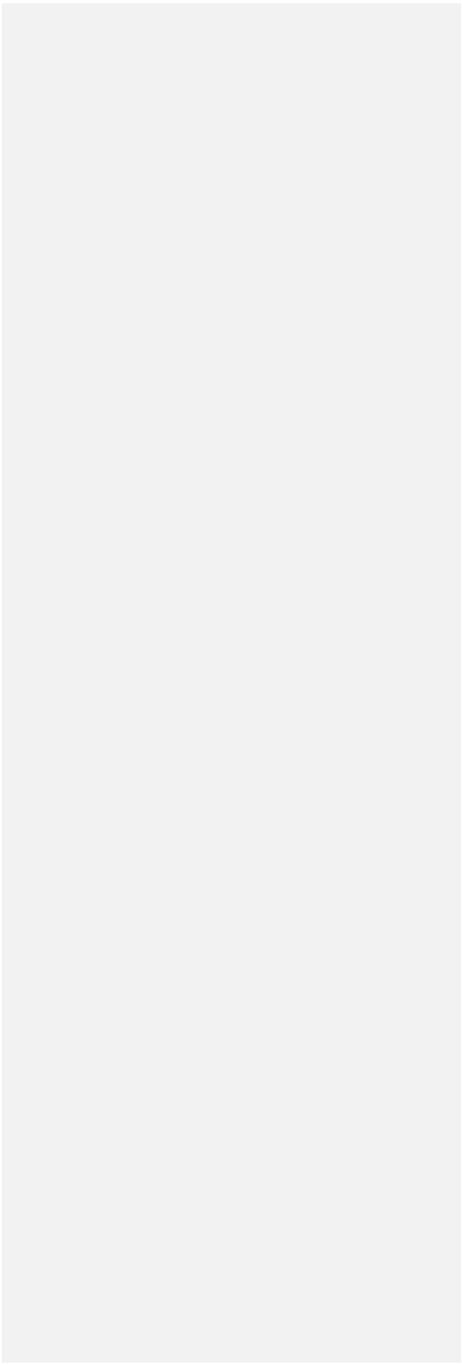




Basic Cloud Forecasting

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Introduction

There are dozens of different cloud types, and one could spend hours on the simple skill of identifying various cloud types. However, not every cloud has the same priority in terms of weather forecasting. A few specific cloud types have significant forecasting value to the onboard forecaster. This tool will discuss the two most significant clouds for sailors: **Cirrus and Cumulus**.

NOTE: Are you having trouble figuring out whether clouds are following a clockwise and counterclockwise pattern from your vantage point onboard a vessel? The [Perspective](#) tool will help you understand this once and for all.

Cirrus Clouds

When combined with other clouds, Cirrus clouds often foretell the approach of:

- storm centers,
- thunderstorm cells, and
- high pressure centers.

Cirrus clouds typically do not have an immediate effect on surface wind direction and speed. Rather, they are longer-range indicators, unlike convective clouds (Cumulus) that imply an imminent change to conditions. Cirrus clouds are often located some distance away from a cold or warm front. The time it takes for the front to get to you will depend on the front's speed and direction – factors which can be partially determined by looking at animated satellite imagery.

- If the front is moving towards your position, the high altitude streaky clouds may indicate that a front will be near you in a day or perhaps even less.
- If the front is moving at an angle to your position – not moving directly towards you – the front may actually not reach your position for a couple of days or more.
- If the front is moving parallel to your position, you may never experience the front, despite the fact that you see the high altitude Cirrus clouds.

