



Tides around New Zealand

This fact sheet discusses tides around New Zealand, and how they influence sea level.

The sun, the moon and the sea

Tides are generated by gravitational forces exerted by the sun and moon on the oceans. Once the open ocean tides reach estuaries and harbours, they are modified by:

- *wave shoaling*, where shallower water causes the wave to slow down and increases the tide range
- friction from the seabed and constrictions such as estuary entrances, river mouths and straits.

New Zealand's tides are *semi-diurnal*. That is, on most days, two high and two low tides will occur. One complete cycle of a high and a low tide happens on average every 12 hours and 25 minutes. Tides can be predicted for many years in advance.

The greatest differences between high and low waters happen around full and new moons, and are known as *spring tides*. A *spring tide* happens every two weeks, when the Earth, sun and moon are nearly aligned. A *perigean spring tide* occurs three or four times a year when a spring tide coincides with the moon being at its closest point in its orbit around the Earth.

The size of spring tides varies around New Zealand, reaching 3.5–4 metres on the west coast, but only 1–2 metres on the east coast (figures 1 and 2).

The smallest difference between high and low tides happens just after the first and third quarters of the moon, and are known as *neap tides*. The *Foxton tide*, in figure 2, shows the spring-neap-spring tide cycle that occurs approximately every fortnight.

Mean high water spring

Mean high water spring (MHWS) describes the highest level that spring tides reach, on average, over a long timescale – often 18–20 years. The highest visible line of seaweed, driftwood and other marine debris that gathers on a shoreline over a year is generally a good indicator of MHWS.

While MHWS sets the boundary for coastal planning, defining just where it lies can be complicated, as there are a number of

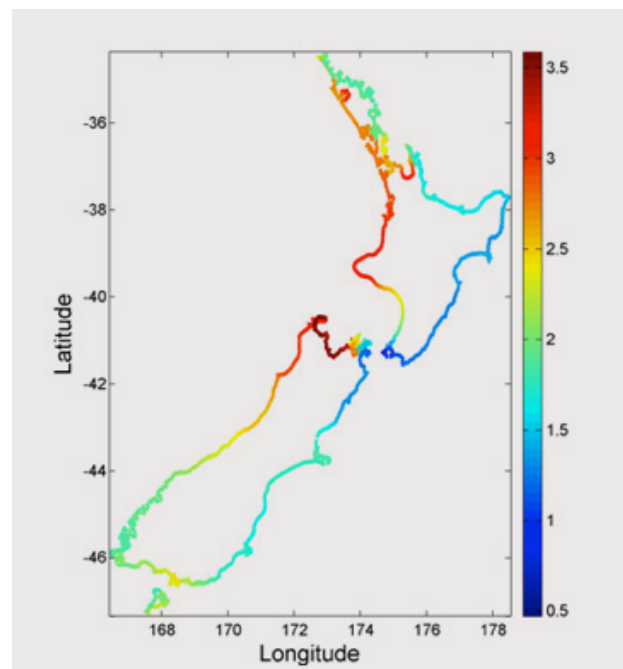


Figure 1: Spring tide range (in metres) around the coast of New Zealand.

Source: NIWA

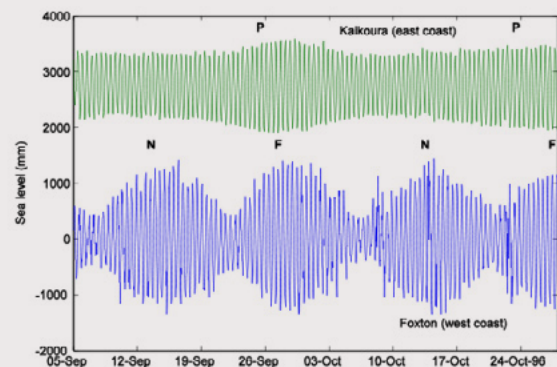


Figure 2: Comparison of tide characteristics between Kaikoura (east coast) and Foxton (west coast). P= perigee, N= new moon and F= full moon.

Source: NIWA

different ways to do so. A commonly used nautical definition calculates MHWS as, 'the long-term average of the highest spring tides that occur around every new and full moon'. Normally, only about 10–15 per cent of all high tides exceed the nautical definition for MHWS. One exception is those along New Zealand's central–eastern coasts. For example, at Kaikoura (see figure 2), nearly 43 per cent of high tides exceed the nautical MHWS level.

This is because the sun's influence on tides along the central and eastern coasts is relatively weak, and creates only a small difference between their fortnightly neap and spring tides. The higher tides peak just once a month (about every 27.5 days), when the moon's elliptical orbit is closest to the Earth – known as the *lunar perigee*.

King tides

The largest of the high tides cluster around dates when a full or new moon coincides with the moon in its perigee. These peak approximately every seven months and are known as perigean-spring tides, or *king tides*. They can be predicted and publicised well ahead of time. If bad weather coincides with these red alert days, the likelihood of coastal flooding in low-lying areas greatly increases. This is described in more detail in fact sheet 2 of this series, which covers coastal flooding due to storms.

Tide prediction resources

Official tide predictions at standard and secondary ports in New Zealand are available at: www.linz.govt.nz/sea/tides/tide-predictions.

Open coast and exclusive economic zone tide predictions for up to one month at any location around New Zealand, for any time period since 1830, are available at: www.niwa.co.nz/services/online-services/tide-forecaster.

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