Observations and numerical modelling of tsunami waves on the Pacific Coast of Canada

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Modern numerical models predict large tsunami waves that can be generated by the Cascadia subduction zone earthquake (M=9) off the West Coast of North America and show the existence of locally amplified waves of up to 16-m height and of dangerous currents in narrow channels, or near headlands, with speeds of up to 17 m/s (33 knots) (http://www-sci.pac.dfo-mpo.gc.ca/osap/projects/tsunami/default_e.htm). Such model-generated results are generally consistent with geological records of past events along the West Coast of North America and with recent observations of disastrous tsunamis in other parts of the world, for example, in Chile in 1960, or in Sumatra in 2004. However, although deposits of the AD 1700 event and other inferred Cascadia tsunamis have been found in coastal marshes and nearshore lakes located less than 5 m above mean sea level, no tsunami deposits have been identified in sedimentary archives above this altitude. Preliminary field work in the Victoria area on the south coast of Vancouver Island has revealed some deposits that may be tsunamigenic, but no such deposits have been observed in coastal marshes in the Strait of Georgia.

Additional information about the behavior of incoming tsunami waves on the West Coast of Canada are provided by ongoing observations of sea level by the Canadian Hydrographic Service. These measurements show the possibility of resonant amplification in local inlets, such as the destructive waves in Port Alberni from the Alaska, 1964, earthquake and tsunami. Even smaller and less remarkable (at least, on this coast) tsunamis provide valuable information about wave propagation and transformation, motivating future expansion of the Canadian observational network, including the proposed installation of bottom-mounted pressure recorders at all nodes of the cabled Neptune Canada observatory (http://www.neptunecanada.ca) and of a tsunami-meter array at its offshore ODP1027 deep-water node. This array will not only measure incoming tsunami waves of even small amplitude, but can also be used for inversion of leading wave-train shape and frequencies, well before they approach the coast. Such expanded ocean observations and renewed search for tsunami deposits on the coast,

will provide us with additional guidance about the design of numerical models and with better predictive ability for future destructive tsunami waves and possible coastal inundation in this area of the North America coast.