CHAPTER EIGHT

METEOROLOGY

So you have at last got yourself to the beach; kayak loaded, navigation well planned. Someone ashore knows your ETA (estimated time of arrival) and has been briefed to raise the alarm should you be over late. You may well have a group of kayakers with you, all with great expectations. You have checked yours and your parties safety gear and you really are ready to launch. But wait, you have one final and most important decision to take before paddling beyond the safety of the bay -do you consider it safe to leave and will you remain safe for the duration of your crossing or trip along the coast (remember coastal paddling often involves long crossings demanding a fair commitment). You may well be a strong group and have all the right equipment, but your safety is finally determined by the weather.

WHETHER OR NOT, WEATHER OR NOT.
Of course it would be most unusual to get down to the beach and then finally decide not to go at the last moment. You would have taken careful notice of the weather forecast over the preceding several days and your decision to leave home might well have been based on the knowledge that the weather system will remain stable. Often you have crawled out of your tent whilst on an extended sea kayaking expedition and may well be under pressure to carry on despite adverse weather. How many of us have travelled many hundreds of miles only to find that the weather fails to play fair. In both these events it matters little how you have studied the forecasts prior to standing on the beach; you were committed to being on that very beach at that very time despite the weather forecast telling you "NO, NO, NO'. So it is back to the tent or the nearest 'pub' until the weather improves. Now you listen carefully to the forecasts and watch the wind and clouds. This chapter is about understanding weather, interpreting its signs and official forecasts and finally making the decision to go or stay. It can be harder to stay than to go. There can be a lot of circumstantial as well as psychological pressure to set off into the deteriorating weather.

Some years ago I motored all the way from the south coast of the U.K. to the NE coast by the Scottish border to paddle with a group assembled from many parts of the country. There was much disappointment and muttering among the ranks when I determined to adjourn to the bar at Seahouses because of the deteriorating weather; I wanted to live to return another day. Another time we spent a terrible night in a bivvy bag, sheltered among the sand dunes. I was up at day break and radioed the Coastguards, -heavy winds, gusting stronger later. The surf was crashing on the beach blow us. "We'll go' I said fully expecting my two friends to say, “Not bloody likely”. I was not really serious. But amazingly they agreed and I thought, 'What the heck -we'll give it a try, -we can always turn back”. We had a nine hour crossing, were being swept off course at one stage and arrived in bad shape. It was a wrong decision to go. I think we were lucky to live for another day! There was no margin for safety or for error. Looking back it was stupid!

Group pressure can be difficult to withstand and I succumbed whilst running a course for the Dutch. All week the weather had been rough and we found, shelter on the lee side of the island. On the final day we agreed to strike out for another island some 15 ks away. The wind, very strong, persistently strong, was beating at the sea. Spin drift helped to make the already poor visibility even worse. As I was directing this course so had a direct responsibility for safety. Everyone was keen but me. I gave in -we went. We got away with it, -in fact our surf ride back later in the day was terrific -but we did have capsizes. At one time a kayak zoomed past my shoulder -at shoulder height and was carried by a breaking wave for many metres before disappearing beneath the white froth and spray. The wind was so strong we could not communicate and we seemed to be heading away from the island, which in any event was not visible through the mist of spray. We should certainly not have been out. I was bitterly regretting my crazy decision to go. The group had to have me along, it was a condition laid down by the course organisers, I should have said no. Now we were all in trouble. But we got away with it. Suddenly we came within the lee of some sandbanks and we re-assembled and, somewhat shaken - certainly I was -, we eventually made our island, terra firma and some lunch. After a few years paddling I know we can all tell stores of how we got away with it. We beat the weather, the winch and sea. This is sheer arrogance. No-one beats these elements. If they decide they no longer want to play your game, then look out for real difficulty. '

'For they did drown, but only drowned a little bit'

For many it is the weather, the rough seas that attract. It is enjoyable to paddle calm seas whilst you admire the scenery or take photographs. On the other hand it is exhilarating to plough through the waves as the water whips your face and ears. My preamble to this chapter is really meant to emphasise the over-riding importance of weather to the sea kayaker. Once out on the water, away from the coast and with a group for whom you are responsible, or simply half way through a lengthy crossing with competent paddlers then having some certainty of fair weather is a must. This chapter should help but the art of weather forecasting comes with experience as well as with a good understanding of the science.

WEATHER -WHAT IS IT?

Meteorology is defined as the science dealing with the phenomena of the atmosphere, especially weather and weather conditions. So what is 'weather'. "Weather' has many aspects, each of differing importance to different people at different times in different places and for differing reasons. The word "weather' can be used in two ways. First it may mean all the aspects of atmospheric state and movement which can be experienced and which affect human activity. For example, the study of weather must. include wind., clouds, rainfall, temperature and waves on the ocean. Weather forecasts must give details of these, leaving the individual to pay particular attention to that aspect of the forecasts which is important to him or her and the proposed activities.

Second, the term "weather' can have a much more restricted meaning in that it may be used to refer to the immediate conditions of the environment such as air temperature, is it sunny or dull, is it wet or dry.
I suppose this is the most common usage because these factor affect us all continually. Do we don a jacket or make do with a tee shirt, do we turn on the heating or open windows, do we take the umbrella. Indeed in our country the weather is usually the start of most conversations as it is changeable and unpredictable.

WEATHER FACTORS

The weather is made up of five factors,
viz; WIND, WEATHER, CLOUD, VISIBILITY and SEA STATE.

1 THE WIND

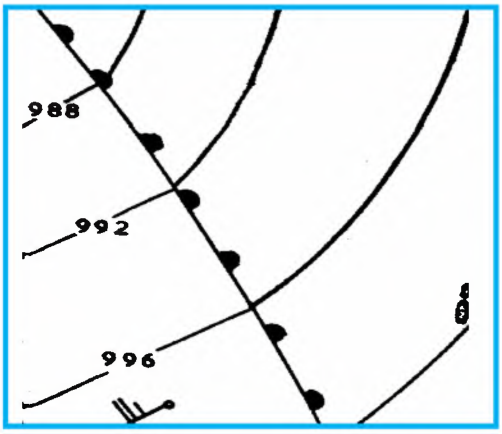
THE WIND IN A FROLIC

'The wind one morning sprang up from sleep,
Say, 'Now for a frolic! now for a leap!
Now for a mad cap galloping chase!
I'll make a commotion in every place!'
William Howitt

We need to consider where the moving air has come from, how long it has taken and what strength it has. Wind, like water, moves and its speed is determined by pressure difference known as the GRADIENT. It can move rapidly or slowly, horizontally or vertically. Wind is air in motion trying to equalise areas of different pressure. Such variation in pressure are most often caused by differences in temperature. When air moves from one area to another it seldom does so in a straight line. The rotation of the earth causes it to curve. In the Northern hemisphere the wind circulates clockwise around an area of high pressure (anti-cyclone) and anti-clockwise round an area of low pressure (depression or cyclone). Changes of weather are caused by air masses having a certain temperature and humidity. It is these movements of air masses which meteorologists watch, and upon which they base much of their forecast. Air is called POLAR if it comes from near polar regions and clearly this air is cold TROPICAL winds obviously come from the tropics and is warm. If the air moves over large land masses to get to us it is called CONTINENTAL and if it comes from the sea it is called MARITIME. Continental air masses are dry and obviously maritime air masses, collecting much water vapour en route, are wet.

WARM FRONT

When two air masses meet the warmer tends to ride over the colder. This meeting and overlapping is called a FRONT and often causes depressions. When a mass of moisture-laden (maritime) warm air mounts an attack against a stronghold of cold dry air (POLAR-CONTINENTAL), it rides up and over the denser cold air masses at the same time pushing it slowly forwards. This causes the warm air to rise causing it to cool. As it cools its water content condenses into clouds. This is where cloud identification and air pressure differences as measured by a barometer (Baros is Greek for weight) become useful guides to what is happening. The first warnings of this rising and cooling air are the icy CIRRUS and CIRROSTRATUS clouds. These thicken into ALTOSTRATUS which heralds the coming of the much lower tumid NIMBO-STRATUS cloud which signifies warm air at ground level and with it a long siege of steady rain. Trailing along behind is low altitude STRATUS, a rear guard capable only of drizzle. Once this warm front, shown on a weather map thus:-



passes through we often find the rain stops, the sun comes out and a warm spell begins. You may have noted that I started this section by discussing wind and it has led me neatly into discussing clouds and fronts. More of these two in a moment. For now, back to wind. So we know that wind is a moving mass of air with a particular set of characteristics such as humidity, temperature, air pressure, and speed over the ground. In case you fancy trying your hand at basic meteorology I will quickly describe how these characteristics are measured. By measuring them and recording these measurements over time it becomes possible to predict the future of the air mass by simply extrapolation; bearing in mind that rarely are extrapolation and weather easy partners!!

HUMIDITY

Humidity is the measure of water vapour present in the air. The maximum amount of water vapour an air mass can contain is dependent on its temperature. The warmer air is the more water vapour it can hold. This is why warm air rising and consequently cooling loses much of its moisture as it condenses and falls as rain. First the rising air mass reaches its dew point or critical temperature to bring it to saturation point. Once the temperature drops below the dew point it has to surrender its water vapour and down it comes. Both the relative humidity and the dew point of the atmosphere can be obtained by use of an instrument called a HYGROMETER. This consists of two thermometers, one of which has its bulb of mercury kept moist by means of a strand of cotton wick immersed in a small reservoir of distilled water.

The drier the air the more rapidly the evaporation from around the 'wet-bulb' and as evaporation and cooling are synonymous so the 'wet-bulb' thermometer will read lower than the 'dry-bulb' thermometer. From the difference between the two temperatures, tables immediately give the relative humidity of the atmosphere. When the wet and dry bulb read the same the relative humidity is 100% - the air is saturated.

TEMPERATURE

This is simply read directly from the dry-bulb thermometer if you are using a. hygrometer or from any outdoor thermometer. Both the hygrometer or the thermometer must be sheltered from direct sunlight or artificially high readings will result when the sun shines; hence the use of white louvered boxes a.s seen at meteorological stations, known as Stevenson Screens.

AIR PRESSURE

Air has weight, a. fact that tends to escape us as we move freely through it and are not conscious of any weight bearing down on us. A column of air equal in height to that of the atmosphere (about 130 miles), resting on one square inch of the Earth's surface at sea level weighs just under 15 Ibs. It is now usual to go metric and we talk of a unit of pressure called a MILLIBAR (mb) which is roughly equal to I gram per square centimetre. The average atmospheric pressure at sea level is 1013 mb. This is all very interesting, you may say, but how do we actually measure this pressure. We use a MERCURIAL BAROMETER at weather stations because they are large and cumbersome, some three feet in length or an ANEROID BAROMETER which is essentially a small concertina-like box, partially exhausted, of air which is squeezed or stretched as the actual atmospheric pressures rises or falls. This box is connected with a dial which shows the pressure reading on a graduated dial.

The average atmospheric pressure (1013 mb) is equal to a height in the mercury column of a mercurial barometer of 29.92 inches. One inch of mercury equals about 34 mb. Because atmospheric pressure is due to the weight of air immediately overhead there will obviously be a difference between the pressure at, say, sea level and the top of a high mountain. In fact air pressure decreases at the rate of about 34 mb for each 1,000 feet of ascent. Measurement of atmospheric pressure made regularly at a given place for a long period of time will show that it is seldom constant for very long. As the atmospheric pressure changes so the air about the barometer is either becoming more dense or less dense. Obviously density of the air varies with pressure. In other words the air is moving in or away from the column of air above to cause the readings to change.

There can be two reasons for this.

1. Changes in air temperature. Warm air expands, cool air contracts

or

2. More air moving in over head than is moving out.

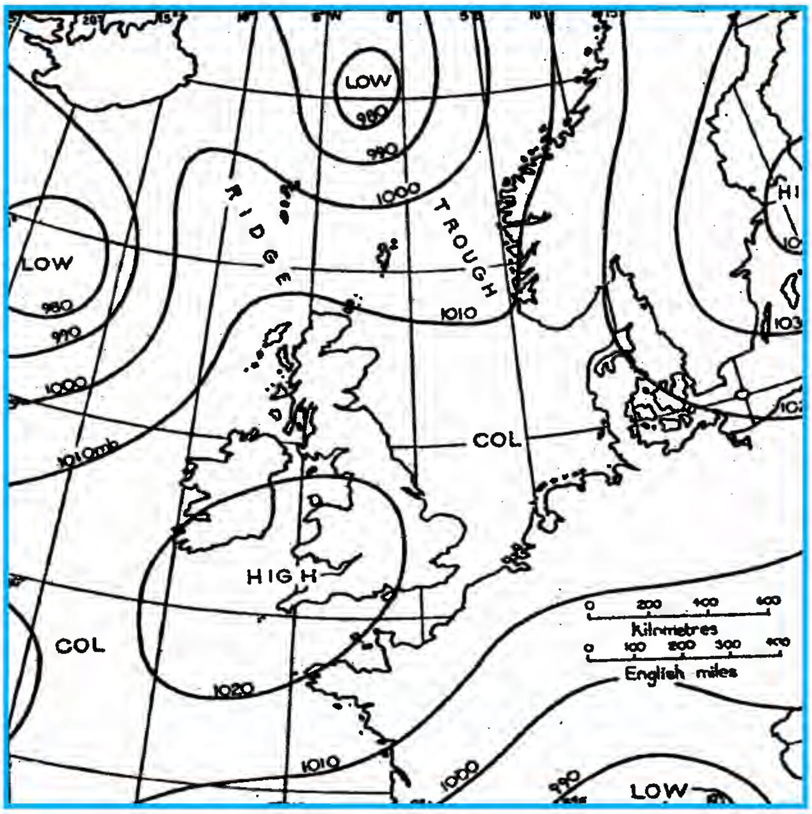
Such changes of pressure with time (and place) are associated with wind, weather and their changes and for this reason atmospheric pressure is one of the most important factors in forecasting weather. A barometer, particularly one of those expensive barometers which displays the changing air pressure over time on a slowly revolving drum of graph paper, is a very useful instrument.But now there is no need for such an investment. Comparatively cheap watches now display changing air pressure over time and I never go hill walking or kayaking without one.

