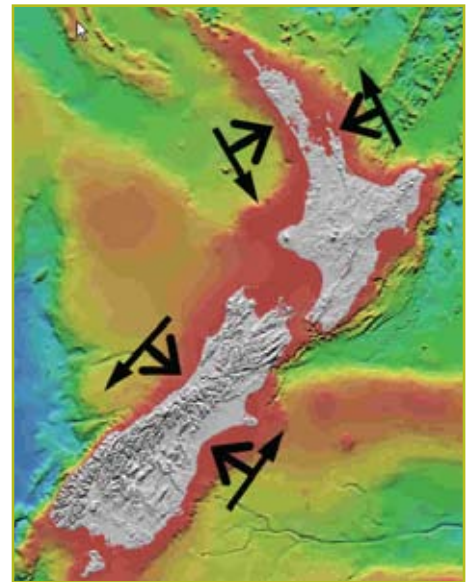




# Storm surge

Storm surges are temporary increases in ocean and estuary water levels associated with storm conditions that last a few hours to a few days. Storm surge is produced by a combination of two processes:

- low barometric pressure allows sea level in a region (100 km<sup>2</sup> or more) to rise above the pre-storm sea level. This is known as the ‘inverted-barometer’ effect and results in approximately a 1-cm rise in sea level for every 1-hPa drop in barometric pressure below the mean annual barometric pressure. In central and northern New Zealand, mean annual barometric pressure is about 1014 hPa; in southern New Zealand it is about 1012–1013 hPa
- strong persistent winds blowing either onshore or alongshore, with the coast on the left, cause water to ‘pile up’ against the coast.

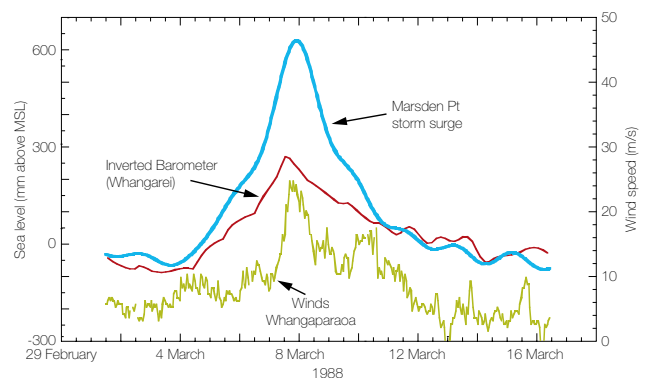


Alongshore and onshore wind directions around New Zealand that contribute to storm surge at the coast.

The mix of both the wind and inverted barometer effects can vary widely, depending on the track of the low-pressure system and the clockwise rotation of the winds around the pressure system. However, generally, the inverted barometer effect contributes at least 50 per cent or more to the storm surge height.

Storm surge height rarely gets larger than one metre on open coasts around New Zealand but it may be higher in certain estuaries and harbours. Hence, the coinciding of storm surge with high tide, and the spring-neap or perigean tidal cycle, is the dominant factor in determining whether a high storm surge will result in inundation problems.

Cyclone Bola, one of the most damaging cyclones to hit New Zealand in recent years, tracked southwards over New Zealand in early March 1988. At Marsden Point, the storm surge measured over 600 mm (blue line). At the peak of the storm surge, approximately 50 per cent was due to the inverted barometer effect (red line), with the remainder due to the influence of the strong winds (green line).



## Storm surge monitoring

[www.niwascience.co.nz/services/free/sealevels](http://www.niwascience.co.nz/services/free/sealevels): monitored sea-level and storm surge data for the last five days at sea-level monitoring sites coordinated by NIWA.

[www.mulgor.co.nz/](http://www.mulgor.co.nz/): storm surge data for the last five days at Port Taranaki and Marsden Point.