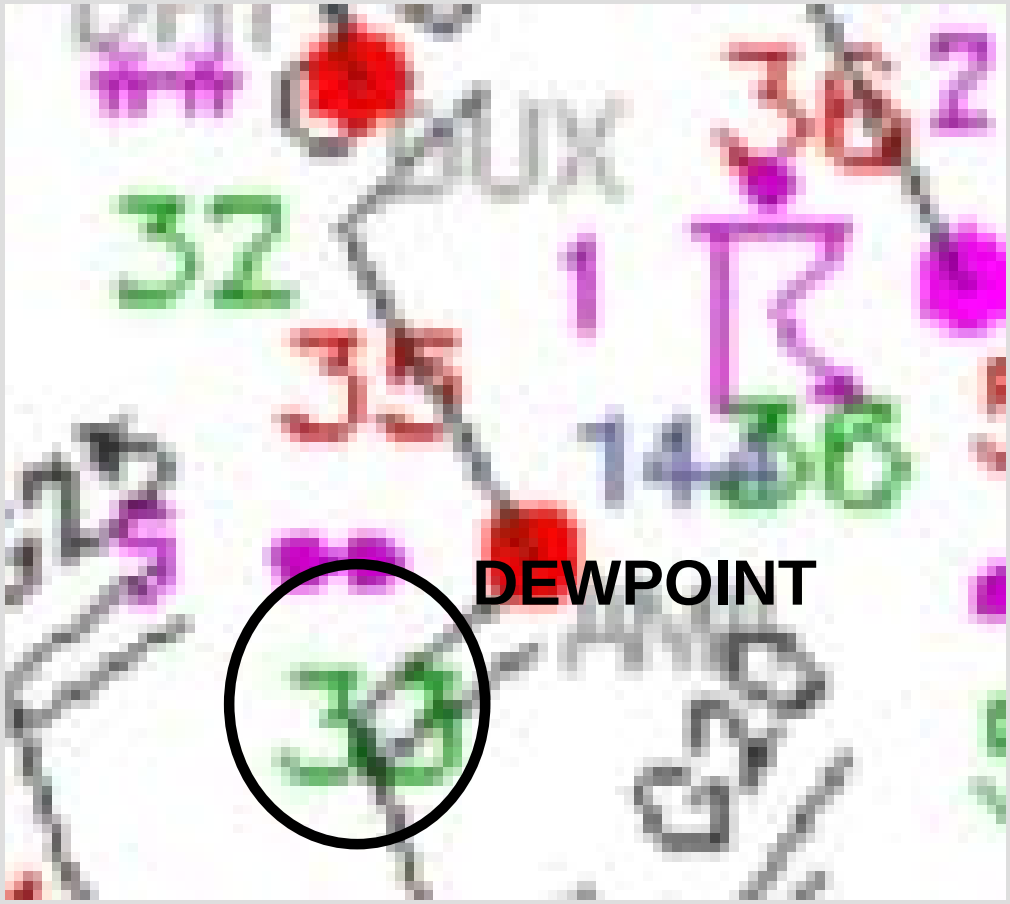
Amarillo, Texas (AMA)



Weather conditions

Temperature: 35°F

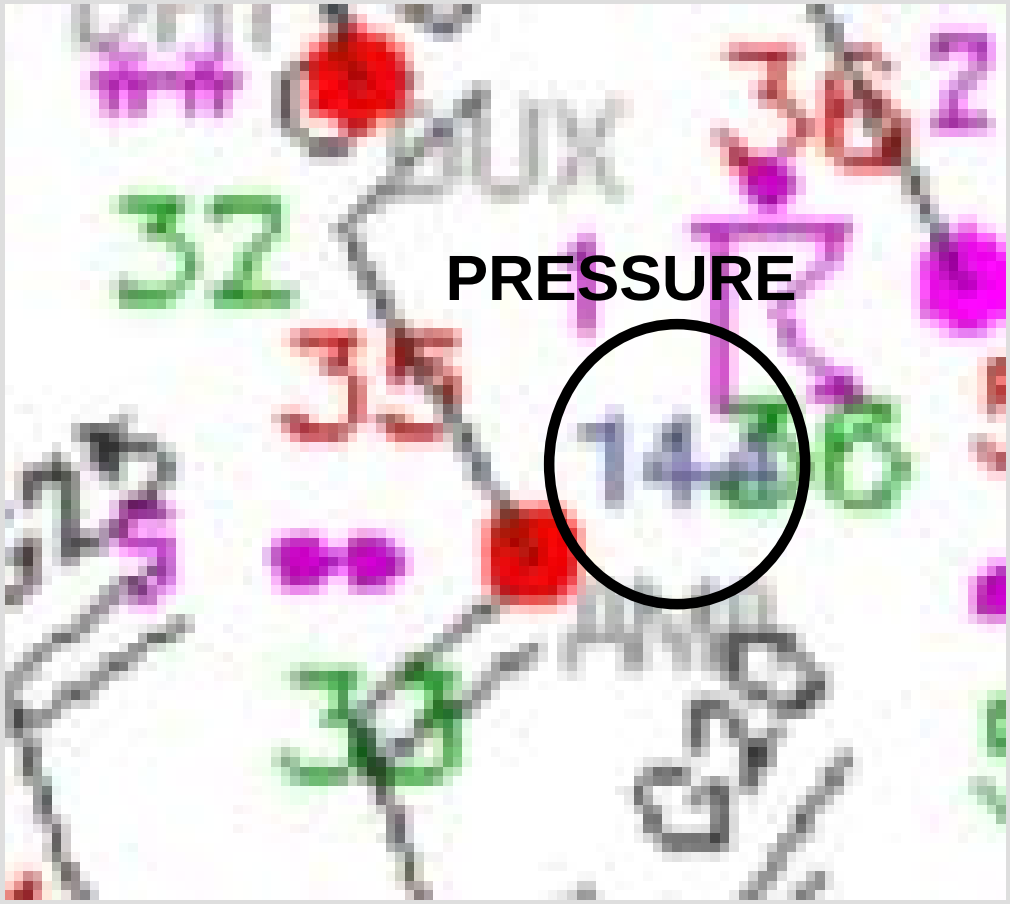
Amarillo, Texas (AMA)



Weather conditions

Temperature: 35°F
Dewpoint: 33°F

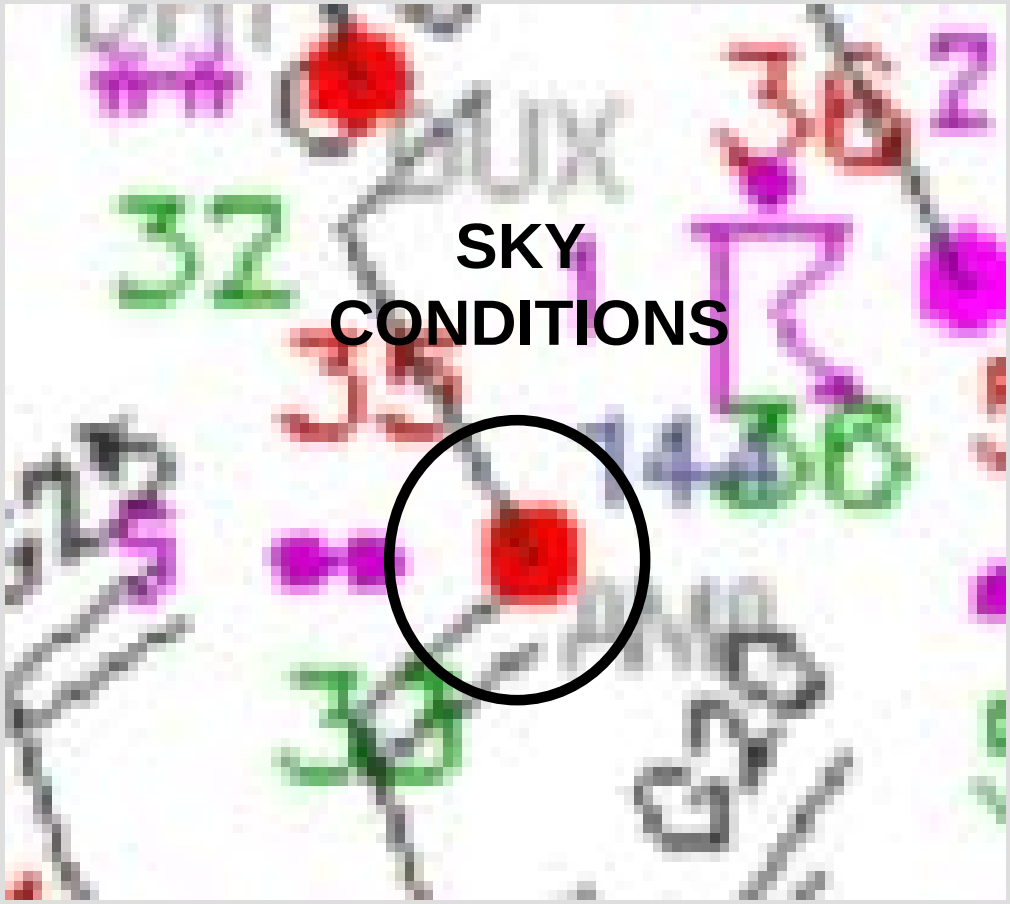
Amarillo, Texas (AMA)



Weather conditions

Temperature: 35°F
Dewpoint: 33°F
Pressure: 1014.4 mb

Amarillo, Texas (AMA)



