Tide Simplified

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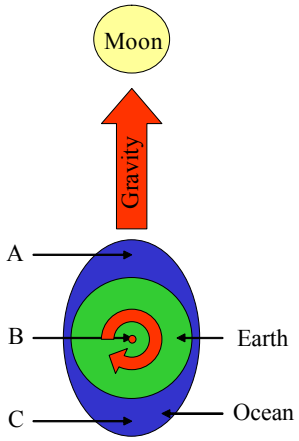
Tide is one of those areas that the more you learn about it, the more you realise you don't know. As sea kayakers, and not necessarily scientists, we don't have to know every detail but a simplified understanding can help us to understand and predict what we might expect to see when we are out on the water. In this article we look at the areas of tide you need to know about without having to look it up in a book.

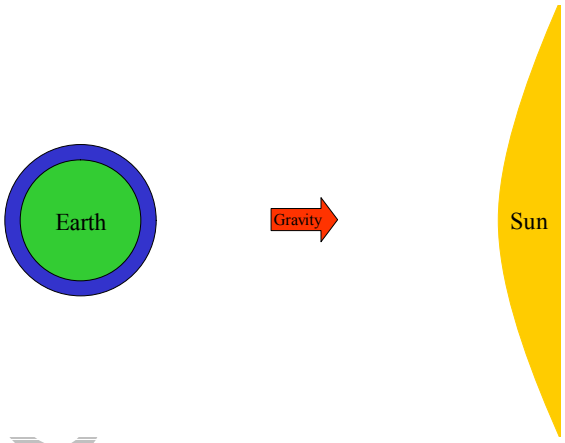
Causes of tides

To understand tide is convenient to imagine the earth with an envelope of water all around it, spinning once every 24 hours on its north-south axis with the moon on a line parallel to the equator.

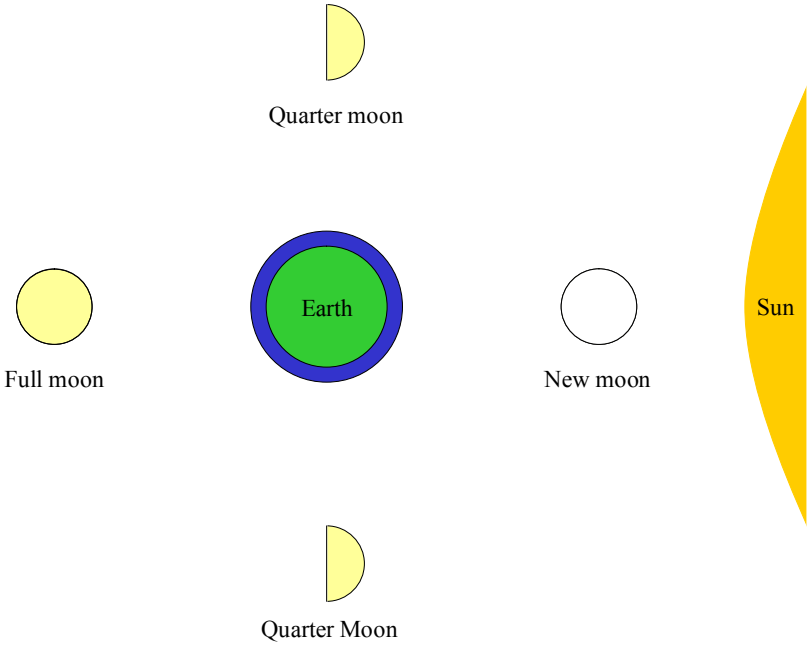


The tides are primarily caused by the gravitational attraction of the moon. Simplifying a bit, at point A the gravitational pull is the strongest causing a high tide, point B experiences a medium pull towards the moon, while point C has the weakest pull causing a second high tide. Because the earth spins once every 24 hours, at any location on its surface there are two high tides and two low tides a day. There are approximately six hours between high tide and low tide. One way of predicting the approximate time of high tide is to add 50 minutes to the high tide of the previous day.

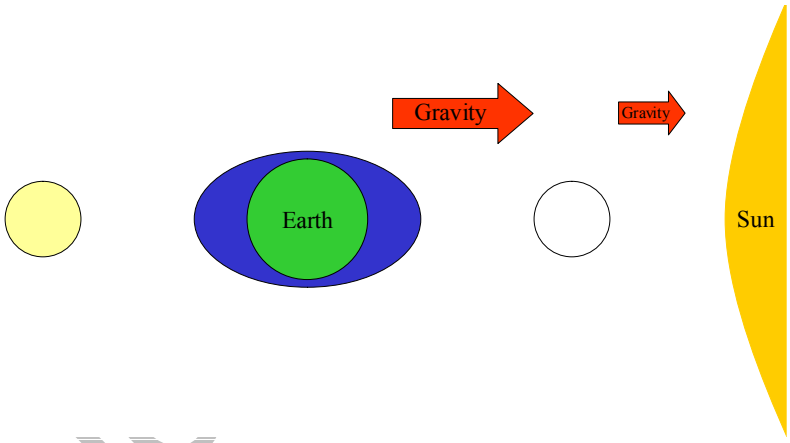
The sun has a similar but weaker gravitational effect on the tides. On average this is about 40 percent of that of the moon. The main importance of the sun is the effect of either reinforcing the moon's force or reducing it depending on their positions relative to each other.