BAROMETRIC TENDENCY

You will find legends on many barometers, particularly the long mercurial type, which say 'Very Dry', 'Stormy' etc. If the reading shows against such a legend, chances are that the weather outside matches up, but truly speaking, it is the movement of the barometric reading that is important. Is it rising or falling? So Barometric Tendency is the change in the barometric pressure over time, usually restricted to the previous three hours preceding an observation.

PRESSURE SYSTEMS

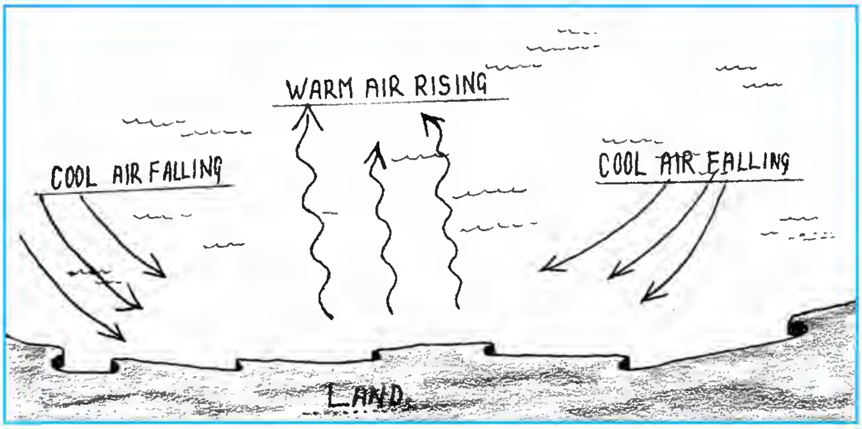
If atmospheric pressures are recorded simultaneously at a number of different places, then corrected to what they should be if at sea level to provide a direct comparison and some form of uniformity, then these readings are plotted on a map, we should see a pattern emerge. If all the readings showing the same pressure are joined together (bylines we call ISOBARS) then this pattern becomes clear and we can identify (so long as the map covers a sufficiently large area) areas of high and low pressure together with their associated isobars which decrease in pressure as they move from the centre of a high pressure area or increase in pressure as they circulate around a centre of low pressure. We now have the start of a SYNOPTIC CHART, so called because it provides a synopsis or general view of the weather conditions over the area covered by the map.



A centre of high pressure is known as an ANTI-CYCLONE or HIGH whilst a centre of low pressure is termed a DEPRESSION or LOW Relationship between Pressure and Wind.

We all know that warm air rises and cool air comes in at the bottom to take its place, - hence convection currents.

It can be seen from my rough diagram that the cool air tends to have a horizontal movement to it, -it has and we call it wind as it blows against us and moves the leaves and branches. A change in temperature causes, normally, a change in atmospheric pressure and it is the relationship between wind and atmospheric pressure in the horizontal plane that is the major factor in forecasting wind direction and strength. In theory wind should flow directly from a high to a low pressure area, that is at right angles to the isobars as it crosses them. Thanks to the CORIOLIS or centrifugal force of the Earth's rotation, air which is drawn in towards a centre of low pressure is deflected to the RIGHT in the NORTHERN hemisphere and a circulation is set up in a anti-clockwise direction about the centre of low pressure. Similarly, a clock-wise circulation is set up around a centre of high pressure in the northern hemisphere. In the southern hemispheres these directions are reversed. The effect of this deflection is to cause the wind to blow parallel to the isobars because the deflecting force varies with the speed of the wind and is exactly equal, and opposite, in direction to the pressure force. The closer the isobars are together on a weather map the greater the pressure gradient and consequently the greater the wind speed.



BUYS BALLOTS LAW
This law states that if you stand with your back to the wind, the lowest pressure lies on your left in the northern hemisphere. This law only applies to winds in the middle latitudes of the hemisphere and does not apply to local winds such as land and sea breezes.

MEASURING WINDS
Wind direction is always quoted as the direction FROM which it blows. (Tides TO where they flow).After all, it usually brings 'weather' along with it so that where it has come from is usually more important than where it is blowing to. It is given in relation to True North and. is quoted as a compass point; thus a SW

wind is simply blowing in from this direction. Two terms are used to describe a change in wind direction. If it changes in a CLOCKWISE direction it is VEERING and if changing in a.n ANTI-CLOCKWISE direction it is BACKING. Wind strength is measured in nautical miles per hour and it was a British Admiral, Sir Francis BEAUFORT (1774-1857) who devised the scale.

THE BEAUFORT SCALE OF WIND

Beaufort wind force	Mean Wind speed in knots	Descriptive terms	Sea State	Probable height of waves in ft.
0	0	Calm	Sea like a mirror	-
1	2	Light air	Ripples with the appearance of scales are formed, but without foam crests.	-
2	5	Light Breeze	Small wavelets, still short but more pronounced; crests have a glassy look, but do not. break.	1/2
3	9	Gentle Breeze	Large wavelets. Crests begin to break. Foam of glassy appearance with scattered white horses.	2
4	13	Moderate Breeze	Small waves, becoming longer, fairly frequent white horses.	3 1/2
5	18	Fresh Breeze	Moderate waves of longer form; many white horses ~ chance of some spray.	6
6	24	Strong Breeze	Large waves begin to form; foam crests more extensive - probably some spray.	9 1/2
7	30	Moderate Gale	Sea heaps up - white foam from breaking waves blown along in the direction of wind - some spin drift.	13 1/2

THE BEAUFORT SCALE OF WIND (Continued)

Beaufort wind force	Mean Wind speed in knots	Descriptive terms	Sea State	Probable height of waves in ft.
8	37	Fresh Gale	Moderately high waves of greater length; edges of crests break into sprindrift. Foam blown in well marked streaks along the direction of wind.	18
9	44	Strong Gale	High waves, dense streaks of foam. Sea begins to roll. Spray may effect visibility.	23
10	52	Whole Gale	Very high waves with long overhanging crests. Resulting foam blown in dense white streaks along direction of wind. Surface of sea takes on a white appearance. Rolling sea becomes heavy and shocklike. Visibility affected.	29
11	60	Storm	Exceptionally high waves. Sea completely covered with long white patches of foam lying along direction of wind. Everywhere edges of wave crests are blown into froth. Visibility affected.	37
12	68	Hurricane	Air filled with foam and spray. Sea completely white with driving spray. Visibility seriously affected.	-

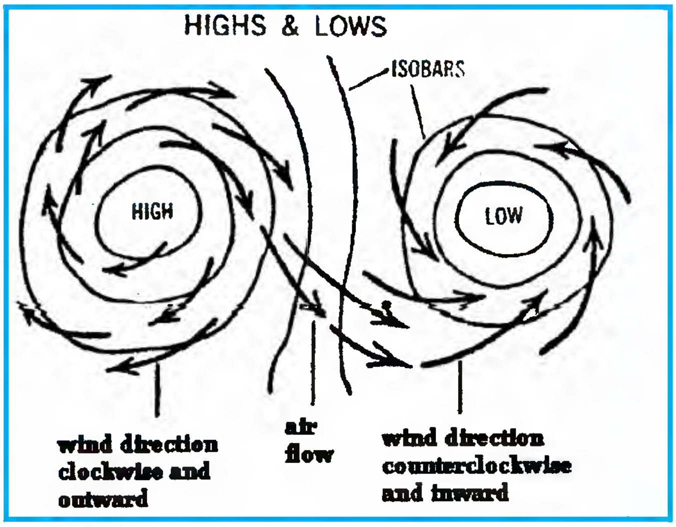
N.B. Sea conditions here refer to the open sea, not necessarily areas such as the Solent, protected waters between the Isle of Wight and the mainland.

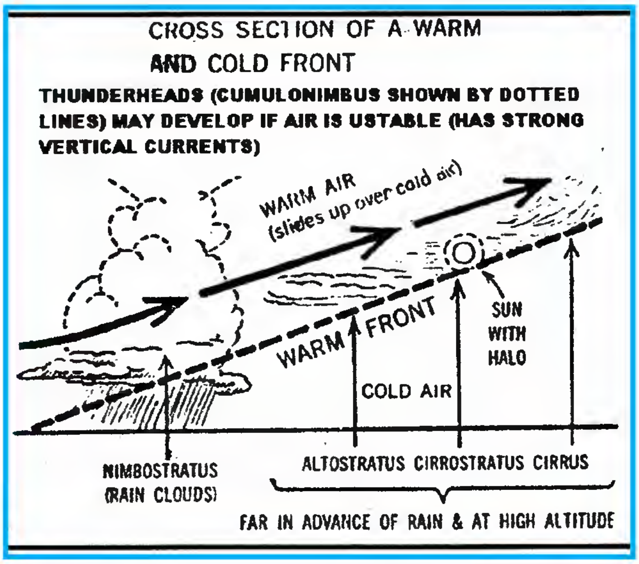
(2) WEATHER

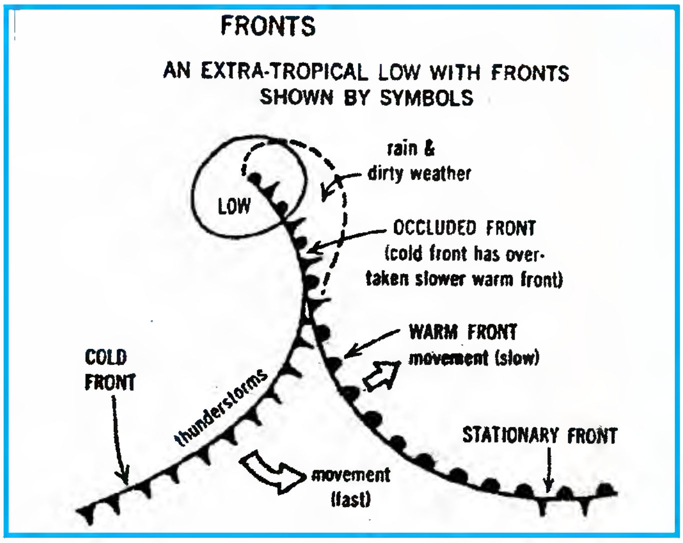
So far I have discussed weather and from what I have said you will see that it is the power house that drives our weather- machine. The coming together of different air masses causes atmospheric changes or weather. Should there be no such changes, if the conditions remained fairly static as they do around the tropics, then we would have a climate. In the temperate latitudes and above, particularly by the sea we suffer (in my view, enjoy) weather. It may be cloudy, warm, breezy, wet or dry, - all depends on what the winds have brought us.

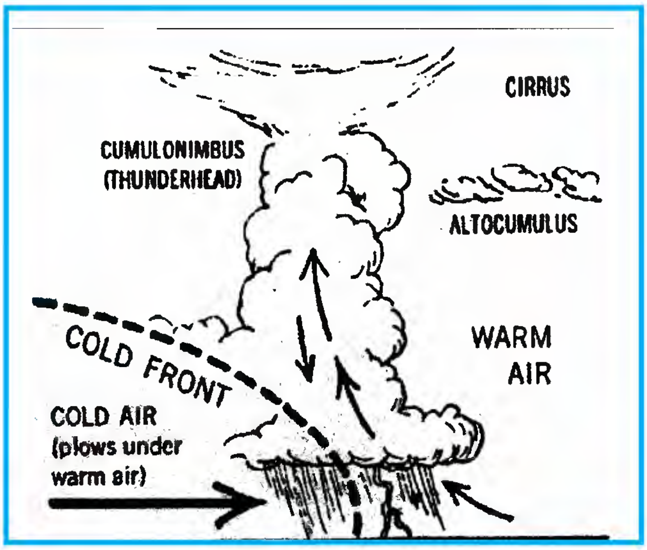
FRONTS

An air-mass will meet with another air mass which came from a different source, followed a different track and has different properties. Air masses do not readily mix. Have you ever been the first in an outdoor swimming pool which has been in the sun. You will feel warm and cold water at the same time. Soon the water mixes as you swim around. It is the same with air masses, they do not readily mix and need to be considered as distinct for some time after they initially meet up. The area between two air masses is known as a FRONTAL ZONE. It is in this zone that the temperature gradient will be at its greatest relative to the temperature difference in the air masses themselves. A. frontal zone slopes upwards above the colder air mass which thus lies in the form of a wedge below the warmer air. A FRONT is the intersection of this frontal zone with the Earth's surface, or the line along which the warmer air leaves the surface on its upward climb above the colder air.

