

A PILOT'S GUIDE TO



AVIATION WEATHER SERVICES

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

THE NATIONAL AVIATION WEATHER SYSTEM is the most complete ever made available to general aviation pilots. This brochure is designed to help you use the system to the fullest extent, through the aviation weather services of the NOAA Weather Service and the Federal Aviation Administration. Use it regularly—and fly safely!

PRE-FLIGHT

Continually updated short-flight forecasts are provided by continuous **Transcribed Weather Broadcast (TWEB)** and the **Pilot's Automatic Telephone Weather Answering Service (PATWAS)**.

For longer flights, a telephone call or visit to the nearest **FAA Flight Service Station (FSS)** or **NOAA Weather Service Office (WSO)** is necessary. In marginal weather, briefers are busy and telephone delays are common. While you wait, get basic information from TWEB and PATWAS—but do make the call to the briefer. Remember that new aviation weather observations from distant stations are normally available by 10 minutes past the hour.

After receiving weather information, either for short or long-range flights, consider carefully whether conditions are suitable for your flight. **If not, delay your flight.**

IN-FLIGHT

Weather information is available by calling any FAA/FSS facility within radio range. Selected FSS's broadcast current weather reports, in-flight advisories, PIREPs, RAREPs, and NOTAMs at 15 minutes past every hour. TWEB also can be received in the air. **Monitor weather broadcasts routinely and do not hesitate to request specific information from FAA/FSS.**

BEFORE LANDING

At many terminals, information helpful to landing and takeoff is continuously broadcast over a navigational aid frequency. Prior to descent, request current weather for terminal area as well as field conditions at destination.

During marginal conditions, keep a particularly close check on en route, terminal, and alternate terminal weather.

Conversion Tables

TIME

STANDARD TO GMT

Eastern	+ 5 hr = GMT
Central	+ 6 hr = GMT
Mountain	+ 7 hr = GMT
Pacific	+ 8 hr = GMT
Yukon	+ 9 hr = GMT
Alaskan	+ 10 hr = GMT
Bering	+ 11 hr = GMT

Add one less hour for Daylight Time.

