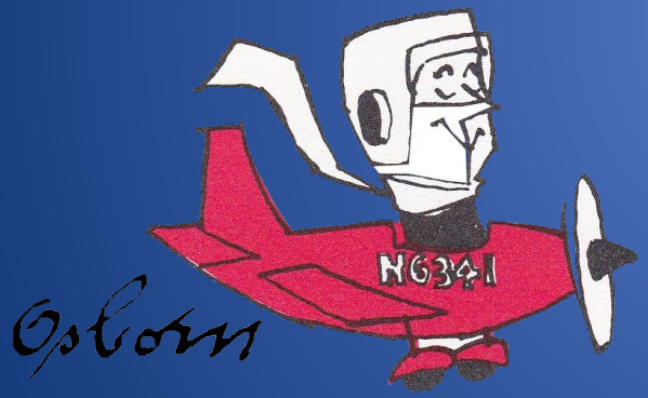
Intermountain West Aviation Weather Safety Workshop
June 10-11, 2022
Desert Research Institute - Reno, NV

Aviation Weather Reports & Forecasts— Myths, Misunderstanding, & Misinterpretations

"Respecting the mountains; protecting pilots"



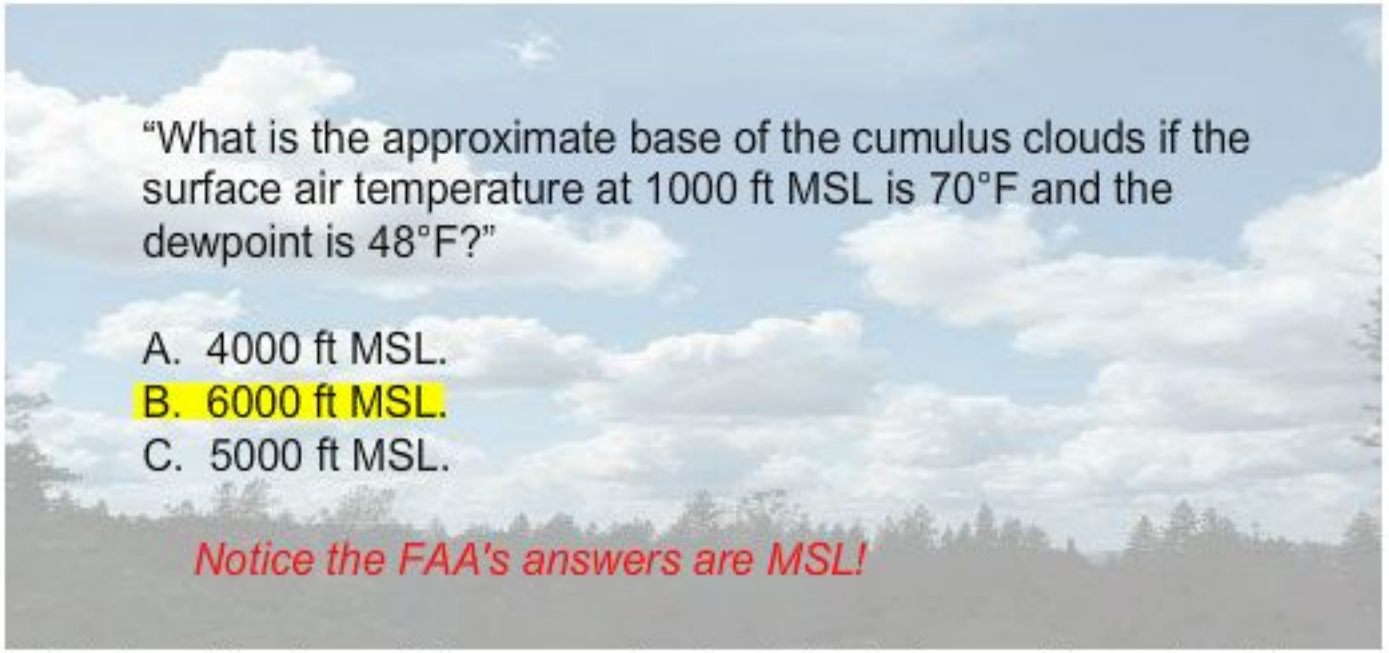
Developed
by
Terry Lankford

Reality Check

"Every theory of the course of events in nature is necessarily based on some process of simplification of the phenomena and is to some extend therefore a fairy tale."

Sir William Napier Shaw
Manual of Meteorology, 1926

Overview



From AC 00-6A Aviation Weather: "You can estimate height of cumuliform cloud bases using surface temperature-dewpoint spread. Unsaturated air in convective currents cools at about 5.4°F (3.0°C) per 1000 feet; dewpoint decreases at about 1°F (5/9°C). Thus, in a convective current, temperature and dewpoint converge at about 4.4°F (2.5°C) per 1000 ft."

(Temperature) – (Dewpoint) ÷ 4.4 X 1000 = Cloud Base AGL

70 - 48 ÷ 4.4 X 1000 ≈ 5000 AGL

Introduction to METARs

Wally AWOS, and his cousins, take automated observations and disseminate data via telecommunication circuits, telephone, and radio broadcasts.

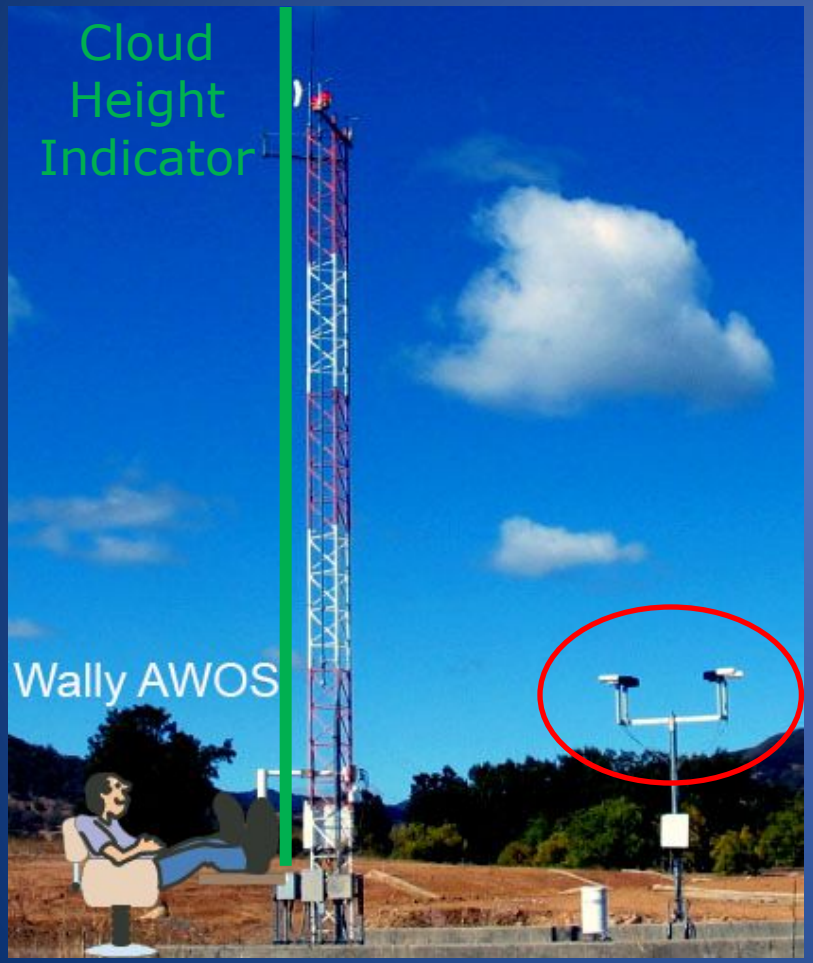
Letter to the Editor *Flying* (Magazine) April 1997:

"I am an active general aviation pilot and FSS specialist. I have learned that in aviation the only thing that doesn't change is change itself. Anyone that has a problem with change doesn't belong in Air Traffic Control or Aviation. I am tired of pilots and controllers whining about the new METAR/TAF codes…."

"Terry T. Lankford"

"Thanks, Terry, Do you know the difference between a jet engine and a pilot? The engine finally stops whining.—Ed."