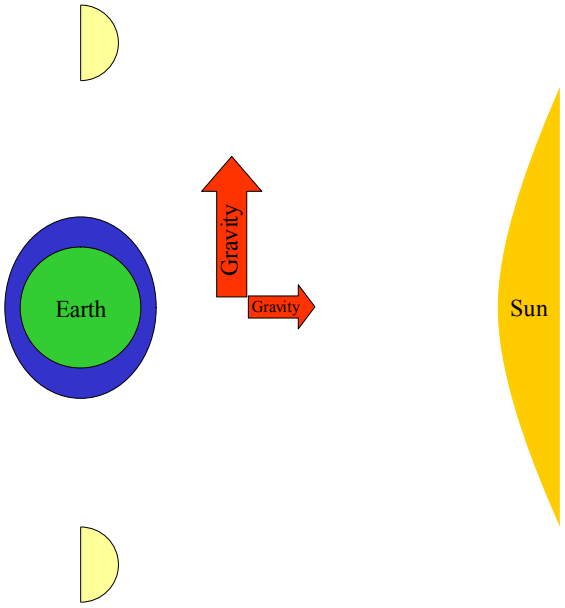
The moon orbits around the earth once every lunar month or 29 ½ days, this changes its position in relation to the sun. You can tell where the moon is in relation to the sun by its phase.



When the sun and moon are in line with each other both their forces work together to create spring tides. Spring tides have higher ‘high water’ and lower ‘low water’ (i.e. the greatest range). The word spring is derived from the Norse word sprungen, meaning big.

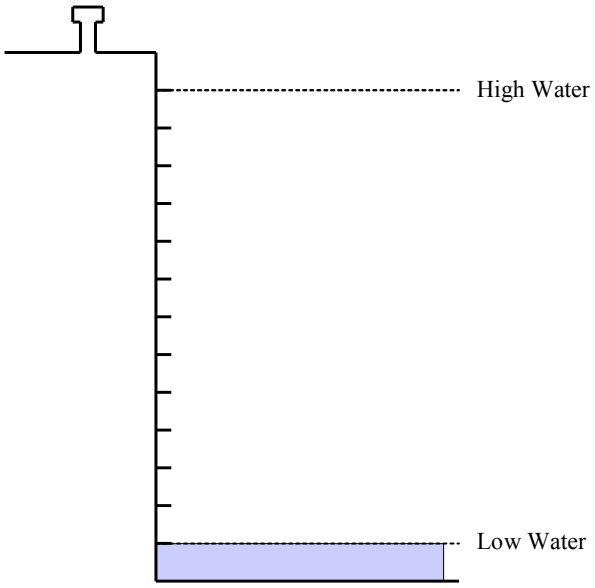


Neap tides occur when the sun and moon's forces oppose each other. They have lower 'high tides' and higher 'low tides' (i.e. the smallest range). There are two spring tides every lunar month and two neaps. There are approximately seven days between springs and neaps. The spring and neap tides lag the lunar phase by approximately two days (i.e the spring tide is two days after the full moon).

