

Ground Lesson: Weather Services

Objectives:

1. to understand the weather services available to pilots
2. to be able to read and interpret printed/graphical reports and forecasts
3. to be able to make a sound go/no-go decision based on available weather information

Justification:

1. weather is a constant part of every flight. weather services are a major means for understand what weather to expect if flight
2. helps develop proper judgement for weather interpretation
3. knowledge is required for the private pilot checkride

Schedule:

Activity	Est. Time
Ground	2.0
Total	2.0

Elements Ground:

- services overview
- printed reports
 - METAR
 - AWOS, ASOS
 - ATIS
 - PIREPS
- graphical reports
 - weather depiction chart
 - surface analysis chart
 - radar summary chart
 - satellite weather pictures
- printed forecasts
 - TAF
 - FA
 - winds and temp aloft forecast
- graphical forecasts
 - significant weather prognostic charts
 - convective outlook chart
 - winds and temperature aloft chart
- severe weather
 - AIRMETs/SIGMETs
 - severe weather outlook charts
- sources of information

Completion Standards:

1. when the student can properly retrieve, read, and interpret printed/graphical weather information
2. when the student can make correct go/no-go decisions based on weather information

Presentation Ground:

Weather Services Overview

1. There are 2 types of weather information
 - (1) reports - observations made by an observer or automated system at a given time
 - (2) forecasts - predicted weather for some time in the future based on available current information
2. There are 2 forms of weather information
 - (1) printed - reports or forecast written in "coded" language for brevities sake
 - (2) graphical - graphic representations of printed information, or stand alone graphic representation of current/past, or forecasted weather information
3. The life cycle of weather information is: observation, communication, processing, dissemination
4. a consistent order for gathering weather information is a good habit
 - (1) big picture, reported weather at departure/destination, reported weather en route, forecast departure/destination, forecast weather en route

Printed Weather Reports

1. **METAR** - Aviation Routine Weather Reports

- (1) *:hourly weather report providing current or past weather at a particular airport*
- (2) Format:
 - i. type or report, station id, date/time of report, modifier, wind, visibility, significant weather, sky conditions, temperature/dewpoint, altimeter, remarks
- (3) in US, Temperature - °C, visibility - SM, pressure - in. Hg
- (4) example
 - i. METAR KPAO 010150Z 00000KT 15SM SKC 08/03 A3040
 - ii. METAR KSJC 010253Z 25003KT 10SM FEW180 09/01 A3040 RMK AO2 SLP293 T00940011 53002

2. **ASOS and AWOS** - Automated Surface/Weather Observing System

- (1) automated weather reporting systems. ASOS is the newer more capable version of AWOS
- (2) transmits continuously updated information over a COM or NAVAIID frequency
 - i. some systems have a phone number associated with them
- (3) type and capabilities are as follows:
 - i. AWOS-A : altimeter setting
 - ii. AWOS-1 : AWOS-A + wind speed, direction, gusts, temperature, dew point
 - iii. AWOS-2 : AWOS-1 + visibility
 - iv. AWOS-3 : AWOS-2 + cloud and ceiling data
 - v. ASOS-1 : AWOS-3 + variable clouds, variable vis, rapid pressure change, precipitation type, intensity, accumulation, start/end times
 - vi. ASOS-2: ASOS-1 + difference between liquid and frozen precipitation
- (4) limitation
 - i. since automated equipment have fixed sampling paths, the system is unable to get "big picture" observations that an observer would be able to get, thus the information may not be completely accurate

3. **ATIS** - Automatic Terminal Information Service

- (1) :continuous broadcast of recorded non-control information at certain airports containing weather information, runway in use, and other pertinent remarks
- (2) updated on receipt of any official weather, regardless of content change or reported value
- (3) reads similar to METAR report

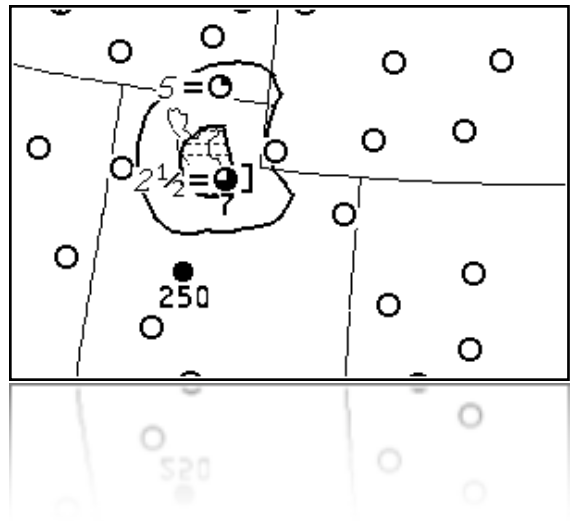
4. **PIREPS** - Pilot Weather Reports

- (1) :pilot reported weather observations at a given location
- (2) Format
 - i. required: location (OV), time (TM), altitude (FL), aircraft type (TP)
 - ii. optional: sky cover (SK), flight visibility and weather (WX), temp °C (TA), wind velocity (WV), turbulence (TB), icing (IC), remarks (RM)
 - (i) a minimum of one optional item makes up a pirep
- (3) example:
 - i. UA /OV YSP 090025 /TM 2120 /FL050 /TP BE99 /SK 020BKN040 110OVC /TA -14 /WV 030045 /TB MDT CAT 060-080 /IC LGT RIME 020-040 /RM LGT FZRA INC

