= Surface weather observation =

Surface weather observations are the fundamental data used for safety as well as climatological reasons to forecast weather and issue warnings worldwide . They can be taken manually , by a weather observer , by computer through the use of automated weather stations , or in a hybrid scheme using weather observers to augment the otherwise automated weather station . The ICAO defines the International Standard Atmosphere (ISA) , which is the model of the standard variation of pressure , temperature , density , and viscosity with altitude in the Earth 's atmosphere , and is used to reduce a station pressure to sea level pressure . Airport observations can be transmitted worldwide through the use of the METAR observing code . Personal weather stations taking automated observations can transmit their data to the United States mesonet through the Citizen Weather Observer Program (CWOP) , the UK Met Office through their Weather Observations Website (WOW) , or internationally through the Weather Underground Internet site . A thirty @-@ year average of a location 's weather observations is traditionally used to determine the station 's climate .

= = Airports = =

Surface weather observations have traditionally been taken at airports due to safety concerns during takeoffs and landings . The ICAO defines the International Standard Atmosphere (also known as ICAO Standard Atmosphere) , which is the model of the standard variation of pressure , temperature , density , and viscosity with elevation / altitude in the Earth 's atmosphere . This is useful in calibrating instruments and designing aircraft , and is used to reduce a station 's pressure to sea level pressure (SLP) where it can then be used on weather maps .

In the United States , the FAA mandates the taking of weather observations at larger airports for safety reasons . To help facilitate the purchase of an automated airport weather station , such as ASOS , the FAA allows federal dollars to be used for the installation of certified weather stations at airports . The airport observations are then transmitted worldwide using the METAR observing code . METAR reports typically come from airports or permanent weather observation stations . Reports are generated once an hour ; however , if conditions change significantly , they may be updated in special reports called SPECIEs .

= = Data Reported = =

Surface weather observations can include the following elements :

The Station Identifier , or Location identifier , consists of four characters for METAR observations , with the first representing the region of the world the station lies within . For example , the first letter for areas in and around the Pacific ocean is P , and for Europe is E. The second character may represent the country / state the location lies within . For Hawaii , the first two letters are " PH " while for Great Britain , the first two letters of the station identifier are " EG " . Canada and the contiguous United States are an exception , with the first letters C and K representing the regions , respectively . The final two or three letters normally represent the name of the location or airport .

Visibility , measured in meters for most sites worldwide , except in the United States where statute miles are reported .

Runway visibility , measured in meters in many locations worldwide , or feet within the United States .

Temperature is a measure of the kinetic energy of a sample of matter . Temperature is the unique physical property that determines the direction of heat flow between two objects placed in thermal contact . If no heat flow occurs , the two objects have the same temperature ; otherwise heat flows from the hotter object to the colder object . Temperature , within meteorology , is measured with thermometers exposed to the air but sheltered from direct solar exposure . In most of the world , the degree Celsius scale is used for most temperature measuring purposes . However , the United States is the last major country in which the degree Fahrenheit temperature scale is used by most

lay people , industry , popular meteorology , and government . Despite this , METAR reports from the United States also report the temperature (and dewpoint , see below) in degrees Celsius .

Dew point is the temperature to which a given parcel of air must be cooled , at constant atmospheric pressure , for water vapor to condense into water . The condensed water is called dew . The dew point is a saturation point . When the dew point temperature falls below freezing it is called the frost point , as the water vapor no longer creates dew but instead creates frost or hoarfrost by deposition . The dew point is associated with relative humidity . A high relative humidity indicates that the dew point is closer to the current air temperature . If the relative humidity is 100 % , the dew point is equal to the current temperature . Given a constant dew point , an increase in temperature will lead to a decrease in relative humidity . At a given barometric pressure , independent of temperature , the dew point determines the specific humidity of the air . The dew point is an important statistic for general aviation pilots , as it is used to calculate the likelihood of carburetor icing and fog . When used with the air temperature , a formula can be used to estimate the height of cumuliform , or convective , clouds .

Wind is determined using anemometers and wind vanes , or aerovanes , located a standard 10 metres (33 ft) above ground level (AGL) . Average wind speed is measured using a two @-@ minute average in the United States , and a 10 @-@ minute average elsewhere . Wind direction is measured using degrees , with north representing 0 or 360 degrees , with values increasing from 0 clockwise from north . Wind gusts are reported when there is variation of the wind speed of more than 10 knots (5 @.@ 1 m / s) between peaks and lulls during the sampling period .

Sea level pressure (SLP) is the pressure at sea level or (when measured at a given elevation on land) the station pressure reduced to sea level assuming an isothermal layer at the station temperature . This is the pressure normally given in weather reports on radio , television , and newspapers or on the Internet . When barometers in the home are set to match the local weather reports , they measure pressure reduced to sea level , not the actual local atmospheric pressure . The reduction to sea level means that the normal range of fluctuations in pressure is the same for everyone . The pressures which are considered high pressure or low pressure do not depend on geographical location . This makes isobars on a weather map meaningful and useful tools .

