Natural Hazards and Earth System Sciences Discussions

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Reply on RC1

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Community comment on "Assessing local impacts of the 1700□CE Cascadia earthquake and tsunami using tree-ring growth histories: a case study in South Beach, Oregon, USA" by Robert P. Dziak et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-427-CC1, 2021

1. I assume that the soil is sandy and if the pp in this area is above 800 mm the salinity that was deposited after the tsunami had a short effect. It will be interesting to cite any work on this issue.

Yes, the soil is quite sandy (a weakly consolidated sand dune) and we expect the salinity to have had a short effect given the nearly 2000 mm of rain that falls per year and that the earthquake occurred in the rainy winter season. There is, however, a pond adjacent to the stand that may have served as a reservoir for tsunami water, and this could have maintained a high-salinity environment near the roots of many trees for a somewhat longer period of time.

2. If the tree-rings allows it, it will be interesting to see the effect of the tsunami years after the event because I am completely sure that even though the forest survived the tsunami the growth of the remaining forests might have changed.

We had expected growth suppression, and possibly releases for other survivors that were less damaged but experienced reduced competition. Indeed, growth suppressions occurred on trees inundated by the 2011 tsunami in Japan, as the reviewer notes below. However, we were surprised to find only subtle, temporary reductions in growth that were only evident when growth was compared to control sites. It may be that this stand is relatively far inland and buffered from the full force of the tsunami. But overall, the growth responses were less than expected.

3. The tsunami in Japan affected tree growth for 4 to 5 years. Based on Figure 4, the effect in the study of South Beach site seem to be a much shorter disturbance.

Yes, these responses are much shorter (about a year in duration) and less pronounced than the studies conducted on trees inundated by the 2011 tsuami in Japan.

4. A final suggestion, not for this study of course, but for future studies I would suggest the use of d13C in tree rings to understand not only the physical recovery (inferred from tree ring growth) but also the physiological recovery (inferred from the isotope analysis).

This is an excellent suggestion and one we have begun pursuing. Two years ago we sacrificed wood from these tree cores to measure levels of bromine, which is a potential

indicator of seawater inundation. Despite annual cycles of bromine in the wood, there were no sustained bromine signatures coincident with the tsunami. This past fall we decided to sample several rings around 1700 for 13C in our last remaining core that contained a ring for the year 1700 (and several years prior). This did show a shift in 13C consistent in direction and magnitude with those found following the 2011 Japan tsunami. As soon as covid restrictions permit, we will re-sample some of the oldest trees at our study site to replicate and hopefully verify this 13C pulse.