Graphical Weather Reports

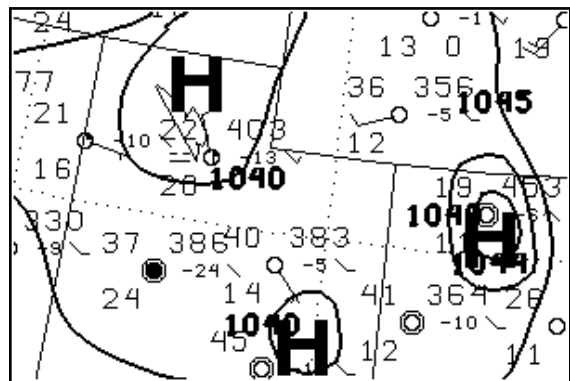
1. **weather depiction chart**

- (1) :chart providing overview of favorable and adverse weather conditions for the given chart time
- (2) information plotted is derived from METARS
- (3) areas of MVFR and IFR are depicted via contour lines and shaded areas respectively
- (4) transmitted every 3 hours
- (5) station models depict basic weather info for given location
 - i. sky cover
 - ii. cloud height
 - iii. weather/obstructions to visibility
 - iv. visibility (if less than 5SM)
- (6) station models with “J” next to sky cover symbol indicate automated system



2. **surface analysis chart**

- (1) :chart providing weather conditions, including pressure patterns, for the given chart time
- (2) transmitted every 3 hours
- (3) basically a more detailed version of the weather depiction chart
- (4) station model - see AC 00-45E 5-5
 - i. sky cover
 - ii. temp
 - iii. wind
 - iv. present weather
 - v. low, med, high clouds
 - vi. sea-level pressure
 - vii. pressure tendency



viii. 6-hour precipitation amounts (in hundredths of inches)

(5) station models with square sky cover indicate automated system

3. radar summary chart

(1) :computer-generated chart graphically depicting location, size, shape, and movement of precipitation areas

(2) generated 35 minutes past each hour

(3) note that this chart only depicts precipitation, not all cloud formations

(4) NA means no report was received

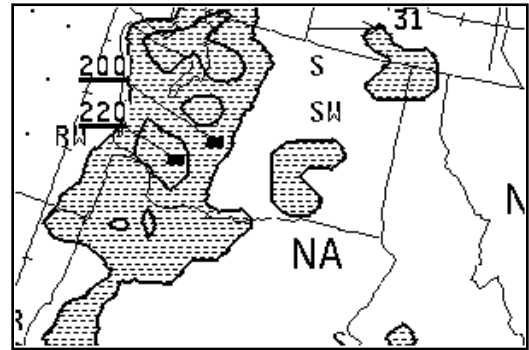
(5) NE means no echoes were detected by the reporting station

(6) tops denoted by number with underline

i. note this is tops of precipitation, *not* clouds

(7) bases denoted by number with overline

(8) 3 contours of shade represent 6 levels of intensity (light - mod, heavy - very heavy, intense - extreme)



4. satellite weather pictures

(1) :infrared or visible pictures taken from satellites

(2) Visible photos are primarily to determine the presence of clouds as well as shape and texture

(3) IR photos depict the heat radiation emitted by cloud tops and earth's surface

i. differences in temp between clouds can be used to determine cloud height

ii. colder temps = whiter image -> whiter clouds = higher clouds

(4) generated every 30 minutes (no visible photos as night)

Printed Weather Forecasts

1. TAF - terminal aerodrome forecast

(1) :printed forecast providing estimate of what the weather will be in the future at a specific airport

(2) generated 4 times daily (0000Z, 0600Z, 1200Z, 1800Z) and valid for 24 hours

(3) format:

i. type, station id, date/time, valid period, forecast, forecast change groups

ii. note the similarity to the METAR coding

(4) change groups are used to denote significant permanent changes to the weather conditions at the given time

(5) TEMPO and PROB codes are used to signify temporary conditions (last less than 1 hour) and probability of occurrence (if 30 -49% chance)

