The Canadian North-East Pacific Undersea Network Experiments (NEPTUNE-Canada) is a 825 km long cable network of realtime geophysical observatories located off the southwest coast of British Columbia. As part of this network, an array of six high-precision bottom pressure recorders (BPRs) was installed on 26 September 2009 at depths from 100 to 2600 m over the continental margin seaward of Vancouver Island. Four days after deployment, the BPRs recorded waves of 1.5 to 6 cm amplitude associated with the trans-Pacific tsunami generated by the $M_w = 8.1$ earthquake that occurred near the Samoan Islands at 17:48 UTC on 29 September 2009. The waves reached the coast of British Columbia 11.5 hours after the earthquake. Since this event, the NEPTUNE-Canada network has recorded three additional trans-Pacific tsunamis generated by the moderate $M_w = 7.8$ Vanuatu earthquake of 7 October 2009, the destructive $M_w = 8.8$ Chile earthquake of 27 February 2010, and the moderate $M_w = 7.4$ Bonin Islands earthquake of 21 December 2010. The open-ocean wave records from these tsunamis have been used to construct and refine an effective realtime regional numerical tsunami model. Model simulated waves are found to be in good agreement with observed tsunami records, for both the shelf BPRs and nearby coastal tide gauges. This ability to input near “pristine” tsunami data from the open-ocean sites into an operational wave model makes it possible to better mitigate the consequences of tsunamis waves impinging on the west coast of British Columbia and northern Washington State.