

= Weather front =

A weather front is a boundary separating two masses of air of different densities , and is the principal cause of meteorological phenomena . In surface weather analyses , fronts are depicted using various colored triangles and half @-@ circles , depending on the type of front . The air masses separated by a front usually differ in temperature and humidity . Cold fronts may feature narrow bands of thunderstorms and severe weather , and may on occasion be preceded by squall lines or dry lines . Warm fronts are usually preceded by stratiform precipitation and fog . The weather usually clears quickly after a front 's passage . Some fronts produce no precipitation and little cloudiness , although there is invariably a wind shift .

Cold fronts and occluded fronts generally move from west to east , while warm fronts move poleward . Because of the greater density of air in their wake , cold fronts and cold occlusions move faster than warm fronts and warm occlusions . Mountains and warm bodies of water can slow the movement of fronts . When a front becomes stationary , and the density contrast across the frontal boundary vanishes , the front can degenerate into a line which separates regions of differing wind velocity , known as a shearline . This is most common over the open ocean .

= = Bergeron classification of air masses = =

The Bergeron classification is the most widely accepted form of air mass classification . Air mass classification involves three letters . The first letter describes its moisture properties , with c used for continental air masses (dry) and m for maritime air masses (moist) . The second letter describes the thermal characteristic of its source region : T for tropical , P for polar , A for arctic or Antarctic , M for monsoon , E for equatorial , and S for superior air (dry air formed by significant upward motion in the atmosphere) . The third letter is used to designate the stability of the atmosphere . If the air mass is colder than the ground below it , it is labeled k . If the air mass is warmer than the ground below it , it is labeled w . Fronts separate air masses of different types or origins , and are located along troughs of lower pressure .

= = Surface weather analysis = =

A surface weather analysis is a special type of weather map which provides a view of weather elements over a geographical area at a specified time based on information from ground @-@ based weather stations . Weather maps are created by plotting or tracing the values of relevant quantities such as sea @-@ level pressure , temperature , and cloud cover onto a geographical map to help find synoptic scale features such as weather fronts . Surface weather analyses have special symbols which show frontal systems , cloud cover , precipitation , or other important information . For example , an H may represent high pressure , implying fair weather . An L on the other hand may represent low pressure , which frequently accompanies precipitation . Low pressure also creates surface winds deriving from high pressure zones . Various symbols are used not just for frontal zones and other surface boundaries on weather maps , but also to depict the present weather at various locations on the weather map . In addition , areas of precipitation help determine the frontal type and location .

= = Front types = =

There are two different words used within meteorology to describe weather around a frontal zone . The term " anafont " describes boundaries which show instability , meaning air rises rapidly along and over the boundary to cause significant weather changes . A " katafront " is weaker , bringing smaller changes in temperature and moisture , as well as limited rainfall .

= = = Cold front = = =

A cold front is located at the leading edge of the temperature drop off , which in an isotherm analysis shows up as the leading edge of the isotherm gradient , and it normally lies within a sharp surface trough . Cold fronts often bring heavy thunderstorms , rain and hail . Cold front can produce sharper changes in weather and move up to twice as quickly as warm fronts , since cold air is denser than warm air and rapidly replaces the warm air preceding the boundary . On weather maps , the surface position of the cold front is marked with the symbol of a blue line of triangle @-@ shaped pips pointing in the direction of travel , and it is placed at the leading edge of the cooler air mass . Cold fronts come in association with a low @-@ pressure area . The concept of colder , dense air " wedging " under the less dense warmer air is often used to depict how air is lifted along a frontal boundary . The cold air wedging underneath warmer air creates the strongest winds just above the ground surface , a phenomenon often associated with property @-@ damaging wind gusts . This lift would then form a narrow line of showers and thunderstorms if enough moisture were present . However , this concept isn 't an accurate description of the physical processes ; upward motion is not produced because of warm air " ramping up " cold , dense air , rather , frontogenetical circulation is behind the upward forcing .

= = = Warm front = = =

Warm fronts are at the leading edge of a homogeneous warm air mass , which is located on the equatorward edge of the gradient in isotherms , and lie within broader troughs of low pressure than cold fronts . A warm front moves more slowly than the cold front which usually follows because cold air is denser and harder to remove from the Earth 's surface . This also forces temperature differences across warm fronts to be broader in scale . Clouds ahead of the warm front are mostly stratiform , and rainfall gradually increases as the front approaches . Fog can also occur preceding a warm frontal passage . Clearing and warming is usually rapid after frontal passage . If the warm air mass is unstable , thunderstorms may be embedded among the stratiform clouds ahead of the front , and after frontal passage thundershowers may continue . On weather maps , the surface location of a warm front is marked with a red line of semicircles pointing in the direction of travel .

= = = Occluded front = = =

An occluded front is formed when a cold front overtakes a warm front. and usually form around mature low @-@ pressure areas . The cold and warm fronts curve naturally poleward into the point of occlusion , which is also known as the triple point . It lies within a sharp trough , but the air mass behind the boundary can be either warm or cold . In a cold occlusion , the air mass overtaking the warm front is cooler than the cool air ahead of the warm front and plows under both air masses . In a warm occlusion , the air mass overtaking the warm front is warmer than the cold air ahead of the warm front and rides over the colder air mass while lifting the warm air .

