KILLALOE
NATIONAL WATER ACTIVITY CENTRE

Weather

Version 1.3

Diarmuid Ó Briain

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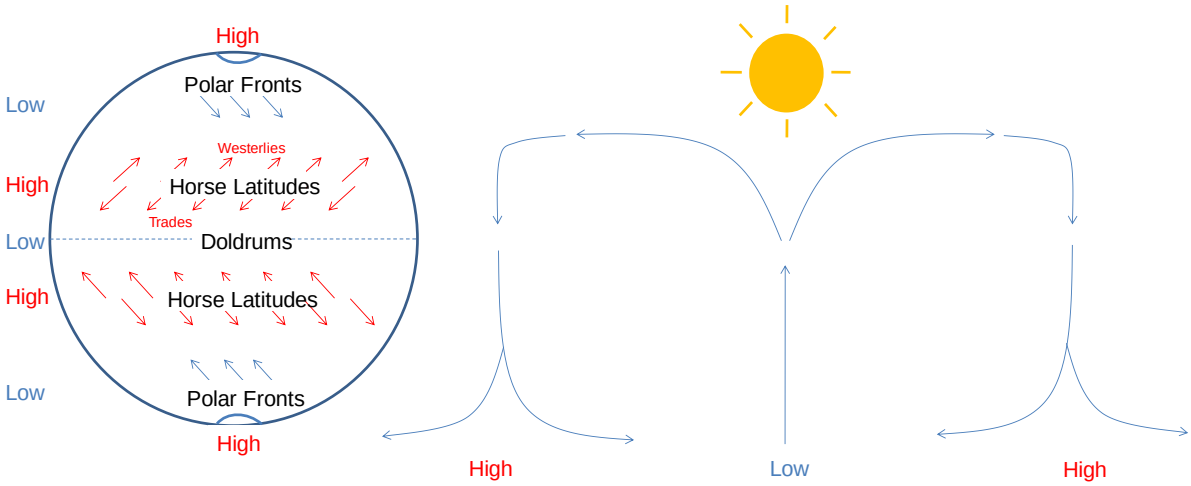
Contents

Global Winds



Global - Caused by the earth's rotation (Coriolis Effect) and movement of warm air away from the equator

Doldrums- An area of calm found at the equator. Also called the Intertropical Convergence Zone (ITCZ)

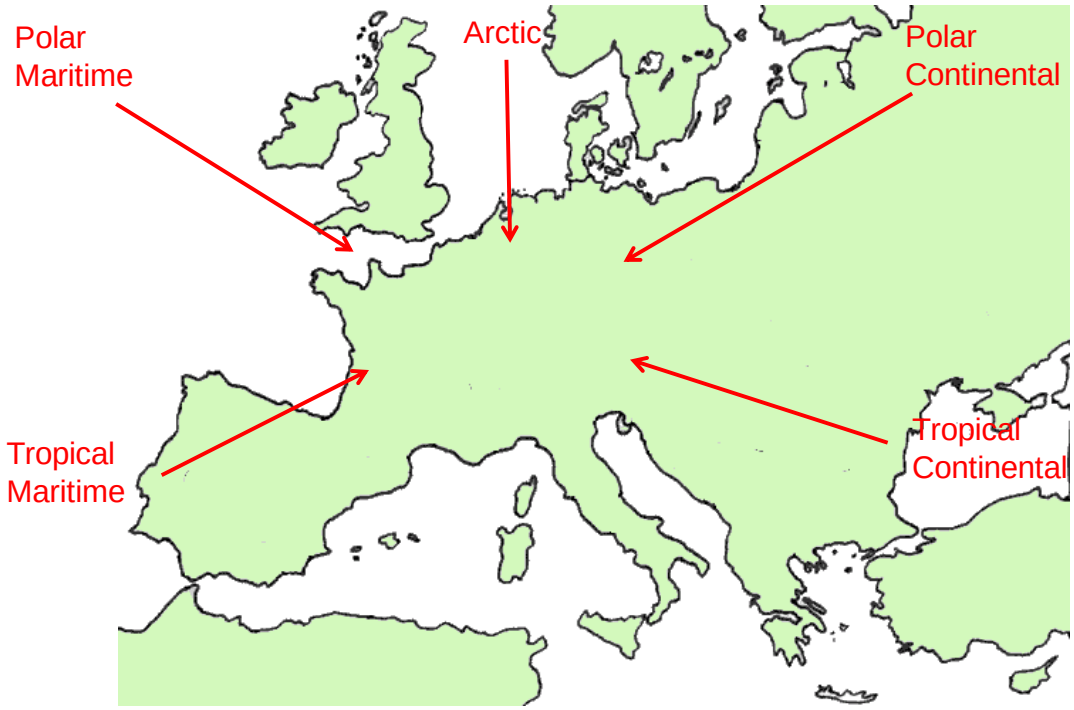
Tropical Easterlies - When warm air from the equator rises, it cools, and flows back toward the equator. It appears to flow to the west because of the Coriolis Effect.