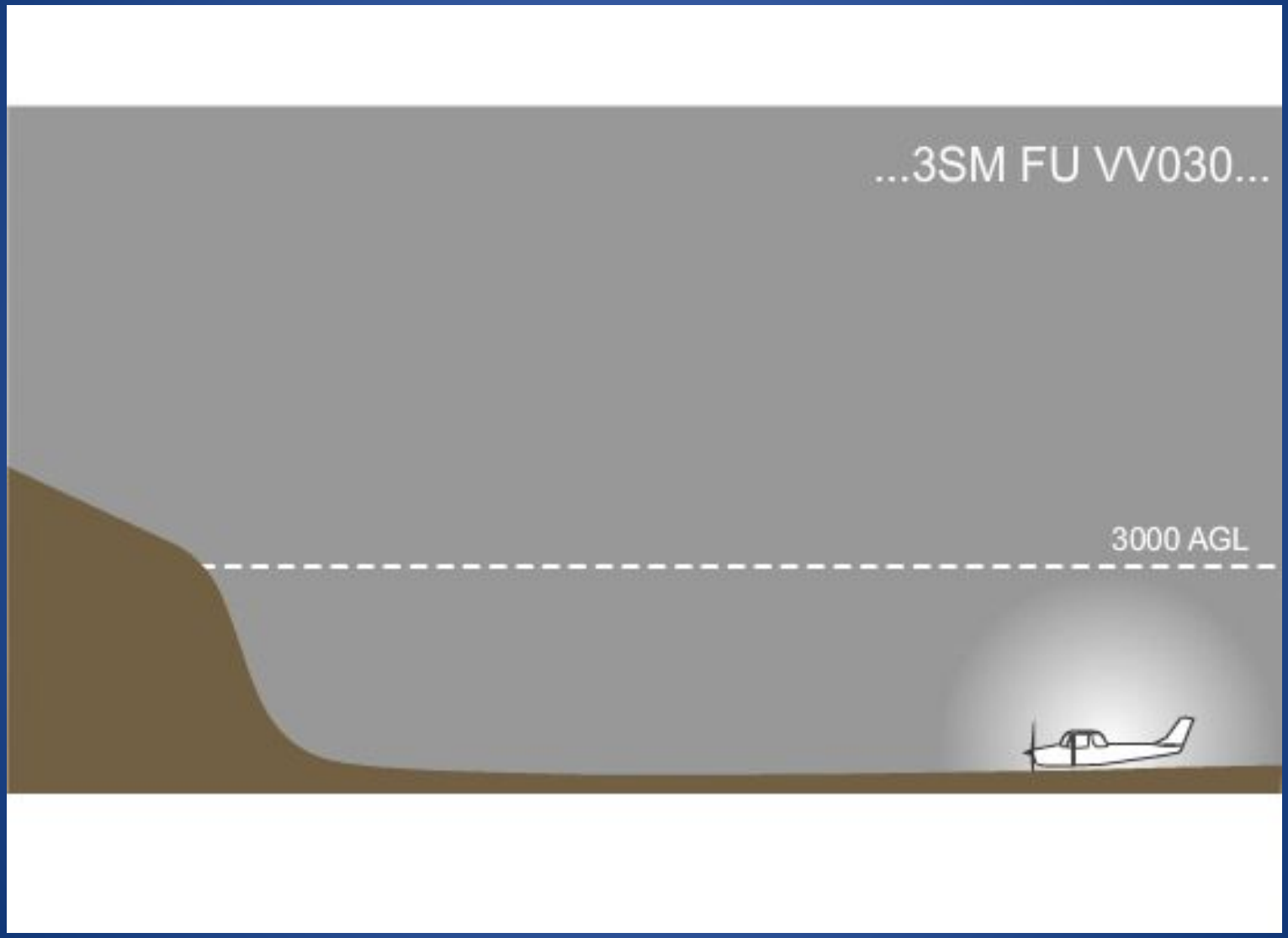
Automated Observations



- Limited sample.
- Only detects cloud elements directly over the sensor.
- Sample every 30 seconds.
- Processes last 30 minutes of data.
- Average one minute value for past 10 minutes.
- Double-weighs last 10 minutes of data.
- Indirectly derives visibility value.
- Generates sky cover and height.
- May not be representative of surrounding conditions.

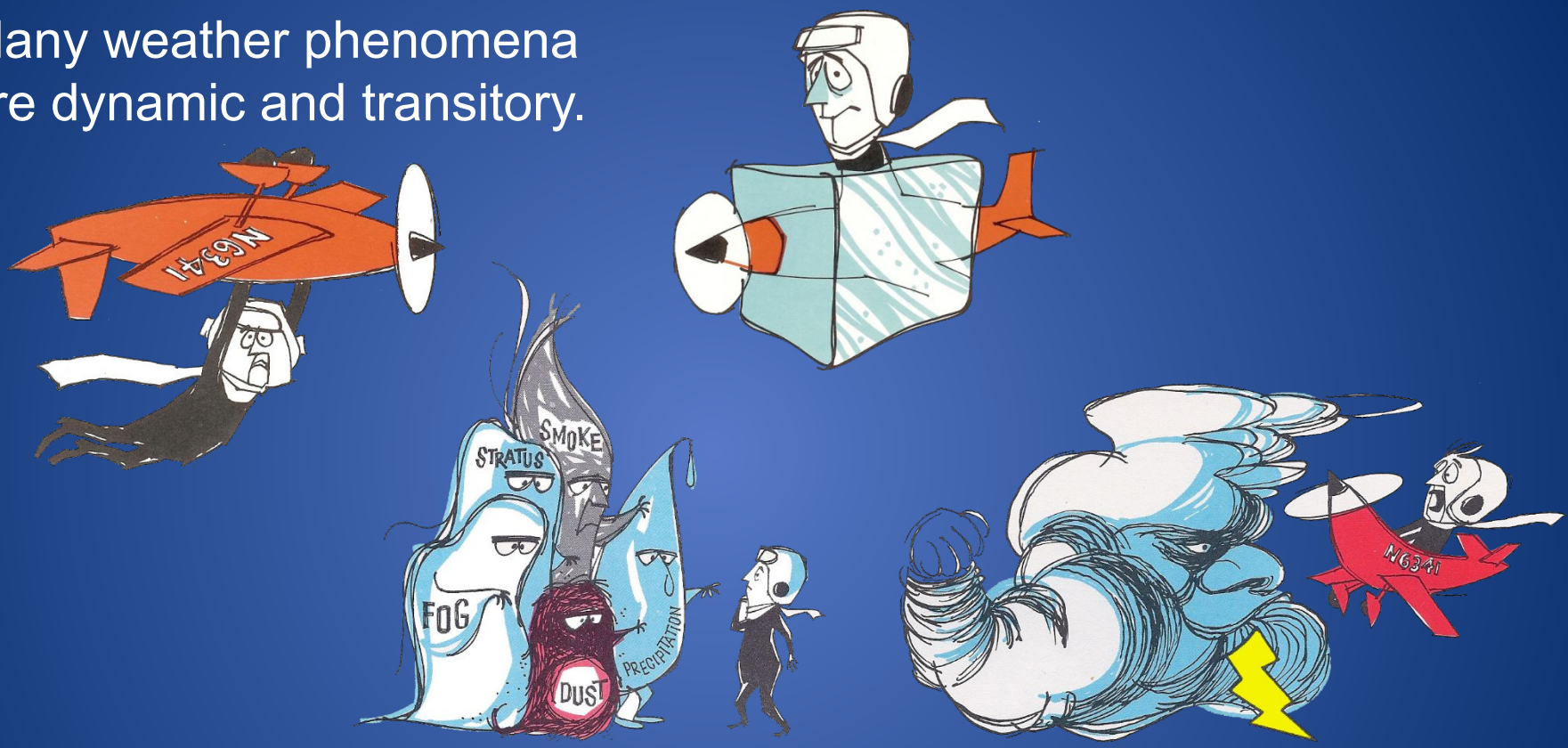
Effects of Dense Smoke

Operational Impact



Introduction to Forecasts

Many weather phenomena are dynamic and transitory.



"The weather-wise pilot looks upon a forecast as professional advise rather than as the absolute truth.“

AC 00-6 Aviation Weather (1965)

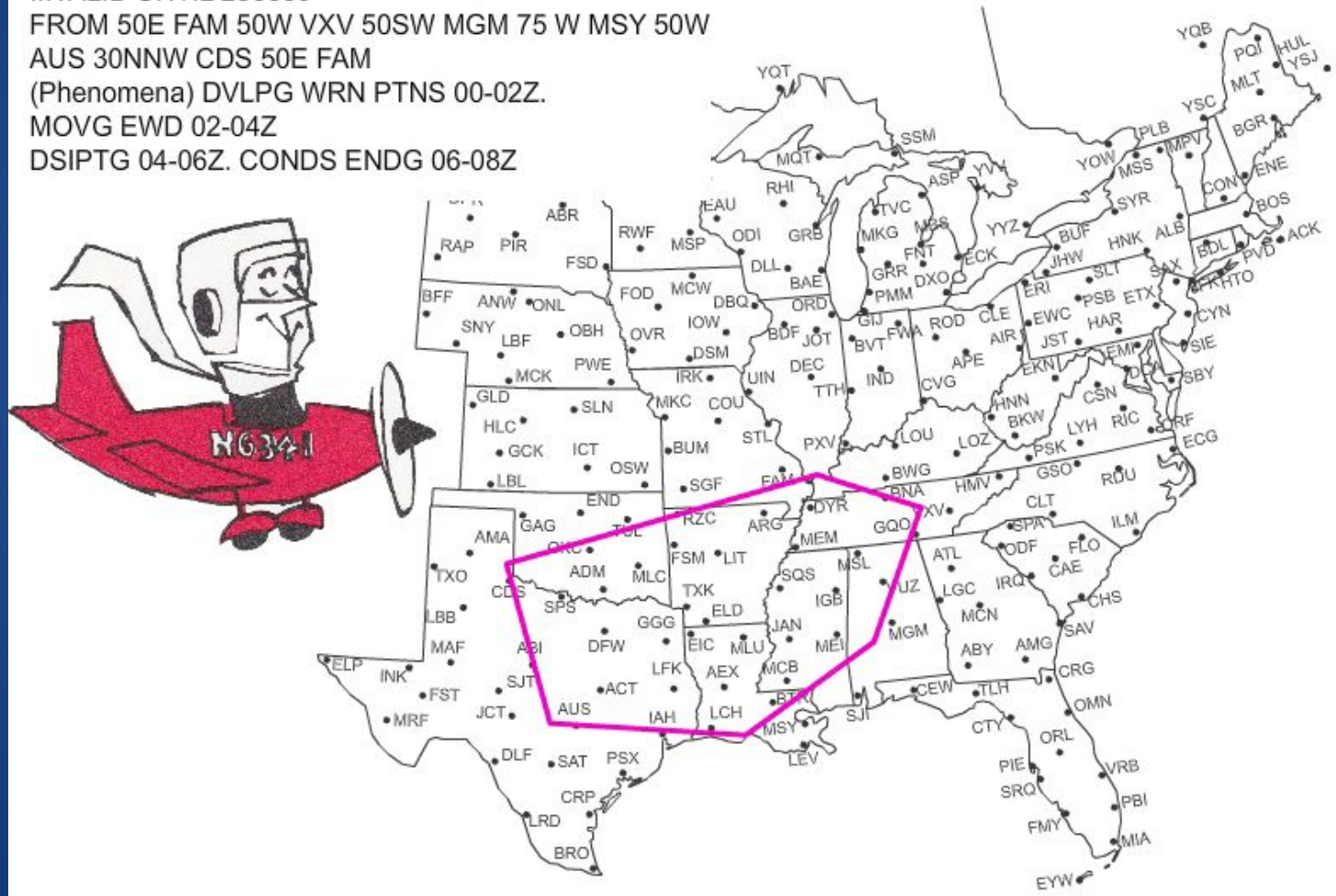
General Limitations

- The time freezing rain will begin,
- Forecasts for good weather are more likely to be correct than forecasts for poor weather.
- severe or extreme turbulence, severe icing,
- Forecasts are most reliable for distinct weather systems.
- ceilings of 100 ft or zero before they exist,
- Forecasts are most accurate during the first hours of the period, accuracy deteriorates the farther into the forecast.
- the onset of thunderstorms that have not yet formed,
- Errors in timing are more prevalent [illegible] nce.
- the movement of tornadoes, and
- The evolution of forecasts, issuance [illegible]
- low-level windshear.

