

Tsunami Source Characterization for Western Pacific Subduction Zones

USGS Tsunami Subduction Source Working Group
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An *ad hoc* working group of USGS geophysicists and geologists convened a series of meetings in September 2005 to characterize western Pacific subduction zones relevant to potential tsunami sources. This effort was in support of ongoing NOAA efforts to optimize the deployment of Deep-Ocean Assessment of Reporting of Tsunamis (DART) stations in the Pacific. The working group's study region extended from the western Aleutian Islands south to New Zealand and from the Philippines in the west to approximate 190°E, encompassing DART deployment groups 2, 4, and 9.

Our working group had two objectives: (1) Characterize the geometry (strike and dip) of interplate thrust zones in these subduction systems for use by NOAA/PMEL in its Tsunami Forecast Models that use what PMEL calls the "unit source discretization scheme" that evaluates the effects of interplate thrust fault sources of unit size on subduction plate boundaries for a given geographic position, strike, and dip of a boundary. (2) Identify geologic and geophysical characteristics of subduction zones that tend to produce large magnitude ($M > 8.4$) interplate thrust earthquakes—the sources for most far-field tsunamis.

Under the second objective, the working group developed an internally consistent methodology based on the geological and dynamical factors present in subduction systems that produce such megathrust earthquakes and associated tsunamis from 1895 to the present. A segment-by-segment characterization of western Pacific subduction zones estimated the relative likelihood that a particular segment could support a great interplate thrust earthquake in the future, using a descending scale of A, B, and C. Most of the factors that we considered as indicators of such possible tsunami sources are not new, but the way that we integrated these factors and looked systematically at the subduction zones of this region in light of modern observations was new. This presentation reviews these factors and the conclusions drawn from this study. General scientific conclusions from this report are as follows: (1) Specific subduction zones may have been under-characterized or overlooked. In the western Pacific study area, these include: (a) the west Luzon system (i.e., Manila Trench) facing the South China Sea and the north Sulawesi subduction zone marking the southern margin of the Celebes Sea; (b) the Manus subduction zone NE of New Guinea; (c) the southern Ryukyu subduction zone near Taiwan; and (d) the western Aleutian subduction zone extending to the Kamchatka-Aleutians trench cusp. (2) Subduction zones with many indicators for many large-magnitude ($M \geq 8.4$) interplate thrust earthquakes during the historical and instrumental periods include: (a) Nankai, (b) NE Japan, (c) Hokkaido/Southern Kuriles, and (d) Kamchatka.