NWS14-2014-000022

Abstract for an Invited Paper
for the NWS14 Meeting of
the American Physical Society

Physics of Earthquakes and Tsunamis: Implications for the Pacific Northwest[1]

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We are all familiar with the iconic volcanoes of the Pacific Northwest, which are a product of the Cascadia subduction zone, where the Juan de Fuca plate descends into the mantle beneath the North American plate. Earthquakes and tsunamis are another product of this subduction zone, and other subduction zones around the world, although no very large subduction zone earthquakes have occurred in Cascadia since the advent of seismic recording networks. The longer geologic record, however, indicates that large earthquake have occurred in the past, most recently on January 26, 1700. Several very large subduction earthquakes, however, have occurred elsewhere during the past decade, including the 2004 and 2005 Sumatra earthquakes, the 2010 Chile earthquake and the 2011 Tohoku earthquake in Japan. Modern networks of seismometers and GPS stations provide detailed information on the strain accumulation prior to and the rupture history during these events, and on the impact of the rupture history on the characteristics of the resulting tsunami. These three events were quite different in terms of the area of rupture, distribution and amount of slip on the rupture plane, and relationship between rupture in the earthquake and existing geologic structure. Studies of these earthquakes, coupled with studies of crustal structure and deformation in Cascadia, may provide some further clues about what we should expect in a future Cascadia subduction earthquake.

[1]An overview based on the work of many colleagues, generally supported by the National Science Foundation and US Geological Survey.