Weather conditions

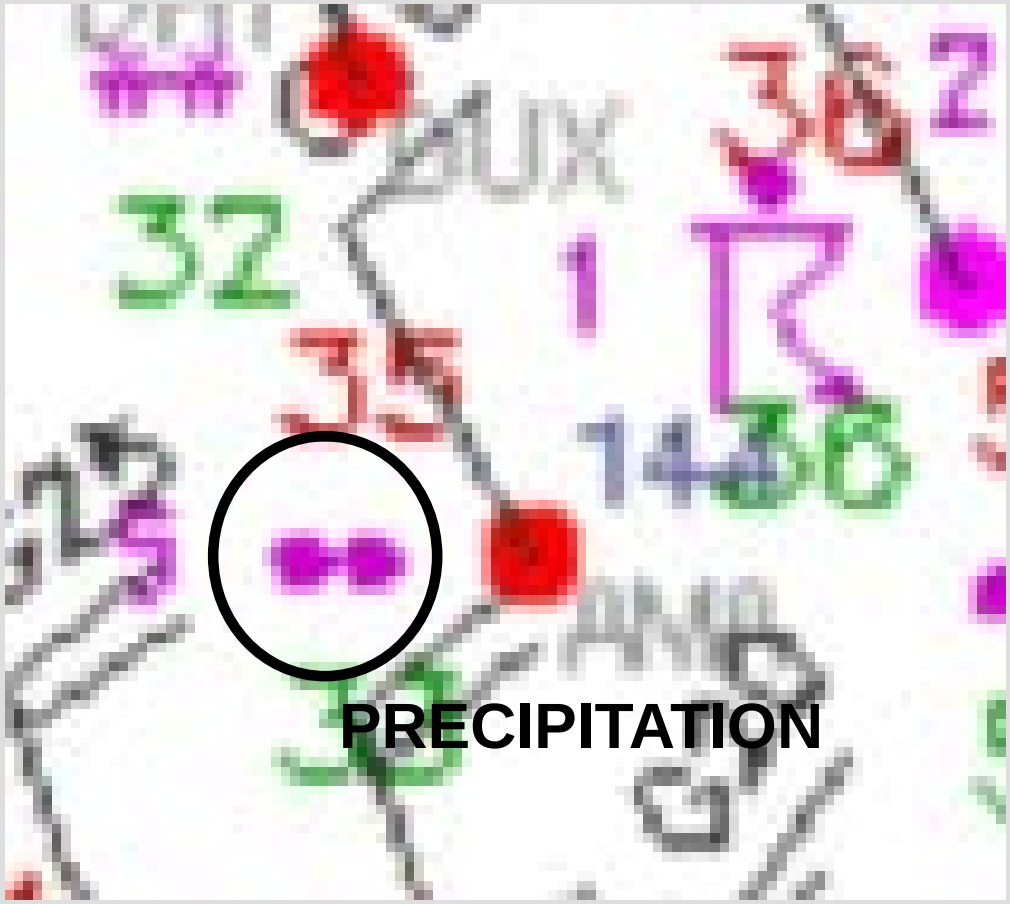
Temperature: 35°F
Dewpoint: 33°F
Pressure: 1014.4 mb
Sky conditions: Overcast

Amarillo, Texas (AMA)

Weather conditions

Temperature: 35°F
Dewpoint: 33°F
Pressure: 1014.4 mb
Sky conditions: Overcast
Wind: Northwesterly at 10 knots

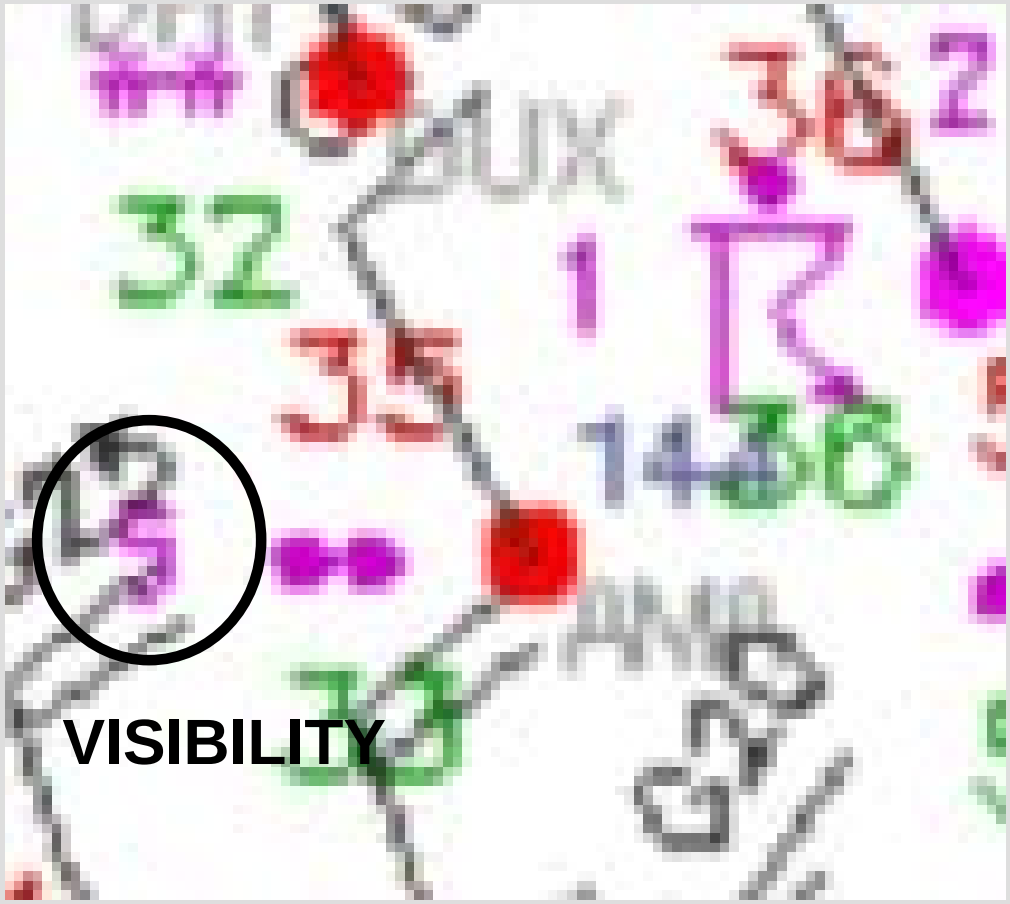
Amarillo, Texas (AMA)



Weather conditions

Temperature: 35°F
Dewpoint: 33°F
Pressure: 1014.4 mb
Sky conditions: Overcast
Wind: Northwesterly at 10 knots
Precipitation: Light rain

Amarillo, Texas (AMA)



Weather conditions

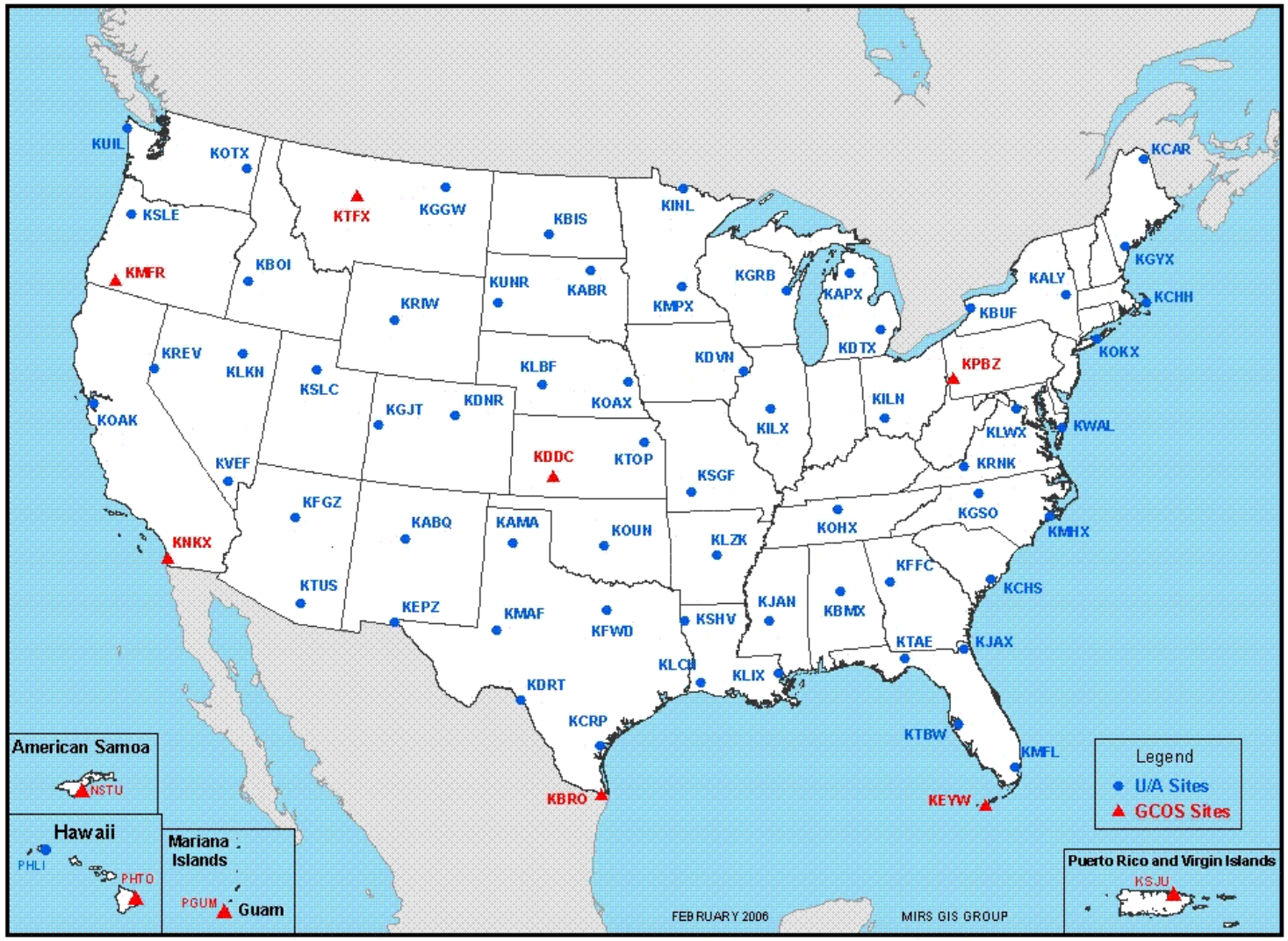
Temperature: 35°F
Dewpoint: 33°F
Pressure: 1014.4 mb
Sky conditions: Overcast
Wind: Northwesterly at 10 knots
Precipitation: Light rain
Visibility: Five miles

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)