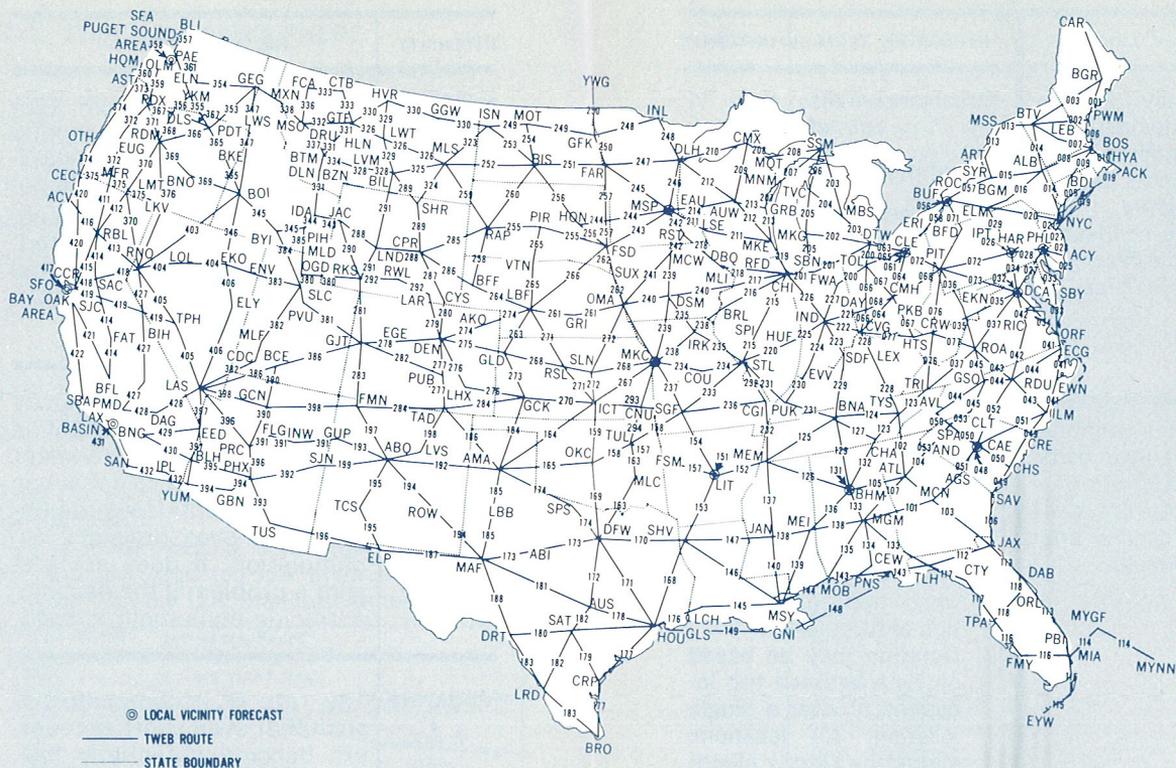
WINDSPEED

MPH	Knots
1-2	1-2
3-8	3-7
9-14	8-12
15-20	13-17
21-25	18-22
26-31	23-27
32-37	28-32
38-43	33-37
44-49	38-42
50-54	43-47
55-60	48-52
61-66	53-57
67-71	58-62
72-77	63-67
78-83	68-72
84-89	73-77
119-123	103-107

Knots x 1.15 =
Miles Per Hour
Miles Per Hour x
0.869 = Knots



TWEB ROUTE CONFIGURATION MAP



TERMINAL FORECASTS (FT)

East of Rockies: 0940Z, 1440Z, 2140Z
 Rockies westward: 0940Z, 1540Z, 2240Z
 24-hour fcst with last 6 hours in categorical form (LIFR, IFR, MVFR, VFR)

AREA FORECASTS (FA)

—at 0040Z and 1240Z
 18-hour fcst + 12-hour outlook in categorical form (LIFR, IFR, MVFR, VFR)

TRANSCRIBED WEATHER BROADCASTS (TWEBs) plus a SYNOPSIS (SYNS)

East of Rockies: 1040Z, 1740Z, 2240Z
 Rockies westward: 1140Z, 1840Z, 2340Z

IN-FLIGHT ADVISORIES (WS, WA, WAC)—as required

SIGMET (WS)—for all aircraft
AIRMET (WA)—for small aircraft

AIRMET (WAC) for Continuous Low Ceiling and/or Visibility or Moderate Turbulence over Mountainous Terrain.