Prevailing Westerlies - When air moves toward the poles, it flows from west to east.

Polar Fronts - Air over the poles cools and sinks back down, it eventually returns to the equator.

Winds are named for the direction from which they begin, not the direction they flow. The Tropical Westerlies are also called Trade Winds. You can think of air pressure like a balloon, when you let go of it, the air rushes out because of the high pressure of the air inside.

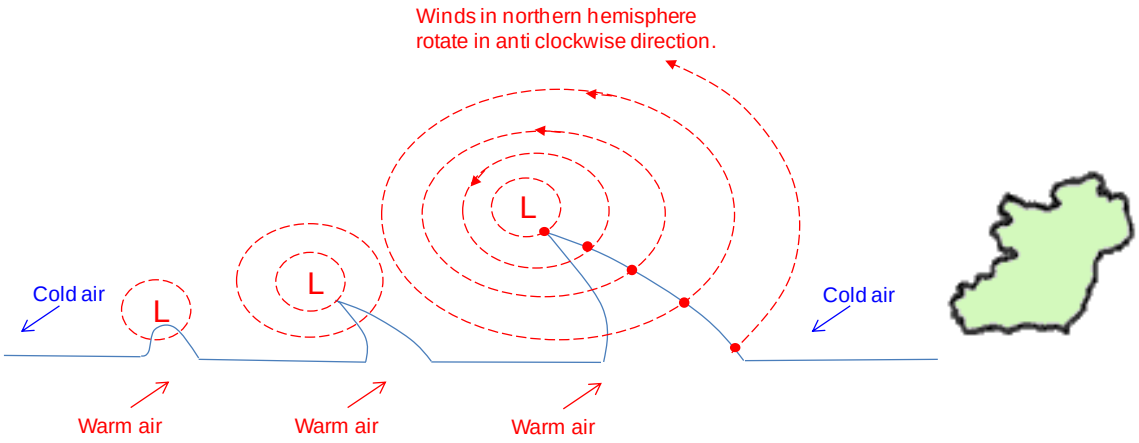
Regional winds



In Ireland we are in the main influenced by wind tropical maritime winds or westerly's. However there are other wind influences which are named in the chart from where they originate.

Weather Front

A weather front is a boundary separating two masses of air of different densities. 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.



Atmospheric pressure

Atmospheric pressure is defined as the force per unit area exerted against a surface by the weight of air above that surface at any given point in the Earth's atmosphere. In most circumstances atmospheric pressure is closely approximated by the hydrostatic pressure caused by the weight of air above the measurement point. Low pressure areas have less atmospheric mass above their location, whereas high pressure areas have more atmospheric mass above their location. Similarly, as elevation increases there is less overlying atmospheric mass, so that pressure decreases with increasing elevation.

Mean sea level pressure

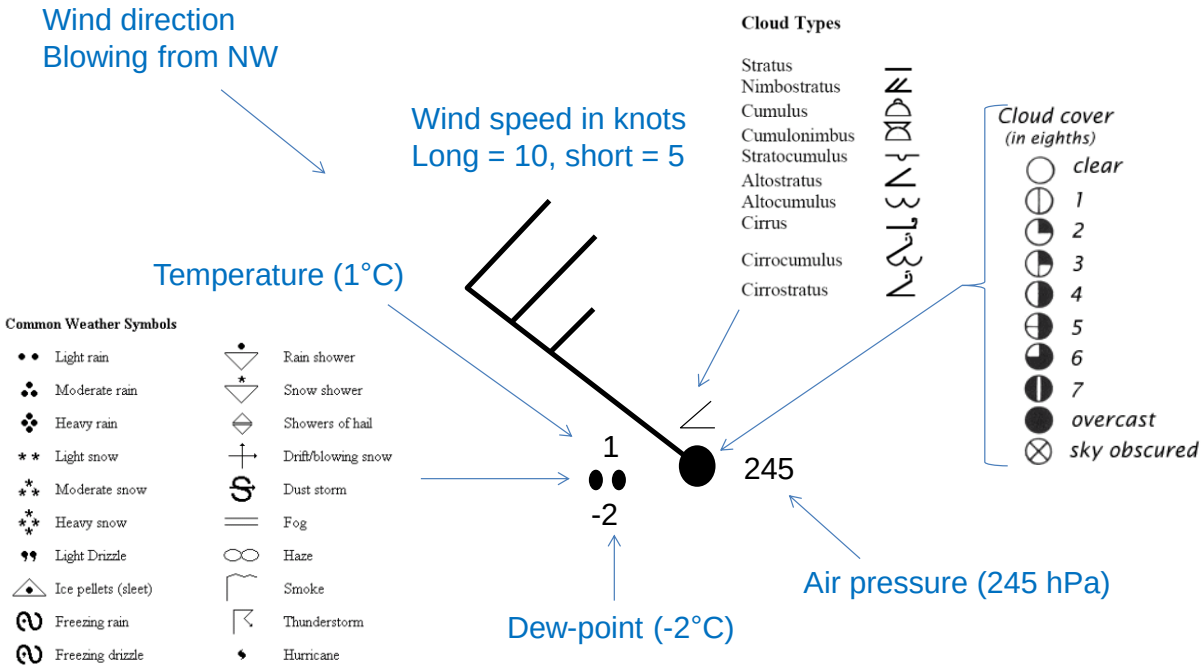
Mean sea level pressure (MSLP or QFF) is the pressure at sea level or (when measured at a given elevation on land) the station pressure reduced to sea level assuming an isothermal layer at the station temperature.