KUIL
KOTX
KTFX
KGGW
KBIS
KINL
KCAR
KSLE
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KMFR
KBOI
KUNR
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KGRB
KAPX
KALY
KCHH
KRIW
KBUF
KREV
KLKN
KLBF
KDVN
KDTX
KPBZ
KOKX
KSLC
KOAX
KOAK
KGJT
KDNR
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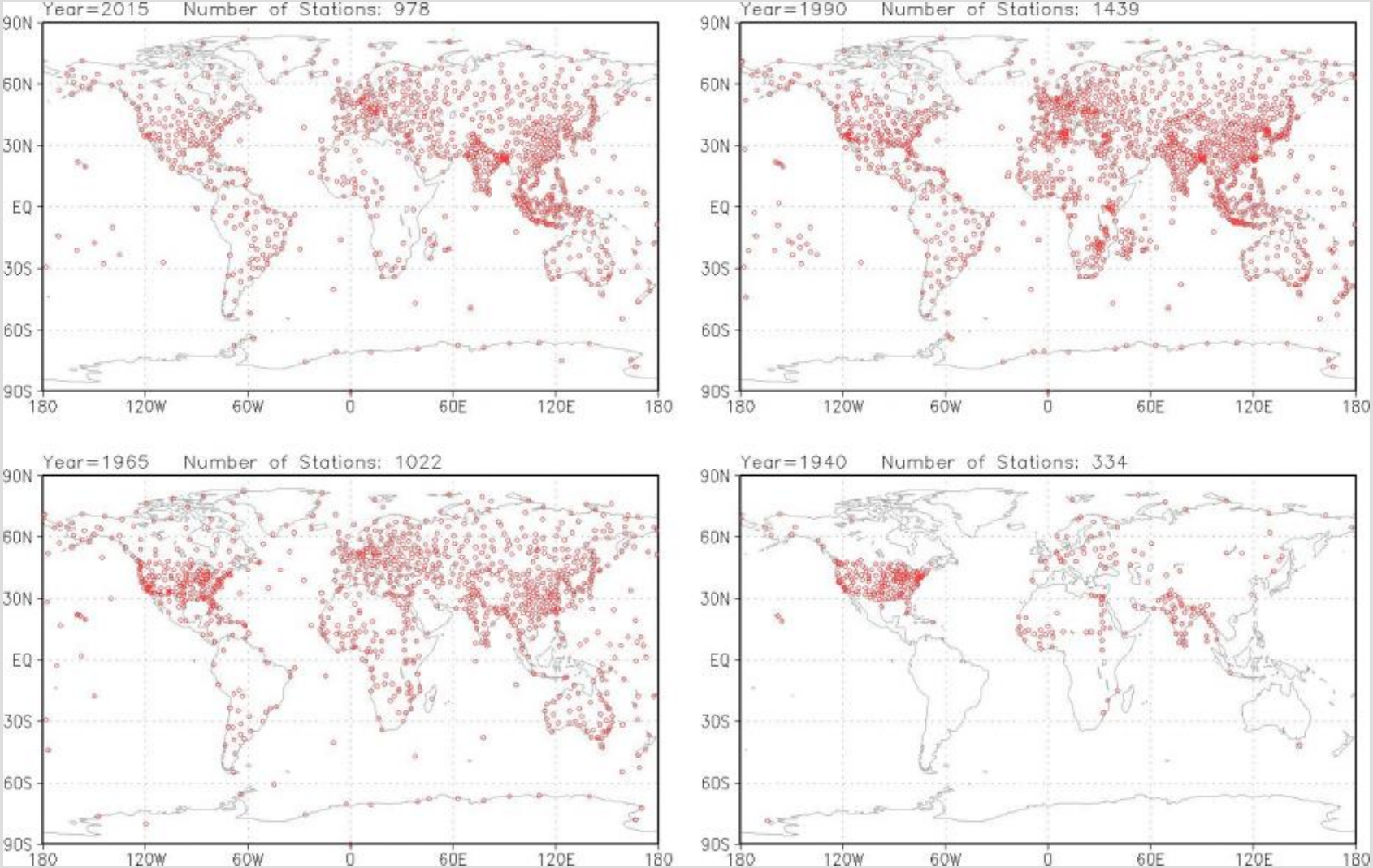
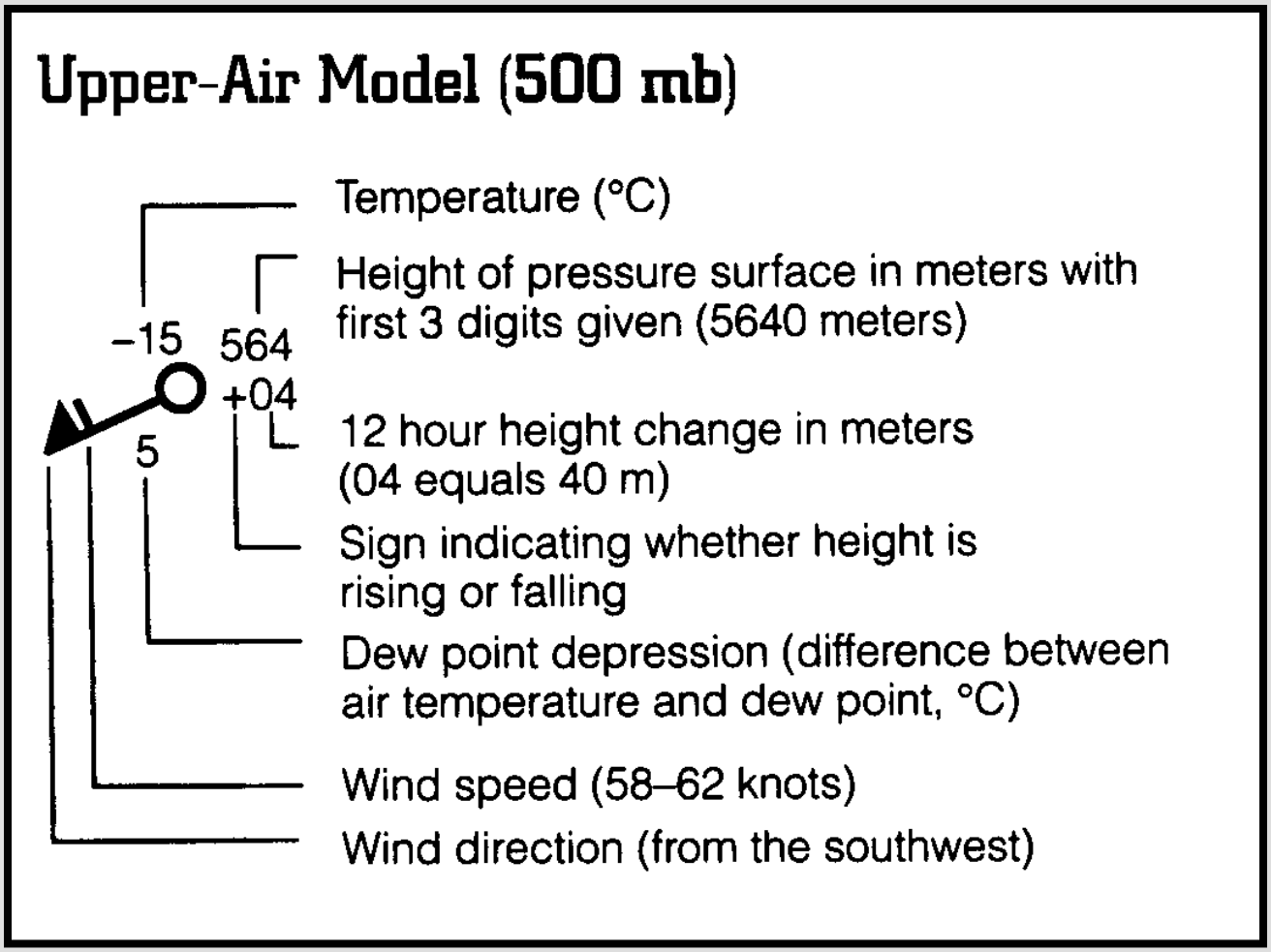
KABQ
KAMA
KOUN
KLZK
KFFC
KCHS
KTUS
KEPZ
KMAF
KFWD
KSHV
KJAN
KBMX
KJAX
KTAE
KLCH
KLIX
KDRT
KCRP
KTBW
KMFL
KBRO
KEYW
American Samoa
NSTU
Hawaii
PHLI
PHTO
Mariana Islands
PGUM
Guam
Legend
U/A Sites
GCOS Sites
Puerto Rico and Virgin Islands
KSJU
FEBRUARY 2006
MIRS GIS GROUP

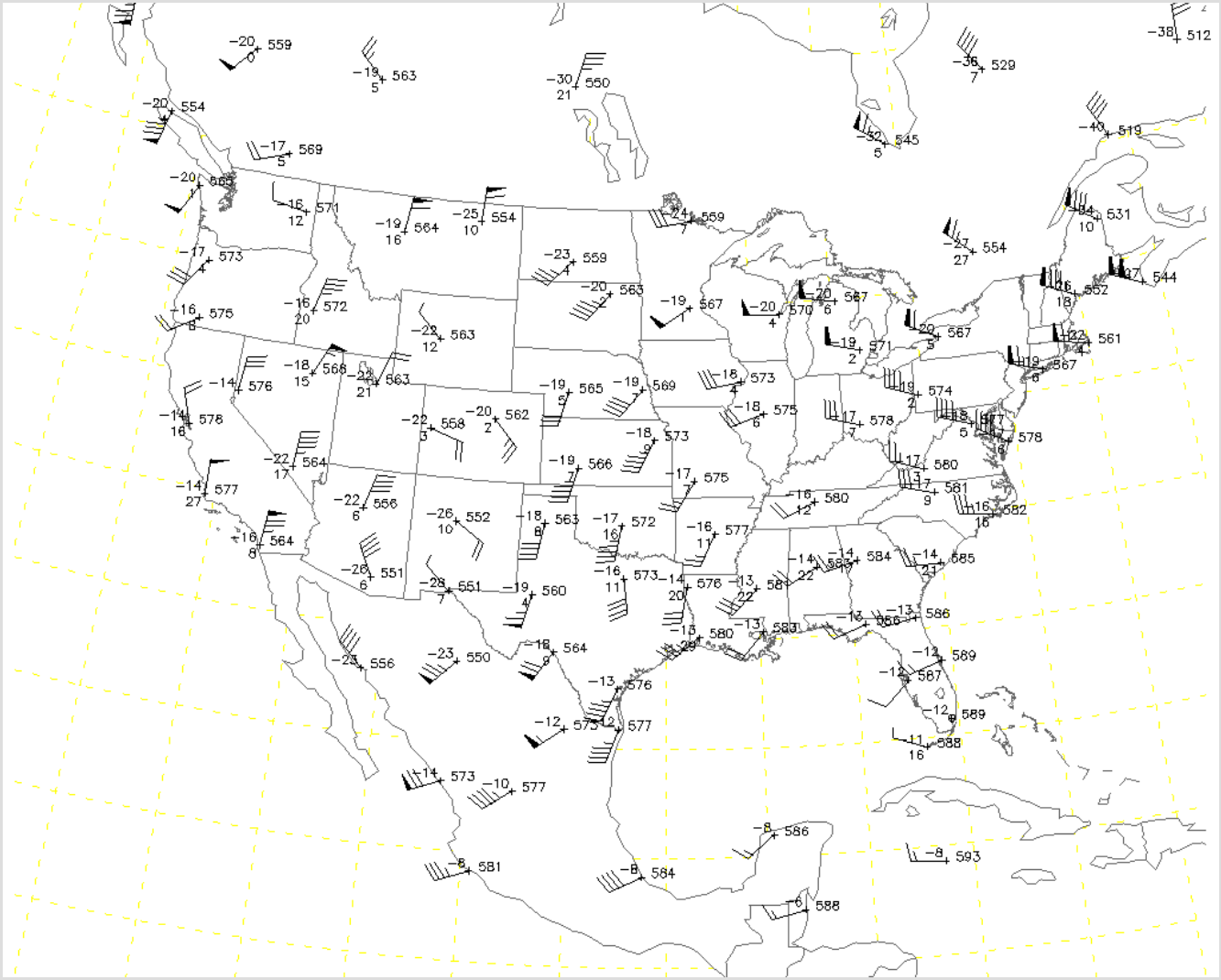


https://www.ncdc.noaa.gov/data-access/weather-balloon/integrated-global-radiosonde-archive