CATEGORIES CEILING

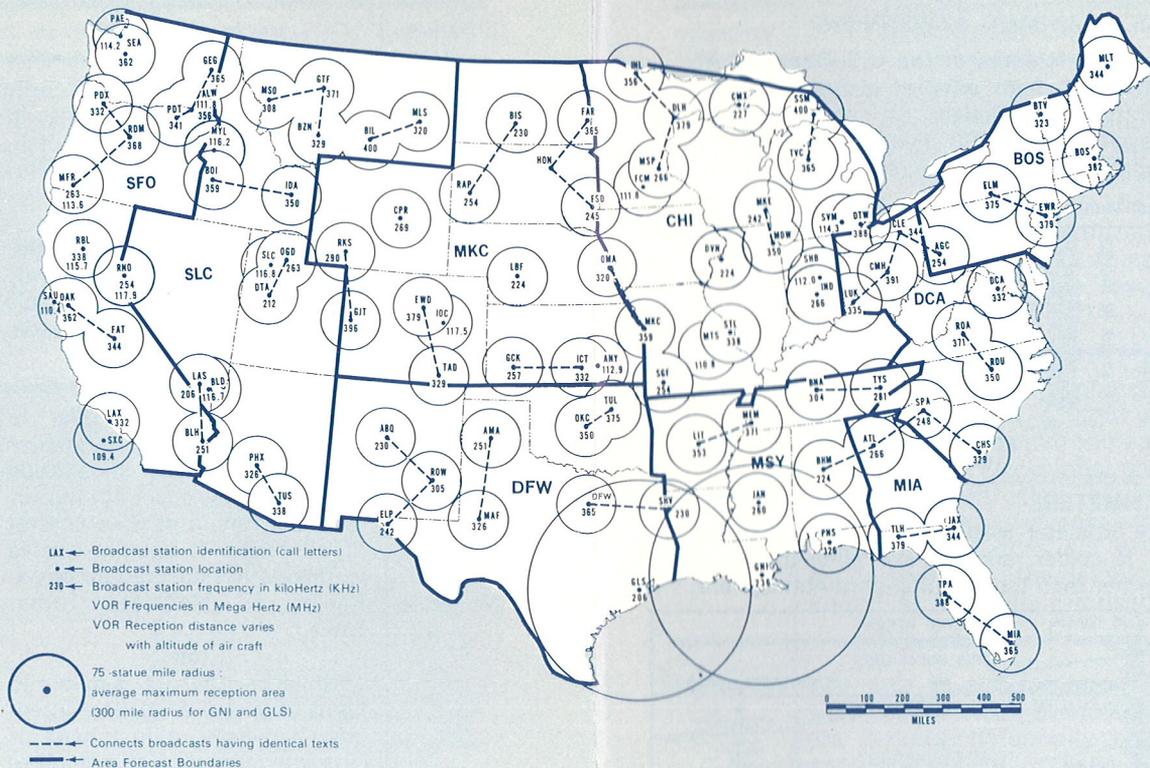
LIFR	<500	and/or	<1
IFR	≥ 500—<1000	and/or	≥ 1—<3
MVFR	≥ 1000—<3000	and/or	≥ 3—<5
VFR	>3000	and	>5

VISIBILITY

WINDS/TEMPERATURES ALOFT FORECASTS (FD)

Prepared by National Meteorological Center (call letters, WBC)
 Contain upper air temperature forecasts issued for 100 locations in 48 states
 Winds for in-between points can be obtained by interpolation.

TWEB OUTLETS AREA FORECAST RESPONSIBILITIES



Forecast texts are prepared and furnished to FAA for dissemination via the continuous **Transcribed Weather Broadcasts (TWEBs)** over specified low/medium frequency (L/MF) (200–415 KHz) and very high frequency (VOR) (108.0–117.95 MHz) and the **Pilots Automatic Telephone Weather Answering Service (PATWAS)**. These texts serve as weather briefings for local or limited cross-country flights. There are 104 TWEB outlet locations in the conterminous states. The TWEB outlet locations in the 48 states are shown above. Telephone numbers for PATWAS outlets in the conterminous states are shown in the panel at right. Also depicted in solid lines is the outline of forecast office responsibilities for the preparation of the Area Forecasts (FA) and In-Flight Advisories (WS, WA, WAC).

TRANSCRIBED WEATHER BROADCAST SERVICE (TWEB) provides:

Continuous weather information useable within receiving range (about 75 miles) of the broadcast outlet; Identification; Synopsis; Flight Precautions; TWEB Route Forecasts; Winds Aloft Forecasts; RAREPs; PIREPs; Surface Weather Reports; NOTAMs.

AVIATION WEATHER TELECAST ON PUBLIC BROADCASTING SERVICE TELEVISION NETWORK

A half-hour show, Thursday and/or Friday evenings, featuring weather and aeronautical briefings. Consult local listings for time and station.

Key to Aviation Weather Reports

LOCATION IDENTIFIER AND TYPE OF REPORT*	SKY AND CEILING	VISIBILITY WEATHER AND OBSTRUCTION TO VISION	SEA-LEVEL PRESSURE	TEMPERATURE AND DEW POINT	WIND	ALTIMETER SETTING	RUNWAY VISUAL RANGE	CODED PIREPS
MKC	15 SCT M25 OVC	1R-K	132	/58/56	/1807	/993/	R04LVR20V40	/UA OVC 55

SKY AND CEILING

Sky cover contractions are in ascending order. Figures preceding contractions are heights in hundreds of feet above station.