This is the 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.

Average sea-level pressure is 101.325 kPa or 1013.25 mbar.

This plastic bottle was closed at approximately 2,000 m altitude, then brought back to sea level. It was crushed by air pressure.

Station Model



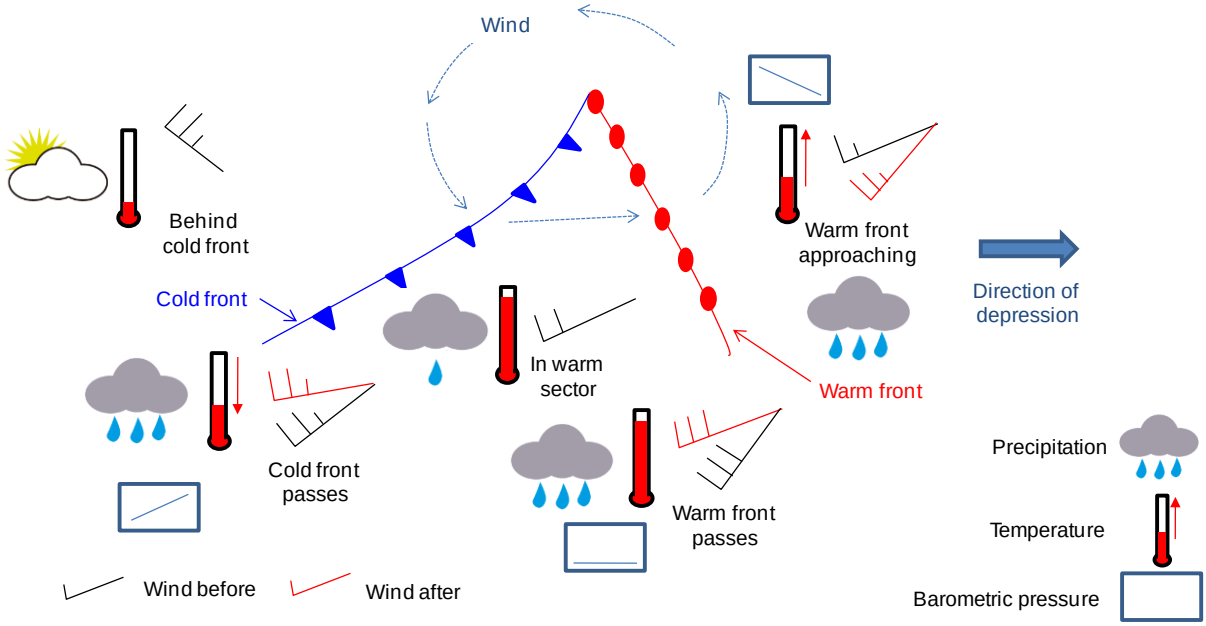
A station model is a symbolic illustration showing the weather occurring at a given reporting station. Meteorologists created the station model to plot a number of weather elements in a small space on weather maps. Maps filled with dense station-model plots can be difficult to read, but they allow meteorologists, pilots, and mariners to see important weather patterns.

A computer draws a station model for each observation location. The station model is primarily used on surface-weather maps, but can also be used to show the weather aloft. A completed station-model map allows users to analyze patterns in air pressure, temperature, wind, cloud cover, and precipitation.

Buys Ballot's Law

In the Northern Hemisphere standing with your back to the wind the low pressure is on your left and the high pressure on the right.

Depression in the Northern Hemisphere



A low pressure area, or "low", is a region where the atmospheric pressure is lower in relation to the surrounding area. Tropical storms, extratropical cyclones, and polar cyclones are called low-pressure cells.