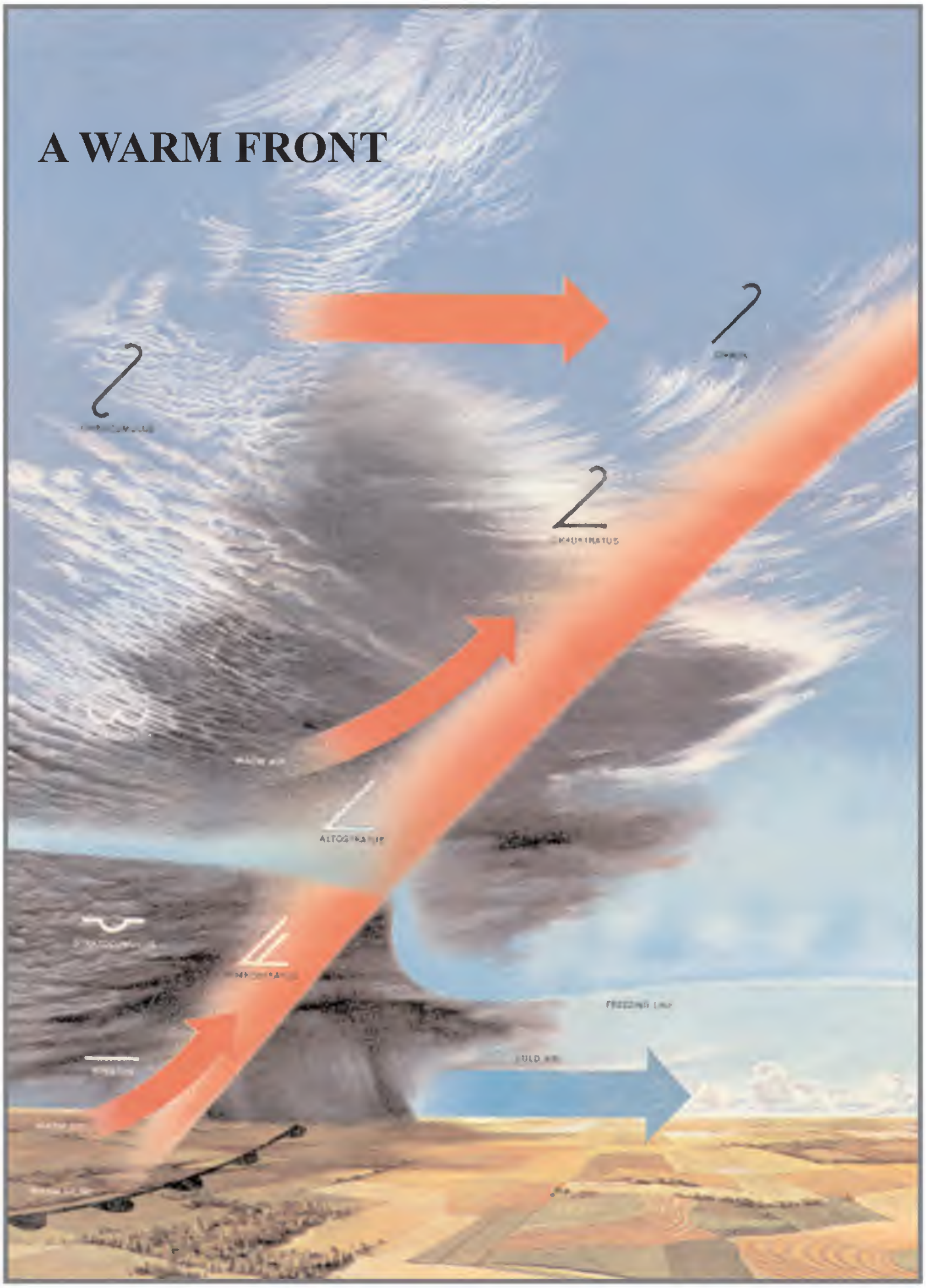






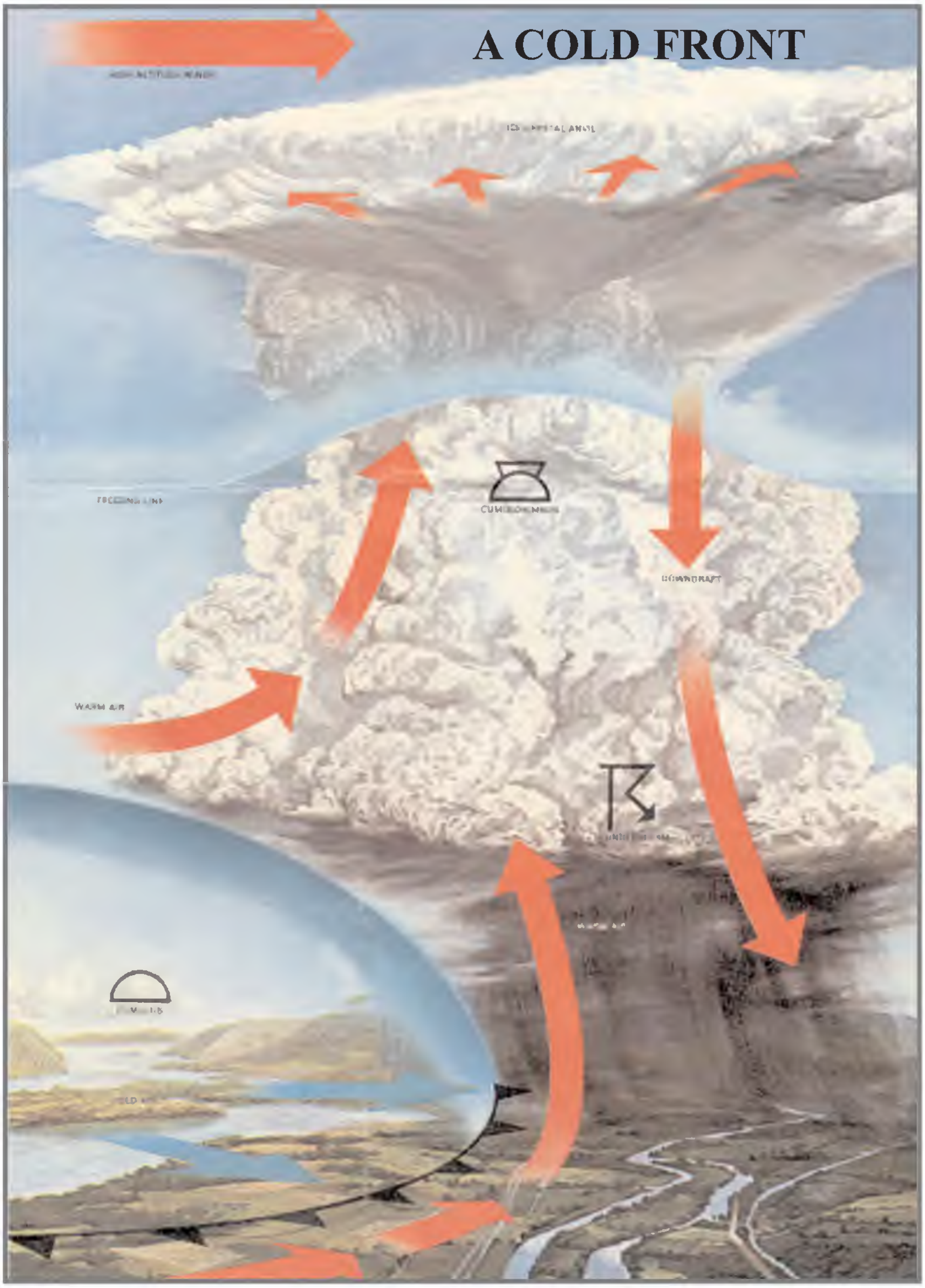


If the warm air is replacing cold air, the front is called a WARM FRONT. As the warm air is lighter it ascends over the colder heavier air. If the cold air is replacing the warm air the front is called a COLD FRONT.



In a cold front the cold air undercuts the warm air and forces it upwards. When a mass of cold dry air invades an area where moisture laden warm air holds sway, there is often no warning of its coming. It is like a wedge that suddenly ploughs into and under the warm air throwing it turbulently upwards to form the lowering thunderhead of CUMULONIMBUS cloud. The characteristic anvil-like form of the thunder-head is caused by winds shearing off its top. After the cumulonimbus spawns its violent thunderstorm, the sun may well shine again and the storm clouds are succeeded by fair weather CUMULUS clouds that sail white and puffy through a clear sky. Note that the slope of the frontal zone in a warm front is about I in 100/150 whereas the slope in a cold front is somewhere near I in 50, at lest twice as steep, so that in a cold front the warm air, as described above, ascends much more rapidly.

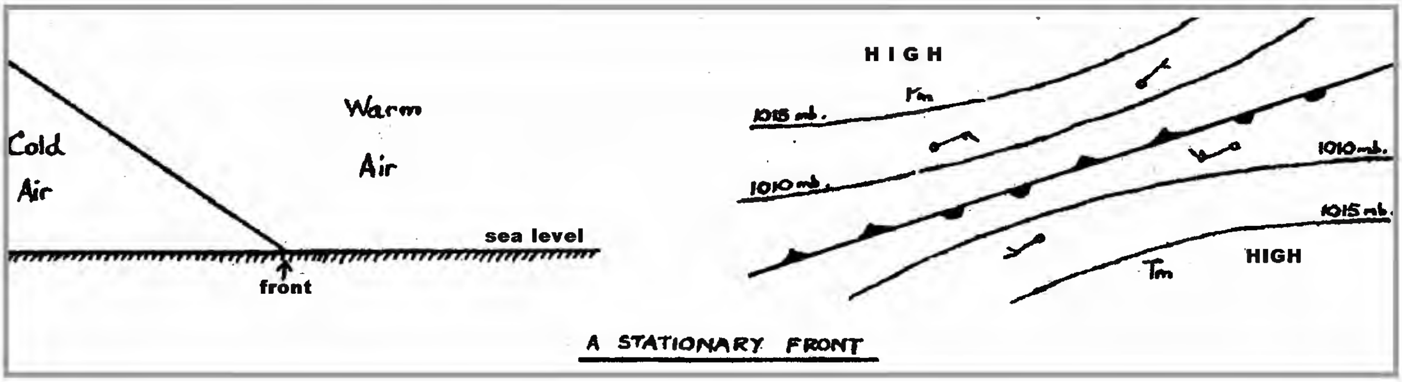
On synoptic charts it is found that where the isobars cross a front, there is a distinct "kink' and this kink always points towards the higher pressure, so that the wind, which we know blows along the isobars, always veers at a front - whether it is a warm or cold front - as that front passes over.



A front is in motion when either warm air or cold air are replacing eachch other, in the case of a warm front at the speed and direction of the surface wind, and in the case of a cold front, at the faster speed near that of the geostrophic wind. The geostrophic wind is that calculated in terms of direction and speed by studying the pressure gradient or the distance between adjacent isobars. Weather maps have a geostrophic wind scale from which it is possible to measure the speed of the wind for a given distance apart of isobars in any given latitude.

STATIONARY FRONT

When a front forms the boundary between two air masses moving in the same or opposite directions so that neither is replacing the other, its movement is small and irregular and it is called a Stationary Front.