amendment criteria reflect these lim

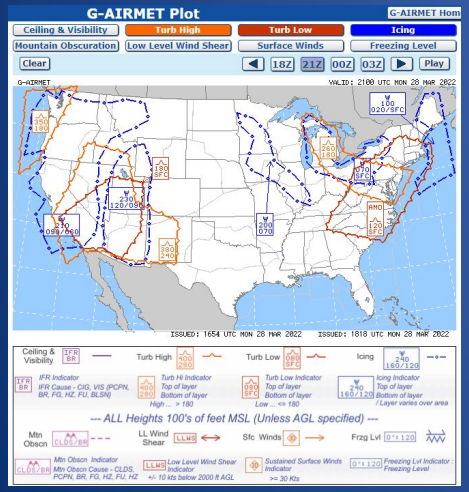
TEXT Products

(WX ADZ ISSUED) 280000
...VALID UNTIL 280600
FROM 50E FAM 50W VXV 50SW MGM 75 W MSY 50W
AUS 30NNW CDS 50E FAM
(Phenomena) DVLPG WRN PTNS 00-02Z.
MOVG EWD 02-04Z
DSIPTG 04-06Z. CONDS ENDG 06-08Z

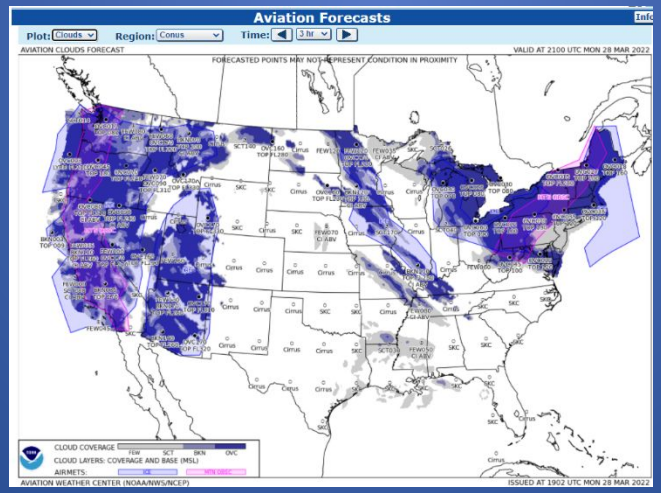


Graphical Products

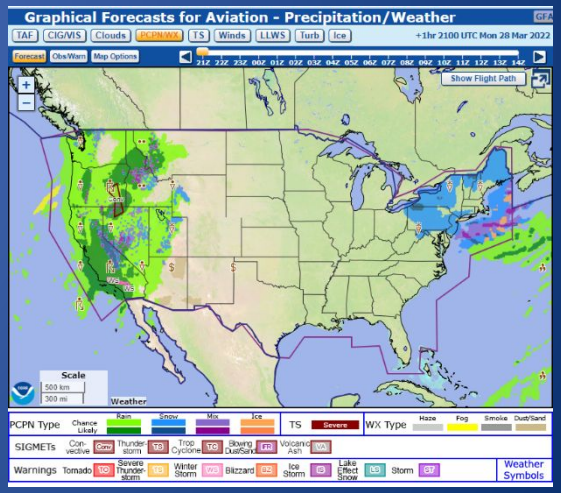
Since their inception weather briefers and pilots have complained about the so called "broad brush" approach of textual weather forecasts. To help resolve these issues the Aviation Weather Center has developed graphical weather products.



G-AIRMET



Aviation SFC/CLDS

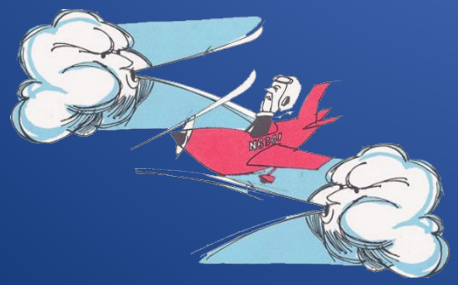


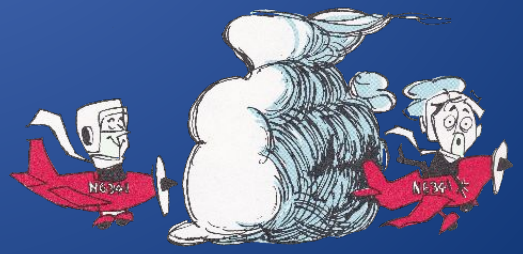
GFA

Overview (Forecast Issuance/Resolution Limitations)

Aviation Forecast Products

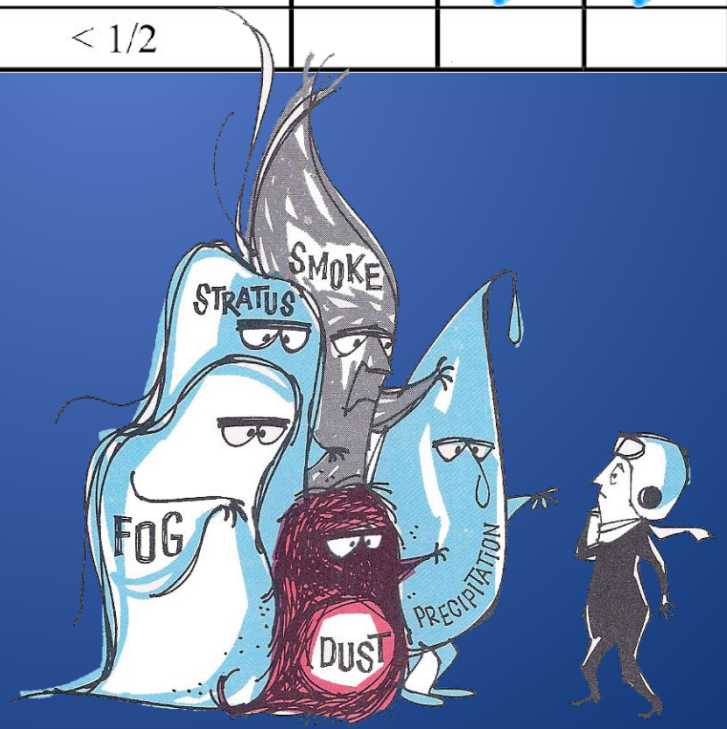
Product	Issuance	Resolution	Valid/Outlook Hours														
			1	2	3	4	5	6	7	8	9	10	11	12	18	24	30
WA	Scheduled	6 Hours															
G-AIRMET	Scheduled	3 Hours															
WS	Unscheduled	4 Hours															
WST	Unscheduled	2 Hours															
CWA	Unscheduled	2 Hours															
SFC/CLDS	Scheduled	3 Hours															
GFA	Scheduled	1 Hour															
FB	Scheduled	6/12/24 Hr															
TAF	Scheduled	24/30 Hr															





Operational Categories

Operational Categories/Forecast Products								
Category	**Ceiling (FT)**		**Visibility (SM)**	**WA**	**CWA**	**SFC**	**GFA**	**TAF**
VFR	> 3000	and	> 5			✓	✓	✓
MVFR	1000 to 3000	and/or	3 to 5			✓	✓	✓
IFR	≥600 to < 1000	and/or	≥ 2 to < 3	✓		✓	✓	✓
LIFR	≥ 200 to < 600	and/or	≥ 1/2 to < 2		✓	✓	✓	✓
VLIFR	< 200	and/or	< 1/2				✓	✓



Weather Advisories

•SCOPE: Weather advisories typically address large scale events. Although, specific smaller scale phenomena are included. Widely varying conditions may use conditional terms.

•PURPOSE: Weather advisories forecast adverse conditions for preflight planning and alert enroute pilots to hazardous or potentially hazardous weather.

• LIMITATIONS: Although some phenomena may be included or implied in other forecasts, pilots must consult advisories to obtain the "complete picture." Yet, advisories cannot be issued for each individual thunderstorm, or instance of turbulence, icing, or IFR weather. Severe weather can develop before an advisory is written and distributed.

Warning

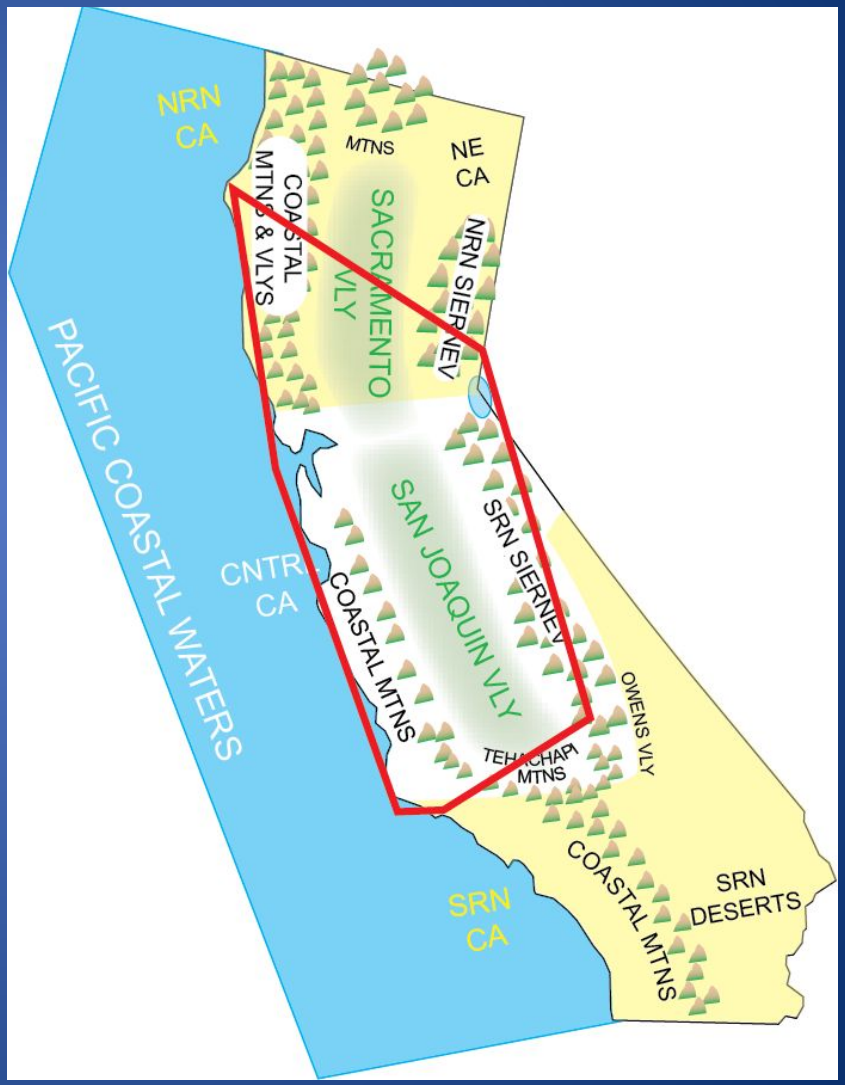
Graphical forecasts provide static “snapshot” images of expected conditions. Changes occur at a regular or irregular rate at an unspecified time between forecast periods—avoid interpolation between valid times.