Lows are frequently associated with stronger winds and atmospheric lift. This lift will generally produce cloud cover through adiabatic cooling, once the air becomes saturated as it rises. Thus, low pressure typically brings cloudy or overcast skies, which may minimize diurnal temperature extremes in both summer and winter. Since the clouds reflect sunlight, incoming shortwave solar radiation is less which causes lower temperatures during the day. At night, the absorptive effect of clouds on outgoing longwave radiation, such as heat energy from the surface, allows for warmer diurnal low temperatures in all seasons. In Europe (especially in Ireland), reoccurring low pressure weather systems are typically known as depressions. These tend to bring wet weather throughout the year.

Phases of the depression

As the **warm front approaches** the wind backs and increases, air pressure falls, the cloud base descends and thickens, the rain becomes heavier and visibility decreases in the rain.

As the **warm front passes** the winds veers and the air pressure stops falling. Humidity increases and the rain turns to drizzle. Visibility remains poor.

In the **warm sector** the wind direction and air pressure remain steady. It is quite humid with patchy drizzle or light rain, visibility is moderate and fog is likely.

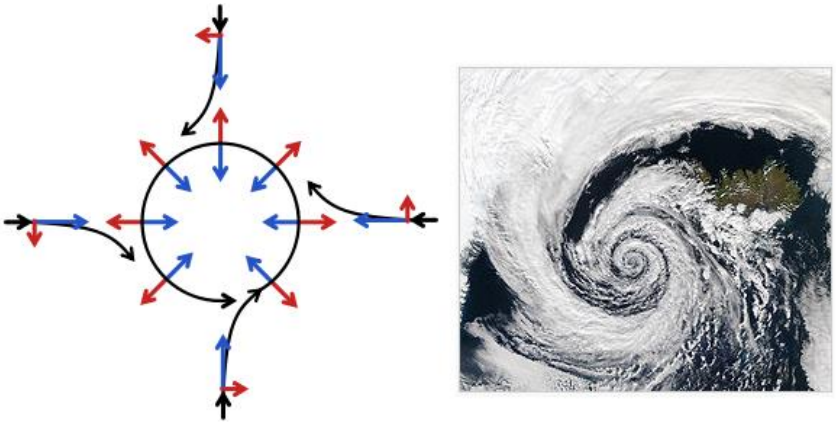
As the **cold front passes** the wind veers off suddenly. Air pressure rises sharply and the rain becomes heavy with possibility of hail and thunder. Visibility poor in the rain.

Behind the cold front the wind direction becomes steady and stronger, possibly gusty. Air pressure rises then levels off. Sunshine and showers with good visibility.

Coriolis effect

Low pressure areas

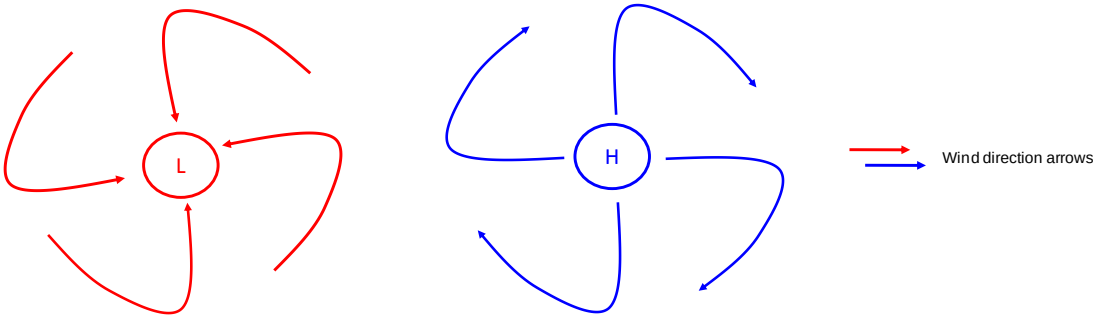
The Coriolis effect is an apparent deflection of moving objects when they are viewed from a rotating frame of reference. The most commonly encountered rotating reference frame is the Earth. Freely moving objects on the surface of the Earth experience a Coriolis force, and appear to veer to the right in the northern hemisphere, and to the left in the southern. Movements of air in the atmosphere and water in the ocean are notable examples of this behaviour: rather than flowing directly from areas of high pressure to low pressure, as they would on a non-rotating planet, winds and currents tend to flow to the right of this direction north of the equator, and to the left of this direction south of the equator.