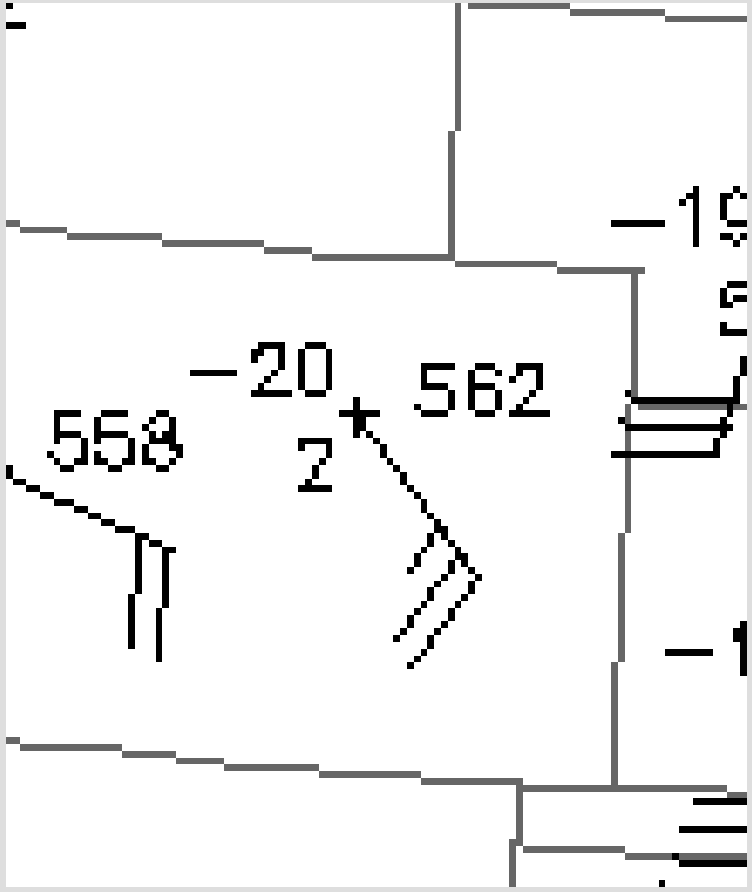
Upper Air Station Model
(At specific pressure level)



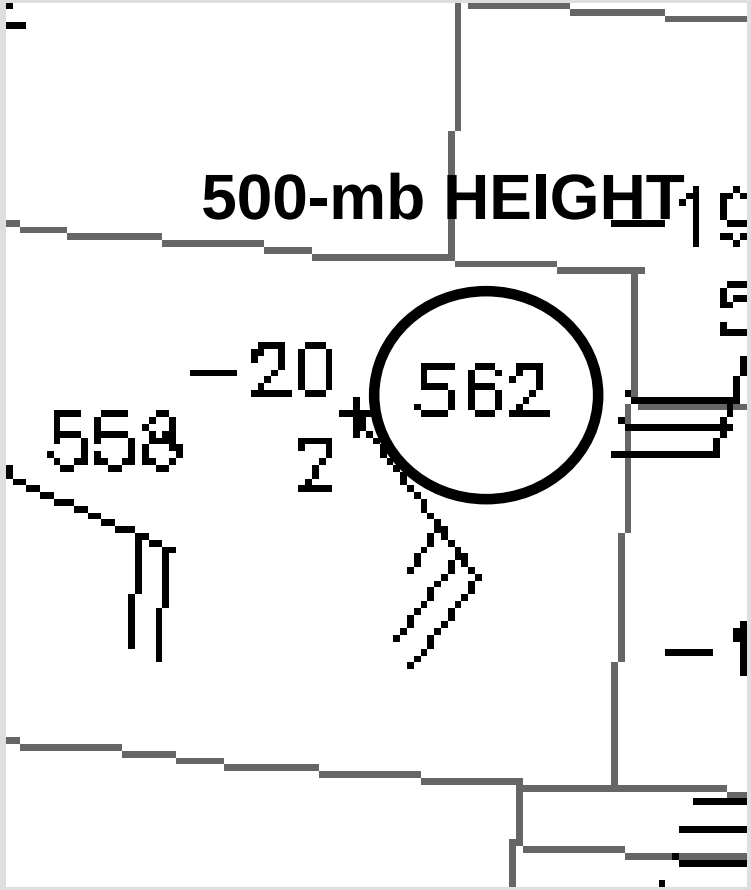
500-mb Map: 12-29-06



500-mb Conditions at Denver (DEN)

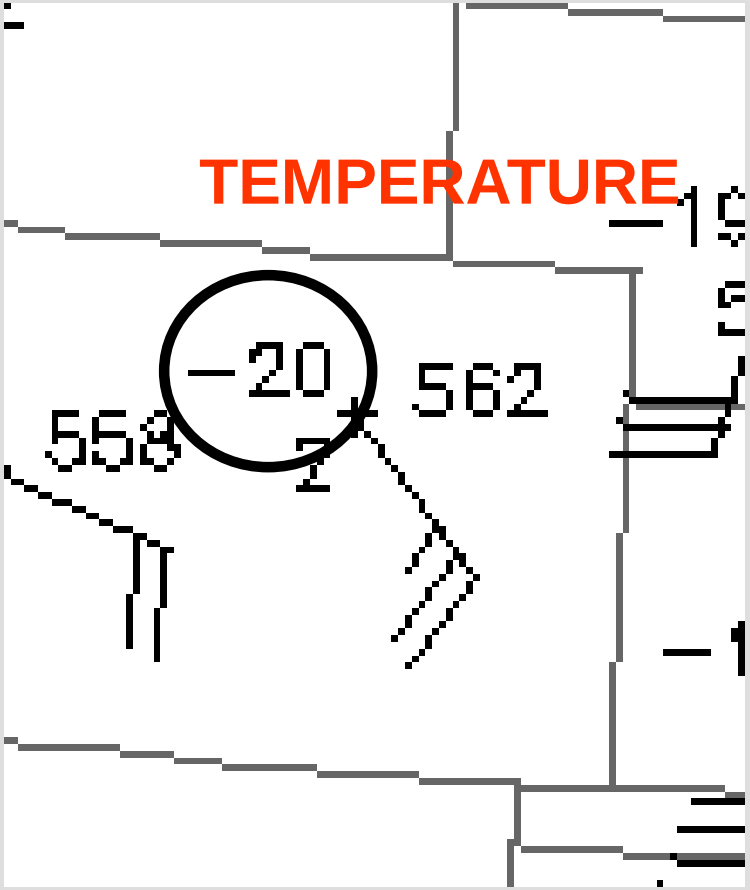


500-mb Conditions at Denver (DEN)



Height of 500-mb Surface:
5620 m

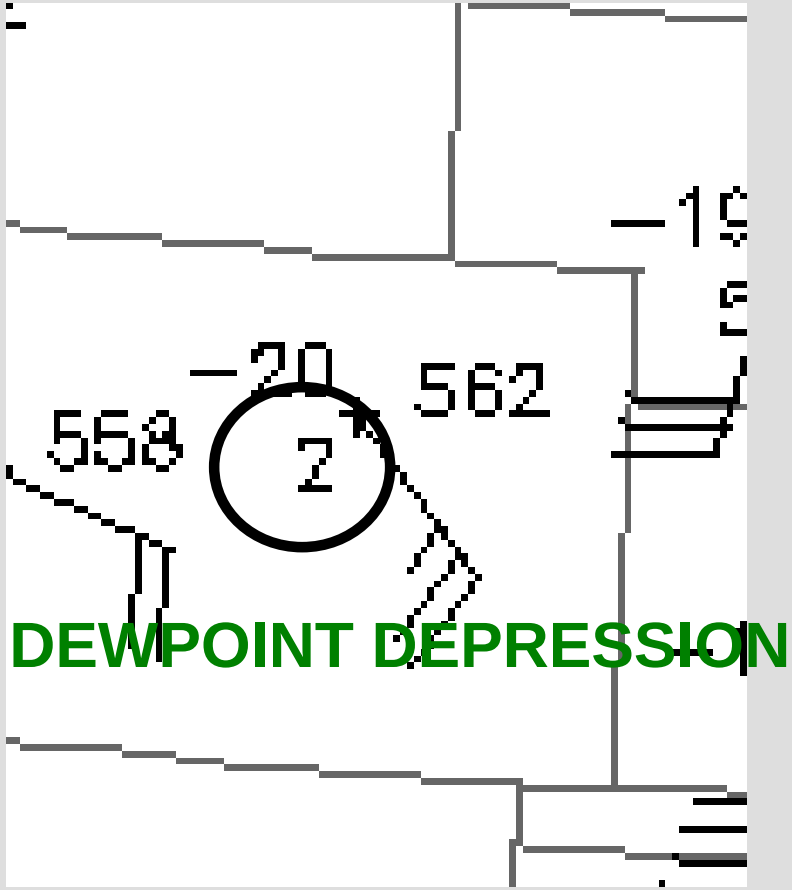
500-mb Conditions at Denver (DEN)



Height of 500-mb Surface: 5620 m

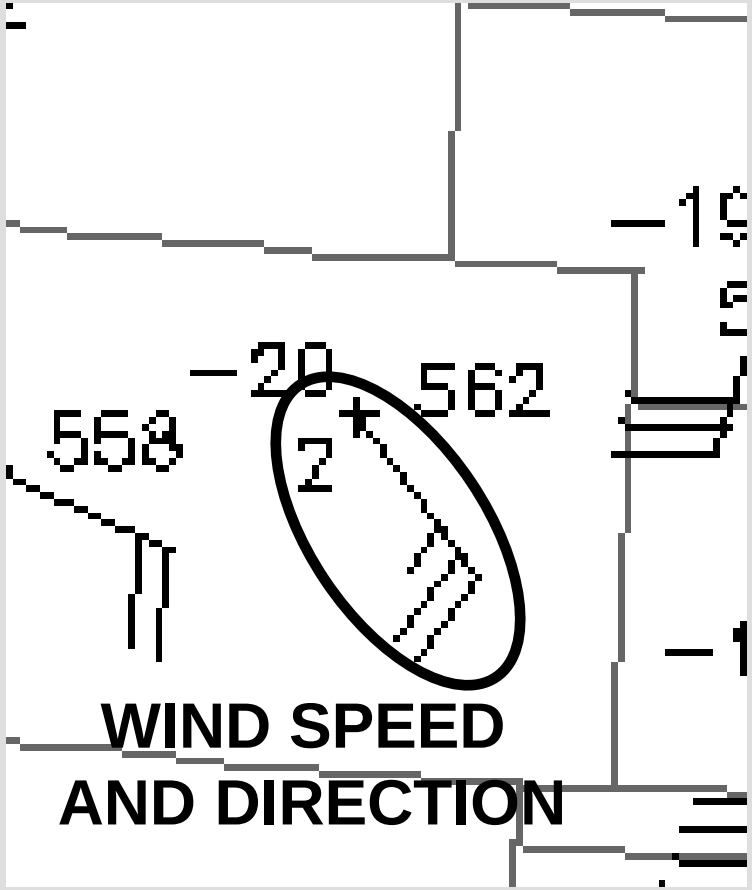
Temperature: -20° C

500-mb Conditions at Denver (DEN)