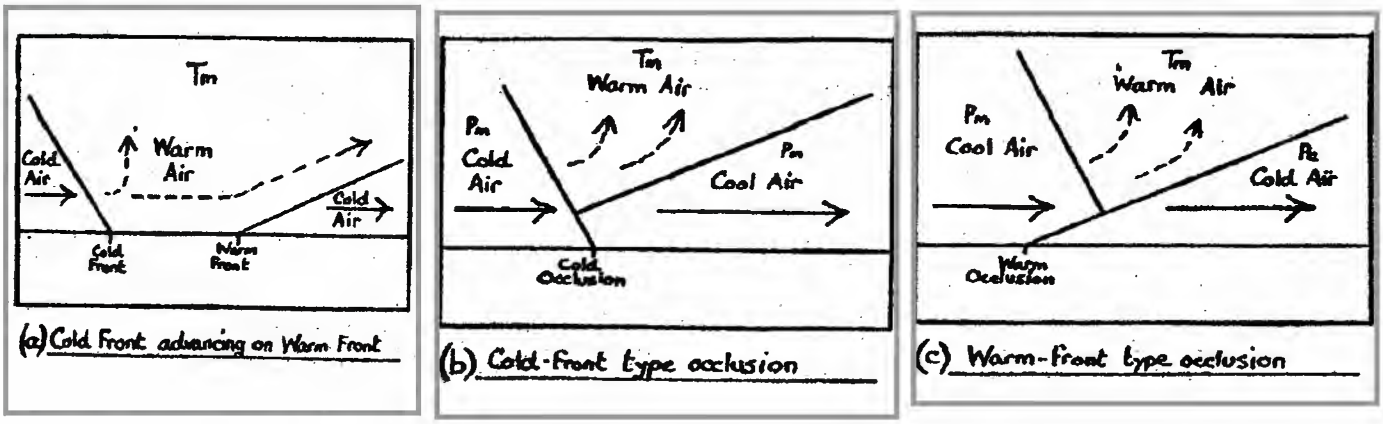


A STATIONARY FRONT

OCCLUDED FRONT

Because of its greater speed, a cold front often overtakes a warm front, and an OCCLUDED FRONT or OCCLUSION results.

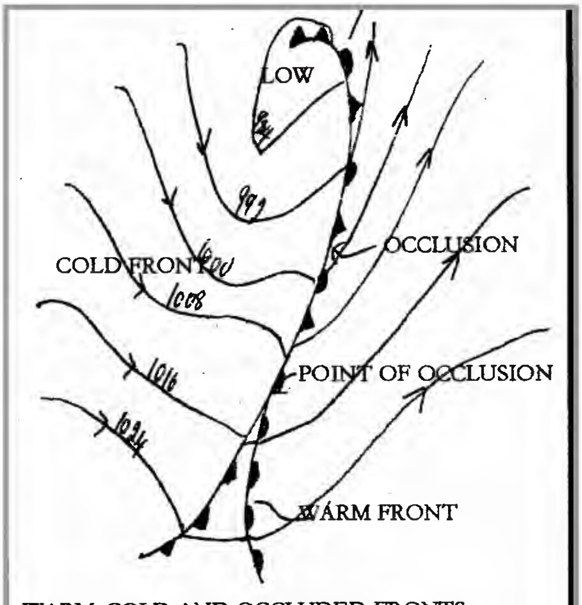
The three illustrations below show the different sorts of occlusions.



(a) Cold front advancing on a warm front

(b) shows a COLD FRONT type occlusion where the overtaking cold air mass is colder than the air ahead of the occluded front and undercuts it

(c) shows a WARM FRONT type occlusion where the overtaking cold air is not as cold as the air mass ahead of the front and rises above it.



WARM, COLD AND OCCLUDED FRONTS ON A CHART

The figure adjacent shows a synoptic chart plan presentation of the formation of an occlusion. There is the same characteristic kink in the isobars and consequent veer of wind on passage of an occlusion as with other fronts, but the very nature of an occlusion is a weakening process - the temperature gradient across the front becomes weaker as the occlusion develops and eventually the front disappears altogether.

Remember:-


represents a warm front


represents a cold front


represents an occlusion and

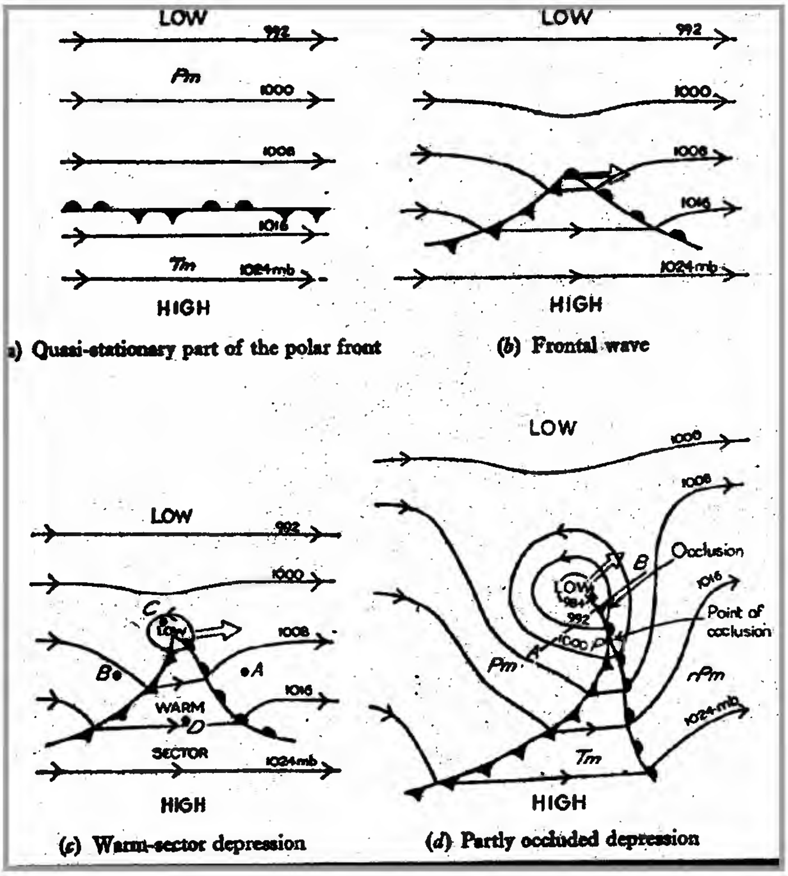

represents a stationary front

FRONTAL DEPRESSIONS

As the cause of frequent weather change in temperature latitudes is largely attributable to depressions with their associated front travelling in an easterly direction across the oceans, it is wise for we as kayakers to understand something about their development and constitution.

I referred above to the stationary front formed by the boundary between two air masses moving in the same or opposite directions.

In my next set of figures - below- (a) shows such a front over the North atlantic lying in an east-west direction separating Polar- maritime (Pm) or to the north and tropical-maritime (I'm) to the south, with both air streams flowing to the east.



a) Quasi-stationary part of the polar front (b) Frontal wave (c) Warm-sector depression (d) Partly occluded depression

Often this arrangement is distorted locally by a surge of tropical air northwards, and this bulge of warm air, called a frontal wave, moves along the front with the speed of the warm air stream.

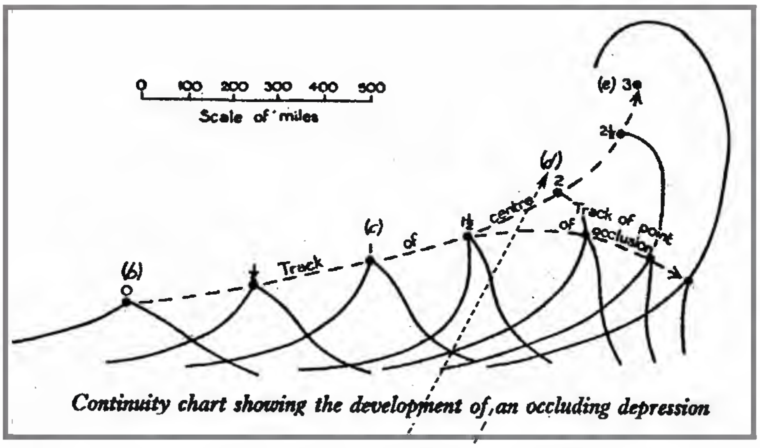
Figure (b). The leading edge of this frontal wave is a warm front, and the rear edge a cold front. Some waves may die, whereas other increase in size and a low pressure centre, with a complete circulation of wind around it, forms at the crest of the wave as in Figure (c).

This condition would occur about one day later than Figure (b), and it will be seen that the warm bulge is larger, and the initial stationary front distorted further.

The area between the two fronts is called the WARM SECTOR of the depression, and in it the isobars are a little closer together than initially and so the warm air moves faster, and because the isobars have backed a little, slightly to the left of its original course. Once a low has reached the warm sector stage it usually continues to develop or 'deepen' as this is called; pressure continues to fall and the pressure gradients become large so that strong winds are produced. The warm sector increases in amplitude and at the same time becomes narrower, and at this stage the depression is said to be fully developed.

The cold front steadily catches up on the warm front until an occlusion occurs, first near the centre of the low, but later progressively outwards as the development continues as in Figure (d) in the last set of Figures. The final stage in the life-cycle of a depression is the rapid occluding of its warm sector, weakening of the temperature gradients across the occlusion - that is, the front becomes weaker with less disturbed conditions, rain and squalls. A transfer of the Lows centre from the tip of the occlusion to the cold air (The Figure at the bottom of Pg 239 illustrates this condition in a decaying depression. After this, the depression's movement becomes slow and irregular and it slowly dies or 'fills-up', that is, the pressure within it rises. During the course of its development, the Lows centre may have moved some 1,500 miles, say from the east coast of the USA to a position between Iceland and Scotland.

The Figure below shows the position of a typical Low at 12 hourly intervals, in which the letters correspond to (b) and (d) of the Figure on Pg 240 and the figures give the age of the depression in days. Note particularly the curve of the path of the centre to the left, and the decline in the speed of its forward movement after occlusion commences.



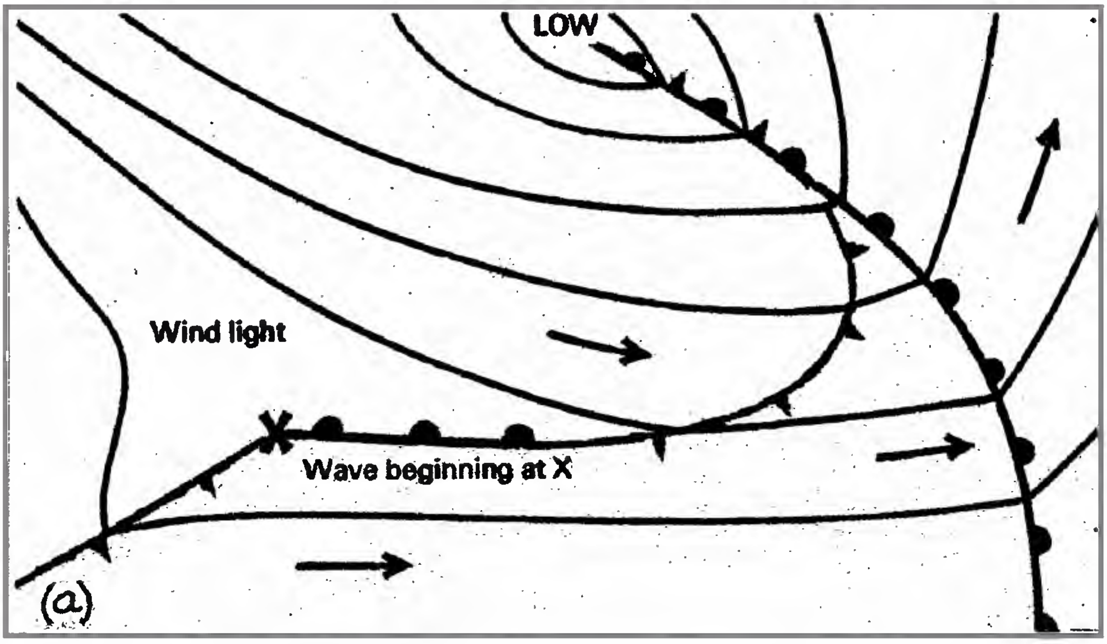
Continuity chart showing the development of an occluding depression

Most occluding Lows reach Britain when the occlusion process is already well advanced, as Figure (d) on the previous page and the Figure above at (d)

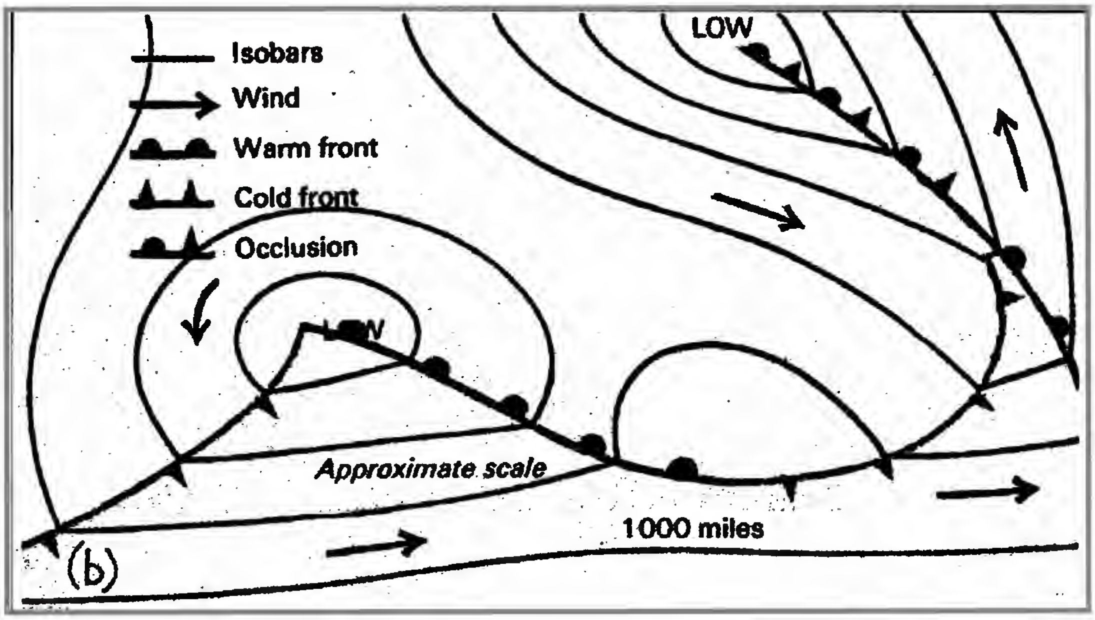
Note that in the Figure above the Continuity chart shows the development of an occluding depression at 12 hourly intervals.