Sky cover contractions are:

- CLR** Clear: Less than 0.1 sky cover.
- SCT** Scattered: 0.1 to 0.5 sky cover.
- BKN** Broken: 0.6 to 0.9 sky cover.
- OVC** Overcast: More than 0.9 sky cover.
- Thin (When prefixed to the above contractions.)
- X Partial obscuration: 0.1 to less than 1.0 sky hidden by precipitation or obstruction to vision (bases at surface).
- X Obscuration: 1.0 sky hidden by precipitation or obstruction to vision (bases at surface).

Letter preceding height of layer identifies ceiling layer and indicates how ceiling height was obtained. Thus:

- E** Estimated height
- M** Measured
- W** Indefinite
- V** Immediately following numerical value, indicates a variable ceiling

VISIBILITY

Reported in statute miles and fractions. (V=Variable)

WEATHER AND OBSTRUCTION TO VISION SYMBOLS

A Hail	SG Snow grains
BD Blowing dust	SP Snow pellets
BN Blowing sand	SW Snow showers
BS Blowing snow	T+ Severe thunderstorm
D Dust	T Thunderstorm
F Fog	ZL Freezing drizzle
GF Ground fog	ZR Freezing rain
H Haze	K Smoke
IC Ice crystals	L Drizzle
IF Ice fog	R Rain
IP Ice pellets	RW Rain showers
IPW Ice pellet showers	S Snow

Precipitation intensities are indicated thus: —Very Light; —Light; (no sign) Moderate; + Heavy.

WIND

Direction in tens of degrees from true north, speed in knots. 0000 indicates calm. G indicates gusty. Peak speed of gusts follows G or Q when gusts or squall are reported. The contraction WSHT followed by GMT time group in remarks indicates windshift and its time of occurrence. (Knots X 1.15 = statute mi/hr.)

EXAMPLES: 3627=360 Degrees, 27 knots; 3627G40=360 Degrees, 27 knots, peak speed in gusts 40 knots.

ALTIMETER SETTING

The first figure of the actual altimeter setting is always omitted from the report.

RUNWAY VISUAL RANGE (RVR)

RVR is reported from some stations. Extreme values during 10 minutes prior to observation are given in hundreds of feet. Runway identification precedes RVR report.

CODED PIREPS

Pilot reports of clouds not visible from ground are coded with ASL height data preceding and/or following sky cover contraction to indicate cloud bases and/or tops, respectively. UA precedes all PIREPs.

DECODED REPORT

Kansas City: Record observation, 1500 feet scattered clouds, measured ceiling 2500 feet overcast, visibility 1 mile, light rain, smoke, sea-level pressure 1013.2 millibars, temperature 58°F, dewpoint 56°F, wind 180°, 7 knots, altimeter setting 29.93 inches. Runway 04 left, visual range 2000 feet variable to 4000 feet. Pilot reports top of overcast 5500 feet.

*TYPE OF REPORT

The omission of type-of-report data identifies a scheduled record observation for the hour specified in the sequence heading. An out-of-sequence, special observation is identified by the letters "SP" following station identification and a 24-hour clock time group, e.g., "PIT SP 0715 —X M1 OVC." A special report indicates a significant change in one or more elements.

Key to Aviation Weather Forecasts

TERMINAL FORECASTS contain information for specific airports on expected ceiling, cloud heights, cloud amounts, visibility, weather and obstructions to vision and surface wind. They are issued 3 times/day and are valid for 24 hours. The last six hours of each forecast are covered by a categorical statement indicating whether VFR, MVFR, IFR or LIFR conditions are expected. Terminal forecasts will be written in the following forms:

CEILING: Identified by the letter "C"

CLOUD HEIGHTS: In hundreds of feet above the station (ground)

CLOUD LAYERS: Stated in ascending order of height

VISIBILITY: In statute miles

but omitted if over 6 miles

WEATHER AND OBSTRUCTION TO VISION: Standard weather and obstruction to vision symbols are used

SURFACE WIND: In tens of degrees and knots; omitted when less than 10.