Graphical AIRMETs

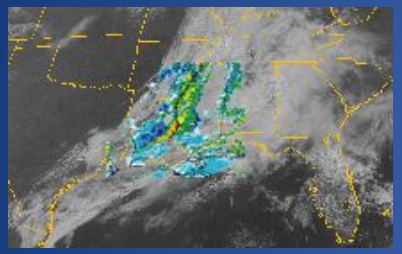
SIGMETs

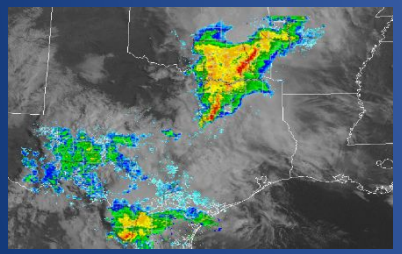
SFON WS 152130
SIGMET NOVEMBER 3 VALID UNTIL 160130
CA
FROM FOT TO 50NW FMG TO 50NE EHF TO RZS TO 40W RZS TO 30W OAK TO FOT
OCNL SEV TURBC BLO 100 XCP BLO 150
VCNTY SIERRAS. CONDS CONTG BYD 0130Z.

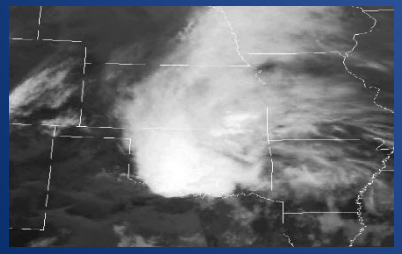
Occasional (OCNL) infers phenomena will affect greater than half of the delineated area at any one time during the forecast period.



Convective SIGMETs





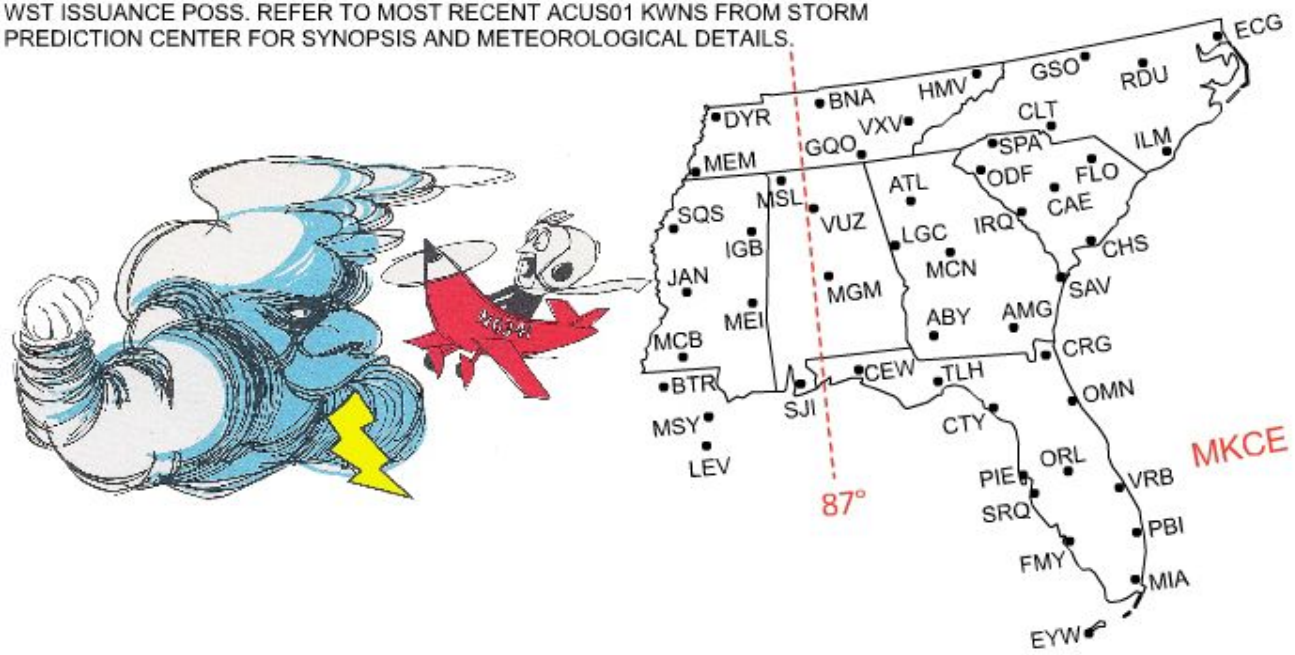


- Severe thunderstorms (tornadoes, hail ≥ 3/4 in, wind gust ≥ to 50 knots).
- Embedded thunderstorms.
- A line of thunderstorms at least 60 ml long affecting at least 40% of the line.
- An area of active thunderstorms having a significant impact on the safety of aircraft operations covering at least 40% of the area.

WST 46E

MKCE WST 021555
CONVECTIVE SIGMET 46E
VALID UNTIL 1756Z
FL GA AL AND FL AL CSTL WTRS
FROM 20NE ABY-110ESE LEV
LINE TS 40 NM WIDE MOV FROM 24025KT TOPS ABV FL450.
TORNADOES...HAIL TO 2 IN. WIND GUST TO 60KT POSS.

OUTLOOK VALID 021755-022155
FROM 20SW SAV-OMN-CTY-40W SJI-20SW SAV
WST ISSUANCE POSS. REFER TO MOST RECENT ACUS01 KWNS FROM STORM PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.



Watch Notification Message (AWW)—Public Severe Thunderstorm/Tornado Watch Notification Message (WW)—Convective SIGMET (WST)

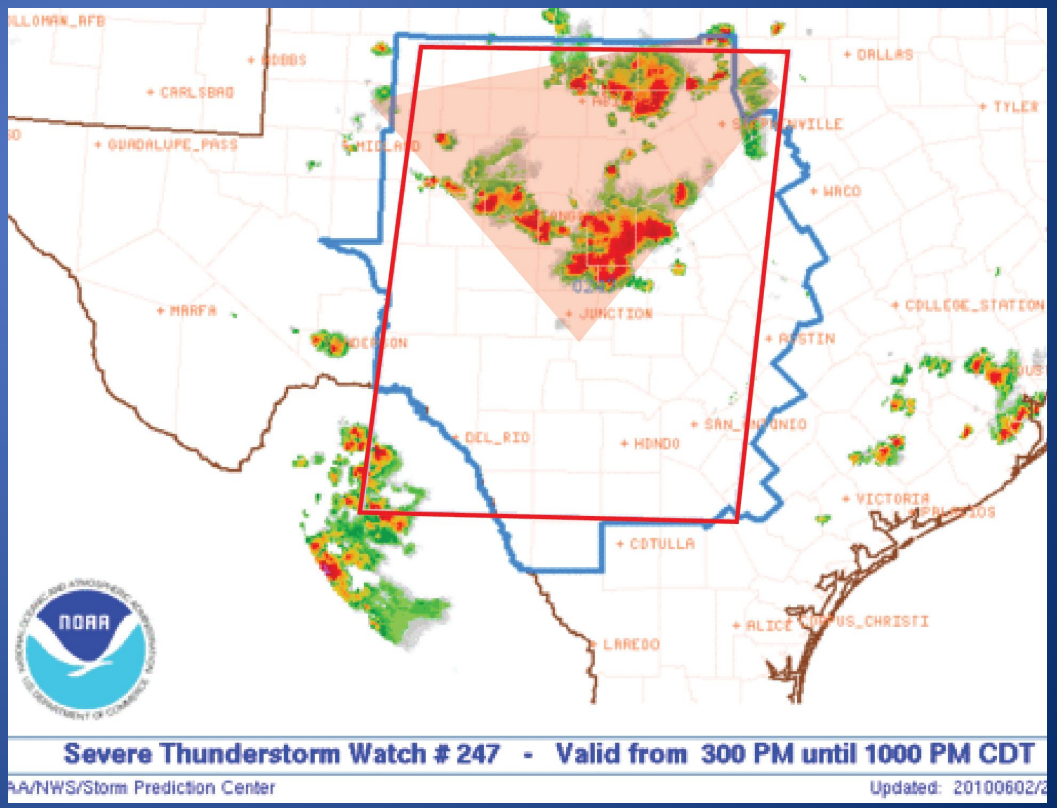
SPC AWW 022100
WW568 SEVERE TSTM TX 022100Z – 030300Z
AXIS..115 STATUTE MILES EAST AND WEST OF A LINE..
35 NNW ABI/ABILENE TX/ – 65 SW HDO/HONDO TX/
WSUS32 KKCI 022055
SIGC CONVECTIVE SIGMET 80C NUMBER 247
VALID UNTIL 2252Z
TX
FROM 50SSE SPS-30SW TTT-30SSE JCT-30NNW
MAF-50SSE SPS
AREA SEV TS MOV LTL. TOPS ABV FL450. HAIL
TO 2.5 IN...WIND GUSTS TO 60KT POSS.
LARGE PORTION OF CENTRAL AND
SOUTHWEST TEXAS

EFFECTIVE NOON AND
EVENING F M CDT.
HAIL TO 2.5
THUNDERS MPH...AND
DANGEROU LE IN THESE
AREAS.