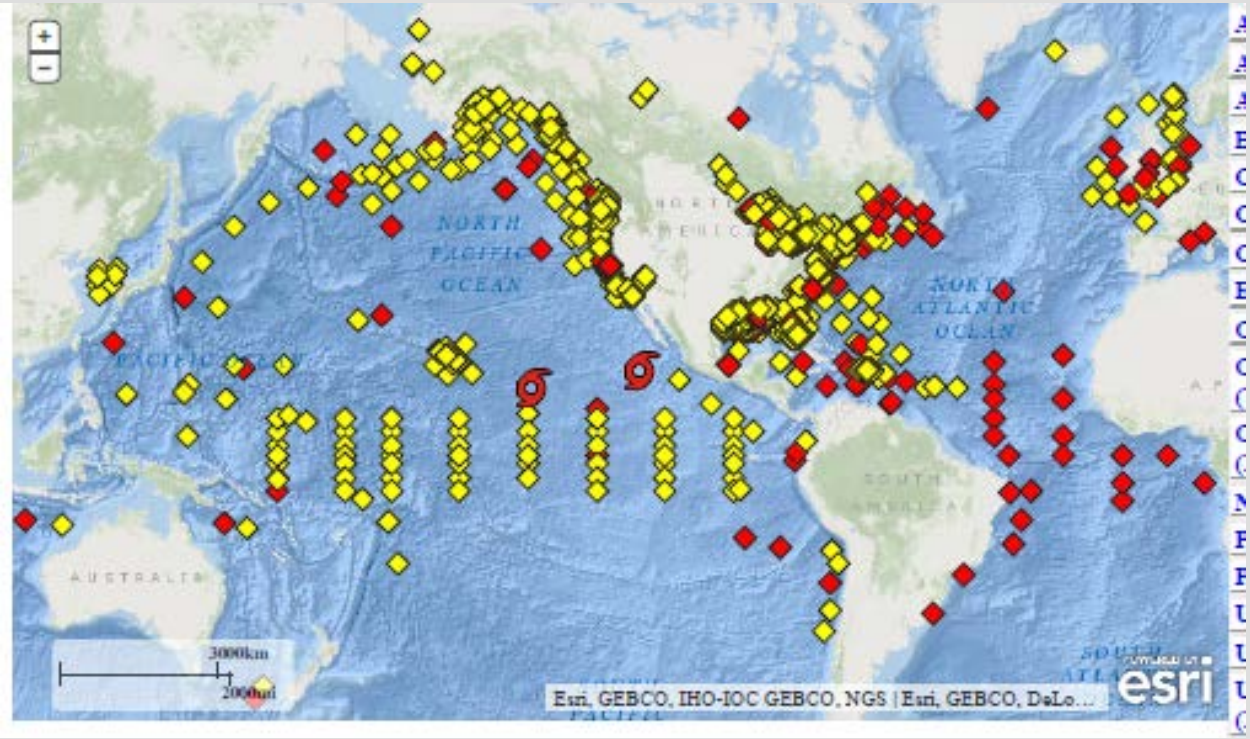
Height of 500-mb Surface: 5620 m
Temperature: -20° C
Dewpoint: -22° C

500-mb Conditions at Denver (DEN)



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

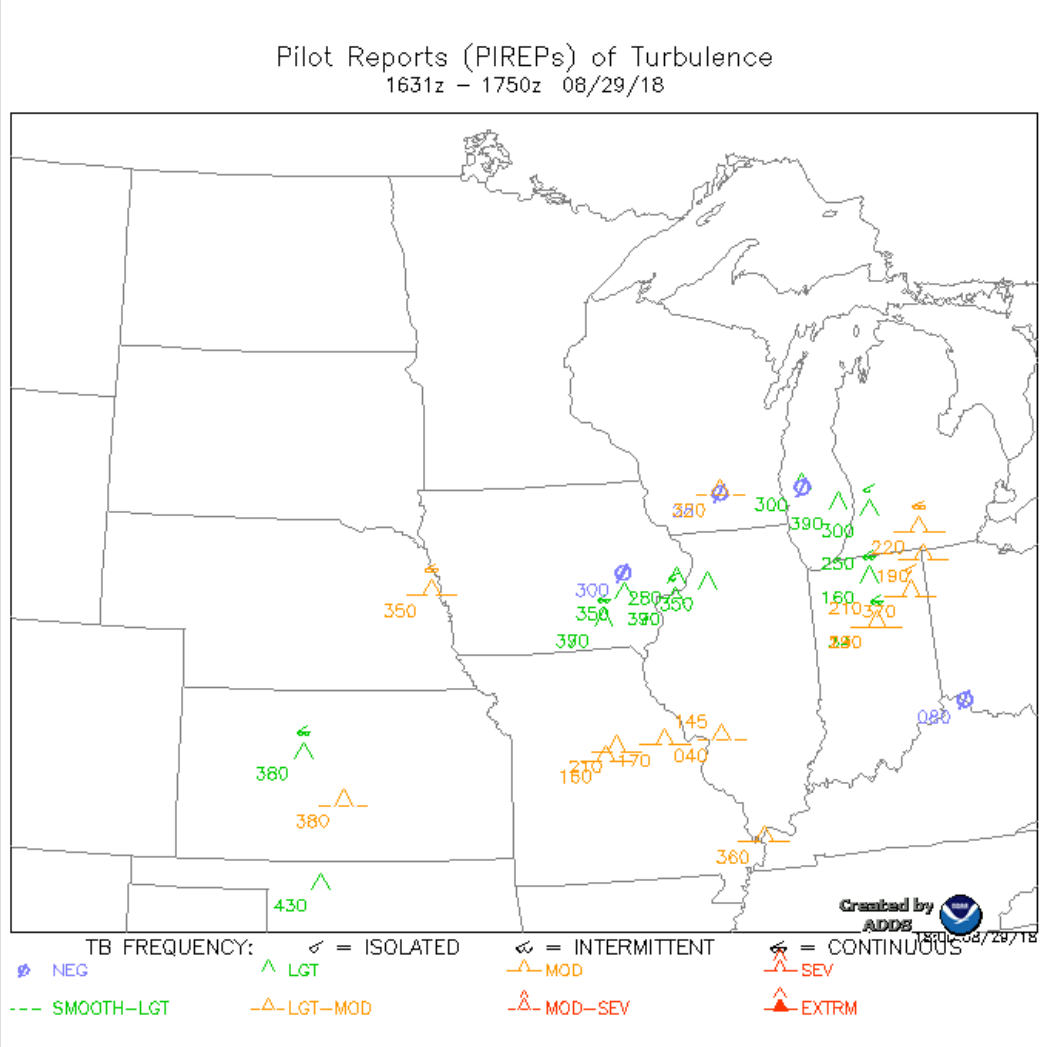
Ocean data
National Buoy Data Center



Drifting and moored ocean buoys.

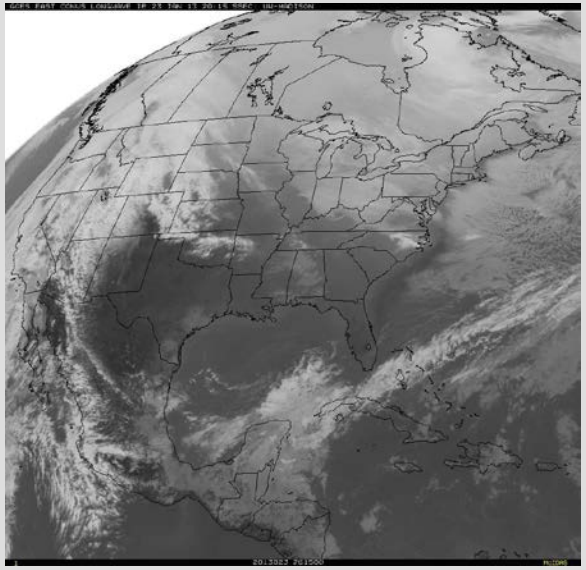
https://www.ndbc.noaa.gov/

Aircraft reports: Aviation Weather Center



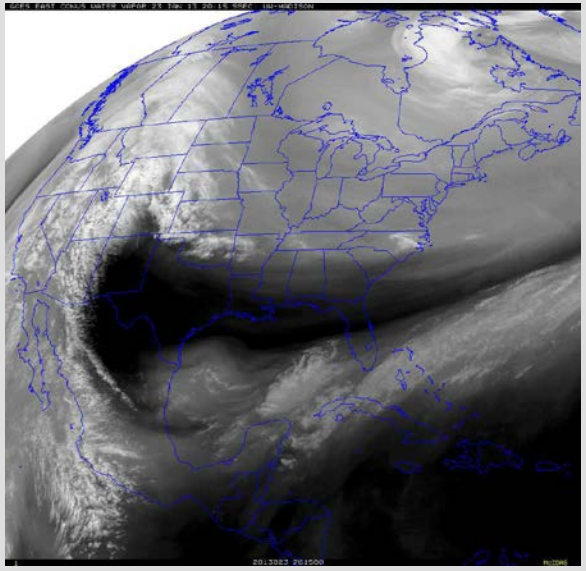
https://www.aviationweather.gov/

IR (10.7 microns)