SECONDARY DEPRESSION

When a depression is occluded, its speed of advance is reduced and even stop - as in the Figure adjacent (a). When this occurs, secondary disturbances or waves are liable to form on the trailing cold front. Sometimes the only effect is that the barometer ceases to rise and there is a temporary reversion to an overcast sky with little or no rain.



A secondary depression may, however, develop to a considerable extent as shown in the Figure below (b).



Secondary depressions travel round the primary depression in an anti-clockwise direction in the northern hemisphere and sometimes become deep and absorb the parent depression.
A secondary, especially in winter, may give rise to severe gales on the side away from the primary.

WEATHER ASSOCIATED WITH DEPRESSIONS
Usually the most active regions of a depression are near its fronts, with which are associated most of the cloud and rain in a new Low. The part of the warm front which usually gives the most cloud and rain lies near the Low's centre, whereas with the cold front it is its trailing part which does this. In the later stages of the occlusion process, the remaining part of the warm front often gives a weak cloud and precipitation (rain) area, while the cold front is more active.
A useful rule-of -thumb is:-
An active warm front passing an observer is followed by an inactive cold front, and vice versa.

The Figure below (a) shows a plan of a depression or a Low and the Figure on Pg 234 (b) shows a vertical section which lies to the south of the Low's centre - a typical situation over Britain. The passage of such a Low from west to east over an observer situated at A would most likely give rise to the following sequence of weather.

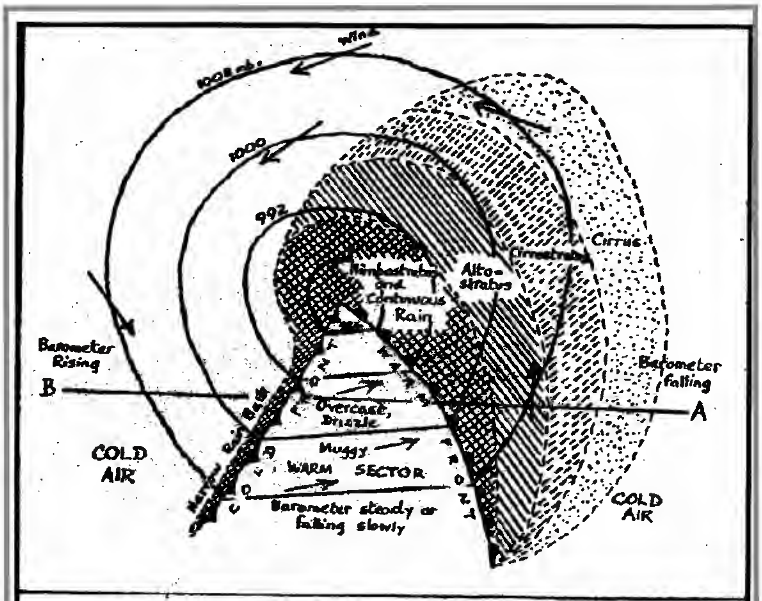
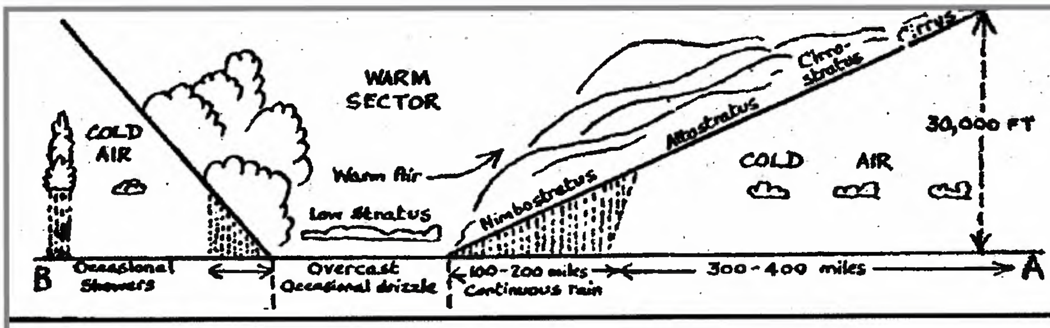


FIG. (a): PLAN OF A DEPRESSION

Note that I will be describing the clouds in more detail further along in this chapter.

IN ADVANCE OF THE WAR FRONT, as the warm air of the depressions warm sector is rising over the colder air in which the observer- is situated, cloud is formed anything up to 500 miles ahead of the front. Since this ascent is more or less uniform throughout the area affected, the cloud is all of the STRATIFORM or sheet type. Further ahead of the warm front and about 15 hours before passage of that front over the observer, wisps of CIRRUS, followed by CIRROSTRATUS cloud will occur at heights exceeding 20,000 ft, gradually increasing and obscuring the blue sky to give it a. milky appearance. At this stage the barometric pressure will begin to fall very slowly and the relative humidity to rise slowly. As the warm front approaches, the cloud becomes lower and denser, the CIRROSTRATUS giving way gradually to ALTOSTRATUS and later, NIMBOSTRATUS. The wind will be from between S and SE and increasing.



(b) Vertical Section through AB in (a)

FIG. (b)

The wind will be from between S and SE and increasing. Some four to six hours before passage of the surface front when it is between 100 and 200 miles away, rain, which becomes continuous will begin. The cloud continues to get lower until within 50 miles or so of the warm surface front it is almost at sea level and surface visibility becomes poor - largely due to the evaporation of the falling rain into the colder air through which it is falling. This also causes the relative humidity to increase more rapidly. As the front approaches the barometric pressure falls more rapidly - at the rate of about one or two millibars an hour, and the wind continues to increase in strength.

ON PASSAGE OF THE WARM FRONT the barometer will cease to fall, or fall more slowly, and may even rise slowly. The wind will veer quite suddenly, usually to between SW and W, and may continue to freshen, with squalls as the surface front passes. The main cloud mass moves away and is replaced by the STRATUS or STRATOCUMULUS typical of the warm air mass in the warm sector of the depression, and the rain will change to drizzle. The change from cold to warm air causes a temperature rise of about 5 degree C concentrated over a period of between one to two hours as the front passes.

IN THE WARM SECTOR the barometer remains fairly steady or falls very slowly but the temperature and humidity remain high causing "muggy' weather. The wind will remain steady in direction, fairly strong if near the centre of the depression and possibly freshening a little. The sky will remain overcast with low STRATUS or STRATOCUMULUS giving either intermittent or continuous drizzle with moderate to poor visibility.

ON PASSAGE OF THE COLD FRONT because of the steeper slope of the cold front, the speed of ascent of the warm air is about twice as that of the warm front, so condensation is more rapid and there is a short period of heavier rain. As the front passes, the cloud may include NIMBOSTRATUS, but this quickly gives way to ALTOSTRATUS, ALTOCUMULUS and finally CIRROSTRATUS and CIRRUS with patches of clear sky.

The rear edge of the cloud mass, found at high levels, is often very clear-cut and extends as almost a straight line across the sky. The barometer will rise sharply as the cold front passes, and the wind will veer to N or NW with possible squalls. The temperature will fall sharply as the front passes and the relative humidity will begin to decrease.

IN THE REAR OF THE COLD FRONT there is a gradual improvement, with clearer skies and the characteristic CUMULUS or CUMULONIMBUS clouds of the cooler air mass giving brighter, showery weather. The barometer will continue to rise but progressively more slowly, and the wind will probably decrease in strength and continue to veer for a while. The temperature will continue to fall slowly and the visibility will improve.

IF THE FRONT IS OCCLUDED the cloud systems of the warm and cold fronts have combined, and an approaching occlusion is heralded by conditions very similar to those before a warm front, although a period of rain ahead of the front is usually shorter. The difference from a warm front is noticed as soon as the front passes because instead of the warm sector air there is a direct change to a colder air mass.

The passage of the occlusion and subsequent conditions consequently resemble that of the cold front, although there is perhaps less chance of showers in the clearer weather after the occlusion has passed.

DEPRESSION CENTRE TO THE SOUTH OF THE OBSERVER. Here no front is experienced, the barometer will fall steadily for a while then rise steadily, with no abrupt change, and the wind will back slowly from SE to NE. There will be a period of STRATIFORM cloud probably bringing prolonged rain.

LOCAL MODIFICATION OF WEATHER NEAR COASTS. The weather near a coast as predicted from the general air mass and pressure system is likely to be modified by the contour of the land in the following ways:-

(1) If the coastline is steep then winds approaching such a shore at an angle are usually deflected along the shore line and they increase a little in force. Strong winds blowing directly on to a steep coast at right angles to it create contrary, gusty winds close inshore.

(2) The wind as expected from the prevailing pressure system may be modified by land and sea breezes during fine settled summer weather. On warm, clear days, the land becomes warmer than the adjacent sea. Convection is set up in the warmed air above the land and cooler air from the sea is drawn in to replace it. This onshore wind is simply called a SEA BREEZE and it usually occurs from six to eight hours after sunrise until shortly before sunset. A sea breeze can blow up to force 4 and may extend up to 20 miles inland.

After sunset the land becomes cooler than the sea and the process is reversed, resulting in a LAND BREEZE which blows seaward from about midnight to sunrise, although it is never as strong as the sea breeze and rarely extends more than 5 miles seaward.

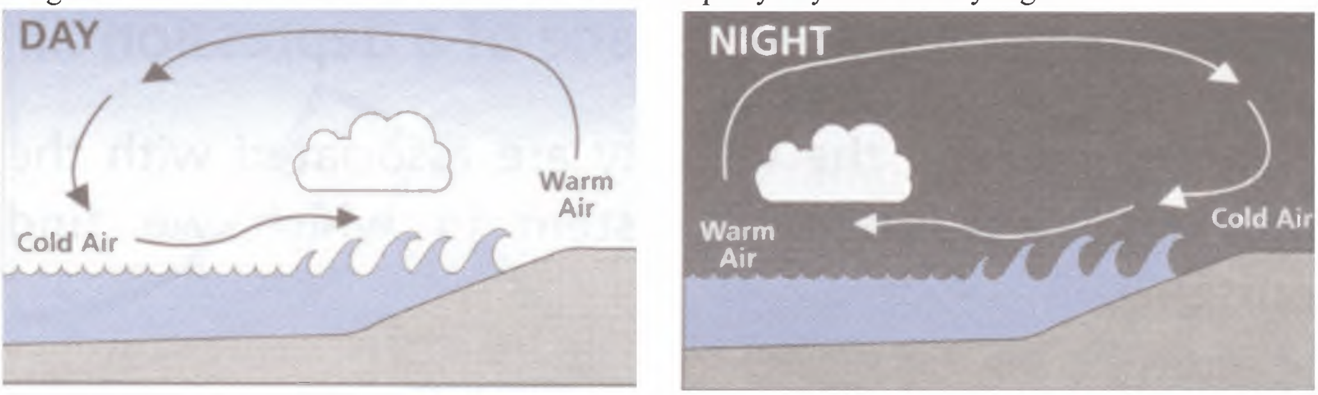
(3) Winds approaching a strait or estuary tend to blow along the strait and increase in force as the strait or estuary narrows, particularly in the afternoons.

(4) Cold, offshore winds as from off snow covered land, are usually squally of hilly coasts.

(5) Near headlands or steep sided islands, there may be large changes in wind direction of up to 90 degree. Wind force also changes as it is pushed around the headlands rather than rising over them.

(6) Drizzle and poor visibility are often experienced along coasts towards which a warm, moist air stream is blowing. Poor visibility is often experienced leeward of an industrial area on land from which smoke is blowing.

The figures below demonstrates how a sea breeze develops by day and then by night.



The earth convects the heat it has received from the sun and rapidly heats the air in the atmosphere. The air rises and creates a vacuum at the earth's surface which is filled by cooler air drawn in from the sea. This is a Sea breeze.

At night the opposite happens. The earth quickly cools by radiation and the air above becomes more dense than the air over the sea. The breeze then blows offshore. This is the Land breeze

<u>Two conditions are necessary to trigger the breeze phenomenon:</u>

1: The cloud cover has to be thin enough to facilitate convection. The presence of Cumulus during the day is an indication of unstable air, which assists the upward movement of air.