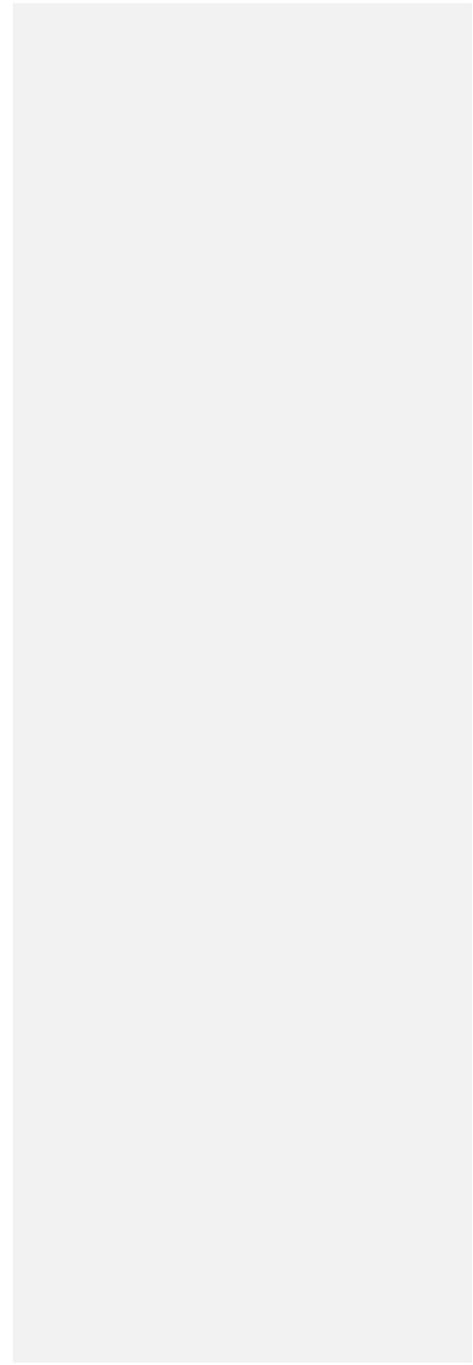
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Action	Explanation
Identify Cirrus clouds.	<p data-bbox="590 391 1461 440">Below are a few common Cirrus clouds. For more examples and descriptions, refer to any of the following websites:</p> <p data-bbox="590 464 1016 513">Australian Severe Weather: <a data-bbox="590 492 1016 513" href="http://australiasevereweather.com/photography/">http://australiasevereweather.com/photography/</p> <p data-bbox="590 540 1024 589">NOAA: <a data-bbox="590 568 1024 589" href="http://www.photolib.noaa.gov/nws/clouds1.html">http://www.photolib.noaa.gov/nws/clouds1.html</p> <div data-bbox="590 634 1228 885"></div> <p data-bbox="590 917 1549 966">Cirrus clouds are at about the height of the jet stream. Due to the cold temperature, they are made up of ice crystals.</p> <ul data-bbox="632 971 1549 1079" style="list-style-type: none">• Cirrus clouds are much brighter and lighter than lower clouds because of the higher reflectivity of the ice crystals.• Cirrus clouds are solid looking and clearly defined, again due to their composition of ice crystals.• Cirrus clouds do not normally have shadows.

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Action	Explanation
Determine whether there are other types of clouds as well.	<p data-bbox="590 396 1547 467">There are some old sayings and “wives’ tales” that would have you believe that “Mare’s tails and mackerel scales: soon you’ll shorten sails.” This saying indicates that these Cirrus clouds usually portend the arrival of foul weather.</p> <p data-bbox="590 496 1507 597">Cirrus clouds alone are generally associated with fair weather. However, if they are followed by a sequence of lower and thicker clouds, they are often the forerunner of rain or snow such as in an approaching warm front. When only Cirrus clouds are visible, there will usually be a period of fair weather of 12 to 24 hours. It usually takes that long for the rest of the lower-level weather to catch up.</p>

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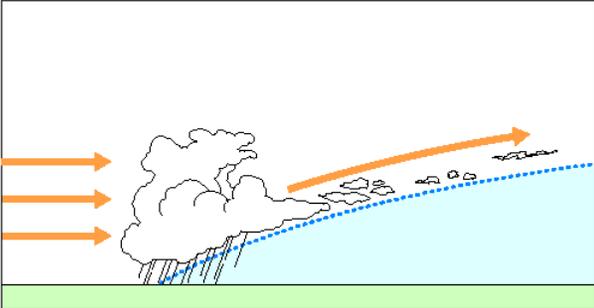


