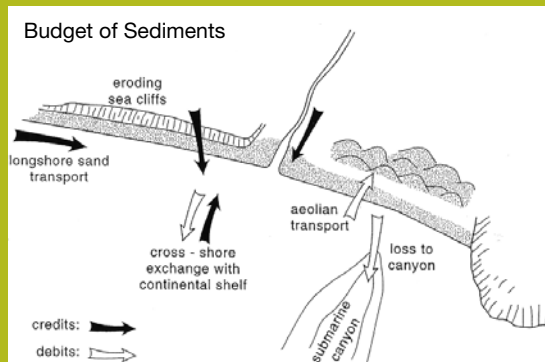




Coastal erosion



Typical sediment sources to nearshore coastal systems in New Zealand:

- longshore transport into area
- input from rivers
- wind transport onto beach
- erosion of sea cliffs upcoast
- onshore transport
- beach nourishment
- trapping of sand by dune vegetation.

Typical sediment losses from nearshore coastal systems in New Zealand:

- longshore transport out of area
- wind transport away from beach
- offshore transport
- abrasion
- sand mining.

Source: Komar, P 1998. *Beach Processes and Sedimentation*. Prentice-Hall Inc: New Jersey 544pp.

Coastal erosion becomes a hazard where human activity or settlement is threatened by a **temporary or permanent cutback of the shoreline**. Coastal accretion is the opposite, where the shoreline builds out over time.

Changes in the position of the coastline result from a complex interaction of different natural factors and processes, including:

- the interactions and influences of the driving processes eg, swell, waves, tides, storm surge, currents, storm sequences and the effect of climatic variability. Climate change may have an effect on each of these processes
- the characteristics of the coastal margin (eg, beach and barrier type, sediment characteristics, geological controls, such as headlands and islands) – and how these characteristics respond to, and interact with, the driving processes. For example, spits are often extremely unstable and prone to large changes in the position of the coastline
- the rate and relative balance of sediment supply and losses to coastal margins (see figure on left)
- tectonic factors influencing coastal uplift or subsidence.

Because there are so many factors involved in coastal erosion, shoreline change from sediment 're-distribution' within a nearshore beach system will not be consistent year after year in the same location.

Erosion and accretion can occur in a cyclic pattern ranging in timeframes from seasonal up to several decades (particularly on sandy coastlines). They can also occur in a series of episodic steps related to storm events. There may be little change for many years and then rapid cutback may occur during a storm, or sequence of storms. Over short distances of coast the patterns of erosion and accretion can vary, producing erosion hotspots linked to the occurrence and movements of nearshore sand bars.

There is a wide range of timescales over which coastal erosion occurs, ranging from individual storms, through annual and El Niño cycles, up to long-term retreat at decadal or century scales. Therefore, normal practice is to deal with erosion on two timescales: *short-term fluctuations* (days to a few months, including storm cutback) and *long-term trends* (seasonal to decades or centuries).

The complexity of processes related to coastal erosion means that it is very difficult to estimate future coastal erosion at a specific locality without adequate data and historic information on shoreline position and changes.

TYPICAL RANGES OF COASTAL EROSION RATES		
	Storm response (short term)	Long-term erosion rates
Sandy beaches	Highly variable even within a locality and can be 10+ m during an extreme storm	Highly variable even in a locality but generally less than 5 m/yr
Spits	Extremely variable, with storm-related movements of 100+ m at the ends of unstable spits	Extremely variable, with storm-related fluctuations typically dominating long-term trends. Fluctuations can be of the order of 200+ m
Gravel	Can be up to 5–10 m during extreme storms, with stable periods between storms	Generally < 1 m/yr on average but can be 2–3 m/yr in more vulnerable locations, particularly where the land backing the gravel barrier is low-lying or where the longshore supply is interrupted
Estuarine shores	Highly variable, dependent on storm wave direction and timing with high tides. Changes can be of the order of 10s of metres during storm conditions but can vary substantially over short distances	Variable over short distances, with erosion tending to occur as a series of storm-related steps. On average, < 2 m/yr and up to 5 m/yr at some vulnerable locations, eg, where channels cut in
Cliffs	Highly variable depending on the geological characteristics and hydraulic processes. Negligible for hard rock cliffs but can be substantial on unconsolidated cliffs, particularly if landslipping also occurs	On unconsolidated cliffs, average rates tend to be up to 1–2 m/yr.

Human intervention can markedly alter natural coastal sediment processes through:

- catchment activities eg, land-use practices, urbanisation, dams, water abstraction (affects sediment supply from land sources via rivers and streams)
- dredging of tidal entrances and harbour channels (affects sediment movements within coastal systems)
- sand or gravel extraction from the coastal marine area (removes sediment from the nearshore system)
- coastal protection works eg, groynes, breakwaters, artificial reefs, seawalls (affects the natural movement and distribution of nearshore and beach sediments)
- beach nourishment (adds sediment to the beach and nearshore system)
- permanent modification of coastal margins eg, dune removal, vegetation removal or change, reclamations, waterways, wharfs and marinas (affects the natural movement of beach and nearshore sediments).