2: The difference between the temperature of the sea and that of the air needs to be more than 3 degrees centigrade.

The vertical development of Cumulus clouds over the coast is an indication of the spread of the sea breezes at the surface.

If the vertical height of the cloud is:
More than 2000 metres = strong breeze up to 15 miles offshore
More than 1500 metres = moderate breeze up to 8 miles
More than 1000 metres = light breeze up to 4 miles
More than 500 metres = very light breeze

(3) CLOUDS

THE CLOUD

I bring fresh showers for the thirsting flowers,
From the seas and the streams;
I bear light shade for the leaves when laid
in their noonday dreams.

From my wings are shaken the dews that waken
the sweet buds every one,
When rocked to rest on their mother's breast,
As she dances about the sun.

I wield the flail of the lashing hail,
And whiten the green plains under,
And then again I dissolve it in rain,
And laugh as I pass in thunder.

PERCY BYSSHE SHELLEY

Recognition of the different types of cloud, and knowledge of how they form, move, change and decay is a great help when studying the local weather or making your own forecasts. When observing clouds the extent of cover, the heights and types of cloud present, and their direction of movement should all be recorded. If this is too much to undertake then try determining the dominant types of upper and lower cloud. There are four different types of cloud, depending on how the air is made to ascend and is therefore cooled so that the dew point is reached.

(1) CONVECTION CLOUDS
In unstable conditions rising air is coiled, to its dew point and forms heaped up cumulus cloud - described in a moment.

(2) CLOUDS DUE TO TURBULENCE
Over the sea turbulence may extend to about 600 m (2,000 ft) when the wind is strong. If the air is sufficiently damp to be cooled to its dew point at this height, a sheet of stratus cloud may be formed.

(3) OROGRAPHIC CLOUDS
This is the type of cloud formed when damp air is forced up and over the top of high ground. By its nature it. is not of much direct consequence to kayakers.

(4) FRONTAL CLOUD
This is caused by a mass of relatively warm air meeting a mass of cooler air, so that the warm air, being lighter, climbs up over the cold air or it is forced upwards by the cold air driving underneath.

CLOUD HEIGHT. Basically clouds are divided into three levels - high, medium and low levels depending on the heights of their base.

In some cases it may not be easy to decide the actual height of clouds, but it is usually simple to decide their other main feature - whether they have vertical development and individual form (cumulus type) or whether they are a shapeless type of spreading cloud (stratus type).

MAIN CLOUD TYPES

CIRRUS	Ci	High Clouds	Typically above
CIRROCUMULUS	Cc		67,000 m (22,000 ft)
CIRROSTRATUS	Cs		
ALTOCUMULUS	Ac	Medium Clouds	2135 - 6100 m
ALTOSTRATUS	As		(7,000 - 20,000 ft)
NIMBOSTRATUS	Ns	Low Clouds	Usually below
STRATUS	St		2135 m (7,000 ft)
STRATOCUMULUS	Sc		
CUMULUS	Cu	Low Clouds but these may extend vertically into high clouds	
CUMULONIMBUS	Cb		

The following descriptions of the ten most common types of cloud listed above should be read in conjunction with the coloured cloud pictures.

These pictures show (I to 6) a typical warm front sequence of CIRRUS, CIRROCUMULUS, CIRROSTRATUS, ALTOCUMULUS, ALTOSTRATUS, NIMBOSTRATUS.

1. Cirrus

2. Cirrocumulus

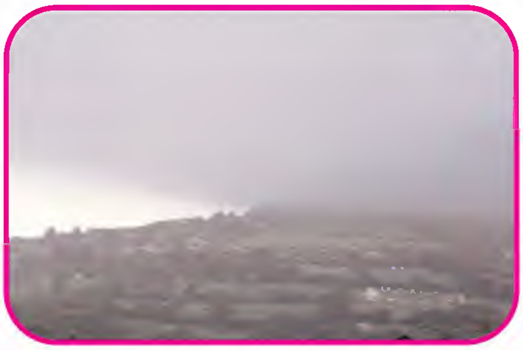
3.Cirrostratus

4.Altocumulus

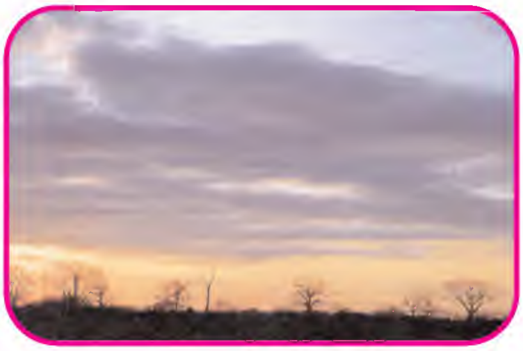
5.Altostratus

6.Nimbostratus

Pictures 7 and 8 show warm sector weather clouds, STRATUS, STRATOCUMULUS and picture 9 and 10 shows cold front clouds of CUMULUS and CUMULONIMBUS. Finally pictures 11 and 12 show the growth of CUMULUS cloud.



7.Stratus



8.Stratocumulus

9.Cumulus

10.Cumulonimbus

11 & 12 The Growth of Cumulus Cloud

In studying cloud types it is helpful to understand the meaning of certain terms :-

CIRRUS -	feathering	ALTO -	medium level cloud
STRATUS -	layers or sheets	NIMBUS -	rain bearing
CUMULUS -	heaped	FRACTO -	broken

HIGH CLOUD - CIRRUS (Ci)

White, feathery, isolated clouds of ice crystals which cast no shadow. When thin and tufted they are often called 'mare's tails'. They usually indicate strong winds at altitude. Thin high level cirrus means good weather, but when it thickens and consolidates into cirrostratus and altostratus, it foretells an advancing depression or frontal system.

CIRROCUMULUS (Cc)

Banks or rows of small white flakes, sometimes rippled or patterned - known as a mackerel sky. Thicker than cirrostratus and usually contrasted against the blue sky. It may indicate changeable weather. A transient form of cloud which often develops from cirrus or cirrostratus, and then changes back to these or other forms of cloud.

CIRROSTRATUS (Cs)
A thin white veil of transparent cloud, often giving haloes round the sun and moon. This cloud often follows cirrus and precedes altostratus, heralding a depression and deteriorating weather.
MEDIUM CLOUD - ALTOCUMULUS (Ac)
Longish layers or patches of white or pale grey cloud, usually in groups or lines. Rather similar to cirrocumulus, but larger and thicker, with a darker pattern. If much vertical development is evident it is a sign of instability which may give rise to thunderstorms.
ALTOSTRATUS (As)
A sheet of cloud which may follow cirrostratus, - although it is lower and thicker, - in which case rain almost invariably follows with an approaching front.Altostratus often varies in density ~ dark in parts whereas the sun can be seen through others. It may cover the whole sky.
LOW CLOUD - NIMBOSTRATUS (Ns)
A dense grey layer of low cloud which forms below altostratus, covering the whole sky and giving steady rain; often, with scud detached from the main cloud layer.
STRATUS (St)
Low sheet of uniform grey cloud., like fog not resting on the ground. The sun can sometimes be seen through it. It may cover the whole sky, or only be patches trailing over the sea. Often associated with drizzle and. poor visibility.
STRATOCUMULUS (Sc)
Irregular masses or rolls of large puffy clouds, with varying degrees of darkness and often a thick wavy appearance. Common in winter, bringing drizzle rather than rain.
CUMULUS (Cu)
Clouds with clear outlines, separated from each other. They have flat, grey bottoms, white puffy sides and billowing tops with considerable vertical development. Cumulus comes in all sizes. Small puffy cumulus usually indicates fair weather.
CUMULONIMBUS (Cb)
Towering and forbidding storm clouds. When they are well developed they are marked by anvil tops indicating powerful rising air currents which often produce squally winds with rain, heavy showers of hail or snow and frequently thunder. These clouds are often embedded in intense cold fronts and vigorous troughs.

(4) VISIBILITY

FOG

Over the oily swell it heaved, it rolled,
like some foul creature, filmy, rebulous.
It pushed out streaming tentacles, took clammy hold,
Swaddled the spars, wrapped us in damp and cold,
Blotted the sun, crept round and over us.

Day long, night long, it hid us from the sky -
Hid us from sun and stars as in a tomb.
Shrouded in mist a berg went groaning by,
Far and forlorn we heard the blind ships cry,
Like lost souls waiting in a hopeless gloom.
CROSBIE GARSTIN

Meteorologists speak of fog when visibility at ground level is below I km, of mist when it is between 1 and 2 km. Fog and mists met with at sea are closely associated with the phenomena of advection and radiation.

ADVECTION FOG.
This the most common type at sea. Advection ~ in contrast with convection - is displacement of air horizontally. Advection fog arises from condensation occurring in a mass of warm, damp air passing over

a cold surface. This sort of fog is almost permanently over the Newfoundland Banks where the air, warmed and saturated with humidity over the Gulf Stream, meets the cold Labrador Current.Generally speaking, the higher the latitude, the colder the sea and the more frequently this type of fog is met. It is commoner in winter than in summer. The turbulence that occurs in swift tidal streams brings cold water up to the surface.

RADIATION FOG.

Is essentially a land fog that occurs in clear calm weather. During the night, the Earth loses its heat by radiation; the air in contact with it cools and the water vapour it contains condenses. This fog is particularly dense at first light, that is, the coldest hour. It lingers for a long time on low ground where the cold air tends to gather. It occurs in estuaries and sometimes spills over a little out to sea, obscuring coastal lights.

Fog is often only dissipated by a complete change in wind direction which brings drier air; and occasionally by a considerable increase in wind strength so that drier air is brought down from above.

A feature of sea fog is that, unlike fog over land, it can persist in quite strong winds. Another type of fog which may be met with at sea, but which does not normally persist for too long, is that associated with the passage of a front. Fog or poor visibility is often experienced in the warm sector after a warm front has passed. On land few activities are curtailed until visibility falls below 180 m (600 ft) due to fog. At sea, visibility is of prime importance. If less than 1,000 metres (just over 1,000 yards) it is officially fog and all vessels, irrespective of size or electronic aids, are required by law to reduce speed and make noises indicating where they are and what they are doing.

I recall three of us paddling back from Lundy Island in the Bristol Channel in a real pea souper. We had stopped for a rest and a bite to eat when we heard 'chug, chug, chug', getting louder by the moment. The engine noise reverberated around being "bounced' by the fog. All we realised was that it was becoming louder as it proceeded towards us. There was nothing to be gained from taking avoiding action; by paddling one way or another we could well be actually heading into collision. We waited for what seemed like an age, expecting to see the dark hulk emerge from the gloom. Suddenly we were bobbing up and down on its wake and we realised it had passed us by. All quite unnerving.

Visibility is also an important factor in navigation at sea. We rely on being able to see the coastline as well as predominant features on and around it, to maintain course and position. Visibility is coded. It goes like this:-

CODE	DESCRIPTION	OBJECTS NOT VISIBLE AT
0	Dense Fog	50 yds
1	Thick Fog	200 yds
2	Fog	400 yds
3	Moderate Fog	1,000 yds or 1/2 naut. mile
4	Mist or haze *(very poor visibility)*	I nautical mile
5	Poor visibility	2 nautical miles
6	Moderate visibility	5 nautical miles
7	Good visibility	10 nautical miles
8	Very good visibility	30 nautical miles
9	Excellent visibility	Over 30 nautical miles

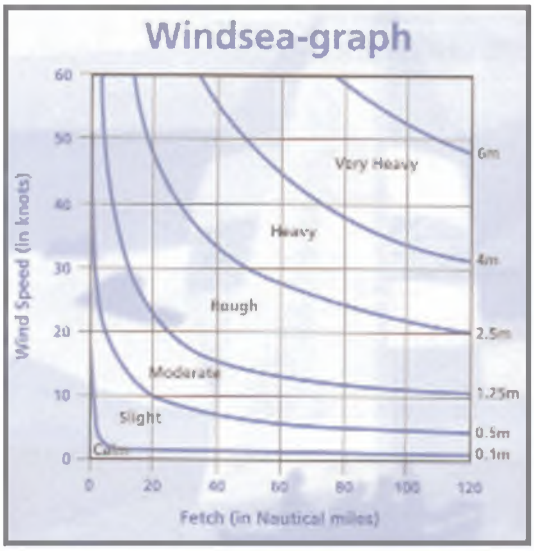
With these fog conditions (codes 0–3) fog signals are obligatory

Remember that
I nautical mile = 10 cables
I cable = 200 yards

(5) SEA STATE

Although sea state is the result and not the cause of weather conditions, this subject is of such importance to sea kayakers, that I shall dwell on it a little. Surface friction between the wind and the sea surface slows down the wind, and the energy thus gained by the sea is transformed into waves.
The mechanism of waves is complex, but their growth is governed by three main factors.

I . The wind speed
2. The duration for which it blows and
3. The fetch or the offshore distance over which it blows.