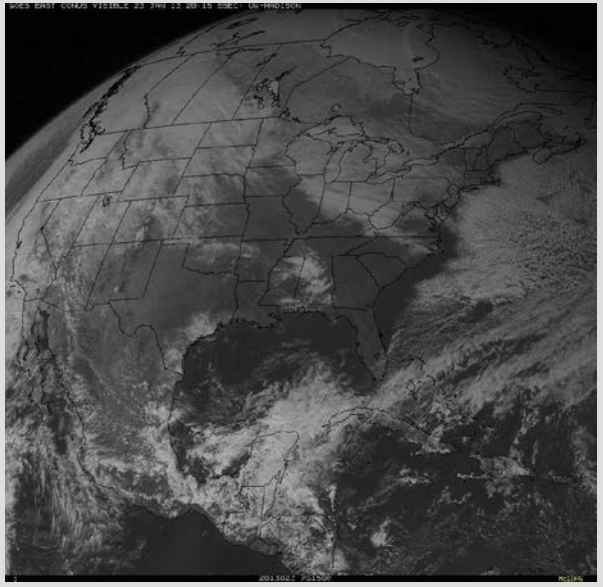


Most commonly used satellite data for daily weather forecasting

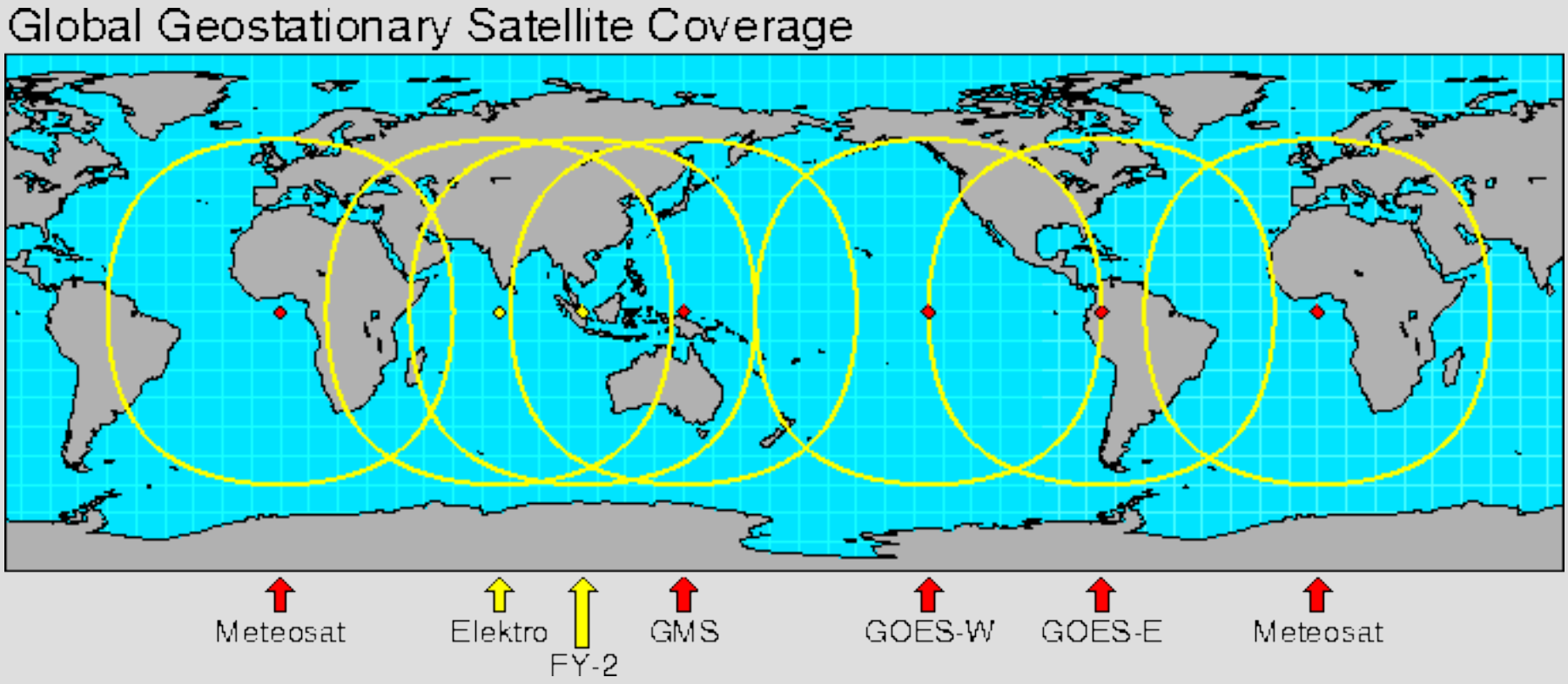
Water vapor (6.5 microns)



Visible (0.63 microns)

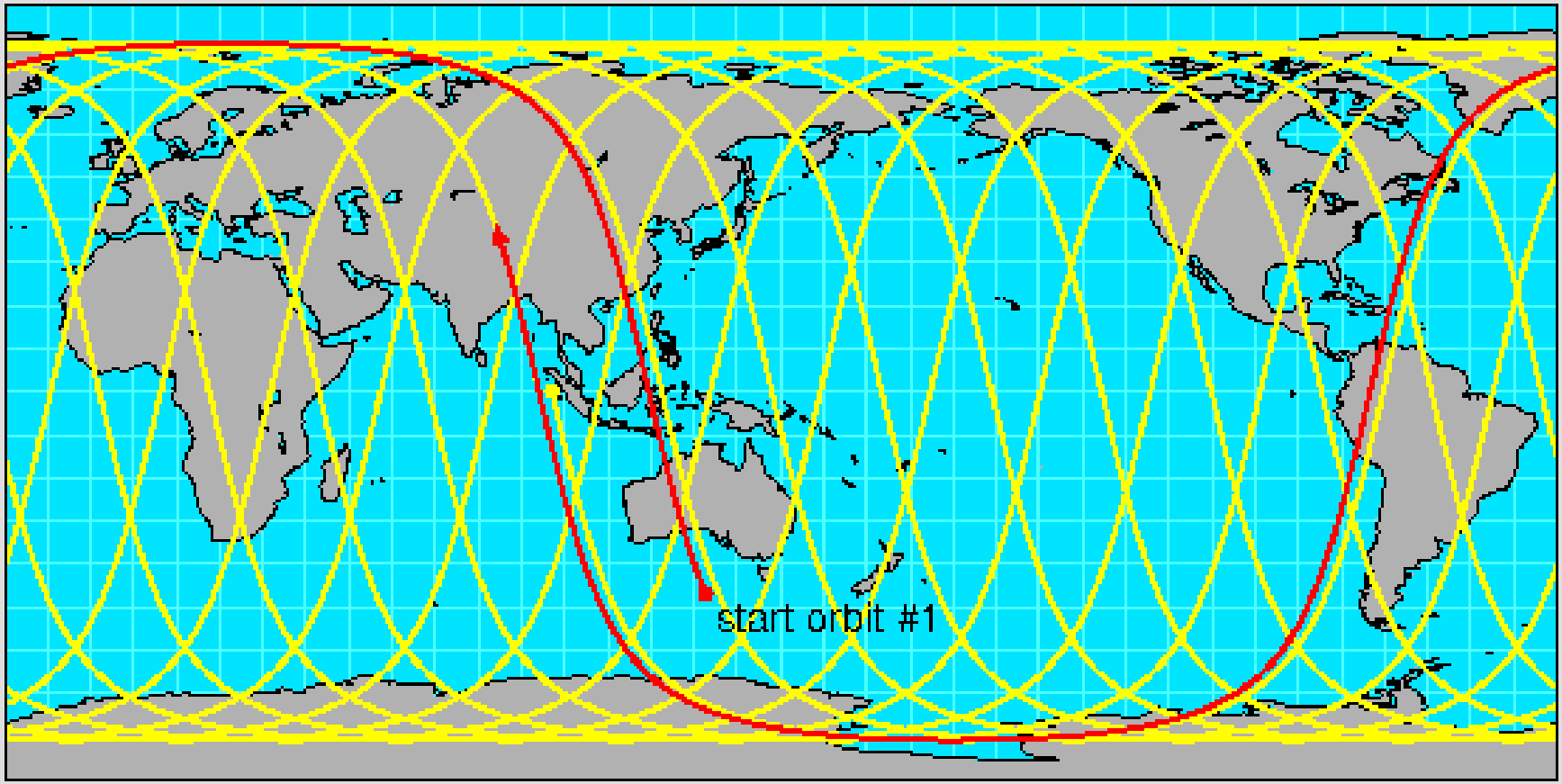


Geostationary satellite data coverage



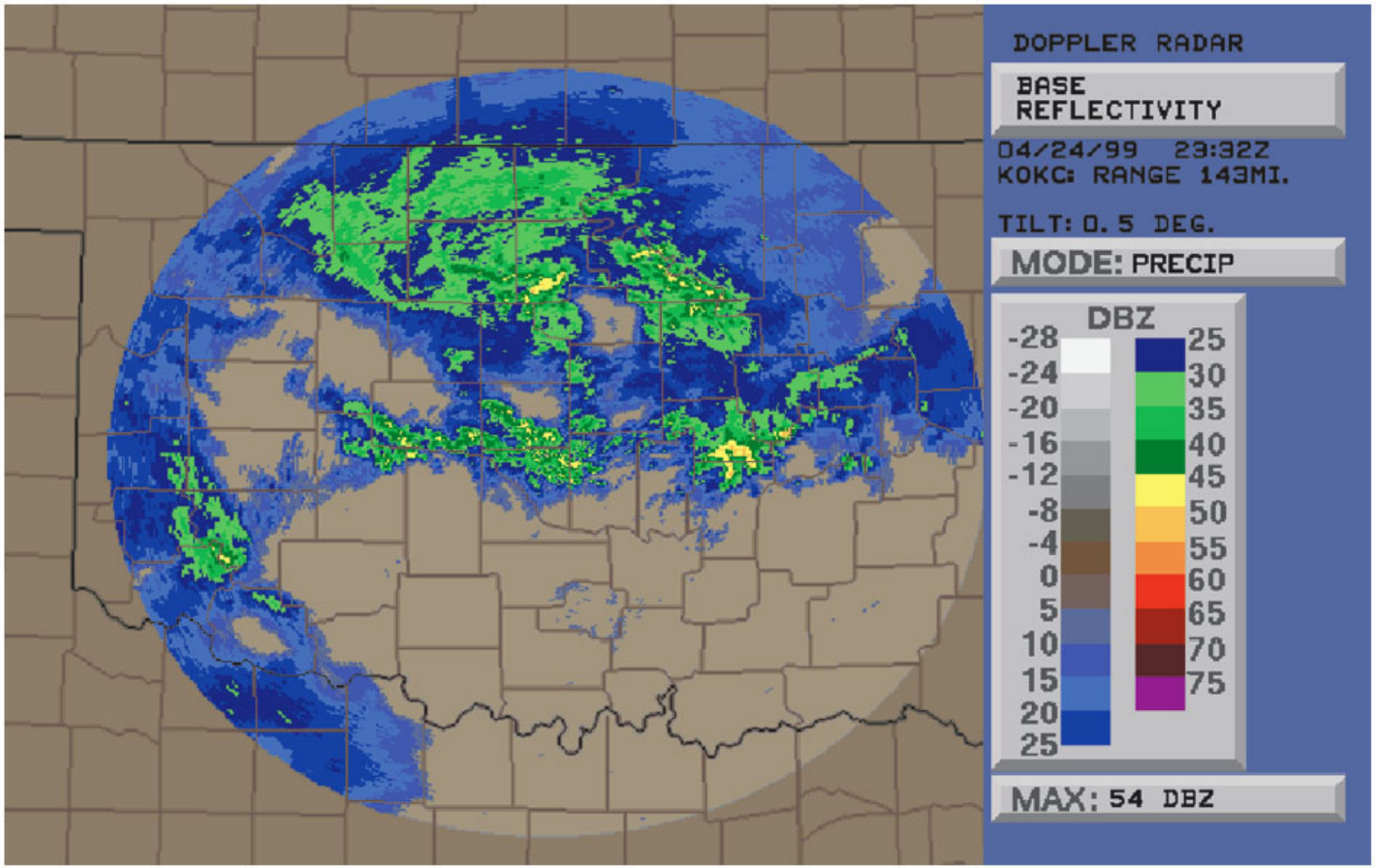
https://www.rap.ucar.edu/~djohnson/satellite/coverage.html#global_coverage