Altimeter setting is a term and quantity used in aviation . The regional or local air pressure at mean sea level is called the altimeter setting , and the pressure which will calibrate the altimeter to show the height above ground at a given QNH airfield .

Present weather , which present restrictions to visibility or presence of thunder or squalls , are reported in observations to indicate to aviation any possible threats during landings and takeoffs from airports . Types included in surface weather observations include precipitation , obscurations , other weather phenomena such as , well @-@ developed dust / sand whirls , squalls , tornadic activity , sandstorms , volcanic ash , and dust storms .

Intensity of precipitation is primarily measured for meteorological concerns . However , it can be of concern to aviation as heavy precipitation can limit visibility . Also , intensity of freezing rain can determine how hazardous it is for pilots to fly nearby certain locations since it can be an in @-@ flight hazard by depositing ice on the wings of aircraft , which can be detrimental to flight .

Precipitation amount over the past 1 , 3 , 6 or 24 hours is of particular interest to meteorologists in verifying forecast amounts of precipitation and determining station climatologies .

Snowfall amount during the past 6 hours is taken for meteorological and climatological concerns . However , it may also be reported hourly using " SNOINCR " remarks to provide air field technicians information on how frequently snow must be plowed from runways and taxiways .

Snow depth is measured for meteorological and climatological concerns once a day . However , during periods of snowfall , it is measured each six hours to determine amount of recent snowfall .

= = = Example of a METAR surface weather observation = = =

METAR LBBG 041600Z 12003MPS 310V290 1400 R04 / P1500N R22 / P1500U + SN BKN022 OVC050 M04 / M07 Q1020 NOSIG 9949 / / 91 =

Personal weather stations , maintained by citizens rather than government officials , do not use

METAR code . Software allows information to be transmitted to various sites , such as the Weather Underground globally , or the CWOP within the United States , which can then be used by the appropriate meteorological organizations either to diagnose real @-@ time conditions , or be used within weather forecast models .

= = Use of weather maps = =

Data collected by land locations coding in METAR are conveyed worldwide via phone lines or wireless technology . Within many nations ' meteorological organizations , this data is then plotted onto a weather map using the station model . A station model is a symbolic illustration showing the weather occurring at a given reporting station . Meteorologists created the station model to plot a number of weather elements in a small space on weather maps . Maps filled with dense station @-@ model plots can be difficult to read , but they allow meteorologists , pilots , and mariners to see important weather patterns .

Weather maps are used to display information quickly showing the analysis of various meteorological quantities at various levels of the atmosphere , in this case the surface layer . Maps containing station models aid in the drawing of isotherms , which more readily identifies temperature gradients , and can help in the location of weather fronts . Two @-@ dimensional streamlines based on wind speeds show areas of convergence and divergence in the wind field , which are helpful in determining the location of features within the wind pattern . A popular type of surface weather map is the surface weather analysis , which plots isobars to depict areas of high pressure and low pressure .

= = Ship and buoy reports = =

For over a century , reports from the world 's oceans have been received real @-@ time for safety reasons and to help with general weather forecasting . The reports are coded using the synoptic code , and relayed via radio or satellite to weather organizations worldwide . Buoy reports are automated , and maintained by the country that moored the buoy in that location . Larger moored buoys are used near shore , while smaller drifting buoys are used farther out at sea .

Due to the importance of reports from the surface of the ocean , the voluntary observing ship program , known as VOS , was set up to train crews how to take weather observations while at sea and also to calibrate weather sensors used aboard ships when they arrive in port , such as barometers and thermometers . The Beaufort scale is still generally used to determine wind speed from manual observers out at sea . Ships with anemometers have issues with determining wind speeds at higher wind speeds due to blockage of the instruments by increasing high seas .

= = Use in establishing climate of a location = =

Climate , (from Ancient Greek klima) is commonly defined as the weather averaged over a long period of time . The standard averaging period is 30 years for an individual location , but other periods may be used . Climate includes statistics other than the average , such as the magnitudes of day @-@ to @-@ day or year @-@ to @-@ year variations . The Intergovernmental Panel on Climate Change (IPCC) glossary definition is :

Climate in a narrow sense is usually defined as the ? average weather ? , or more rigorously , as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years . The classical period is 30 years , as defined by the World Meteorological Organization (WMO) . These quantities are most often surface variables such as temperature , precipitation , and wind . Climate in a wider sense is the state , including a statistical description , of the climate system .

The main difference between climate and everyday weather is best summarized by the popular phrase " Climate is what you expect , weather is what you get . " Over historic time spans there are a number of static variables that determine climate , including : latitude , altitude , proportion of land

to water , and proximity to oceans and mountains . Degree of vegetation coverage affects solar heat absorption , water retention , and rainfall on a regional level .