

= Thermal low =

Thermal lows , or heat lows , are non frontal low pressure areas that occur over the continents in the subtropics during the warm season , as the result of intense heating when compared to their surrounding environments . Thermal lows occur near the Sonoran Desert , on the Mexican plateau , in California 's Great Central Valley , the Sahara , over north west Argentina in South America , over the Kimberley region of north west Australia , the Iberian peninsula , and the Tibetan plateau .

Over land , intense , rapid solar heating of the land surface results in heating of the lowest layers of the atmosphere via reradiated energy in the infrared spectrum . The resulting hotter air is less dense than surrounding cooler air . This , combined with the rising of the hot air , results in the formation of a low pressure area . Elevated areas can enhance the strength of the thermal low as they warm more quickly than the atmosphere which surrounds them at the same altitude . Over the water , instability lows form during the winter when the air overlying the land is colder than the warmer water body . Thermal lows tend to have weak circulations , and can extend to 3 @, @ 100 metres (10 @, @ 200 ft) in height . Thermal lows over the western and southern portions of North America , northern Africa , and southeast Asia are strong enough to lead to summer monsoon conditions . Development of thermal lows inland of the coastline lead to the development of sea breezes . Sea breezes combined with rugged topography near the coast can encourage poor air quality .

= = Formation = =

In deserts , lack of ground and plant moisture that would normally provide evaporative cooling can lead to intense , rapid solar heating of the lower layers of air . The hot air is less dense than surrounding cooler air . This , combined with the rising of the hot air , results in a low pressure area called a thermal low . Over elevated surfaces , heating of the ground exceeds the heating of the surrounding air at the same altitude above sea level , which creates an associated heat low over the terrain and enhances any thermal lows which would have otherwise existed . During the cold season , (winter) , warm water bodies such as the Great Lakes can induce an instability low . Thermal lows which develop near sea level can build in height during the warm season , or summer , to the elevation of the 700 hPa pressure surface , which lies near 3 @, @ 100 metres (10 @, @ 200 ft) above sea level . Heat lows normally are stationary and have a weak cyclonic circulation . As they are strongest at the surface and warm near their center , and weaker aloft where the air is more stable , the thermal low is considered warm core . The strongest versions of these features globally are over Arabia , the northern portion of the Indian subcontinent , Arizona , Mexican plateau , northwest Argentina , southwestern Spain , Australia , and northern Africa . The formation of the heat low over northern Africa leads to a low @-@ level westerly jet stream from June into October .

= = Role in the monsoon regime = =

Monsoons are caused by the larger amplitude of the seasonal cycle of land temperature compared to that of nearby oceans . This differential warming happens because heat in the ocean is mixed vertically through a " mixed layer " that may be fifty meters deep , through the action of wind and buoyancy @-@ generated turbulence , whereas the land surface conducts heat slowly , with the seasonal signal penetrating perhaps a meter or so . Additionally , the specific heat capacity of liquid water is significantly higher than that of most materials that make up land . Together , these factors mean that the heat capacity of the layer participating in the seasonal cycle is much larger over the oceans than over land , with the consequence that the air over the land warms faster and reaches a higher temperature than the air over the ocean . The hot air over the land tends to rise , creating an area of low pressure . This creates a steady wind blowing toward the land , bringing the moist near @-@ surface air over the oceans with it . Similar rainfall is caused by the moist ocean air being lifted upwards by mountains , surface heating , convergence at the surface , divergence aloft , or from storm @-@ produced outflows at the surface . However the lifting occurs , the air cools due

expansion in lower pressure , which in turn produces condensation .

In winter , the land cools off quickly , but the ocean keeps the heat longer due to its higher specific heat . The hot air over the ocean rises , creating a low pressure area and a breeze from land to ocean while a large area of drying high pressure is formed over the land , increased by wintertime cooling . Monsoons are similar to sea and land breezes , a term usually referring to the localized , diurnal (daily) cycle of circulation near coastlines everywhere , but they are much larger in scale , stronger and seasonal .

= = Role in sea breeze formation = =

The sea is warmed by the sun to a greater depth than the land due to its greater specific heat . The sea therefore has a greater capacity for absorbing heat than the land , so the surface of the sea warms up more slowly than the land 's surface . As the temperature of the surface of the land rises , the land heats the air above it . The warm air is less dense and so it rises . This rising air over the land lowers the sea level pressure by about 0 . @ 2 % . The cooler air above the sea , now with higher sea level pressure , flows towards the land into the lower pressure , creating a cooler breeze near the coast . The strength of the sea breeze is directly proportional to the temperature difference between the land and the sea . If the environmental wind field is greater than 8 knots (15 km / h) and opposing the direction of a possible sea breeze , the sea breeze is not likely to develop .

Along the California coast , the cooler water sets up a surface marine layer that is much cooler than inland areas during the summer . At the same time , the intense heating inland creates a pronounced thermal trough aligned with the Great Central Valley and typically linked to the broader thermal low across the North American deserts . As a consequence , a strong pressure gradient is created which draws cool marine air landward . As temperatures plummet , fog and stratus stream in and through the gaps of the Coast Ranges , and especially through the Golden Gate at San Francisco (see San Francisco fog) . The same thermal trough is sometimes pushed toward the coast , especially in late Fall as higher pressure develops to the east due to cooling further east . This setup often brings the warmest temperatures of the year to the normally cool coastline as the seabreeze stops or is even replaced by a dangerously dry land breeze .

= = Role in air pollution = =

In areas where it is hilly or mountainous near the coastline , thermally @-@ forced sea breezes combined with wind circulations up the sides of the mountains can encourage the production of chemicals which can lead to the development of smog . Pollution has been tracked into the mid @-@ levels of the troposphere in the form of ozone , which is concentrated over the circulation of the thermal low as well as adjacent oceanic areas .