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Projecting community changes in hazard exposure to support long-term risk reduction: a case study of tsunami hazards in the U.S. Pacific Northwest

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Abstract

Tsunamis have the potential to cause considerable damage to communities along the U.S. Pacific Northwest coastline. As coastal communities expand over time, the potential societal impact of tsunami inundation changes. To understand how community exposure to tsunami hazards may change in coming decades, we projected future development (i.e. urban, residential, and rural), households, and residents over a 50-year period (2011-2061) along the Washington, Oregon, and northern California coasts. We created a spatially explicit, land use/land cover, state-and-transition simulation model to project future developed land use based on historical development trends. We then compared our development projection results to tsunami-hazard zones associated with a Cascadia subduction zone (CSZ) earthquake. Changes in tsunami-hazard exposure by 2061 were estimated for 50 incorporated cities, 7 tribal reservations, and 17 counties relative to current (2011) estimates. Across the region, 2061 population exposure in tsunami-hazard zones was projected to increase by 3,880 households and 6,940 residents. The top ten communities with highest population exposure to CSZ-related tsunamis in 2011 are projected to remain the areas with the highest population exposure by 2061. The largest net population increases in tsunami-hazard zones were projected in the unincorporated portions of several counties, including Skagit, Coos, and Humboldt. Land-change simulation modeling of projected future development serves as an exploratory tool aimed at helping local governments understand the hazard-exposure implications of community growth and to include this knowledge in risk-reduction planning.

Keywords: tsunami; hazards; exposure; land use projection; Cascadia

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