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The Central Kuril (Simushir) Earthquakes and Tsunamis of 15 November 2006 and 13 January 2007: Predicted Events

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The M_w = 8.3 earthquake of 15 November 2006 seaward of Simushir Island (Central Kuril Islands, NW Pacific) generated a trans-oceanic tsunami, the strongest teletsunami in the Pacific Ocean in last 42 years (since the 1964 Alaska tsunami). Waves recorded around the entire Pacific Ocean revealed the wide-spread reach of the tsunami. Tsunami heights exceeding 1 m were recorded as far as the Hawaiian Islands, Oregon, California and Chile. Significant damage in the port area took place in Crescent City (California) located roughly 6600 km from the source. Maximum recorded wave height at Crescent City was 177 cm. Marked tsunami signals were identified in records from Japan, Alaska, Canada, Peru, New Zealand and the Pacific Islands. Significant waves were recorded at Malokurilsk, Shikotan I. (156 cm), Yuzhno-Kurilsk, Kunashir I. (50 cm), Magadan (63 cm), Petropavlovsk, Starodubsk, Kholmsk, and other sites. The unique feature of this earthquake and tsunami is that in fact that the event was *predicted*. Following the catastrophic 2004 Sumatra tsunami, seismic zones around the Pacific Ocean were thoroughly examined and some potential areas of major earthquakes were selected. The Central Kuril zone was defined as the zone of highest risk for a catastrophic event for the coast of Russia. A detailed pre-event investigation of this zone included two marine geophysical expeditions to the region (in 2005 and 2006), calibration of highly reliable earthquake models and numerical modeling of several scenarios of a possible major tsunami. The region of primary concern was the northeastern shelf of Sakhalin Island in the Sea of Okhotsk, the area of the active oil and gas exploration. The earthquake of 15.11.2006 occurred very close to the

expected source region. Parameters of the actual tsunami were also similar to those predicted, except that fortunately the NW coast of Sakhalin Island was sheltered from the arriving waves by the Simushir coast. Simulated tsunami wave forms were found to agree closely with the offshore island and deep-ocean DART records. The energy flow was mainly directed southeastward toward the Hawaiian Islands and Chile. Our preliminary analysis of this event indicated that a new major earthquake might be expected at the Central Kuril region. Such earthquake (M_w = 8.2) actually occurred on 13 January 2007 with a source area slightly seaward from the source area of the 2006 earthquake. The associated tsunami was weaker than the previous tsunami; however it was clearly recorded in the Kuril Islands, Japan and the Aleutian Islands.