AVIATION...A FEW SEVERE THUNDERSTORMS WITH HAIL SURFACE AND ALOFT TO 2.5 INCHES. EXTREME TURBULENCE AND SURFACE WIND GUSTS TO 60 KNOTS. A FEW CUMULONIMBI WITH MAXIMUM TOPS TO 550.

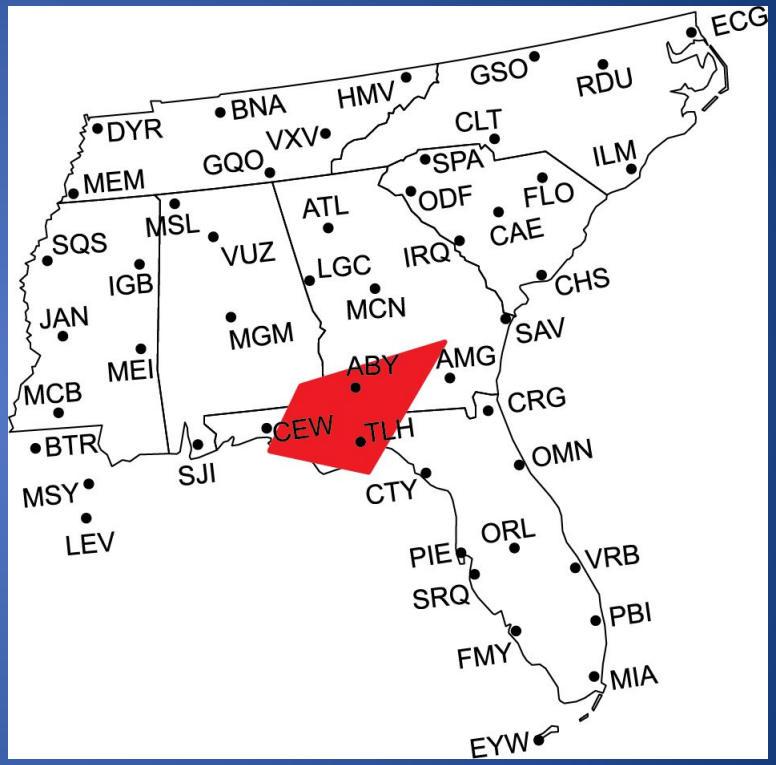
URGENT - IMMEDIATE BROADCAST REQUESTED
SEVERE THUNDERSTORM WATCH NUMBER 247
NWS STORM PREDICTION CENTER NORMAN OK
300 PM CDT WED JUN 2, 2010
THE NWS STORM PREDICTION CENTER HAS
ISSUED A SEVERE THUNDERSTORM WATCH FOR
PORTIONS OF

AVIATION...A FEW SEVERE THUNDERSTORMS WITH HAIL SURFACE AND ALOFT TO 2.5 INCHES. EXTREME TURBULENCE AND SURFACE WIND GUSTS TO 60 KNOTS. A FEW CUMULONIMBI WITH MAXIMUM TOPS TO 550.



Center Weather Advisories

ZLA1 CWA 311930
ZLA CWA 103 VALID UNTIL 312045
FROM 15E TRM TO 60SSE TRM TO 45E MZB TO 40WSW HEC TO HEC TO 15E TRM
OCNL SEV TURB BLW 150. STG MID/LOW LVL SW WINDS OVR MTNS WITH LCL STG UDDF. ASSOCD MTN WVE ACT.



ZJX3 CWA 021515
ZJX CWA 303 VALID UNTIL 021715
FROM 40S CEW-75NE CEW-50N AMG-75S TLH-40S CEW
AREA LIFR CIGS AOB 005 AND VIS 1/2-2SM IN PCPN/FG.
CONDS SPRDG EWD THRU 17Z

Graphical Forecasts for Aviation

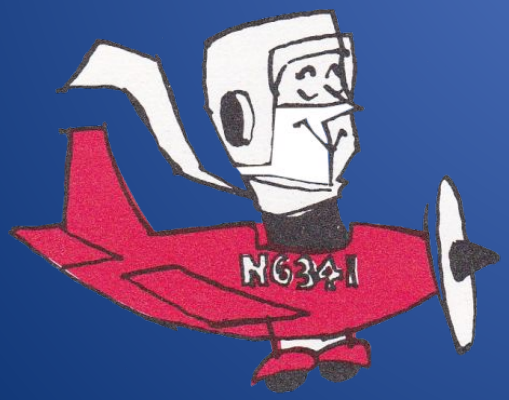
•SCOPE: A mostly synoptic product, graphical forecasts describe conditions produced by weather systems such as high and low pressure, air masses, and fronts. Graphical forecasts typically predict conditions that may affect flight operations over relatively large areas.

•PURPOSE: Graphical forecasts provide a forecast for the enroute phase of flight and for locations without a Terminal Aerodrome Forecast.

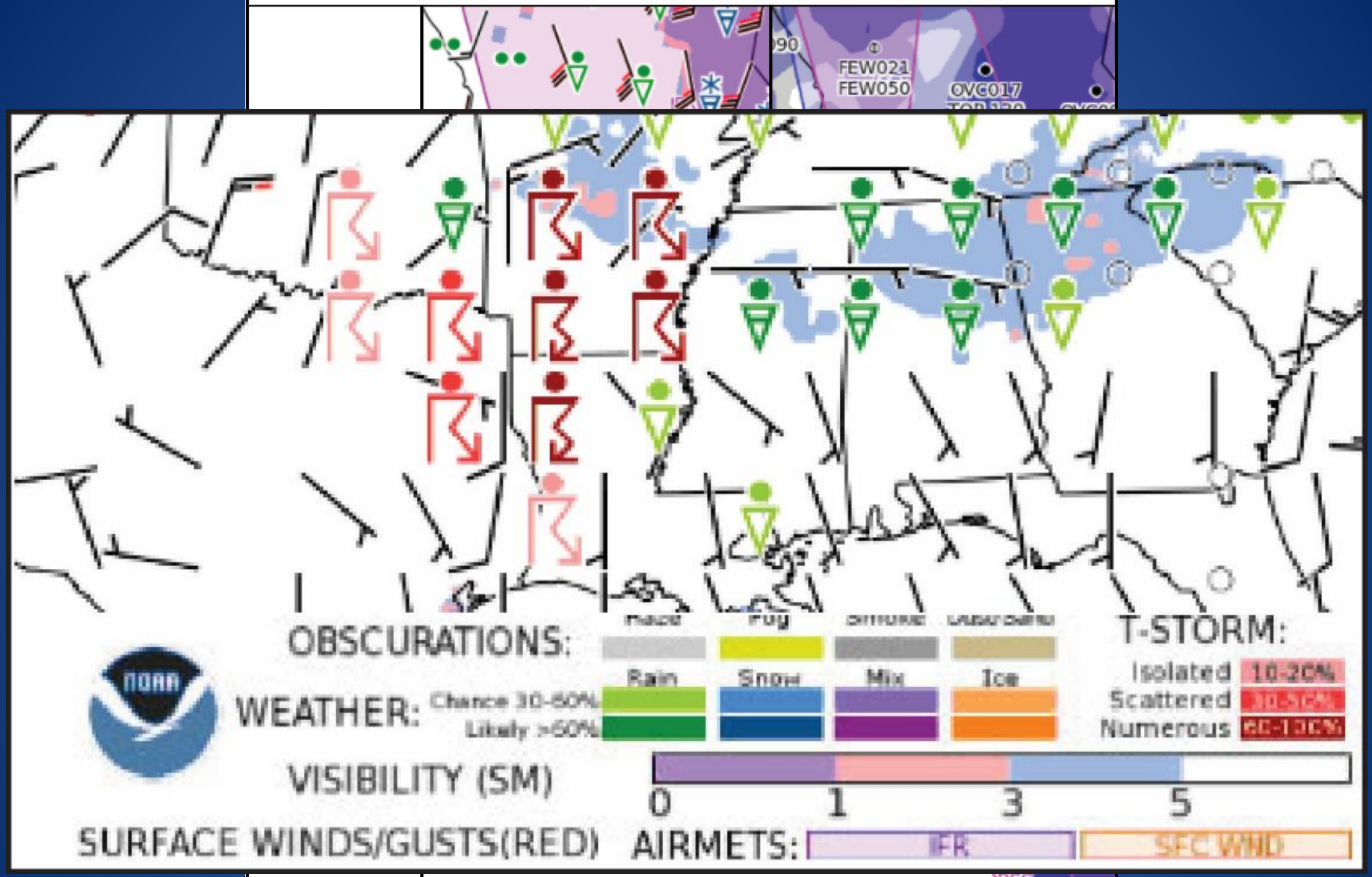
•LIMITATIONS: The GFA suite requires users to view several pages to obtain pertinent data. Displays may suffer from clutter. Users may disable certain grids/overlays, eliminating areas of hazardous weather. Weather grids are point forecasts; may not represent surrounding conditions. Expect differences between grid point forecasts and overlay depictions. No amendments—automated: may not be as accurate as forecast with human involvement.

