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Time-space distribution of tsunamigenic earthquakes along the Pacific and Bering coasts of Kamchatka: insight from paleotsunami deposits

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Kamchatka and Kurile islands are the most seismically active regions of our planet. Strong earthquakes along Kuril-Kamchatka subduction and the west margin of Bering Sea usually generate tsunami. All intensive tsunami leave the geological traces at the coasts. Data about past tsunami, obtained during last ∼20 yr, extend significantly the short historical catalogue of such events. Basing on the distribution of tsunami deposits the runup height and inundation distance for historical tsunami and paleotsunami were estimated, as well as sources and magnitudes of tsunamigenic earthquakes for the past ∼2000 years.

In excavations along the Bering Sea coast 10 layers of tsunami deposits within this period of time were identified. Earthquakes magnitudes (Mt) calculated from tsunami height at the nearest coasts by Abe relation (Abe, 1999) vary between 7.0 and 8.3, and their recurrence interval is 175 to 250 years.

In sections along the Kamchatsky Bay coast 15 layers with tsunami deposits for the past ∼2000 years were identified. Average recurrence interval of strong tsunami (with runup >3-4 m) there is 125-145 year, and estimated Mt vary between 7.6 and 8.4. Two earthquakes, which took place in the Kamchatsky Bay during the past ∼2000 year, caused 1 to 2 m of coseismic subsidence of the coast.

At the Kronotsky Bay coast for the past ∼2000 years average recurrence interval of tsunami with runup >3-5 m is ∼100 year.

At the Avachinsky Bay coast the average recurrence interval of all detected tsunami (for the past ∼2000 years) is about 100 years. At the southern Kamchatka and northern Kurile Island it lowers to 70-80 years, and calculated magnitudes Mt of tsunamigenic earthquakes fall in an interval from 6.7 to 8.7. Average recurrence of tsunami with runup >5 m at the open bays and >2 m at the closed bays from Avachinsky Bay to northern Kuriles is 130-150 year. Three tsunamigenic earthquakes (1952 AD, 1737 AD, ∼600 AD) were accompanied by coastal coseismic subsidence. Each of these earthquakes had M∼9 and a rupture length about 500-600 km.

Paleotsunami reconstructions for the entire Kamchatka suggest that both Mt values and intensity of tsunami increase to the south along the subduction zone, with their recurrence interval decreasing. I infer this may relate to either the variation in the degree of coupling between the Pacific and the Eurasian (Okhotsk) plates, growing to the south, toward the high slip region (Burgmann et al., 2005), or increase in the subduction rate, or both.

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