Action	Explanation
Observe the direction of cloud movement .	<p>Cirrus clouds indicate the direction of upper atmosphere wind – at the level of the jet stream. These winds are indicated by the contours of a 500 mb weather chart.</p> <p>Before you start reefing your sails, you need to consider which way the clouds are actually moving, and therefore the direction from which the upper atmosphere winds are coming. Without a 500 mb weather chart, observing the movement of Cirrus clouds can give you hints about the speed and direction of upper atmosphere winds.</p> <p>As with any other object you encounter while sailing, you can take bearings on the cloud as it approaches. If it is gaining or losing bearing, you know that it will pass either in front or astern of you. If it is maintaining bearing, you are on a “collision course” with the cloud, and your respective paths will intersect. The best way to determine the direction a cloud is moving is to use a handheld compass. Don’t use other clouds as reference points because both clouds may be moving at different speeds and different directions.</p> <p>Since Cirrus clouds are so high (18,000 ft or so), you can detect movement only from rapidly moving Cirrus clouds pushed by strong upper atmospheric wind. Cirrus clouds need to be moving at least 80 to 100 knots to see them move. If you can see them move, it is a good indication that a strong system is on its way. If you can’t see it more, it may indicate a weaker system. Also, look at the cloud shape. Cirrus clouds with mare’s tails, prominent wave patterns, or ragged formations will indicate the presence of strong winds aloft.</p> <ul style="list-style-type: none"> • Be sure you are looking at the cloud movements, not the cloud orientation. Cirrus clouds may band or streak perpendicular to the wind flow. • If the Cirrus band is moving perpendicular across your track and to your rear, you may never encounter the heavier weather of the front. • If the Cirrus band is moving in your direction, you’re probably in the path of the storm track. • Use the entries in your ship’s log to track the direction of the cloud movement as well as the barometric pressure and wind direction changes. <p>Even if you are watching the cloud movements and determining which way they’re moving, keep in mind that although upper atmosphere air currents can help you determine the direction of the surface weather features, they are not always a “sure sign”. The best method is to compare your observations to a surface or upper atmosphere weather map.</p>

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Action	Explanation
<p>Determine direction of movement of upper atmosphere wind by cloud shape.</p>	<p>Can you tell the direction of travel of upper atmospheric air mass by looking at the shape of Cirrus clouds? You can, to some degree.</p> <p>Wind blowing across clouds makes ripples or waves similar to the way wind makes waves as it blows across water, or desert sand for that matter. The direction of the wind is perpendicular to these waves. Cirrocumulus, dense Cirrostratus and Altocumulus clouds prominently display these waves.</p>  <p>In other cases, the clouds are blown into bands or streets that are parallel to the direction of the wind.</p>  <p>Determining wind direction from mare's tail Cirrus clouds is a bit more difficult. The mare's "tail" (fall streak) is caused when the ice crystals of the Cirrus clouds fall to a lower level with a slower wind speed. The wind is blowing in the direction of the head of the cloud.</p>

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Action	Explanation
<p>Determine if a warm front is approaching.</p>	<p>Cirrus Clouds can foretell the arrival of a Warm Front associated with Low Pressure systems: they are the first, telltale signs.</p>  <p>An approaching warm front has a distinct sequence of clouds.</p> <ol style="list-style-type: none"> 1. Appearance of Cirrus cloud in a clear sky, or a sky with fair weather Cumulus clouds. 2. Appearance of ring or halo around the sun indicating a layer of cirrostratus cloud. 3. “Thickening” of Cirrus into denser cirrostratus or Cirrocumulus clouds. 4. Appearance of lower clouds– altostratus, then stratus. 5. Altostratus becoming nimbostratus and start of rain. Rain is steady and light. 6. Continuation of rain until the arrival of the actual Warm Front. <p>This sequence will take 12- 24 hours from the first appearance of Cirrus clouds but ultimately it is dependant on how the front is moving relative to your own position. If the front is moving parallel to your position, it may never get to you. The beginning of the rain marks the approximate halfway point between the appearance of the Cirrus clouds and the arrival of the Warm Front.</p> <p>The barometer will steadily drop throughout this process. As the Warm Front approaches, the wind will veer suddenly and the wind may become gusty. After the Front passes, the wind speed and direction should remain constant.</p>