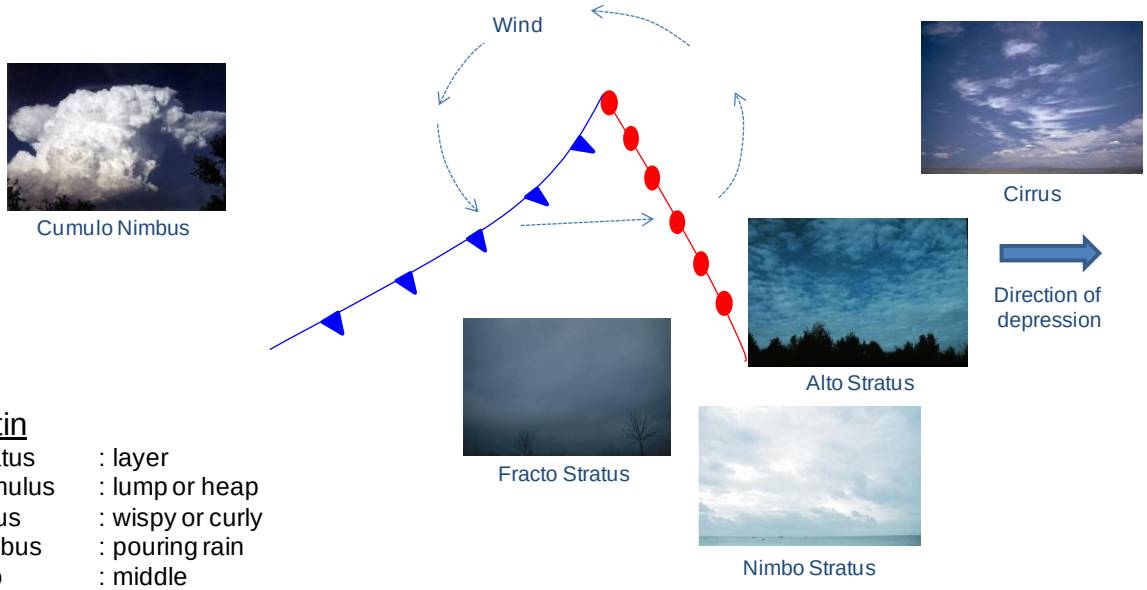
Schematic representation of flow around a low-pressure area in the Northern hemisphere. The Rossby number is low, so the centrifugal force is negligible. The pressure-gradient force is represented by blue arrows, the Coriolis acceleration (always perpendicular to the velocity) by red arrows. Beside this is an satellite view of a low pressure system which is spinning counter-clockwise due to balance between the Coriolis force and the pressure gradient force. This is called a cyclone.

High pressure areas

A high pressure area or anticyclone is a weather phenomenon in which there is a descending movement of the air and a high pressure area over the part of the planet's surface affected by it. Anticyclonic flow spirals in a clockwise direction in the Northern Hemisphere and anticlockwise in the Southern.



Clouds and the depression



Latin

stratus	: layer
cumulus	: lump or heap
cirrus	: wispy or curly
nimbus	: pouring rain
Alto	: middle
fracto	: broken

Watching the movement of a depression we can see the different cloud types in the sky.

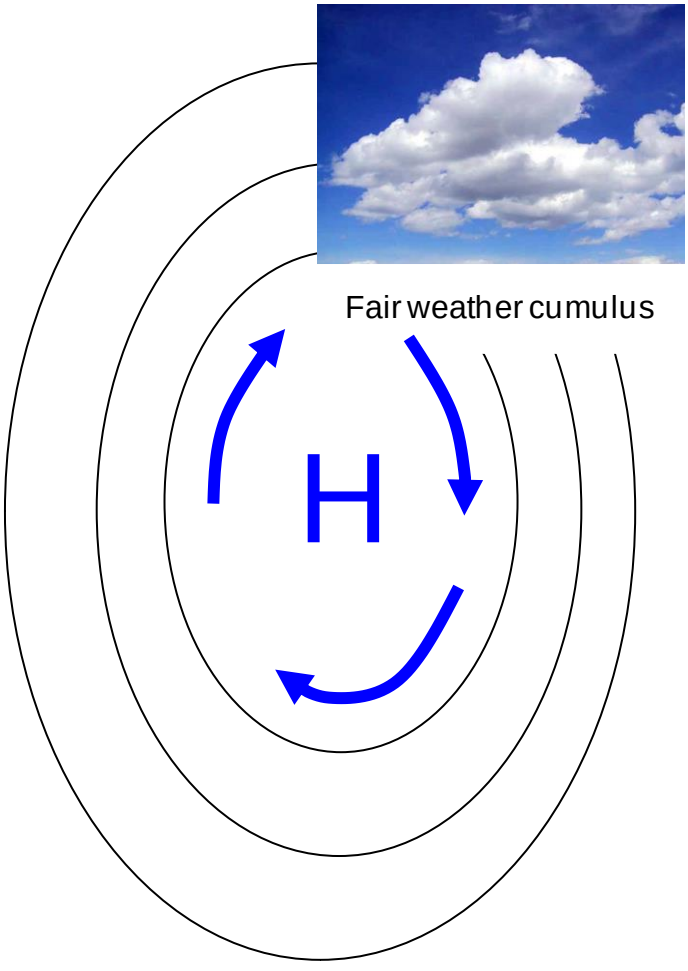
A few Latin words give us the meaning of most cloud names: Stratus meaning layer; cumulus, the word for heap or lumpy and cirrus which means wispyy. The word nimbus means 'pouring rain. Add on alto the latin word for middle, and fracto for broken and you can decipher the names of the clouds. For example Stratocumulus is a layer of lumpy clouds. Cirrostratus is a wispy, curly layer of clouds. Cumulo-nimbus are big lumpy clouds that can pour rain. Fractostratus is a smooth layer of clouds that looks sort of torn apart.