Waves are measured by their height from crest to trough and length from top of one crest to the one behind (or in front), and period which is the time taken for two successive crests to pass a given point. Both duration and fetch must be considered in determining the average size of wave generated by a certain wind force, and therefore the wave heights as shown in the Beaufort Scale (see page 226) are generalisations of what might be expected in the open sea remote from land.

The wave formed on the surface occurs throughout the water but with diminishing effect. In shallow water, where there is still a wave motion on the sea bed, the energy is re-transmitted upwards causing a steepening of the waves, which may then break (I have covered this in greater detail in my chapter on THE SEA, see page 166). This is why shoal water is frequently turbulent. Steepening and breaking of waves also often occurs when a strong tidal stream sets in opposition to the wave direction.

Waves often collect in groups with several large ones followed by smaller ones. This pattern can often be detected with advantage if a change of course is necessary in rough water. The waves so far referred to are those generated by the wind in the immediate area. There is another wave form that is caused by strong winds and may travel hundreds of miles before such waves decay. This is called SWELL. Swell has a longer wave length and a smoother and more regular appearance. Big swells are infrequent in the vicinity of the British Isles. When they are experienced they are usually caused by persistent long fetch south westerly winds over the Atlantic. It is possible to have wind generated waves superimposed upon a swell. Since swell is a result of a weather system that existed perhaps several days previously it is not an indicator of forthcoming weather.

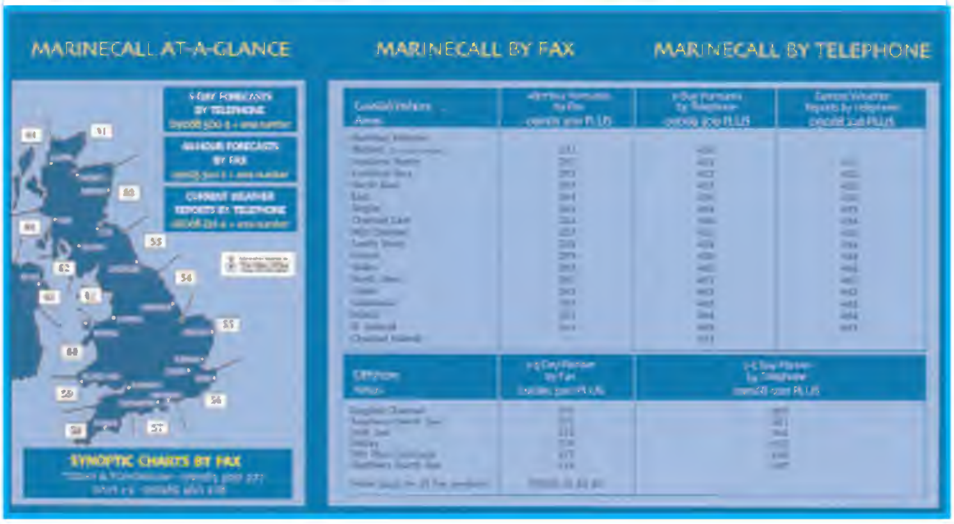
FORECASTING WEATHER

In this country the MET. OFFICE provides detailed weather forecasting services for many specialised interests as well as for the general public. It started in the middle of the last century when rather crude and not always up to date storm warnings were put out by means of cones at principal ports to warn shipping. Since these days there have been a tremendous growth in expertise and technology and with the use of computers and satellites routine weather information is available round the clock.

MARINE CALL

Marine Call is a service for small boat users and is a 24-hour service operated by the Met. Office with Telephone Information Services PLC in association with HM Coastguard, the RNLI and the Royal Yachting Association. With such a comprehensive service always available it could, perhaps, be argued there is no pressing need for us as kayakers to acquire our own weather forecasting skills. Nothing could be further from the truth. In the first place, a basic knowledge of how the elements work gives a better understanding of the forecasts by the Met. Office; they can be seen in terms of distinct weather types and as part of an on-going situation. The kayaker with a background in elementary meteorology should be particularly well placed to allow for occasional errors in the forecasts.

MARINE CALL CARD



WEATHER LORE

There is no better entry to a simple appreciation of weather forces and of weather changes than through a study of weather lore, especially that part of it t.ha.t has been vindicated by scientific principles. Indeed a considerable number of weather lore statements have a maritime flavour. There are those sayings connected with barometric change in relation to general weather and to wind, temperature and visibility features that are often critical for safe kayaking. A lot of the weather lore dates from prime sailing times.

'A veering wind, fair weather;
A backing wind, foul weather'.

Sailors of old were aware that a. backing wind in which the change is anti-clockwise, most usually from north-west to south-west or from south-west to south, indicated, the approach of an Atlantic low-pressure system, the so called 'depression' with its associated rainbelts or fronts. This change was also associated with the passage of the fronts in which the wind veered until eventually its strength decreased and the weather improved.

Even so, one could only be cautiously optimistic at such times, for even after that clockwise change of direction, with a veer perhaps back to north-west again, the weather could still remain quite squally, if generally less windy than ahead of the advancing rain belts. Also, in the van of a depression there are usually showers falling and a temporary deterioration of visibility where they occur. But between showers in a west to north wind the visibility can be excelled. 'The further the sight; the nearer the rain' is a reference to the fact that in the bright air behind a depression one should be ready for a switch back to unsettled weather quite soon - possibly next day. The reason is that depressions often travel across the Atlantic in families, with around 12 to 18 hours of clearer weather between each deterioration.

"'Quick to rise after low foretells a stronger blow".

This refers to the activity of the barometer and is a reliable sign. For a switch from unsettled to really settled weather it is necessary to have a gradual rise of barometric pressure for at least 48 hours.
About 75 per cent of British weather is imported, much of it is of Atlantic origin. Winds that predominate however, maintain quite long phases, even the non-westerly ones. Of particular danger is the east wind created by what begins as a small low pressure system over northern france. Once this gets under way it can endure for several days and, because of the influence of the low to south, it will be wet. Hence

"'Rain from the East
A day or two at least"

And this is despite the fact that east winds normally bring Britain its driest weather spells.

"When rain comes before wind
Halyards, sheets and braces mind;
But - when wind comes before rain;
Soon you may set sail again".

This may appear a little fanciful but this statement is distinguishing between two distinct types of weather situation within an advancing depression. At the advance of the initial warm front, so called because the warmer air is over-riding colder air and, in the process, creating a huge band of lowering cloud from wisps of cirrus to the eventual low nimbostratus, the wind rise is a gradual one and rain will start before this wind has gained its maximum strength. Later, near the rear of the depression comes the cold front where markedly colder air undercuts warmer air. Here the wind increase is sudden and very squally in character. Just afterwards comes a relatively short period of possibly heavy rain but the whole event does not last very long.

Finally, within the often squally showers that are likely to succeed the cold front, temporary winds increase will come within the rainy interval or just before it. Note that in settled weather - and this in itself is a sign that the atmosphere is stable and rain free - winds around the British Isles will tend to be onshore between midday and evening, reaching a maximum strength by late afternoon; and, overnight may change to offshore in direction after first falling to calm.These are the sea and land breezes that I have illustrated on page 236

"'Red sky at night is a shepherds delight
Red sky in the morning, shepherds warning".

A reddening of the sky at sunrise could mean an increase of water vapour in the upper troposphere, perhaps also a high level inversion and some cirrus cloud. In other words a frontal depression may be approaching causing rain and strong winds by and after dusk. The implication of a red sky at dusk are that any rain and strong winds are more likely to occur during daylight. One of the most reliable of old sayings is

"Backing winds and mares tails
Make tall ships carry low sails".

The twisted sheaves of cirrus cloud called 'mares tails' are caused by the strong winds at upper levels which are often associated with a vigorous frontal depression which, if it is approaching, usually causes the wind to back. Another reasonably reliable predictor is

"The moon with a circle brings water in her beak".

The circle in this saying is the lunar halo. Remember that the halo occurs around the sun just as frequently as around the moon, but it is noticed less often because of the glare. Observing clouds on a bright day is much easier when using sun glasses, and often helps to show up cloud formations that cannot be seen quite so well with the naked eye.

"'Warmth in Spring
Sea fog will bring"

contains an element of truth. As I have previously explained air can hold a greater quantity of water vapour with higher temperatures, and in the spring when the sea temperatures have only just started to recover after the winter the air at the surface could be cooled to the dew point - in other words, form fog.

Weather lore should be used with caution although the basis for some can be scientifically explained and can be used by kayakers to alert to possible developments.

LISTENING TO THE VARIOUS WEATHER BULLETINS, DRAWING A SYNOPTIC CHART, RECORDING PRESSURE AND WIND TOGETHER WITH CAREFUL OBSERVATION OF THE SKY IS THE MOST RELIABLE METHOD OF WEATHER FORECASTING.

As to the method used in the preparation of official forecasts, this has not changed in that the basic technique is, as ever, to study and monitor the properties of all incoming and home produced weather systems, together with their movements, in order to arrive at likely developments over the next 12 to 24 hours and, even for longer periods. The difference between forecasting today and that of, say, twenty years ago, is that the use of computers enables the met. officers to reconstruct their meteorology in terms of mathematical models. Additionally, the extremely useful and detailed photographs of our atmosphere provided by satellites in constant positions are an invaluable aid. This said, local forecasting within sea and coastal areas, as well as for land areas, still remains something of an art as well as an earnest science. Consequently weather forecasting offers scope for the kayakers participation on an active basis, and not merely as an official forecast user.

METEOROLOGICAL OFFICE FORECASTS

The only weather forecast suitable for kayakers are those specifically prepared and. issued by the Met. Office for the use of seamen and termed “SHIPPING FORECASTS”. Although some information can be gleaned from the general weather forecasts as broadcast by the BBC throughout the day for land areas, these forecasts are often too sketchy to be of much use to the sea kayaker.

BBC RADIO SHIPPING FORECASTS

Shipping forecasts cover large sea areas, and in a five minute bulletin it is impossible to include very much detail, particularly about variations that can and do occur near land. Hence forecasts for INSHORE WATERS are usually more relevant to us as sea kayakers. Shipping forecasts are broadcast on BBC Radio 4 on 198 kHz (1515m) and a local MF frequencies daily at 0033 - 0038 (includes area Trafalgar); 0555 - 0600; 1355 - 1400; and 1750 - 1755 (clock times) The 0033 and 1355 broadcasts Mondays through to Friday include a 24 hour forecast for the Minches after area Hebrides. The 0033 shipping forecast is also broadcast by Radio Scotland (810 kHz) and is followed by a forecast, valid until 1800 for coastal waters of Great Britain up to 122 miles offshore as well as reports from selected stations.

These shipping forecasts include a summary of gale warnings in force; a general synopsis of the weather for the next 24 hours and expected changes within that period; forecasts for each sea area for the next 24 hours, giving wind direction and speed, weather and visibility; and the latest reports from selected stations. For each station are given wind direction and Beaufort force, present weather, visibility and, if available, sea level pressure and tendency. Apart from being included in shipping forecasts, gale warnings are broadcast at the earliest opportunity on BBC Radio 4 and then following the next news bulletin.

BBC INSHORE WATERS FORECASTS

Forecasts are given for inshore waters, that is, up to 12 miles offshore, of Great Britain until 1800 next day at the end of English, Welsh and Scottish Radio 4 programmes, and on Radio Scotland, at about 0038 local time. The forecast of wind, weather and visibility is followed by the 2200 reports from the following stations; Boulmer, Bridlington, Walton-on-the-Naze, St Catherines Point, Land's End, Mumbles, Valley, Blackpool, Ronaldsway, Killough, Orlock Head, Lame, Corsewall Point, Prestwick, Benbecula, Stornoway, Lerwick, Wick, Aberdeen and Leuchars. Radio Ulster (1341 kHz) gives forecasts for coastal waters of Northern Ireland at 0010 local time each day. A forecast, valid until 1800, is broadcast for inshore waters of Great Britain and Northern Ireland on BBC Radio 3, at 0655 local time daily on 1215 kHz.

Weather forecasts can also be obtained over the telephone by contacting Weather Centres. The telephone numbers of these are to be found in your local telephone directory. See also MARINE CALL - See Page

253. You can telephone for a recorded Met. Office forecast. These are updated twice a day during the winter months, three times a day during the summer. They cover up to 12 miles offshore including the Channel, Irish Sea, Isles of Scilly, Channel Islands, Orkney and the Isle of Man.