EXAMPLE OF TERMINAL FORECASTS

DCA 221010: DCA Forecast 22nd day of month—valid time 10Z-10Z 10 SCT C18 BKN 5SW—3415G25 OCNL C8 X 1SW: Scattered clouds at 1000 feet, ceiling 1800 feet broken, visibility 5 miles, light snow showers, surface wind 340 degrees 15 knots gusts to 25 knots, occasional ceiling 8 hundred feet sky obscured, visibility 1 mile in moderate snow showers.

12Z C50 BKN 3312G22: At 12Z becoming ceiling 5000 feet broken, surface wind 330 degrees 12 knots gusts to 22 knots.

04Z MVFR CIG: last 6 hours of FT after 04Z marginal VFR conditions due to ceiling.

AREA FORECASTS are 18-hour aviation forecasts plus a 12-hour categorical outlook prepared 2 times/day giving general descriptions of cloud cover, weather and frontal conditions for an area the size of several states. Heights of cloud tops, and icing are referenced ABOVE SEA LEVEL (ASL); ceiling heights, ABOVE GROUND LEVEL (AGL); bases of cloud layers are ASL unless indicated. Each SIGMET or AIRMET affecting an FA area will also serve to amend the Area Forecast.

SIGMET or AIRMET messages warn airmen in flight of potentially hazardous weather such as squall lines, thunderstorms, fog, icing, and turbulence. SIGMET concerns severe and extreme conditions of importance to all aircraft. AIRMET concerns less severe conditions which may be hazardous to some aircraft or to relatively inexperienced pilots. Both are broadcast by FAA on NAVAI voice channels. **WINDS (AND TEMPERATURES) ALOFT FORECASTS** are 12-hour forecasts of wind direction (nearest 10° true N) and speed (knots) for selected flight levels. Temperatures aloft (°C) are included for all but the 3000-foot level.

FORMAT OF WINDS ALOFT FORECAST

FT 3000 6000 9000 etc.

DCA 2925 2833+00 2930-03 etc.

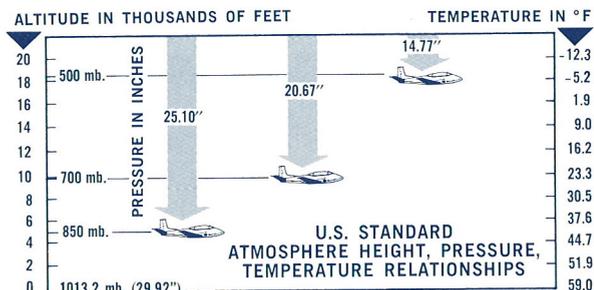
At 6000 feet ASL wind from 280° at 33 knots with temperature 0° Celsius

TWEB (Continuous Transcribed Weather Broadcast)—Individual route forecasts covering a 25 nautical mile zone either side of a course line for the route. By requesting a specific route number, detailed en route weather for a 12- or 18-hour (depending on forecast issuance) period plus a synopsis can be obtained.

Pressure and the Altimeter

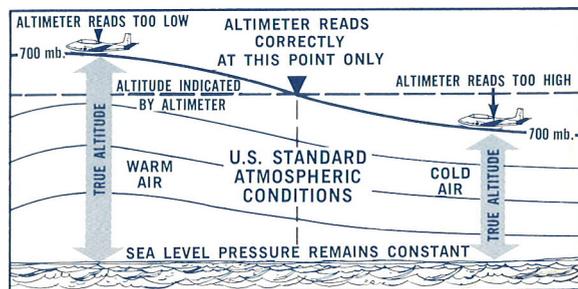
U.S. STANDARD ATMOSPHERE

In these features of the U.S. Standard Atmosphere, note uniform changes of temperature with height as shown on right margin. At 18,000 feet, air pressure is approximately half the sea-level pressure.

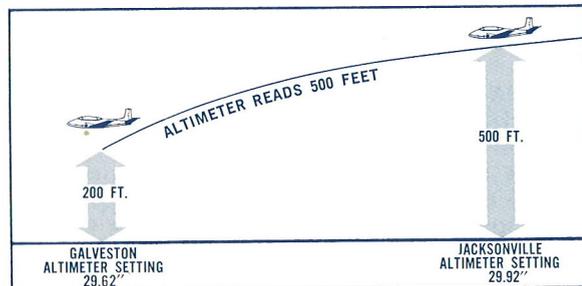


ALTIMETERS

The altimeter reading is too high when the air is colder, and too low when the air is warmer than the U.S. Standard Atmosphere.