Anticyclones

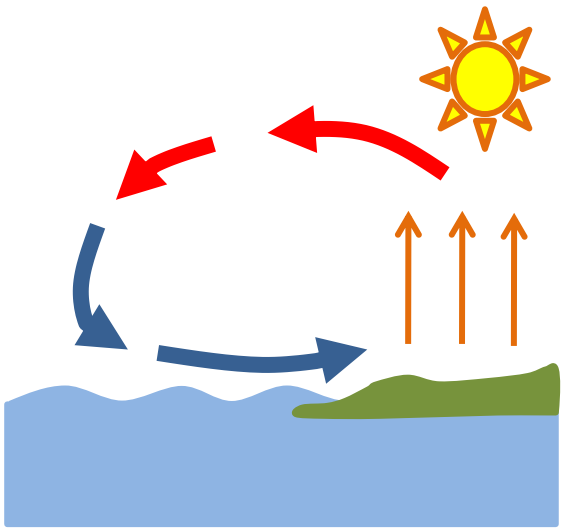
In meteorology, an anticyclone (that is, opposite to a cyclone) is a weather phenomenon in which there is a descending movement of the air and a high pressure area over the part of the planet's surface affected by it. Anticyclonic flow spirals in a clockwise direction in the Northern Hemisphere.

In winter the anticyclonic weather is characterised by clear air with periods of frost, causing fogs in towns and low-lying damp areas, and in summer by still cloudless days with gentle variable winds and fine weather. The low, sharp inversion can lead to areas of persistent stratocumulus or stratus cloud, colloquially known as anticyclonic gloom.

Local geography may cause a range of localised weather phenomena specific to anticyclones, while the interaction of the different air masses, which occurs at weather fronts, may cause a range of weather events.



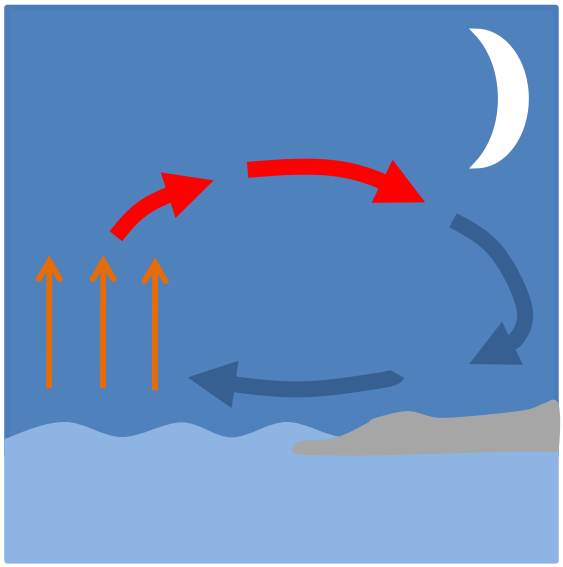
Sea Breeze



A sea-breeze (or onshore breeze) is a wind from the sea that develops over land near coasts. It is formed by increasing temperature differences between the land and water which create a pressure minimum over the land due to its relative warmth and forces higher pressure, cooler air from the sea to move inland.

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 relatively 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 which can be up to force 4. If the environmental wind field is greater than 8 knots and opposing the direction of a possible sea breeze, the sea breeze is not likely to develop.

Land Breeze



On clear, calm evenings and nights the temperature differences between a body of water and neighbouring land produce a cool wind that blows offshore. This wind is called a "land breeze". Land breezes are strongest along the immediate coastline but weaken considerably further inland. Wind is usually no more than force 2 – 3 except near mountains.