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Action	Explanation
<p>Determine if a cold front is approaching.</p>	<div data-bbox="625 397 955 771" data-label="Image"> </div> <p>A Cold Front typically follows a Warm Front. Cirrus clouds also can precede a cold front. The clouds that indicate the more imminent arrival of a cold front are cumulonimbus clouds and will be discussed next. The warm sector between a Warm Front and a Cold Front usually consists of patches of Stratocumulus clouds. The warm sector often has light, scattered showers with steady wind and barometric pressure.</p>
<p>Determine if an occluded front is approaching.</p>	<div data-bbox="604 982 949 1128" data-label="Image"> </div> <p>An approaching occluded front looks very similar to a stationary front with the notable exception that a stationary front has little or no movement between the air masses as its name implies. .</p> <p>In an occluded front, a cold front has overrun a warm front. The air mass from the earlier cold front has “squeezed” the warm air aloft. Usually there is very unsettled weather: rain of varying intensity but relatively calm winds.</p>

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Action	Explanation
Use satellite imagery to locate Cirrus clouds.	When analyzing satellite imagery, it's often a good idea to consider what weather forecast maps are telling you as well as the clouds. Using them together, you can get a better understanding of what is about to happen. For more information, refer to the How to Read a Satellite Image tool. Note that Cirrus clouds are relatively "wispy" and don't show up well in satellite images.

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Cumulus Clouds

Small, low altitude Cumulus clouds are often called “fair weather clouds.” They’re the small cotton ball-like clouds that might be associated with the tradewinds or skies following the passage of a cold front. However, as they imply an unstable air mass (warm air rising and mixing with cooler air aloft), they may develop into Cumulonimbus, or thunderstorm clouds. These larger Cumulus clouds may be the most important cloud type to recognize because they can cause rapidly shifting winds and sudden squalls and require the utmost respect. As squalls are difficult to forecast, and thus are rarely identified in weather maps and forecasts, identifying these clouds is critical.

All Cumulus clouds imply unstable air. This differs from stratiform clouds (flat layers of clouds) that imply stable air.

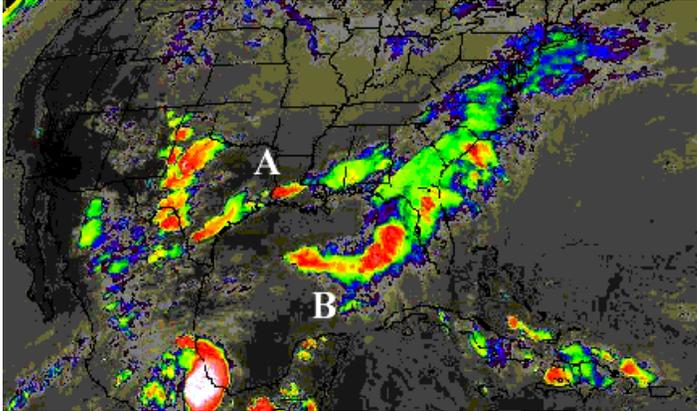
Examples of Cumulus clouds:



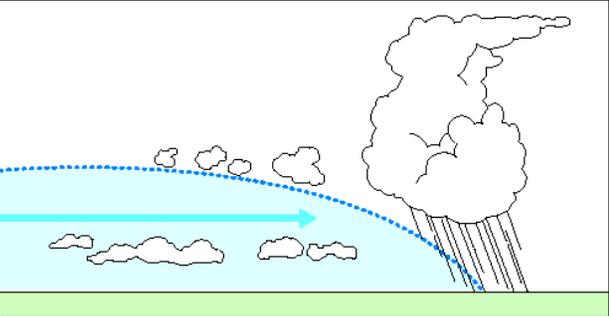
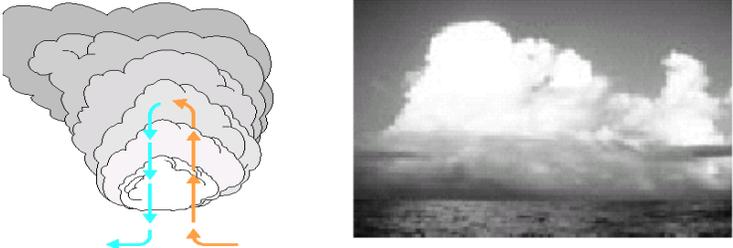
Example of Cumulonimbus cloud:



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ACTION	EXPLANATION
<p>From forecasts, weather maps, and satellite images, determine the likelihood of an approaching Cold Front or squall.</p>	<p>Cumulonimbus clouds can be associated with an approaching cold front, or can be independent of a pressure system. Weather forecasts and maps that indicate the approach of a cold front will prepare you to watch out for the telltale Cumulonimbus clouds.</p> <p>If you're preparing to go sailing, check out IR satellite images, radar images and surface analysis maps to determine if a cold front or Low Pressure system will travel in your area. Using them together, you can get a better understanding of what is about to happen. By looping satellite or radar images, you can estimate when the tall, cold clouds will get to you. Satellite and radar images will show squalls clouds (Cumulonimbus) whether associated with a cold front or independent of one.</p>  <p>This is an infrared satellite image. "A" identifies a Cold Front and the tall, cold clouds associated with it. "B" identifies a squall line with its tall, cold clouds. Both of these imply potentially gusty or even possibly dangerous weather conditions.</p> <p>For more information, refer to the How to Read a Satellite Image tool.</p>

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ACTION	EXPLANATION
	<p>Cumulonimbus clouds associated with an approaching Cold Front will appear along the cold Front border.</p> 
<p>At sea, observe the shape of the Cumulus cloud.</p>	<p>The visual indications that a Cumulus cloud is developing into a threatening cumulonimbus cloud include:</p> <ol style="list-style-type: none"> 1. vertical development (height from base to top) 2. ceiling (distance from sea level to base of cloud) 3. color (the darker, the more threatening) <p>In general, the worst combination is a very tall, low, and black Cumulus cloud.</p> 

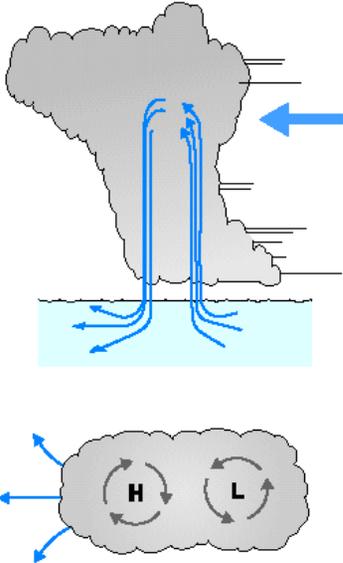
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ACTION	EXPLANATION
Determine if the cloud is billowing and actively growing	<p>As the cloud gets closer, you may see that the cloud is billowing and looks like it is “boiling.” The billowing action implies that the cloud is actively growing – there is warm, moist air rising, cooling, and condensing. Eventually, the cooled, condensing air will begin to descend, creating gusts and downbursts at the bottom of the cloud.</p> <p>Look carefully at the vertical size of the cloud. If the vertical height of the cloud is becoming greater than the distance between the sea level and the bottom of the cloud, it usually indicates that a Cumulus cloud is developing into a Cumulonimbus cloud.</p>
Look at the top of the cloud	<p>Sometimes a tall, Cumulonimbus cloud will have a flat, anvil headed top. If the cloud is very tall and the top is flat, expect a brisk downdraft causing gusty and shifty winds. The implication is that the upper atmosphere wind is blowing the cloud top off, creating an increase in the ventilation at the top of the cloud. This increases the rate of cooling at the top. As the rapidly cooled air suddenly descends, it creates gusts and downbursts at the bottom of the cloud.</p> 
Determine whether the cloud is vertically “even” or “tilted.”	<p>Sometimes, the tilted nature of the cloud implies that there is a convective path within the cloud and that upper altitude winds are moving and cooling the cloud top at an accelerated rate. If the line of clouds is uneven and tilted, there is probably good convection inside the cloud indicating wind underneath.</p>

