The February 27, 2010 Chile and March 11, 2011 Japan tsunami caused tremendous loss of life and damage in the near-source region, and notable impacts in distant coastal regions like California. Comprehensive pre-tsunami surveys and the availability of historic tidal-current data and marina records allow for detailed documentation of these two events by the State of Oregon Tsunami Program (Wilson and others, 2011). Although neither event caused significant inundation of dry land in California because peak arrival occurred during low tide, damage to docks, harbor infrastructure, and boats was noteworthy. The 2010 Chile tsunami caused approximately $5 million in damage to a dozen harbors, primarily in central and southern California locations like Santa Cruz Harbor, Ventura Harbor, and San Diego Bay. The 2011 Japan tsunami caused over $35 million in damage to more than two dozen harbors along the entire coast of California, most notably to harbors/marinas in Crescent City, Hopi Reefs, and Santa Cruz. During both events, strong tsunami currents, with some observed velocities greater than 15 knots, were generated at harbors entrances and along inner bays and harbors within harbors. Preliminary evaluations of harbor infrastructure and the interaction of the boating community during the event show that damage along the base of large ships exacerbated the damage to docks to which the ships were tied. Evaluation of tsunami currents and damage will help to validate/validate of numerical tsunami model outcomes with the ultimate goal of developing tsunami current hazard maps for harbors statewide. These hazard maps will improve emergency response and infrastructure planning within harbors.

Strong Currents

Even relatively minor tidal fluctuations (1-2 meters peak-to-trough) cause strong currents that make navigation difficult and cause damage to boats, docks, and infrastructure. Visual estimates by some harbors operations managers indicate currents could have reached 15 to 20 knots inshore. Additional indicators include: waves from harbor breakers, reported accounts from personnel and boaters, personal communications. Other types of tsunami current hazards include losses such as breakwaters and docks caused during the Alaskan tsunamis. Additional video analysis showed how current velocities and wave heights are not representative of micro-harbor conditions and not a good representative sampling for a harbor overall.

Issues for Maritime Community

• Most recreational boaters don’t understand that strong tsunami activity can last a long time, more than 4 hours during the February 27, 2010 tsunami and 24 hours in during the March 11, 2011 events. For boaters that did do so, activities that did not survive the experience to stay offshore. Some boaters returned to their vessels within the harbors during the tsunami did not survive as well caused damage to other vessels and docks, and many to harbor personnel were trying to help.

Maritime Work

Data from the March 11, 2011 event is still being evaluated, including harbor currents and radiant movement. One of the more interesting situations to be studied is the successful evacuation of most of the commercial fishing fleet in the vicinity of the tsunami. Evaluation of the experiences of these and other boats will help to design decision making processes for future events to go offshore to the safe, and since others cannot experience the same.