(6) example:

i. TAF KOAK 010533Z 010606 08006KT P6SM SKC
 FM1200 VRB03KT P6SM SKC
 FM2100 31008KT P6SM SKC

2. area forecast - FA

(1) :general weather conditions over a wide region (typically several states)

(2) issued 3 times day, valid for 18-hour period

(3) SFO area forecast covers CA, OR, WA, and coastal waters

(4) consists of:

- i. heading section - identifies reporting station, date/time, section validities
- ii. precautionary statements - standard statements about AIRMET sierra, TS implications, and MSL vs AGL heights
- iii. synopsis - brief description of “big picture” information
- iv. VFR clouds and weather - broken down by area, more detailed weather information (valid for 12 hours), followed by a categorical outlook (valid for remaining 6 hours)

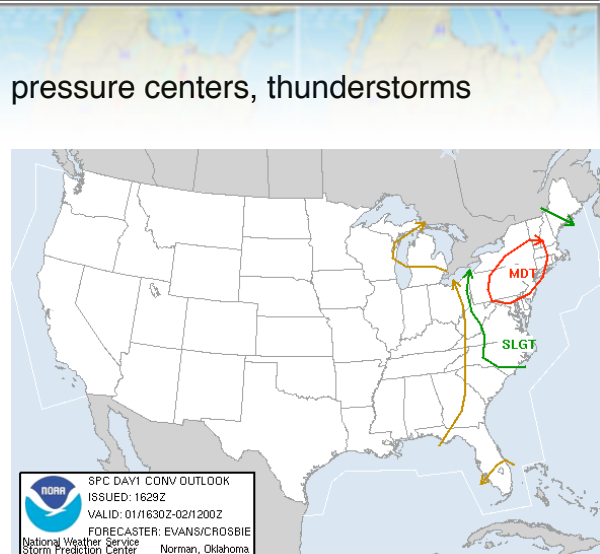
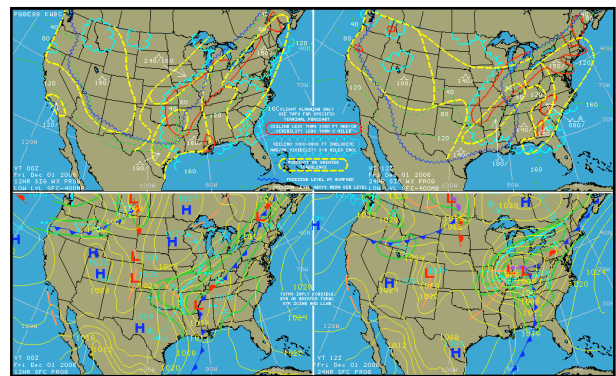
3. winds and temperatures aloft forecast - FD

- (1) :forecast estimate of wind direction in relation to true north, wind speed in knots, and temperatures in °C for selected altitudes
- (2) contains header, date/time, validity, winds and temperatures for given locations/altitude
- (3) issued twice daily based on 00Z and 12Z radiosonde data, valid for specified times
- (4) data is presented such that first two numbers are true direction, and second two numbers are wind speed in knots, last two numbers is temperature. (ex, 3111+11)
 - i. negative temps denoted by “-” up to FL240, then all temps assumed to be negative
- (5) special cases:
 - i. abbreviated headings > 51 means add 100 to velocity, and subtract 50 from abbreviated heading (7701-23=wind 270@101, temp -23°C)
 - ii. if wind velocity is coded as 99, and abbr heading > 51, wind velocity >= 199 kts
 - iii. 9900 = wind light and variable
- (6) notes:
 - i. no winds forecast below 1500 ft AGL
 - ii. no temps forecast within 2500 AGL

Graphical Weather Forecasts

1. significant weather prognostic chart

- (1) :forecast chart designed to estimate areas of low visibility and ceilings as well as regions where turbulence and icing may exist at some given time in the future
- (2) issued 4 times daily (00Z, 06Z, 12Z, 18Z) and forecast 12 and 24-hour periods.
- (3) four panels consist of:
 - i. upper panels: non-convective turbulence, freezing levels, IFR, MVFR
 - ii. lower panels: surface prognostic; i.e. fronts, pressure centers, thunderstorms
 - iii. left panels: 12 hour forecast
 - iv. right panels: 24 hour forecast
- (4) there is low-level and high-level prog charts. low goes up to 24,000 ft, so we aren’t concerned with high-level at this point



2. convective outlook chart

- (1) :48-hour forecast for thunderstorm activity
- (2) issued several times per day
- (3) two panels: left depicts 1st 24-hour period, right depicts 2nd 24-hour period

- i. "day 1" - 12Z to 12Z
- ii. "day 2" - 12Z to 12Z + 24 hours

- (4) when facing the arrow, activity noted is to the right
- (5)