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ACTION	EXPLANATION
Determine if the cloud is producing rain.	<p>There can be a correlation between rain and wind in Cumulonimbus squall clouds. When these clouds “let go,” the strong downburst winds and heavy rain often come together. Before the rain, the clouds are drawing wind into their bases. After the rain starts, the winds fan out from their bases.</p> <p>With practice you can detect whether an approaching cloud is producing rain. If there are streaks underneath the cloud, there may be rain under the cloud. Confirm that the streaks are rain and not just shade. Figure out where the sun is located and make sure that the streaks aren’t merely streaks of light coming through the cloud.</p>
Notice if the streaks are slanted (wind) or straight up and down (little or no wind).	<p>Rain under a cloud does not always imply wind. But if the rain is slanted, it either implies that there is wind under the cloud or that the cloud is moving, dropping rain as it moves along. In either case, there is probably some wind under the cloud.</p> <p>Check to see if the cloud is moving. Sometimes, the slant is caused by upper air currents pushing the cloud along, but with little wind under the cloud.</p> <p>If the slanting rain has several different directions to the slanting, you know that there is a circulation system that has set up under the cloud. Winds under the cloud will be confused and gusting as the cloud has set up its own circulation, high and low pressure regions, and areas of calms and gusts.</p>
Watch the color of the water’s surface under the cloud.	<p>Sometimes you can determine if there is wind by noting the coloration of the water’s surface. If it is darker than in other surrounding areas, the darkness could just be shade. However, it may also be a result of wind blowing small wavelets across the water, making the water appear darker. A clue to differentiate between the two options would be the sun. Where is it located relative to the cloud? Could the darkness be shade or is it in sunshine and due to an increase in small waves?</p>
As the cloud becomes closer, look for an increase in small wind-driven waves and whitecaps.	<p>As the cloud becomes quite close, you’ll see an increase in whitecaps on the surface of the water. That, of course, is assuming that you’re in daylight. You probably won’t see them at night. The presence and increase of the whitecaps is definite proof that you will have an increase in wind. By this point, however, you will be prepared to deal with the conditions if you’ve been alert to the approach of the cloud and paying attention to the above indicators.</p>

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ACTION	EXPLANATION
Plan your approach to the cloud	<p>Depending on the type of sailing that you're doing, you may be able to modify your course to optimize your encounter with the cloud. If you are day racing and approaching the top mark, you may not have too many options left, but if you are cruising or involved with a distance event, you may be able to alter course.</p> <p>With both high and low pressure centers under a cloud, the worst position for a sailor is directly under the cloud as it can be a mixture of gusty, shifty and calm wind. If there is convection, there will be gusting and shifting wind directions under the cloud. Often there will be completely calm patches and occasionally 180-degree wind shifts. Generally, avoid a path directly under the cloud. On a delivery or cruise, it may be prudent to turn the engine on, perhaps leaving it in neutral, if it is impossible to avoid going directly under the cloud.</p> 

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ACTION	EXPLANATION
	<p>In more cases than not, such clouds will have more wind in front of them than behind them as they travel over the surface. If you're racing, you may want to take advantage of the increase in wind, but that will require a degree of caution and care. It's not a decision to be made lightly. Usually, going behind the cloud is the safest option. There's much less chance of getting engulfed in the chaos underneath the cloud, and winds are generally lower, reducing the risk of damage.</p> <p>On occasions when the clouds are on line or they are otherwise unavoidable, you may see light through the rain on the other side of the cloud. You may realize that there is a "thin spot" in the cloud, and you might be able to sail toward that area so that your time under the cloud is minimized.</p> <p>For boats equipped with radar, you may "see" through the rain and locate the quickest route through the rain to the other side. Remember that radar on boats doesn't tell you about the wind – only the rain. There still can be gusting or downbursts even in areas with relatively little rain. In those cases, getting away from the entire system may be the best alternative.</p>
	<p>Offshore racing sailors often attempt to ride in front of a cloud in order to run in a strong breeze. Since clouds often form at night, the best rides may be in the very early hours of the morning. However, be aware that the same cloud may evaporate at daybreak. As the cloud breaks down and evaporates, often the only thing remaining when the cloud is gone is a very calm patch with no wind. If you're riding the cloud, make sure you get away from the cloud at daybreak.</p>
	<p>When crossing a line of clouds, if there is a reduction of wind on your approach to the line of clouds, there are often increases in wind on the other side of the clouds. So, as you go under a cloud line, consider the conditions you initially encounter, and prepare yourself for the reverse of those conditions on the other side of the cloud line.</p>

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