Ministry for the Environment
Manatū Mō Te Taiao

FACT SHEET 6

This is one of a series of fact sheets developed to accompany *Preparing for coastal change*, and provide further information on elements of coastal processes.

Waves

This fact sheet provides additional information on **waves** *around New Zealand.*

What makes a wave?

Waves around New Zealand's open coast are generated from two sources (that often coexist):

- locally generated waves are caused by winds blowing over open water – from tens to hundreds of kilometres. The distance of continuous open water is known as the *fetch*. Long fetches allow the wind to build up larger waves
- distantly generated waves (swell), formed in the Pacific Ocean or Southern Ocean.

Waves are defined by three things:

- *significant wave height* (H_s) – the average height of the highest 33 per cent of waves over a certain period, measured in metres (m). See figure 1
- *wave period* (T_m) – the average time between successive waves, measured in seconds (s)
- *wave direction* – south (S), north (N), east (E) or west (W), or combinations of these – for example, W–SW

Different waves for different coasts

The ocean around New Zealand can be divided into four major zones, each with different wave conditions. Each zone exposes New Zealand's open coasts to different waves:

- *south-facing coasts (Fiordland to Catlins, South Island):* an extremely high energy wave zone (mean H_s = 3–4 m; T_m = 10–12 s; SW–W). Waves are typically steep, indicating a zone of active wave generation, but also contain a sizeable swell component from the Southern Ocean
- *western New Zealand coasts*: a high energy wave zone (mean H_s = 2–3 m; T_m = 6–8 s; SW–W). The waves are steep and respond to the regular passage of weather systems across the Tasman Sea
- *eastern New Zealand, up to East Cape*: a moderate to high energy wave zone (mean H_s = 1.5–3 m; T_m = 6–9 s; S). Sheltered from prevailing westerly winds by the New Zealand land mass, but exposed to southerly winds and swell. Wave steepness is variable, indicating a mixture of swell and wind sea[1].
- north-eastern North Island (East Cape to North Cape): a low energy lee shore (mean Hs = 1–2 m; Tm = 5–7 s, N–E). Wave steepness is variable. Highest waves occur during extropical cyclones, or as swell that is generated by distant Pacific cyclones to the north-east of the North Island.

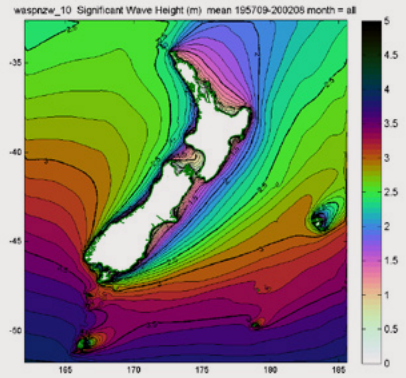

Figure 1: The 45-year average of the significant wave height (Hs) in metres around New Zealand, based on a deep water wave model. *Source: NIWA*

In estuaries and harbours, waves are mostly generated by local winds, and their height is limited by the fetch and the depth of water. Wind waves in estuaries and harbours can still cause erosion and flooding hazards, particularly during very high tides or storm tides.

1 Regional wave conditions which result from recent winds and are generated mainly in the direction of the wind, in contrast to swell.

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