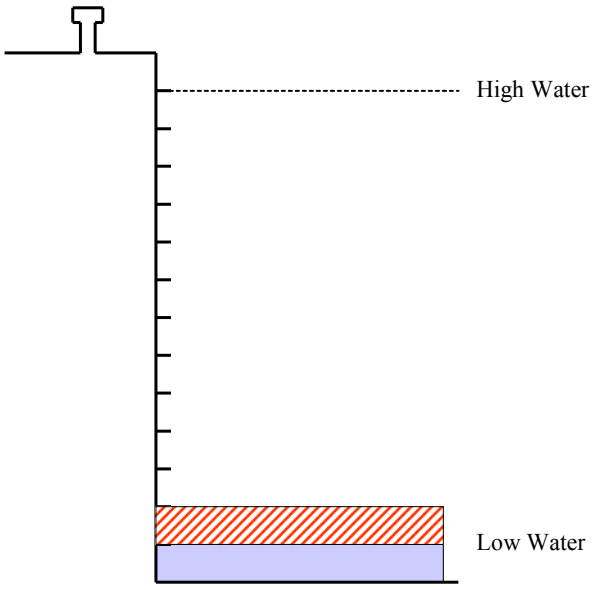


Rate of vertical tide movement

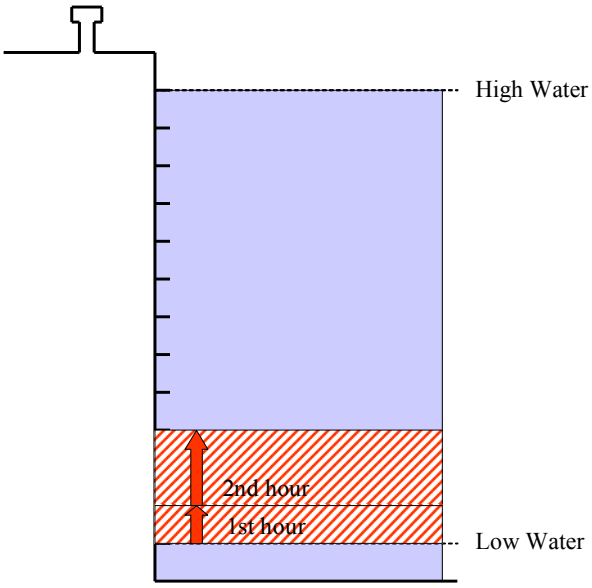
The following diagrams depict a dockside with a ladder with twelve rungs running up its side. Starting from low tide we will look at the rate the tide rises over the six hours till high tide.



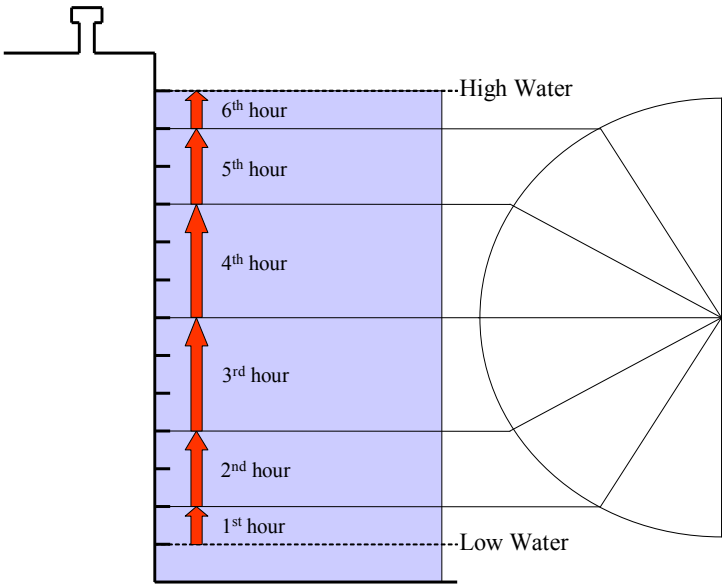
In the first hour the tide rises one twelfth of its overall range.



In the second hour it rises two twelfths on top of the twelfth it has already risen.



In the third, three twelfths. In the fourth, three twelfth, the fifth, two twelfths and the sixth, one twelfth. The cyclical nature of this cam be shown by imagining a clock hand moving through the hours alongside the diagram.



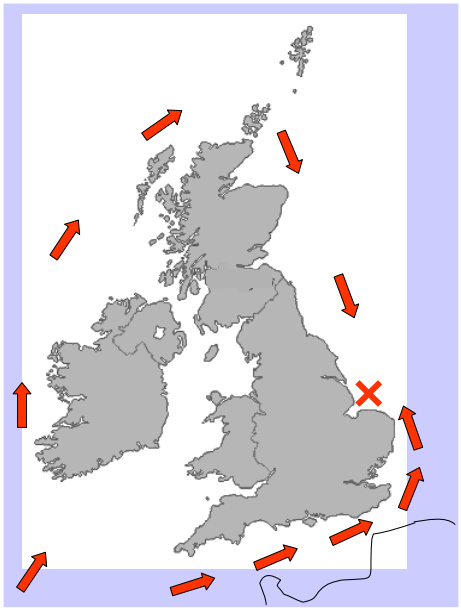
This is called the 'Rule of Twelfths'. Once the tide reaches high tide it starts to drop in exactly the same way. The two important points to note are that in the third and fourth hour there is a lot of tidal movement, and in the first and sixth hour there is very little.