Fog

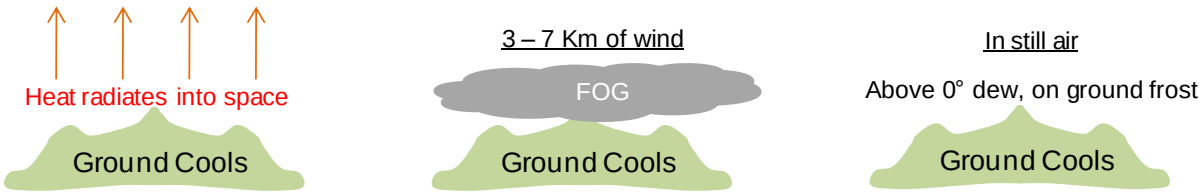
Fog forms when the difference between temperature and dew point is 2.8 °C or less.

Fog begins to form when water vapour (a colourless gas) condenses into tiny liquid water droplets in the air. Conversely, water vapour is formed by the evaporation of liquid water or by the sublimation of ice. Since water vapour is colourless, it is actually the small liquid water droplets that are condensed from it that make water suspended in the atmosphere visible in the form of fog or any other type of cloud.

Conditions for fog formation

- Air cooled below its dew point
- Presence of condensation nuclei (Salt dust)
- The presence of turbulence (3 – 8 Km)

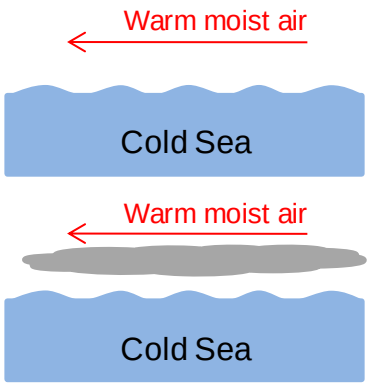
Radiation Fog



Radiation fog is formed by the cooling of land after sunset by thermal radiation in calm conditions with clear sky. The cool ground produces condensation in the nearby air by heat conduction. In perfect calm the fog layer can be less than a meter deep but turbulence can promote a thicker layer. Radiation fogs occur at night, and usually do not last long after sunrise. Radiation fog is common in autumn and early winter.

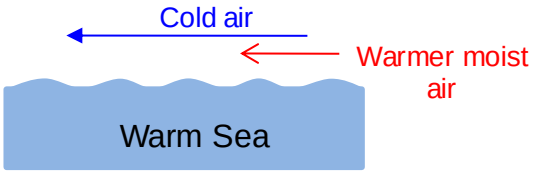
Advection fog

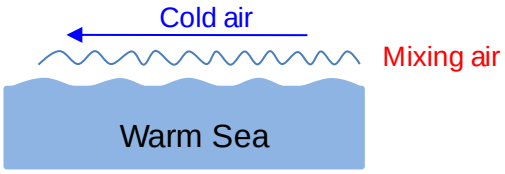
Advection fog occurs when moist air passes over a cool surface by advection (wind) and is cooled. It is common as a warm front passes over an area with significant snowpack. It is normally associated with warm South or South West winds of a depression. It is most common in the spring when the sea temperature is at its lowest.



Sea Smoke

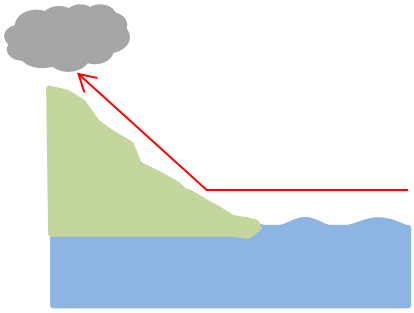
Sea smoke is a cloud over the sea, which could otherwise be called fog, and is usually formed when very cold air moves over warmer water. The physics are in principle similar to lake-effect snow.





Evaporation from exposed water surface depends upon its vapour pressure. If the water temperature is greater than that of the nearby air, the evaporation continues faster than the air can absorb the water vapour, even though the cool air's relative humidity is 100%. This further evaporates immediately and re-condenses as visible fog, which rises up in convective currents. If the wind blows across cold icy areas like the Arctic, the breaks in the ice sheets where clear water is exposed, the water surface steams up into the air, producing fog.

Hill Fog



Hill fog or upslope fog, as its name implies, is formed as mild moist air is forced to ascend a hill or mountain range. As the air moves up the windward side of the mountain it cools down, and again if the air becomes saturated then cloud is formed which, if below the top of the hills, gives fog.

The Beaufort scale

This is a measure for describing wind speed based mainly on observed sea conditions. Its full name is the Beaufort wind force scale.

