

= Outflow boundary =

An outflow boundary , also known as a gust front , is a storm @-@ scale or mesoscale boundary separating thunderstorm @-@ cooled air ( outflow ) from the surrounding air ; similar in effect to a cold front , with passage marked by a wind shift and usually a drop in temperature and a related pressure jump . Outflow boundaries can persist for 24 hours or more after the thunderstorms that generated them dissipate , and can travel hundreds of kilometres ( miles ) from their area of origin . New thunderstorms often develop along outflow boundaries , especially near the point of intersection with another boundary ( cold front , dry line , another outflow boundary , etc . ) . Outflow boundaries can be seen either as fine lines on weather radar imagery or else as arcs of low clouds on weather satellite imagery . From the ground , outflow boundaries can be co @-@ located with the appearance of roll clouds and shelf clouds .

Outflow boundaries create low @-@ level wind shear which can be hazardous during aircraft takeoffs and landings . If a thunderstorm runs into an outflow boundary , the low @-@ level wind shear from the boundary can cause thunderstorms to exhibit rotation at the base of the storm , at times causing tornadic activity . Strong versions of these features known as downbursts can be generated in environments of vertical wind shear and mid @-@ level dry air . Microbursts have a diameter of influence less than 4 kilometres ( 2 @.@ 5 mi ) , while macrobursts occur over a diameter greater than 4 kilometres ( 2 @.@ 5 mi ) . Wet microbursts occur in atmospheres where the low levels are saturated , while dry microbursts occur in drier atmospheres from high @-@ based thunderstorms . When an outflow boundary moves into a more stable low level environment , such as into a region of cooler air or over regions of cooler water temperatures out at sea , it can lead to the development of an undular bore .

= = Definition = =

An outflow boundary , also known as a gust front or arc cloud , is the leading edge of gusty , cooler surface winds from thunderstorm downdrafts ; sometimes associated with a shelf cloud or roll cloud . A pressure jump is associated with its passage . Outflow boundaries can persist for over 24 hours and travel hundreds of kilometers ( miles ) from their area of origin . A wrapping gust front is a front that wraps around the mesocyclone , cutting off the inflow of warm moist air and resulting in occlusion . This is sometimes the case during the event of a collapsing storm , in which the wind literally " rips it apart " .

= = Origin = =

A microburst is a very localized column of sinking air known as a downburst , producing damaging divergent and straight @-@ line winds at the surface that are similar to but distinguishable from tornadoes which generally have convergent damage . The term was defined as affecting an area 4 kilometres ( 2 @.@ 5 mi ) in diameter or less , distinguishing them as a type of downburst and apart from common wind shear which can encompass greater areas . They are normally associated with individual thunderstorms . Microburst soundings show the presence of mid @-@ level dry air , which enhances evaporative cooling .

Organized areas of thunderstorm activity reinforce pre @-@ existing frontal zones , and can outrun cold fronts . This outrunning occurs within the westerlies in a pattern where the upper level jet splits into two streams . The resultant mesoscale convective system ( MCS ) forms at the point of the upper level split in the wind pattern in the area of best low level inflow . The convection then moves east and toward the equator 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 which is normally just ahead of its radar signature . This feature is commonly depicted in the warm season across the United States on surface analyses , as they lie within sharp surface troughs .

A macroburst , normally associated with squall lines , is a strong downburst larger than 4 kilometres

( 2 @. @ 5 mi ) . A wet microburst consists of precipitation and an atmosphere saturated in the low @-@ levels . A dry microburst emanates from high @-@ based thunderstorms with virga falling from their base . All types are formed by precipitation @-@ cooled air rushing to the surface . Downbursts can occur over large areas . In the extreme case , a derecho can cover a huge area more than 200 miles ( 320 km ) wide and over 1 @, @ 000 miles ( 1 @, @ 600 km ) long , lasting up to 12 hours or more , and is associated with some of the most intense straight @-@ line winds , but the generative process is somewhat different from that of most downbursts .

= = Appearance = =

At ground level , shelf clouds and roll clouds can be seen at the leading edge of outflow boundaries . Through satellite imagery , an arc cloud is visible as an arc of low clouds spreading out from a thunderstorm . If the skies are cloudy behind the arc , or if the arc is moving quickly indicate that high wind gusts are likely behind the gust front . Sometimes a gust front can be seen on weather radar , showing as a thin arc or line of weak radar echos pushing out from a collapsing storm . The thin line of weak radar echoes is known as a fine line . Occasionally , winds caused by the gust front are so high in velocity that they also show up on radar . This cool outdraft can then energize other storms which it hits by assisting in updrafts . Gust fronts colliding from two storms can even create new storms . Usually , however , no rain accompanies the shifting winds . An expansion of the rain shaft near ground level , in the general shape of a human foot , is a telltale sign of a downburst . Gustnadoes , short @-@ lived vertical circulations near ground level , can be spawned by outflow boundaries .

= = Effects = =

Gust fronts create low @-@ level wind shear which can be hazardous to planes when they takeoff or land . Flying insects are swept along by the prevailing winds . As such , fine line patterns within weather radar imagery , associated with converging winds , are dominated by insect returns . At the surface , clouds of dust can be raised by outflow boundaries . If squall lines form over arid regions , a duststorm known as a haboob can result from the high winds picking up dust in their wake from the desert floor . If outflow boundaries move into areas of the atmosphere which are stable in the low levels , such as over colder pockets of ocean or through the cold sector of extratropical cyclones , they can create a phenomenon known as an undular bore , which shows up on satellite and radar imagery as a series of transverse waves in the cloud field oriented perpendicular to the low @-@ level winds .