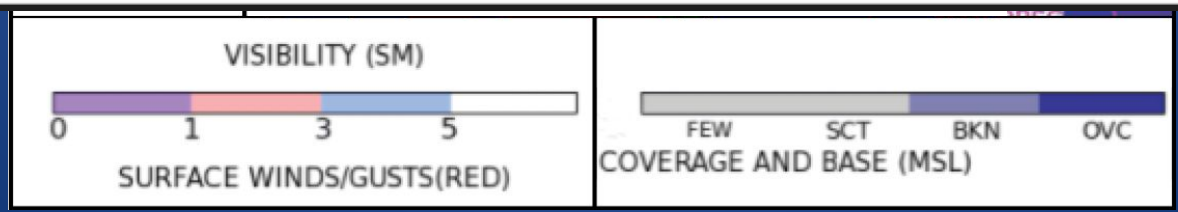
Warning

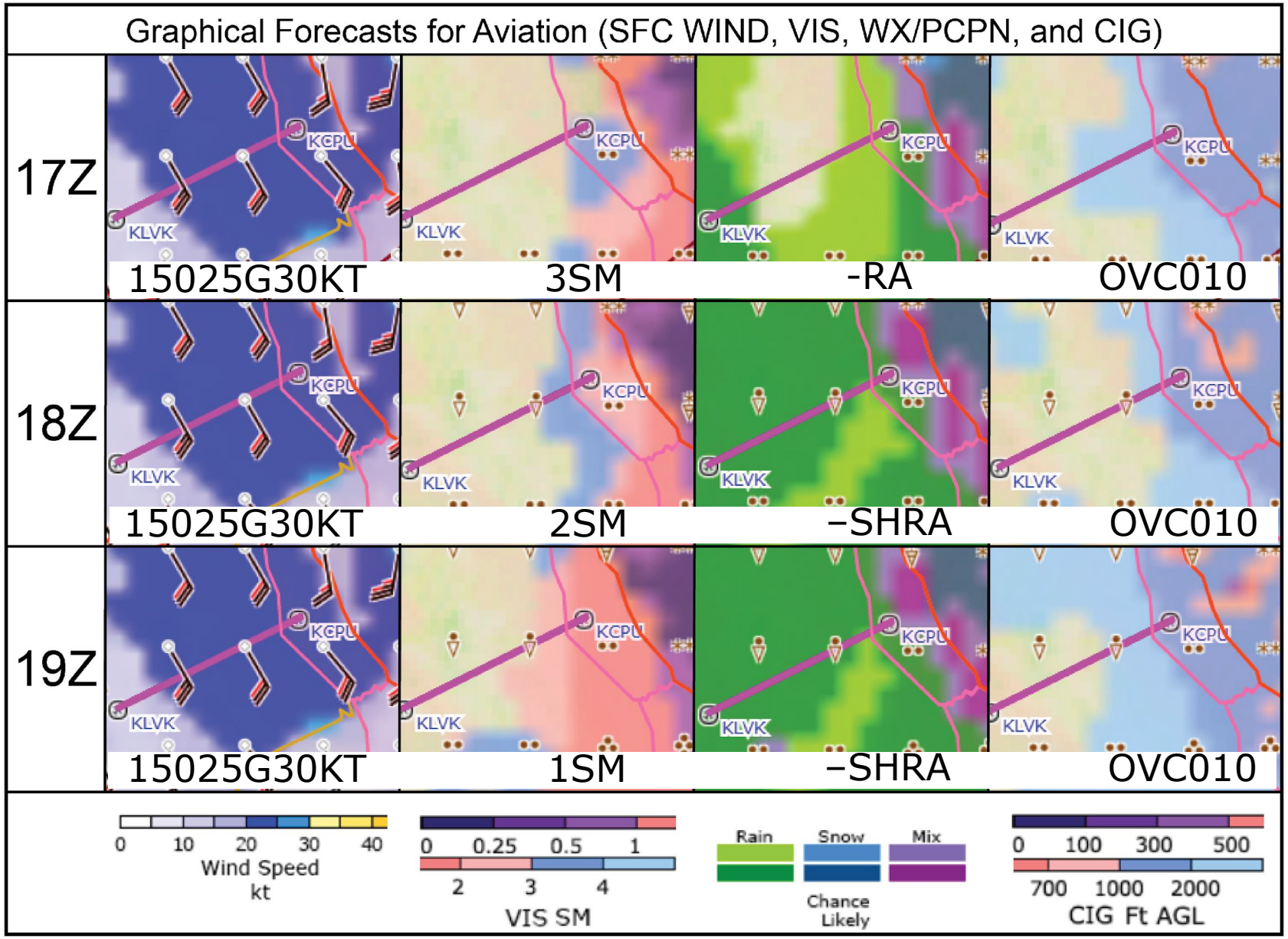
Ceilings, Visibilities, and Clouds heights (bases/tops) provide a range of values. Operationally, for Ceilings, Visibilities, and Clouds bases round DOWN; for Clouds tops round UP. For Winds apply the most significant (unfavorable) values.



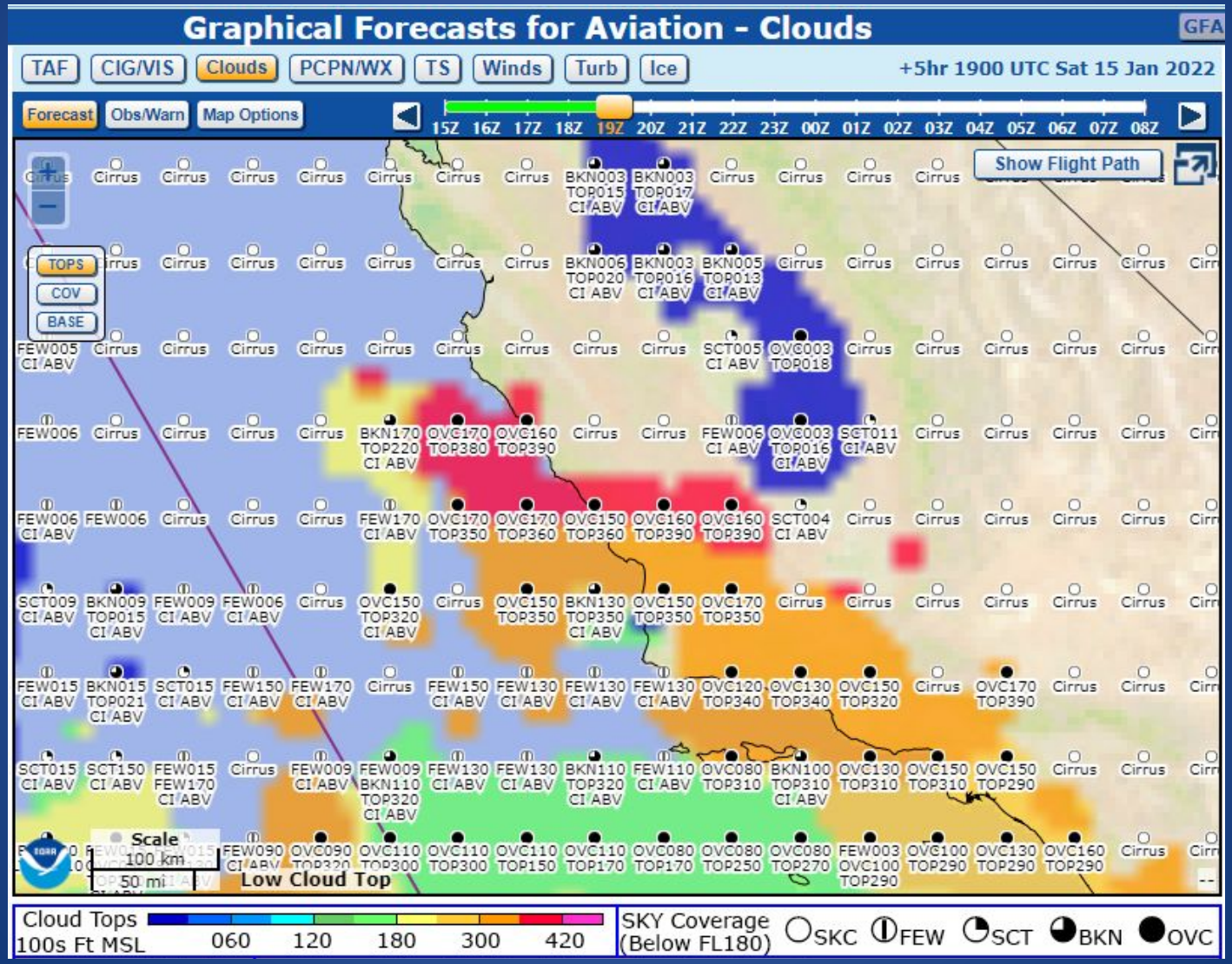
Aviation Surface/Clouds Forecast Graphics