Force	Speed (Km/hr)	Description	Water Condition	Land Condition
0	0	Calm	Flat	Calm, Smoke rises virtically
1	1-6	Light air	Ripples without crests	Wind motion visable in smoke
2	7-11	Light breeze	Small wavelets	Wind felt on exposed skin
3	12-19	Gentle breeze	Large Wavelets	Leaves and small twigs in motion
4	20-29	Moderate breeze	Small waves	Dust and loose paper raised
5	30-39	Fresh breeze	Moderate waves, Foam & spray.	Small trees sway
6	40-50	Strong breeze	Large waves with foam crests and some spray.	Large branches in motion. Whistling heard in overhead wires.
7	51-62	Moderate gale	Sea heaps up and foam begins to streak.	Whole trees in motion. Effort needed to walk against the wind.
8	63-75	Fresh Gale	Moderately high waves with breaking crests forming spindrift.	Twigs broken from trees. Cars veer on road.
9	76-87	Strong Gale	High waves (6-7 m) with dense foam. Wave crests start to roll over. Considerable spray.	Light structure damage.
10	88-102	Storm	Very high waves. The sea surface is white and there is considerable tumbling. Visibility is reduced.	Trees uprooted. Considerable structural damage.
11	103-119	Violent storm	Exceptionally high waves.	Widespread structural damage.
12	120	Hurricane	Huge waves. Air filled with foam and spray. Sea completely white with driving spray. Visibility greatly reduced.	Considerable and widespread damage to structures.

Conversion rule of thumb

To Beaufort scale = (Wind speed in Knots + 5) / 5
To Wind speed in knots = (Beaufort scale * 5) – 5

Onshore and Offshore Winds

From a weather forecast a sailor's most important information is the wind strength and direction. Until trained at reefing you should stay ashore if the wind is predicted to be above Force 3 and remember those offshore winds can be deceptive.

When the wind is blowing offshore, there will be a patch of flat water close to the beach which may lead you to believe that conditions aren't as strong as forecast. It is only when you get further out that you find the full strength of wind and waves; then you may find it difficult to return. With an onshore wind the most difficult thing is simply getting off the beach.

Weather Forecast

In Ireland Met Éireann - The Irish Meteorological Service is the main source of practical weather forecasting.

Internet

Met Éireann forecasts can be gotten from their website at http://www.met.ie. As well as the normal forecasts Met Éireann provides specific forecasts for Sea Area, Coastal Reports and Inland Lakes. Take as an example Lough Derg.

Example::

Meteorological situation at 15:00 hours: An anticyclone of 1032 hPa, between Iceland and Scotland, and a complex area of low pressure, with centres of 1000hPa over the Bay of Biscay and west France, maintain a northeast airflow over Ireland. An occluded front is approaching the south and southeast coasts and will cross the country later today and tomorrow.

Forecast For Lough Derg until nightfall today

Wind :	Northeast force 5 to 6 and gusty.
Weather :	Mainly fair.
Visibility :	Good.
Winds Overnight :	Moderate to fresh and gusty northeast winds.
Outlook for tomorrow :	Fresh and gusty northeast to east winds. Winds decreasing to moderate in the evening. Scattered outbreaks of rain and drizzle.

Other sources of forecasts

Media and Commercial Availability of Sea Area Forecasts

Sea Area Forecasts are issued and broadcast live from Met Éireann's General Forecasting Division on RTÉ Radio 1. Any gale warnings are also included on hourly news bulletin on RTÉ Radio. Any Gale Warnings are also included on hourly news bulletins on RTÉ Radio.

RTE Weather forecasts are broadcast at:

Mon/Fri	***Sat/Sun***
0602	0602
1247	1253
1902	1834
2355	2355

The Irish Coast Guard (ICG) Coast Radio Stations.

ICG Coast Radio Stations make a prior announcement of weather forecasts on Marine VHF Radio Ch16 and then broadcast the forecast on the named relevant VHF Radio working channel. Sea Area Forecasts are broadcast every 3 hours beginning at 0103 local time. i.e. broadcast times are:- 0103, 0403, 0703, 1003, 1303, 1606, 1903, 2203 local time.

Gale Warning broadcasts are also preceded by an announcement on Marine VHF Ch16. They are broadcast on receipt and are repeated at the next one of the following times:- 0033, 0633, 1233 and 1833 local time.

Weatherdial

Telephone recorded sea area forecast, small craft warnings and warnings of gales and heavy swell are available on the Premium Rate Weather Service, which is available on voice or fax. Voice forecasts for each of the four provinces, the greater Dublin Area and for Irish coastal waters and the Irish Sea can be obtained by dialling:

Munster 1550 123 850	**Ulster** 1550 123 853	**Leinster** 1550 123 851
Connacht 1550 123 852	**Dublin** 1550 123 854	**Sea Area** 1550 123 855

Short Message Service (SMS)

Text “SUB WEATHER TODAY” to 53554 to get weather forecasts at 0700 each morning.

Ref: *Wikipedia*
RYA yachtmaster