3. winds and temperatures aloft chart

- (1) :8-panel char containing predicted winds/temperatures at given altitudes for a given period in the future
- (2) issued 00Z and 12Z daily, valid for 12-hours
- (3) arrows point in general direction, with digit at tail representing 10's place
- (4) barbs define wind velocity
- (5) temperatures are near head of symbol
- (6) wind calm defined by no tail, and 99 under symbol

Severe Weather

1. AIRMETS and SIGMETS

- (1) :notify enroute pilots of the possibility of hazardous weather conditions
- (2) will be given during a briefing
- (3) AIRMETS (WAs) - airman's meteorological information
 - i.warn of weather conditions which are particularly hazardous to small aircraft
 - ii.issued every 6 hours, with amendments issued as necessary
 - iii.notify of:
 - (i) moderate icing
 - (ii) moderate turbulence
 - (iii) visibility less than 3 miles and/or ceilings less than 1,000 ft
 - (iv) sustained winds greater than 30 kts
 - (v) extensive mountain obscurement
 - iv.different Identifiers mean different things:
 - (i) Sierra - IFR conditions and mountain obscuration
 - (ii) Tango - turbulence, strong surface winds, and low level wind shear
 - (iii) Zulu - icing and freezing levels
 - v.after they first issuance of the day, they are numbered for ease of sequencing
- (4) SIGMETS
 - i.issued for hazardous weather (other than convective activity) which is considered significant to all aircraft
 - ii.issued SIGMETS are valid for 4 hours (6 hours for hurricane related)
 - iii.warnings include:
 - (i) severe and extreme turbulence
 - (ii) severe icing
 - (iii) widespread dust storms, sand storms lowering visibility to less than 3 SM
 - (iv) clear air turbulence (CAT)
- (5) Convective SIGMETS
 - i.issued for hazardous convective weather which is significant to the safety of all aircraft
 - ii.issued convective SIGMETS are valid for 2 hours unless superseded by new one
 - iii.warnings include
 - (i) tornadoes

- (ii) lines of thunderstorms
- (iii) embedded thunderstorms
- (iv) hail greater than or equal to 3/4 inch in diameter
- (v) wind gusts to 50 kts or greater

iv. issued as eastern (E), central (C) and western (W) United States

Sources of Information

1. Big Picture

- (1) Weather Channel
- (2) newspaper
- (3) etc.

2. FSS

(1) 1-800-WX-BRIEF

(2) when getting a briefing you need to provide the following information:

- i. Type of Flight: VFR or IFR
- ii. Aircraft Identification or Pilot's Name
- iii. Aircraft Type
- iv. Departure Point
- v. Estimated Time of Departure
- vi. Altitude
- vii. Route-of-Flight
- viii. Destination
- ix. Estimated Time En Route

(3) 3 types of briefings

- i. standard briefing - a complete briefing for flights within 6 hours
 - (i) adverse conditions, VNR, Synopsis, current conditions, en route forecast, destination forecasts, winds aloft forecast, NOTAMs, ATC delays,
- ii. outlook briefing - for flights more that 6 hours away, briefer provides forecast information for the route of flight
- iii. abbreviated briefing - does not provide a complete weather briefing. A good source of updated information.
 - (i) pilot must request what information they want

(4) example briefing:

i. "southwesterly flow aloft, mid- and high-level moisture across eastern portions of Colorado. the airmass is expected to become unstable anytime after 11 o'clock. you may see some buildups along the foothills on your way back to Centennial, but it should remain VFR for your flight. I have no precipitation returns on radar. on satellite it's showing some low to mid-level layers along the I-23 corridor, but nothing else across the rest of your route. Centennial reporting, surface wind 180 at 9, visibility 50, 12,000 scattered with broken cirrus above, temperature 22, check density altitude. colorado springs area, few clouds at 10,000 with scattered cirrus above, visibility unrestricted. Pueblo, wind calm, visibility unrestricted with no clouds below 12,000, temperature 23, check density altitude. one pilot report, 20 miles south of jeffco, a cessna 210 a half an hour ago reported light occasional turbulence at 8000. the area forecast through noon calls for 15000 scattered mean sea level with broken cirrus above. after noon, looking for 12000 scattered mean sea level with broken cirrus above and some isolated thunderstorms. forecast for pueblo for your time period, surface wind variable at 5,

visibility greater than 6 with scattered cirrus clouds. forecast for centennial for your time period, wind 040 at 8, visibility greater than 6, 7000 scattered with scattered cirrus above. winds aloft at 9000, departure point and over your route of flight 200 at 8, temperature 15. NOTAMs, at Pueblo, unlighted obstruction 500 AGL 2 miles SW of the airport. I there anything else I can help you with?"

3. Internet

- (1) DUATS - direct user access terminal system
- (2) ADDS - Aviation Digital Data Service
- (3) private industry sources - ex. JeppFax

4. In-Flight

- (1) See XC lesson for details