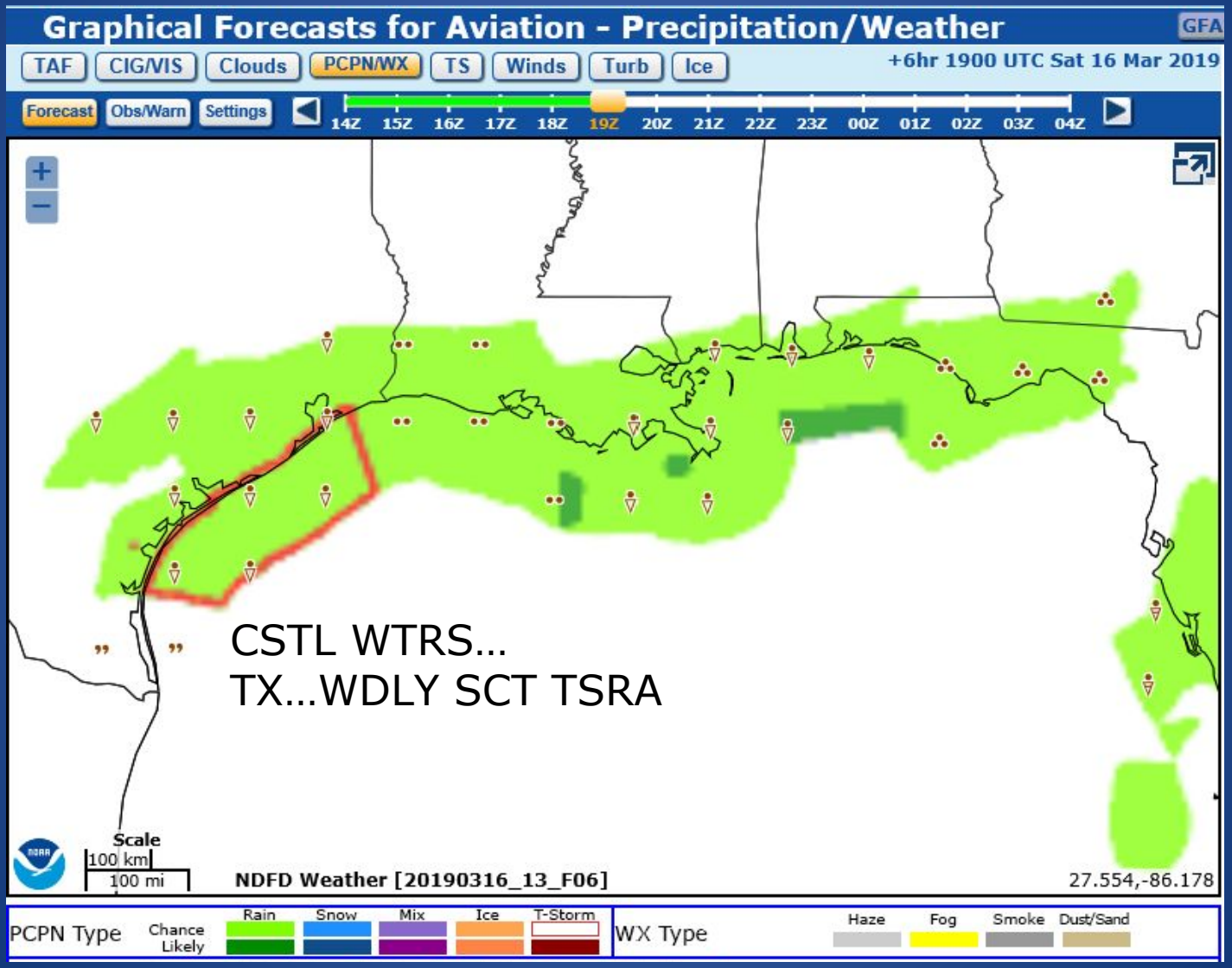



Graphical Forecasts for Aviation (SFC WIND, VIS, WX/PCPN, and CIG)
17Z
18Z
19Z
KCPU
KLVK
15025G30KT
3SM
-RA
OVC010
15025G30KT
2SM
–SHRA
OVC010
15025G30KT
1SM
–SHRA
OVC010
0 10 20 30 40
Wind Speed
kt
0 0.25 0.5 1
2 3 4
VIS SM
Rain
Snow
Mix
Chance
Likely
0 100 300 500
700 1000 2000
CIG Ft AGL

Cloud Tops/Point Forecast-Overlay



Point Forecast-Overlay Limitations



Winds & Temperatures Aloft Limitations

FD1US1
DATA BASED ON 221200Z
VALID 221800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
BIH		9900	2420+02	2536-02	2461-14	2567-24	249638	249549	740560
BLH	9900	2510+12	2415+06	2519+02	2538-11	2655-21	257337	257947	258258
FAT	1514	2016+05	2320+00	2433-05	2461-16	2481-26	740438	740949	741560
FOT	1832	2034+00	2136-05	2240-11	2375-22	2390-31	732243	734150	741255
ONT	9900	2712+10	2616+05	2523-01	2543-12	2464-22	248138	248947	249259
RBL	1628	2019+00	2229-04	2236-09	2366-20	2391-29	741942	742950	744459
SAC	2032	2329+03	2131-02	2238-06	2367-17	2479-28	740341	741350	742857
SAN	9900	2705+12	2709+06	2517+02	2649-11	2558-21	247038	248547	248559
SBA	9900	2710+07	2621+03	2531-02	2347-14	2471-23	238238	249048	740359
SFO	2320	2229+03	2329-01	2346-04	2366-16	2478-27	740141	741049	742258
SIY		2030-01	2337-05	2340-11	2471-23	2394-32	742443	734150	741656
WJF		2812+09	2519+03	2530-01	2447-13	2571-23	248238	248847	249959
AST	2141	2237-02	2237-08	2238-14	2245-27	2251-42	234745	245446	244148
IMB			2423-07	2330-13	2442-27	2479-35	741146	742150	259553
LKV			2332-06	2441-10	2469-22	2495-31	742343	743850	741457
OTH	1943	2042-01	2141-07	2243-12	2447-26	2473-38	730444	239047	247951
PDX	2036	2137-02	2238-08	2344-14	2447-28	2459-41	238044	247847	245949
RDM		2228+00	2330-06	2331-12	2440-27	2481-35	740545	741050	249053
GEG		2431-02	2533-08	2535-15	2449-27	2455-41	259247	258749	255951
SEA	2236	2234-02	2238-08	2238-15	2348-28	2358-42	234546	254846	243449
YKM	2116	2334-01	2431-08	2433-14	2444-28	2245-41	249046	248849	256250

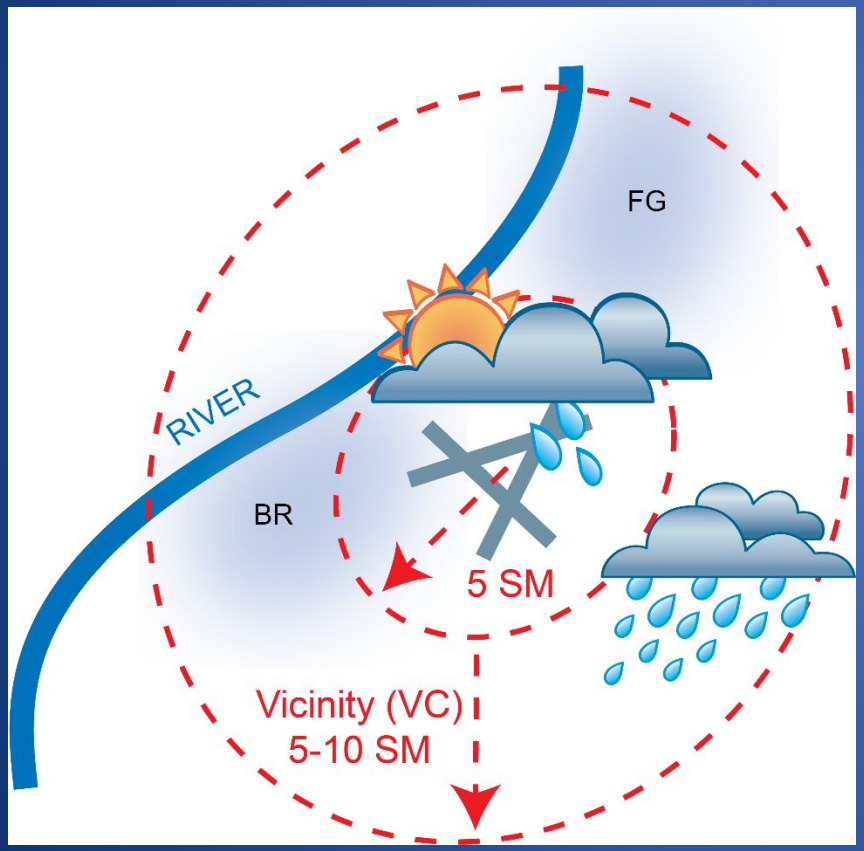
Terminal Aerodrome Forecasts (TAF)

•SCOPE: TAFs forecast events at and adjacent to designated airports.

•PURPOSE: TAFs provide a specific aerodrome forecast for departure, destination, and alternates.

•LIMITATIONS: TAFs are not written for all airports. They do not cover all hazardous events. Pilots must not extrapolate the forecast, especially in mountainous areas. Actual conditions may differ from the forecast. The forecast is considered accurate as long as conditions fall within prescribed parameters.

