The ups and downs of coastlines:

Implications of vertical land motion on coastal hazards

Dr Paul Denys

School of Surveying, University of Otago

PHOTO CREDIT: *Kate Pedley*

PHOTO: *Buffalo Beach Road, Whitianga, August 1989*

More than 10% of the world's population (~600 million people) live in the coastal zone that is within 10 metres of sea level. The combination of global sea level rise (SLR) of 2-3 mm/yr, and late 20th century sea level acceleration, makes coastal communities in many parts of the world vulnerable to gradual inundation that will, in the future, require either adaptation or retreat from affected coastlines. Although the measurement and monitoring of SLR is well established through a combination of globally distributed tide gauge sites and altimeter measurements; what is not well understood is local and regional geodynamical process that result in vertical land motion (VLM) that has the potential to increase coastal hazard.

Often the VLM trend is slow and imperceptible. For example, VLM associated with glacial isostatic adjustment (Scandinavia, North America) are predictable while VLM associated with water and gas extraction (Australia, USA, Malaysia) are not. In the case of seismic activity, VLM caused by earthquake events can be unpredictable and cause vertical displacements of up to several metres. Long period seismic activity, such as postseismic deformation or periodic slow slip events may result in gradual subsidence or uplift VLM over extended periods of time.

New Zealand straddles the Australian/Pacific plate boundary and we are just starting to realise the spatial and temporal complexities associated VLM. GPS/GNSS measurements have been used to monitor the Hikurangi subduction zone (east coast of the North Island) that has resulted in a combination of subsidence (2-5 mm/yr) and slow slip events (1 mm/yr uplift). The recent Kaikōura 2016 earthquake resulted in spatially coherent coseismic displacements that caused subsidence in the Wellington region of 30 mm followed by ongoing postseismic deformation that has uplifted the region by up to 50 mm. In low lying areas of Christchurch we have measure subsidence of up to ~10 mm/yr following the Christchurch 2011 earthquake events. In seismically activate regions and especially coastal zones close to tectonic plate boundaries, the measurement of VLM needs to be included in SLR studies to understand the geodynamics that is affecting the coastal regions hazard and risk assessments.

School of Surveying
Te Kura Kairūri

University of Otago
Te Whare Wānanga o Otāgo
New Zealand

12:00 noon, Thursday, 30 April 2020

Join remotely on Zoom:

https://otago.zoom.us/j/3294272033?pwd=RnUrR2VUYnZnSGRmcHo4cDlwTFhrZz09

Meeting ID: 329 427 2033

P/word: see email alert or contact emily.tidey@otago.ac.nz