Polar orbiting satellite
14 orbits per day, 2x daily snapshots

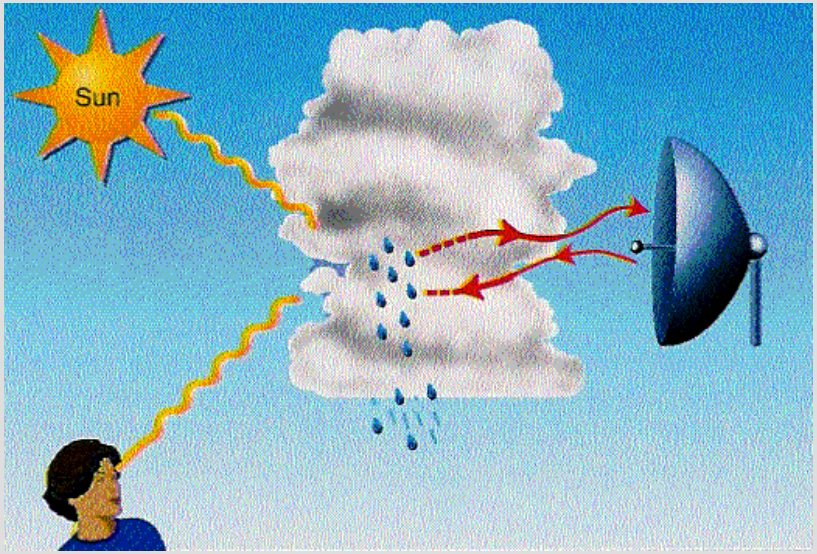


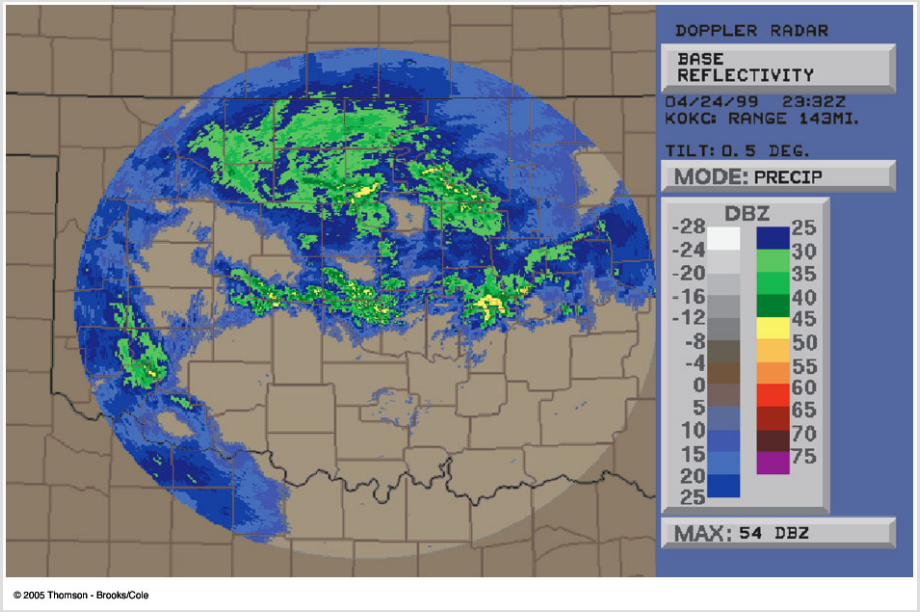
https://www.rap.ucar.edu/~djohnson/satellite/coverage.html#global_coverage

RADAR = ???


DOPPLER RADAR
BASE REFLECTIVITY
04/24/99 23:32Z
KOKC: RANGE 143MI.
TILT: 0.5 DEG.
MODE: PRECIP
DBZ
-28 -24 -20 -16 -12 -8 -4 0 5 10 15 20 25
25 30 35 40 45 50 55 60 65 70 75
MAX: 54 DBZ
© 2005 Thomson - Brooks/Cole

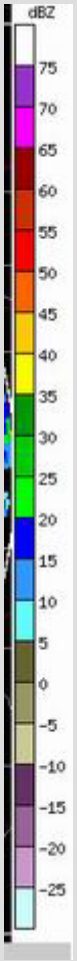
RADAR
(RAdio Detection And Ranging)

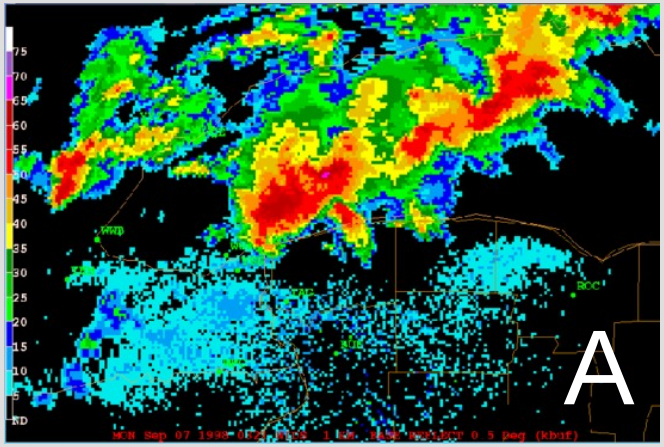


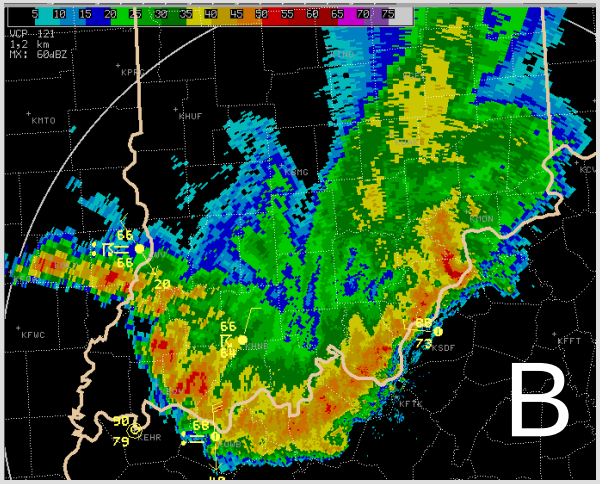


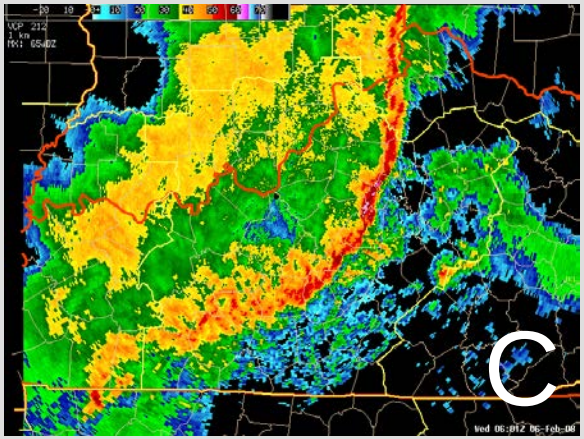
Principle: Detects reflected radiation emitted for short wavelength radio waves. The degree of reflectivity corresponds with the intensity of precipitation (or what ever else in the beam path).

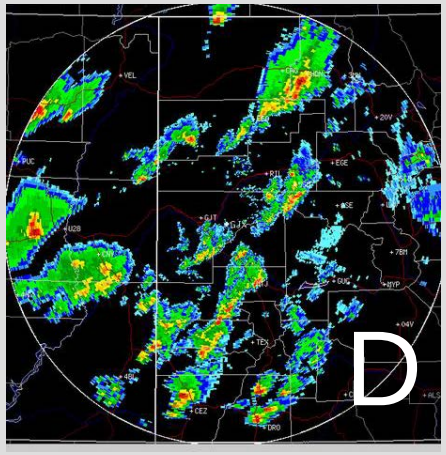
REFLECTIVITY







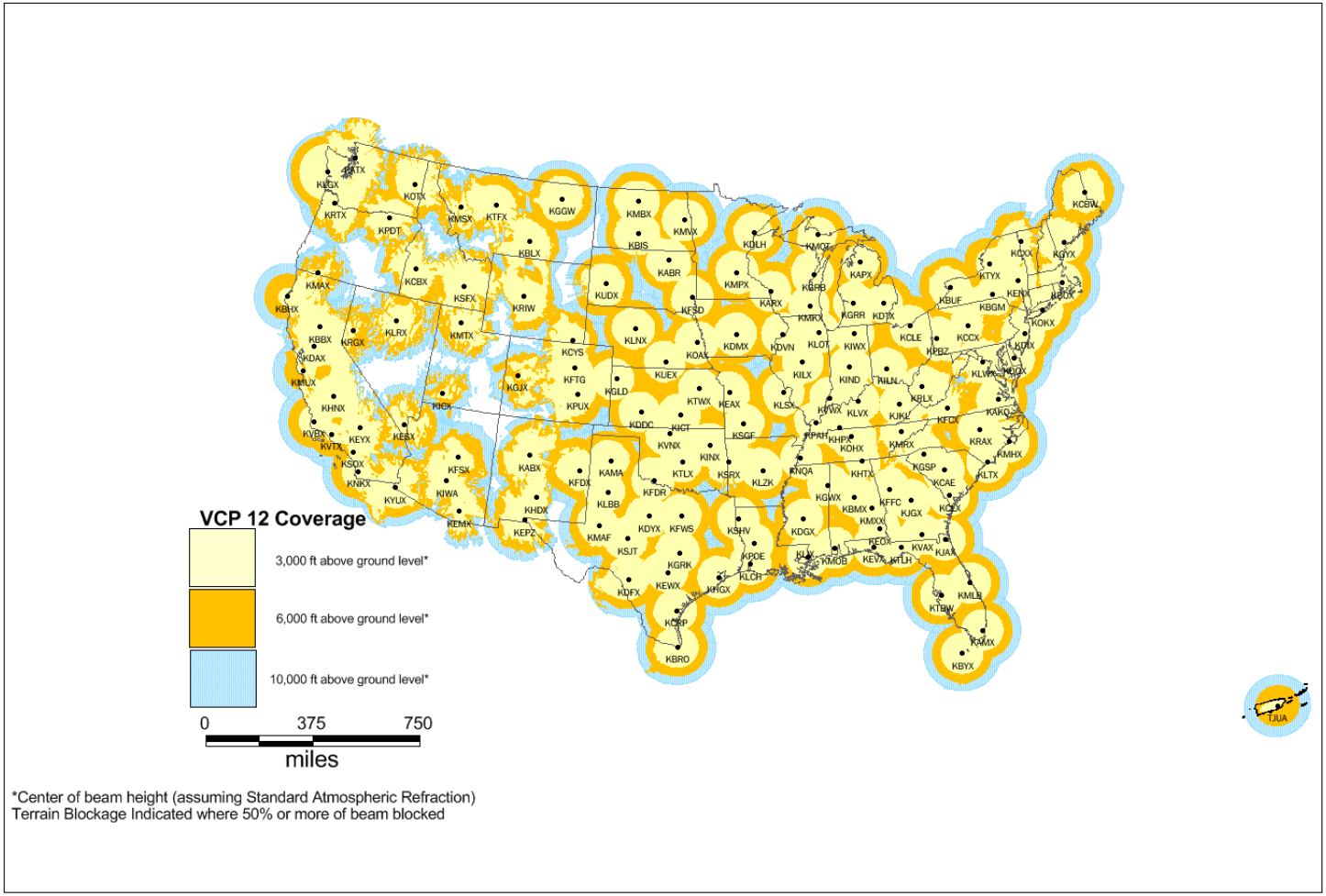




WHICH RADAR IMAGERY INDICATES THE MOST DANGEROUS THUNDERSTORM?