Rule of 1/12ths

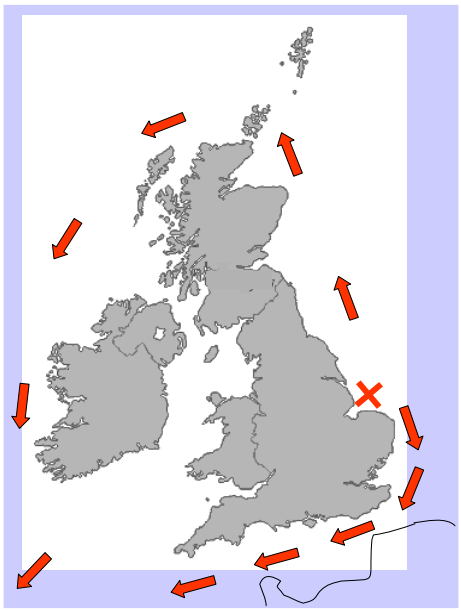
Time since low water	Water level rise
1st hour	1/12th
2nd hour	2/12th
3rd hour	3/12th
4th hour	3/12th
5th hour	2/12th
6th hour	1/12th

Direction and rate of tide streams around the UK

When the moon causes high tide water has to flow in from elsewhere to make up the extra volume of water. This diagram is a very simplified version of the direction the flood tide streams around the UK. The flood tide is the rising tide from low water to high water. Each arrow approximately represents one hour of movement.



The ebb or dropping tide flows in the opposite direction.



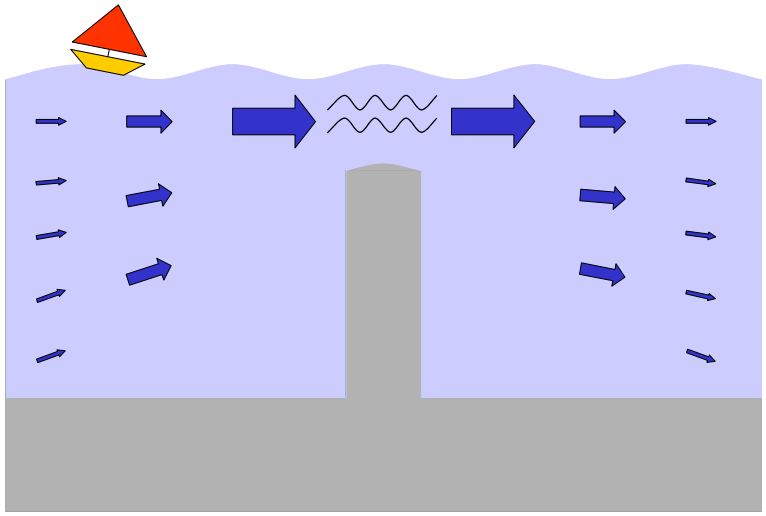
The rate of flow of tide streams during a tidal cycle is roughly calculated using a couple of different rules. The 'Rule of Thirds' is taken directly from the 'Rule of Twelfths' and calculates the average flow for each hour and the '50/90 Rule' calculates the flow at the end of each hour after slack water. Both require that you know the maximum rate of flow for the location.

Rules of thumb for rate of flow

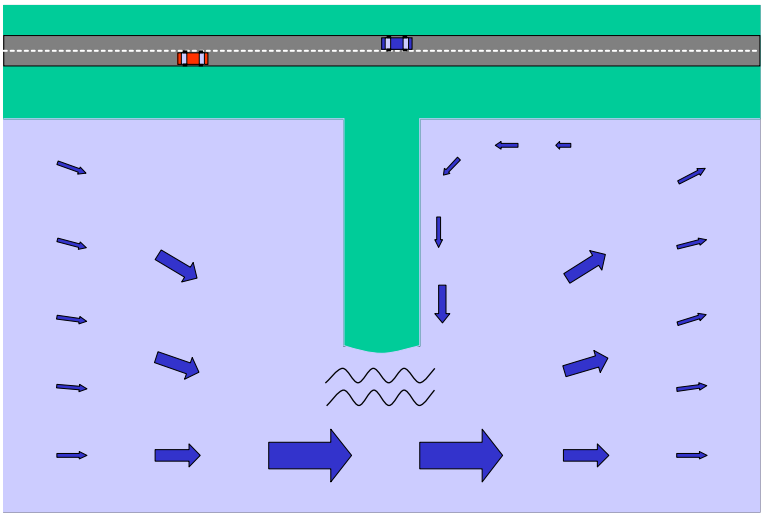
	Hours after slack	1	2	3	4	5	6
Rule of Thirds	Thirds of max rate	1/3	2/3	3/3	3/3	2/3	1/3
	Speed in Knots	1	2	3	3	2	1
50/90 Rule	Percentage of max rate	50	90	100	90	50	
	Speed in Knots	1.5	2.7	3	2.7	1.5	

Tide races and overfalls

When the tide flows along the coast and comes across an obstacle that constricts its flow it speeds up as it goes around or over the obstacle. If it goes over the obstacle it is called an overfall.



If it goes around the obstacle it is called a tide race. In practice a tidal race is often also an overfall as the sea bed around a headland or island tends to be shallow. An eddy (area of still water) or back eddy (area of water flowing against the main flow) will often form behind the obstacle.



Theses areas of fast flowing water can potentially form waves and rough water. We will look at this in more detail in the next article, ‘Playing in Tide Races’.