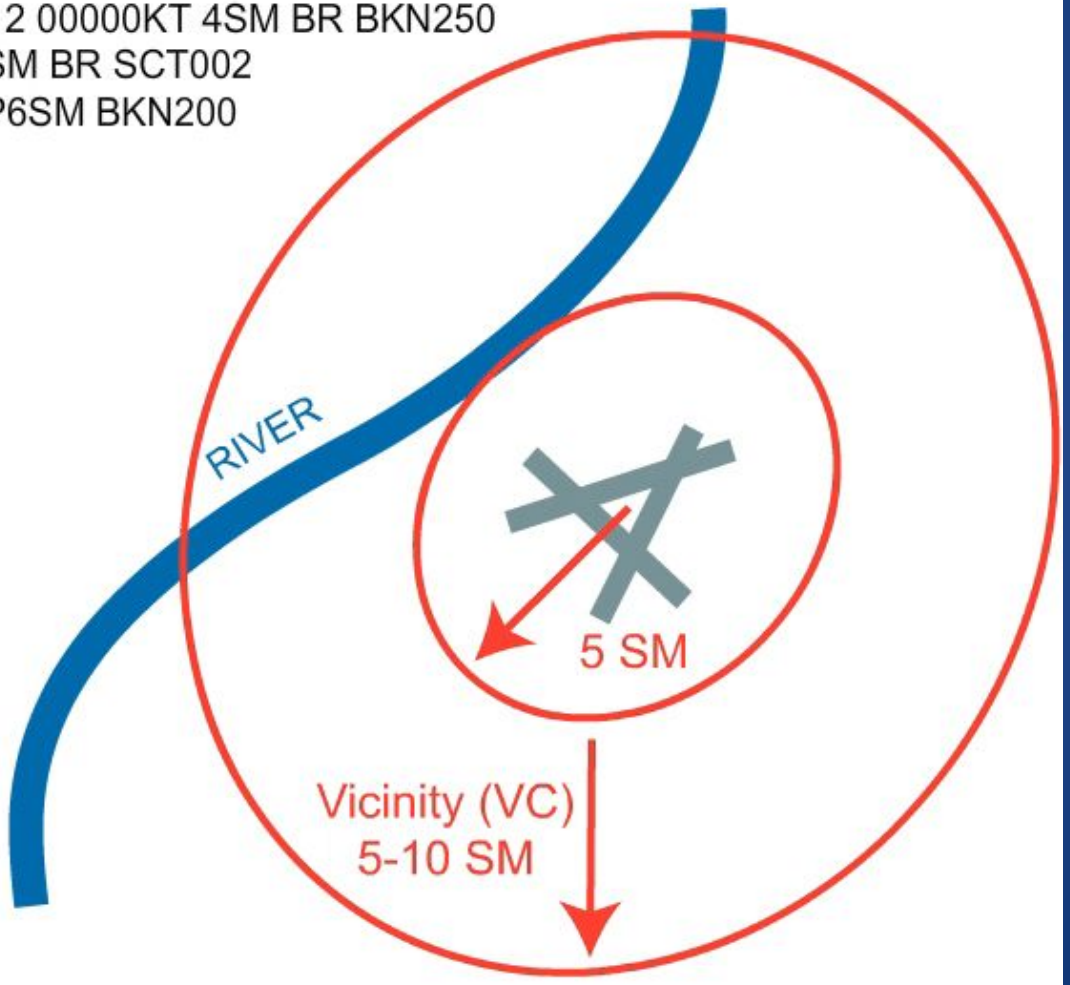
TAF Change Groups/Conditional Terms



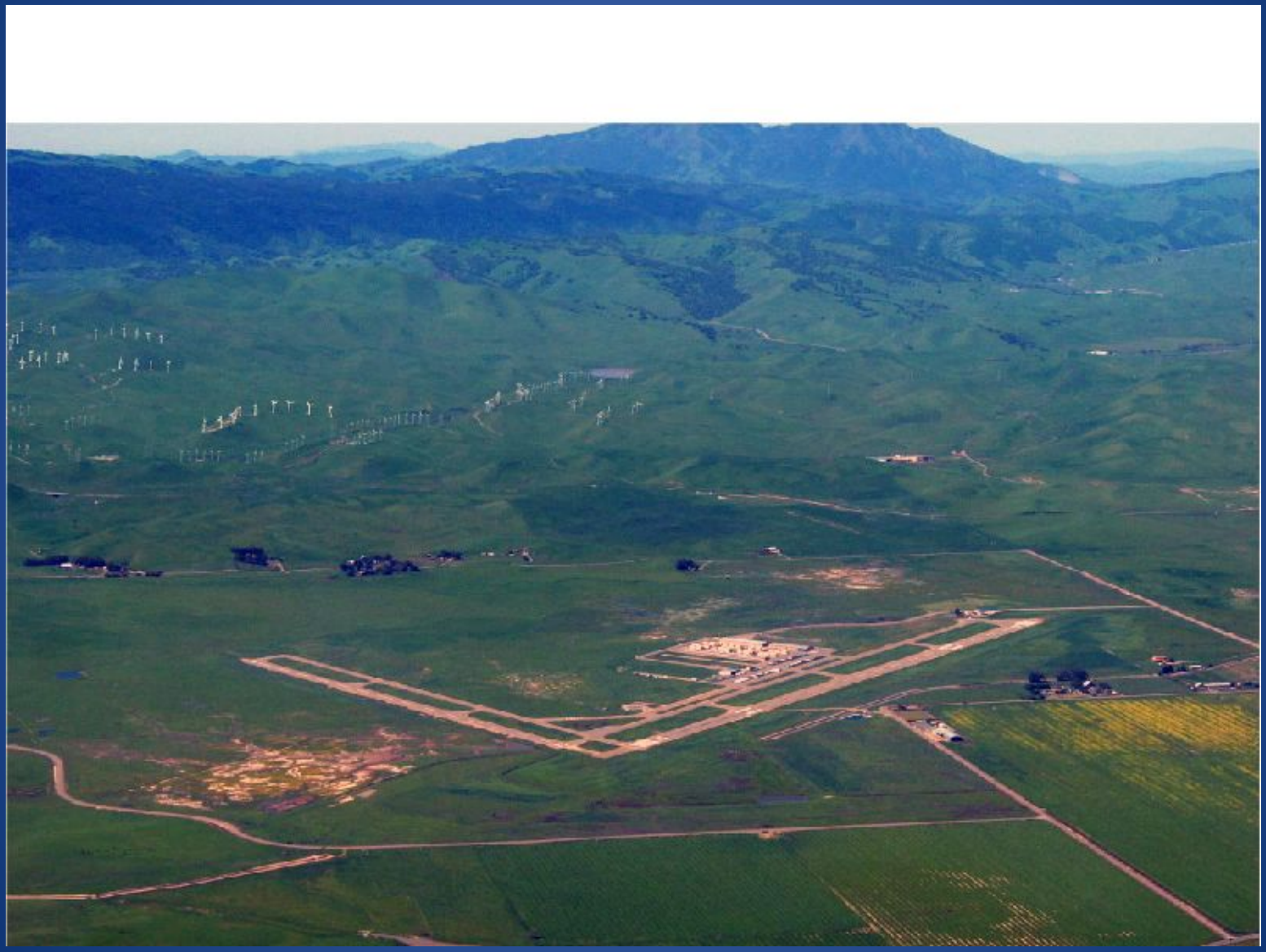
- Change groups consist of from (FM) and becoming (BECMG).
- PREVAILING: An ≥ 50% probability of occurrence expected to last for more than half of the forecast period.
- TEMPO: An ≥ 50% probability of occurrence, expected to last for generally less than an hour at a time, and cover less than half of the forecast period.
- PROB30: A 30% probability of occurrence.

Slight Risk

KSCK 021305Z 0213/0312 00000KT 4SM BR BKN250
TEMPO 0213/0216 2SM BR SCT002
FM022000 31005KT P6SM BKN200



TAF Amendment Criteria

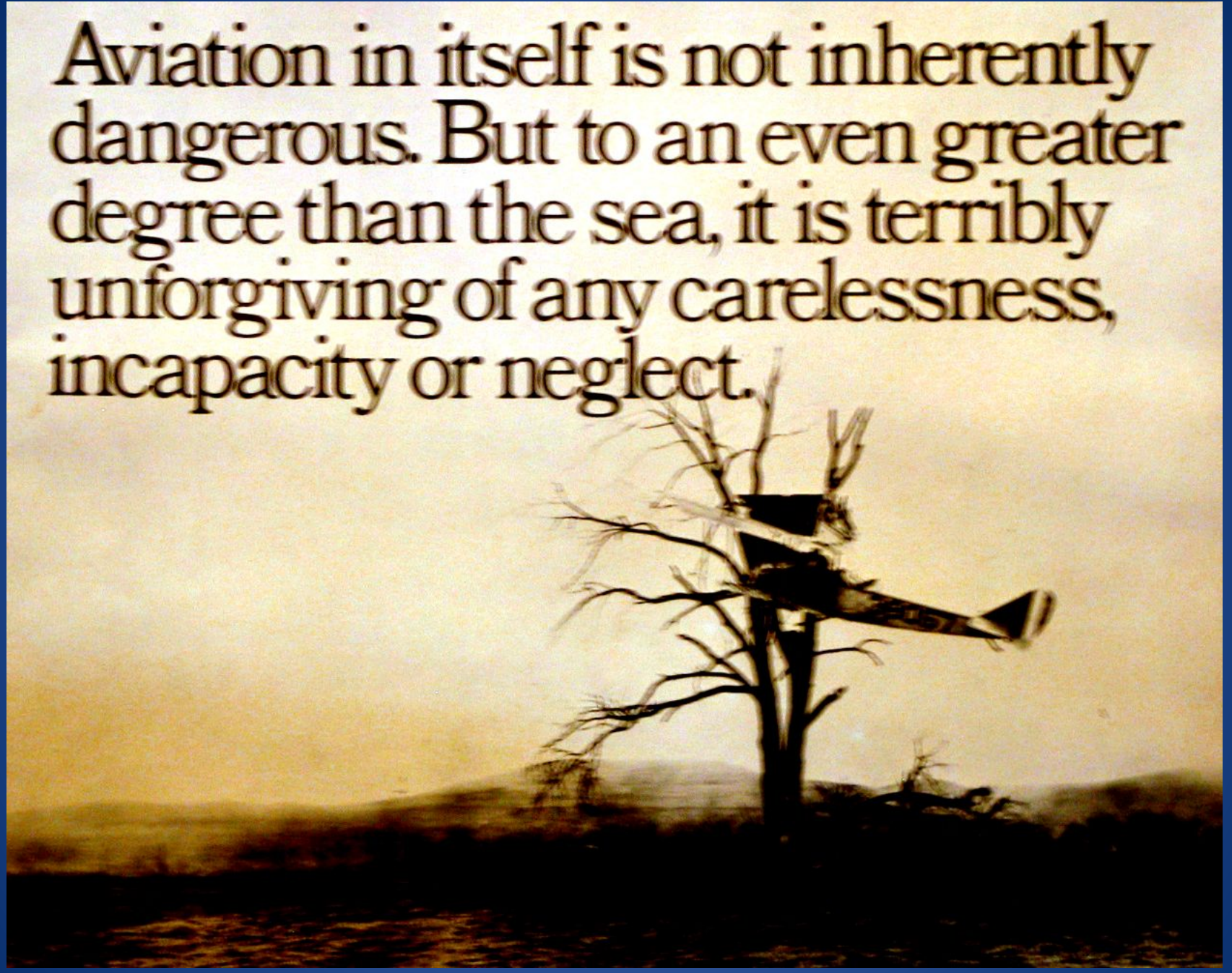


TAF Apparent Inconsistencies

- TAFs consider local effects, which may not be within the scope of other products. The forecaster may not expect phenomena described in other products to occur at or in the vicinity of the airport.
- Cloud heights in graphical products are generally MSL; TAFs are always AGL.
- A pilot should not attempt to extrapolate the TAF beyond its forecast area. Conditions in the TAF may or may not affect outlying airports.
- Conditions may differ from reported, but the forecast remains accurate as long as conditions fall within prescribed element parameters and amendment criteria.
- Prevailing groups only predict an ≥50% probability, for more than half the period.
- Only specific weather phenomena are considered operationally significant.
- Weather can develop or dissipate without the requirement to amend.

Operational Considerations

- Obtain a Standard Weather Briefing.
- Update weather enroute:
  - Check METARs for destination and alternates.
  - Check TAFs—especially at TAF update times.
- Monitor fuel reserves.
- Land short or divert:
  - Should conditions approach, or deteriorate below, regulatory or (*realistic*) personal minimums—including surface winds.
- Do not hesitate to execute a missed approach should circumstances warrant.


Aviation in itself is not inherently dangerous. But to an even greater degree than the sea, it is terribly unforgiving of any carelessness, incapacity or neglect.

Send questions, comments, or suggestions to:

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