The true height of the airplane changes when the surface pressure changes if the pilot flies at a constant indicated altitude and does not reset his altimeter.



Reporting Turbulence

INTENSITY	AIRCRAFT REACTION	REACTION INSIDE AIRCRAFT	REPORTING TERM-DEFINITION
Light	<p>Turbulence that momentarily causes slight erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as Light Turbulence.*</p> <p style="text-align: center;">or</p> <p>Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as Light Chop.</p>	<p>Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.</p>	<p>Occasional—Less than 1/3 of the time.</p> <p>Intermittent—1/3 to 2/3.</p> <p>Continuous—More than 2/3.</p>
Moderate	<p>Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as Moderate Turbulence.*</p> <p style="text-align: center;">or</p> <p>Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as Moderate Chop.</p>	<p>Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.</p>	<p style="text-align: center;">NOTE</p> <ol style="list-style-type: none"> 1. Pilots should report location(s), time (GMT), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence. 2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable. <p>EXAMPLES:</p> <ol style="list-style-type: none"> a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707. b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.
Severe	<p>Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as Severe Turbulence.*</p>	<p>Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.</p>	
Extreme	<p>Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as Extreme Turbulence.*</p>		

* High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (Clear Air Turbulence) preceded by the appropriate intensity, or light or moderate chop.
 SC/AMS Meeting 7/67

Reporting Airframe Icing

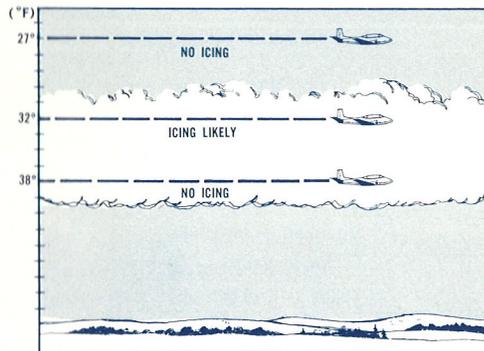
INTENSITY	ICE ACCUMULATION
Trace	Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. It is not hazardous even though deicing / anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour).
Light	The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.
Moderate	The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or diversion is necessary.
Severe	The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary. APPROVED SC/AMS Meeting 4/68

Pilot Report: Aircraft Identification, Location, Time (GMT), Intensity of Type,* Altitude/FL, Aircraft Type, IAS.

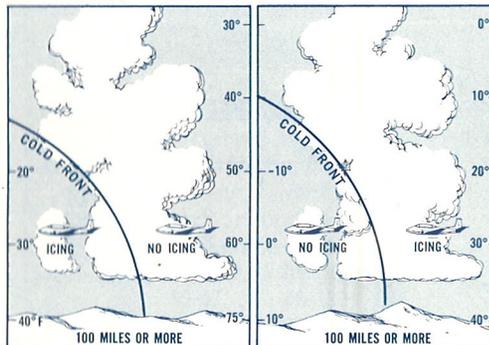
*Rime Ice: Rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets.

Clear Ice: A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets.

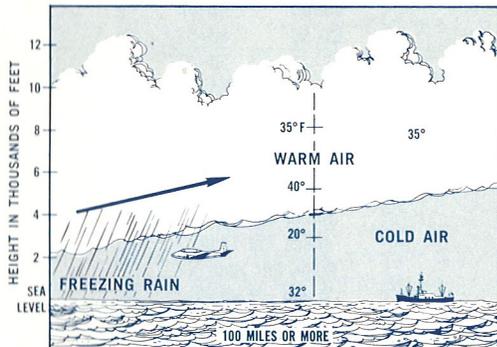
Icing Conditions



Ice forms when temperature is below freezing and there is visible moisture.



Probable icing conditions in these two examples of cold fronts are dissimilar because of different air mass temperatures.



Example of freezing rain under a warm front.