A wide variety of weather can be found along an occluded front , with thunderstorms possible , but usually their passage is associated with a drying of the air mass . Within the occlusion of the front , a circulation of air brings warm air upward and sends drafts of cold air downward , or vice @-@ versa depending on the occlusion the front is experiencing . Precipitations and clouds are associated with the trowal , the projection on the Earth 's surface of the tongue of warm air aloft formed during the occlusion process of the depression .

Occluded fronts are indicated on a weather map by a purple line with alternating half @-@ circles and triangles pointing in direction of travel . The trowal is indicated by a series of blue and red junction lines .

= = = Stationary front = = =

A stationary front is a non @-@ moving (or stalled) boundary between two air masses , neither of which is strong enough to replace the other . They tend to remain essentially in the same area for extended periods of time , usually moving in waves . There is normally a broad temperature gradient

behind the boundary with more widely spaced isotherm packing .

A wide variety of weather can be found along a stationary front , but usually clouds and prolonged precipitation are found there . Stationary fronts either dissipate after several days or devolve into shear lines , but they can transform into a cold or warm front if conditions aloft change . Stationary fronts are marked on weather maps with alternating red half @-@ circles and blue spikes pointing in opposite directions , indicating no significant movement .

When stationary fronts become smaller in scale , degenerating to a narrow zone where wind direction changes significantly over a relatively short distance , they become known as shearlines . A shearline is depicted as a line of red dots and dashes .

= = = Dry line = = =

A similar phenomenon to a weather front is the dry line , which is the boundary between air masses with significant moisture differences . When the westerlies increase on the north side of surface highs , areas of lowered pressure will form downwind of north ? south oriented mountain chains , leading to the formation of a lee trough . Near the surface during daylight hours , warm moist air is denser than dry air of greater temperature , and thus the warm moist air wedges under the drier air like a cold front . At higher altitudes , the warm moist air is less dense than the dry air and the boundary slope reverses . In the vicinity of the reversal aloft , severe weather is possible , especially when a triple point is formed with a cold front . A weaker form of the dry line seen more commonly is the lee trough , which displays weaker differences in moisture . When moisture pools along the boundary during the warm season , it can be the focus of diurnal thunderstorms .

The dry line may occur anywhere on earth in regions intermediate between desert areas and warm seas . The southern plains west of the Mississippi River in the United States are a particularly favored location . The dry line normally moves eastward during the day and westward at night . A dry line is depicted on National Weather Service (NWS) surface analyses as an orange line with scallops facing into the moist sector . Dry lines are one of the few surface fronts where the pips indicated do not necessarily reflect the direction of motion .

= = = Squall line = = =

Organized areas of thunderstorm activity not only reinforce pre @-@ existing frontal zones , but can outrun cold fronts in a pattern where the upper level jet splits apart into two streams , with the resultant Mesoscale Convective System (MCS) forming at the point of the upper level split in the wind pattern running southeast into the warm sector parallel to low @-@ level thickness lines . When the convection is strong and linear or curved , the MCS is called a squall line , with the feature placed at the leading edge of the significant wind shift and pressure rise . Even weaker and less organized areas of thunderstorms lead to locally cooler air and higher pressures , and outflow boundaries exist ahead of this type of activity , which can act as foci for additional thunderstorm activity later in the day .

These features are often depicted in the warm season across the United States on surface analyses and lie within surface troughs . If outflow boundaries or squall lines form over arid regions , a haboob may result . Squall lines are depicted on NWS surface analyses as an alternating pattern of two red dots and a dash labelled SQLN or SQUALL LINE , while outflow boundaries are depicted as troughs with a label of OUTFLOW BOUNDARY .

= = Precipitation produced = =

Fronts are the principal cause of significant weather . Convective precipitation (showers , thundershowers , and related unstable weather) is caused by air being lifted and condensing into clouds by the movement of the cold front or cold occlusion under a mass of warmer , moist air . If the temperature differences of the two air masses involved are large and the turbulence is extreme because of wind shear and the presence of a strong jet stream , " roll clouds " and tornadoes may

occur .

In the warm season , lee troughs , breezes , outflow boundaries and occlusions can lead to convection if enough moisture is available . Orographic precipitation is precipitation created through the lifting action of air moving over terrain such as mountains and hills , which is most common behind cold fronts that move into mountainous areas . It may sometimes occur in advance of warm fronts moving northward to the east of mountainous terrain . However , precipitation along warm fronts is relatively steady , as in rain or drizzle . Fog , sometimes extensive and dense , often occurs in pre @-@ warm @-@ frontal areas . Although , not all fronts produce precipitation or even clouds because moisture must be present in the air mass which is being lifted .

= = Movement = =

Fronts are generally guided by winds aloft , but do not move as quickly . Cold fronts and occluded fronts in the Northern Hemisphere usually travel from the northwest to southeast , while warm fronts move more poleward with time . In the Northern Hemisphere a warm front moves from southwest to northeast . In the Southern Hemisphere , the reverse is true ; a cold front usually moves from southwest to northeast , and a warm front moves from northwest to southeast . Movement is largely caused by the pressure gradient force (horizontal differences in atmospheric pressure) and the Coriolis effect , which is caused by Earth 's spinning about its axis . Frontal zones can be slowed down by geographic features like mountains and large bodies of warm water .