Shipping Forecast Areas

Date ____________________

Time ____________________

Shipping Forecast Record

GENERAL SYNOPSIS at ______ GMT/BST

System	Present position	Movement	Forecast position	at

Gales	SEA AREA FORECAST		Wind (At first)	Wind (Later)	Weather	Visibility
	VIKING					
	FORTIES					
	CROMARTY					
	FORTH					
	TYNE					
	DOGGER					
	FISHER					
	GERMAN BIGHT					
	HUMBER					
	THAMES					
	DOVER					
	WIGHT					
	PORTLAND					
	PLYMOUTH					
	BISCAY					
	FINISTERRE					
	SOLE					
	LUNDY					
	FASTNET					
	IRISH SEA					
	SHANNON					
	ROCKALL					
	MALIN					
	HEBRIDES					
	BAILEY					
	FAIR ISLE					
	FAEROES					
	SE ICELAND					

COASTAL REPORTS at ______ BST GMT	Wind Direction	Wind Force	Weather	Visibility	Pressure	Change
Tiree						
Sumbrugh						
Bell Rock						
Dowsing						
Noord Hinder						
Varne						

COASTAL REPORTS	Wind Direction	Wind Force	Weather	Visibility	Pressure	Change
Royal Sovereign						
Channel Lt V						
Scilly						
Valentia						
Ronaldsway						
Malin Head						
Jersey						

PRESS WEATHER FORECASTS

The delay between the time of issue and the time at which they are available next day make press forecasts of limited value to sea kayakers. However, the better papers publish forecasts which include a synoptic chart which, in the absence of any other chart, can be helpful when interpreting the shipping forecast prior to driving down to the coast.

TELEVISION FORECASTS AND PRESTEL

Some television forecasts show a synoptic chart which with the satellite pictures, can be a useful guide to the weather situation. Weather information is given on TELETEXT by Ceefax on BBC and Oracle on ITV. BBC I Ceefax gives up to date weather maps on Page 581 as well as standard land area weather forecasts on Page 582. ITV Oracle shows a marine forecast, updated three times a day, on Page 302.

PRESTEL, operated over the telephone system, has a great deal of weather information supplied by the Met. Office, including shipping forecasts and synopsis for all British sea areas. The main index page for this is: Key 209

Page 2093 for shipping forecast
Page 20940 for UK weather, actual
Page 2094 for world-wide weather, actual
Page 20915 for European forecasts
Page 20904 for UK weather index.

FORECASTS FROM HM COASTGUARDS

The Coastguard Maritime Rescue Co-ordination Centres (MRCCs) and Sub Centres (MRSCs) will provide information on actual weather conditions prevailing in their immediate area.

You can reach the Coastguards on VHF Ch. 67. Each MRCC and MRSC keeps a listening watch on VHF Ch.16 and operates Ch. 67. They broadcast strong wind warnings for their local area on receipt on Ch. 67 after an announcement on Ch. 16 as well as forecasts every four hours - transmitted the same way; every two hours of their are particularly strong winds.

GALE WARNINGS

Gale warnings are only issued when wind.s of Force 8 or gusts of Force 9 and above are expected.

The term “severe gale” implies a wind of Force 9 or above. The terms, “imminent”, “soon” and “later” indicates gales within 6 hours, between 6 and 12 hours and more than 12 hours, respectively, from the time of issue.

An amended Gale Warning is issued under the following circumstances.

1. If a gale is expected to become more severe or to develop earlier or much later than was initially indicated.
2. If the direction is expected to change by 45 degree or more from the initial direction given.
3. If the direction is expected to change from north of the east-west line to the south of it.

UNDERSTANDING AND MAKING USE OF SHIPPING FORECASTS

The main weakness of a weather forecast is its essential brevity and consequent generality.

The Met. Office has little difficulty in issuing a detailed and accurate forecast for a particular area. The Shipping Forecast, on the other hand, have to cover an area of over half a million square miles between Iceland, the German Bight and Finnisterre. The area 'Wight' alone covers a.bout 10,000 square miles. Usually many different sorts of weather are being experienced, indeed should be expected, over such a vast area. All this weather has to be put across in a statement that can be read out in five minutes. Obviously they are, of necessity, quite generalised. For example, wind directions are referred to in terms such as “becoming westerly to north-westerly”, implying a range of over 45 degree and is consequently to be used with caution by the kayaker should wind direction be critical. In the same way, “becoming F4 to F6”, should leave us wondering what will it like while we are on the water!! Another problem is the time gap between all the necessary information being available to the Met. Office and their ability to make their deductions, predictions and then broadcast. With modern technology the process is quite rapid, but then weather changes can be even faster.

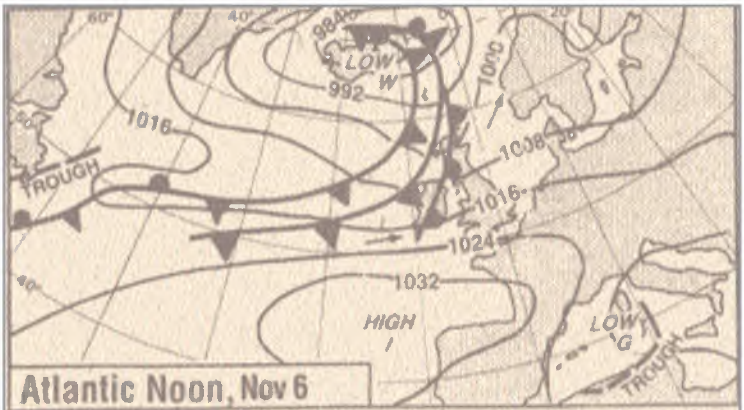
These limitations of the Shipping Forecasts have to be understood but a good deal can be extracted from them by applying a basic knowledge of meteorology coupled with shrewd observation of the local weather. It is important that we understand, the terms used by the Met. Office when they relay the Shipping Forecast. Many will. be explained in the glossary at the end of this book but here are the more important ones.

THE GENERAL SYNOPSIS

The general synopsis of the weather situation gives the position at a stated time of all:-

(1) Depression
(2) Anticyclones
(3) Fronts
(4) Occlusions

The synopsis will also give the expected movements of these four patterns during the forecast period and the degree of activity associated with each one. For example, it will usually refer to the DEPTH and INTENSITY of a depression. The depth of a depression means the barometric pressure at its centre. A deep depression is one with a central pressure of 990 mbs or less and a shallow depression is one with a central pressure of over 1,010 mbs.



High I will drift north-west with similar central pressure Low G will move east. Low W will drift east

An intense depression is one in which the isobars are very close together, that is, there is a steep pressure gradient signifying strong winds. A deep depression will normally be intense but not necessarily so. The intensity depends upon the area covered by the depression.

Depressions with weak gradients are called FEEBLE. These are usually shallow but, again, not always. Even quite shallow depressions can have steep pressure gradients giving fresh or strong winds locally. The qualification FILLING or DEEPENING give a good idea as to whether they are decaying or becoming more active. Anticyclones with very high pressures at their centres are said to be intense. As an anticyclone must have a slack gradient near its centre, an intense one usually covers a very large area. Small anticy-clones are usually described as weak. When the pressure at the centre of a High is increasing, it is said to be INTENSIFYING; when it is decreasing it is said to be GIVING WAY. Fronts are usually described as VIGOROUS, ACTIVE or WEAK, terms which are self-explanatory.

FORECASTING WIND

Forecasts usually begin with wind direction and strength. The direction of a wind is the true bearing of the point of the compass from which it blows. For example, W, NE, SSE, etc. Wind directions are given in the quadnantel system rather than by degrees.The suffix "....ly" (e.g. "easterly") has not yet achieved an internationally agreed degree of approximation, but conventionally covers about a point on either side. In forecasting for large areas it is not usually possible to express wind directions to within three or four points without going into unacceptable length.Wind strength is usually given on the Beaufort Scale (see page 234). The strength of a wind is estimated by Mariners against this Beaufort Scale. Accuracy is difficult to achieve scientifically due to vessels moving with or against the wind and of course the wind itself normally gusts stronger. One's accuracy at estimating wind speeds improves with experience. I have to say that kayakers, as well as most other navigators, professional or amateur, tend to over-estimate the force of light winds and to under-estimate the strong ones.

6. PRECIPITATION (RAIN)

> ***It ain't no use to grumble and complain;***
> ***It's just as cheap and easy to rejoice;***
> ***When God sorts out the weather and sends rain,***
> ***Why, rain's my choice.***
>
> *J. WHITCOMB RILEY*

FORECASTING RAIN

Precipitation is the forecasters expression for the results of the condensation of water vapour into liquid or solid form at, or near, the Earth's surface - in other words, rain, hail, drizzle or snow.

The following terms are used in forecasting ....

Precipitation:-

Rain	precipitation in the form of water drops
Drizzle	precipitation in which the water drops are very small. Visibility is normally poor in drizzle and occasionally it may occur in association with sea fog.
Hail	precipitation in the form of hard ice spheres
Snow	precipitation in the form of soft ice crystals or flakes.

Periods of Rain

Periods of Prolonged Rain -	is rain lasting for several hours, or a lot of rain falling over an extended period, not usually heavy and at times, more like drizzle.
Shower -	brief precipitation with more or less definite clearance between the falls. The rain is heavy for a short time.
Occasional -	not continuous a.nd relatively short periods. In between these periods the sky remains overcast.
Intermittent -	not continuous over a considerable time, the periods of precipitation are of a substantial duration and the sky remains overcast.
Thundery Rain -	occasional or intermittent rain, heavy at times, usually accompanied by thunder.
Thunder Showers -	showers of rain, hail, sleet or snow, usually heavy and accompanied by thunder
Thunderstorms -	thunder and lightning with or without precipitation which may be continuous and heavy at times.

Dry Periods

Fine -	no precipitation or fog; sunshine
Dry -	no precipitation or fog
Sunny -	sunshine most of the time
Sunny Periods -	fairly continuous sunshine for one or two hours at a time ~ more sun shine than cloud
Sunny Intervals -	intermittent sunshine for rather less than half the day
Bright -	diffuse sunshine, maybe some direct sunshine
Bright Periods -	bright sky for more than half the day
Bright Intervals -	intermittent occurrences of a bright sky, too brief to be termed bright periods
Cloudy -	cloud almost or completely covering the sky
Dull -	a complete cloud cover.

Visibility

Visibility is defined as the maximum distance at which an object is clearly recognisable.

In forecasting, the following terms are used:-

Very good or excellent	-	over 30 miles
Good	-	5 to 30 miles
Moderate	-	2 to 5 miles
Poor	-	I to 2 miles
Mist or Haze	-	1/2 to I mile
Fog	-	400 to 1,100 yards
Thick fog	-	below 400 yards

RECORDING AND INTERPRETING SHIPPING FORECASTS

Simply to hear the shipping forecast, is enough to give you a good idea of what the weather intends to do and, given that the weather is not behaving in an ambiguous manner, that is, not changing rapidly over time; the forecast should help you decide to go or not to go on the ocean with your kayak. A lot more benefit can be gained if the whole of the shipping forecast is recorded and then listened to carefully. The Met. Office is forced to cram a lot of information in these five minute forecasts. You will have. heard the announcers hurrying up near the end in order to finish the forecast in time.

The first requirement is to be able to write down the essential details.

- any gale warnings in force
- the general synopsis
- the forecast for sea areas
- 'actuals' from coastal stations

It is best to use an Metmap (as per page 258) as this helps you to write down or tick off the details. These Metmaps can be obtained from: -

RYA,
Shaftesbury Road,
Gillingham, Dorset, SP8 4LJ

It is useful to devise some form of shorthand which will allow all the details to be recorded. There is an internationally agreed standard shorthand, to show weather map symbols and knowing this will help you make sense - or more. sense - of the bulletins posted up at harbour offices and other places.

Once the forecast starts concentrate on writing down the details - the interpretation comes afterwards. Remember that it is important to write down the times as given - the time of the forecast and the time at which the actual weather at coastal stations was recorded. It is easiest to construct your own weather map for the time of the actuals recorded. These are normally about two hours before the broadcast itself. These reports from coastal stations can be plotted directly onto the chart:-

wind strength
wind direction
atmospheric pressure

Wind is best indicated by arrows with one feather for each two Beaufort Forces - Force Five would show 2 1/2 feathers.

Next plot the information contained in the general synopsis, but with the movements of centres and fronts advanced by the time between the forecast and the actuals on the basis of the speeds given in the forecast. Finally, add the wind, weather and visibility forecasts for the various sea areas. Concentrate on the 'at first' forecasts if there are other predictions for 'later'.

Now you can start drawing in the ISOBARS. Use a pencil and be ready to amend. Start by joining up coastal stations with equal pressure, conforming to the general pattern indicated by whatever lows or highs have been given in the general synopsis. More isobars can then be added at suitable angles to the forecast wind directions over the open sea, and at spacings which conform to the geostrophic chart for the forecast wind strengths. Remember that at troughs or fronts the isobars should change direction.

It is largely a matter of trial and error but practice makes perfect.

Armed with such a weather map, especially one that you have drawn up yourself in this way, you should be in a much better position to understand what is happening to the weather in the area of particular interest to you. When interpreting the synoptic chart, do remember that local variations such as sea and land breezes will not be shown on any such chart, but will likely have greater effect on you than the much wider overall weather pattern. So, off large headlands or in rivers or estuaries allowance must be made for significant changes in wind speed and direction. The wind can also be greatly affected by purely local cloud conditions.

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