CHOOSE E IF YOU THINK THEY'RE ALL EQUALLY DANGEROUS.

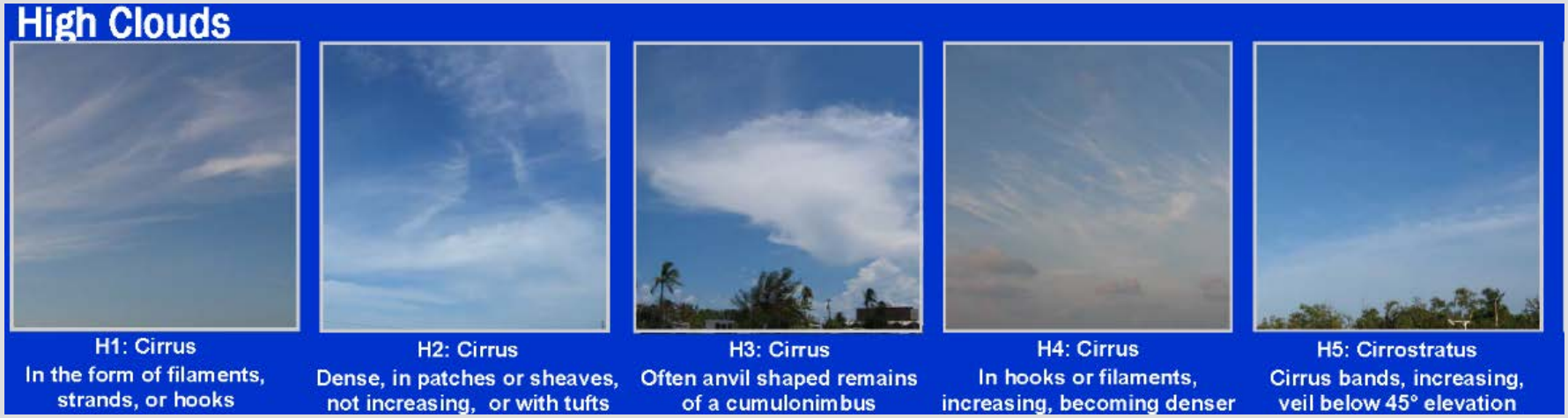
NEXRAD Coverage Below 10,000 Feet AGL

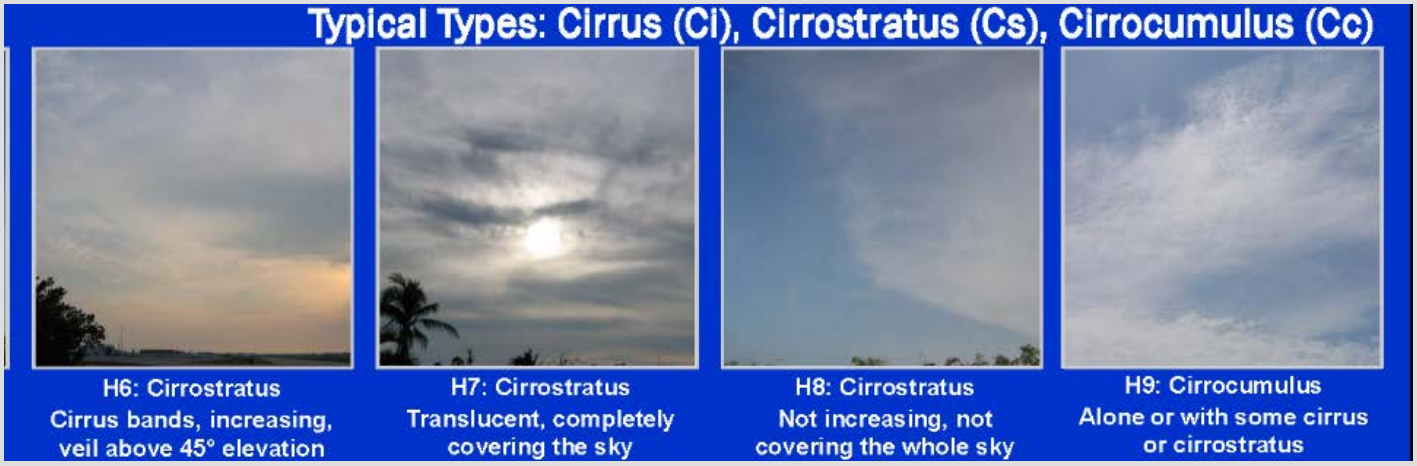


https://www.roc.noaa.gov/WSR88D/

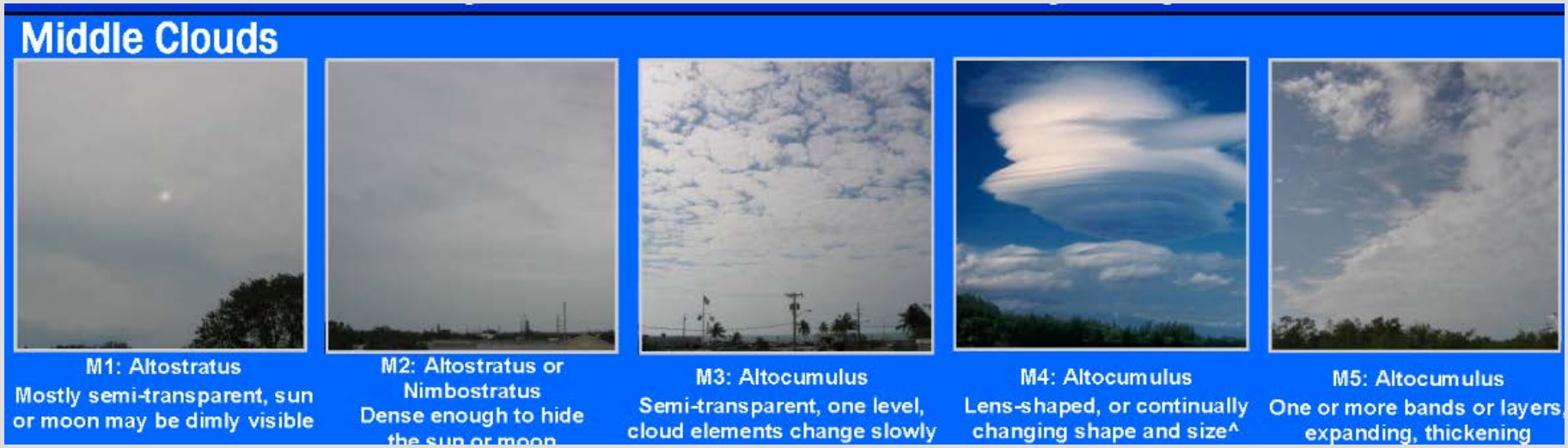
Sky conditions = % cloudiness + cloud type

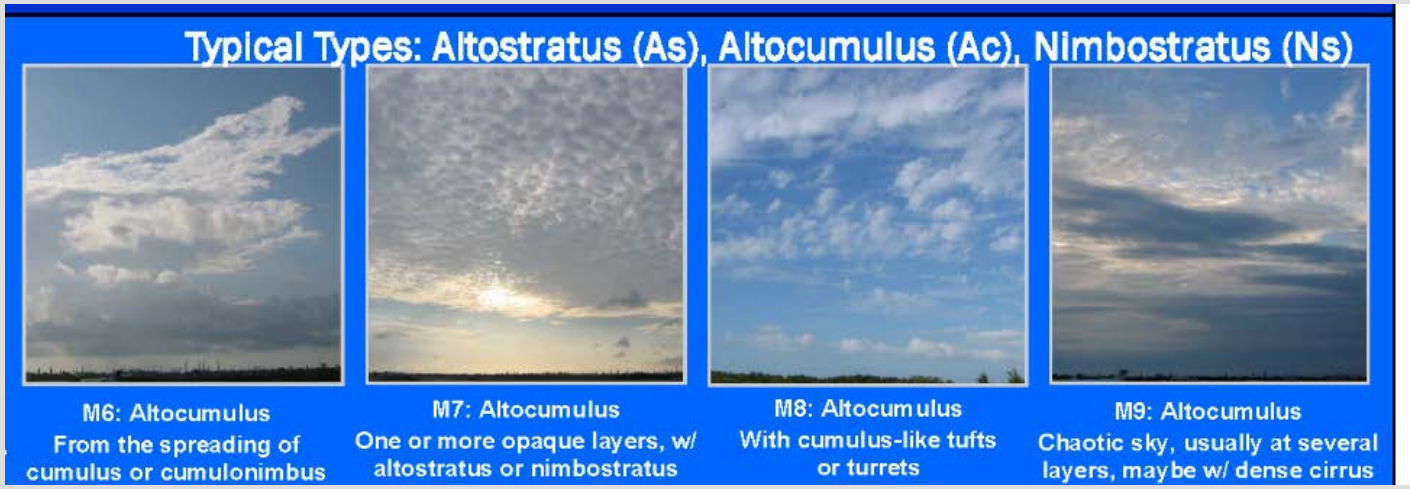
Approx: Above 23,000 ft. (7000 m), less than approximately 300 mb





Approx: Above 6,000-23,000 ft. (1800-7000 m), 800-300 mb





Approx: Less than 6000 ft. (1800m), surface to 800 mb

Low Clouds

L1: Cumulus
With little vertical extent

L2: Cumulus
Moderate/strong vertical extent, or towering cumulus

L3: Cumulonimbus
Tops not fibrous, outline not completely sharp, no anvil

L4: Stratocumulus
From the spreading and flattening of cumulus*

Typical Types: Stratus (St), Stratocumulus (Sc), Cumulus (Cu), Cumulonimbus (Cb)

L5: Stratocumulus
Not from the spreading and flattening of cumulus

L6: Stratus
In a continuous layer and/or ragged shreds

L7: Stratus Fractus and/or Cumulus Fractus
Of bad weather

L8: Cumulus & Stratocumulus
Not spreading, bases at different levels

L9: Cumulonimbus
With fibrous top, often with an anvil

Mammatus
Drooping underside of heavy, rain-saturated clouds

Tornado
Formed by rotation of up and down drafts within thunderstorm

Wall Cloud
Hanging from cumulus, possible tornado formation

Shelf Cloud
Leading edge of fast moving frontal system

Wave Cloud
Formed by strong horizontal winds over uneven terrain