CHARACTERIZING THE EVOLUTION OF DYNAMIC PRESSURE RESULTING FROM THE 18 MAY 1980 PYROCLASTIC DENSITY CURRENT OF MOUNT ST. HELENS USING TREE DAMAGE

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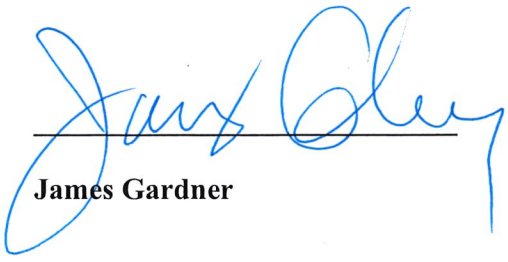
ABSTRACT

Tree damage can provide insights into internal dynamic pressure changes of pyroclastic density currents (PDCs). On 18 May 1980, Mount St. Helens erupted a laterally directed PDC that decimated ~600km^2 of forest, referred to as the blowdown zone. The head of the current contained the peak dynamic pressure, which uprooted or broke off many trees and stripped them of vegetation.

Along mapped flow paths, the density of standing trees was measured by counting the number of tree shadows within 200m^2 areas. The last 25% of runout illustrated a marked increase in tree density, suggesting a marked decrease in dynamic pressure. The tree height calculated within the 200m^2 areas as well as tree radius, failure stress, and the drag coefficient quantified dynamic pressures for the PDC. Dynamic pressure ranged with runout distance from 10-6 KPa in the west, 14-10 KPa in the north, 9-6 KPa in the northeast, and 15-6 KPa in the east.

Additionally, analysis identified 92 clusters of trees still standing in the blowdown zone. Blurry, cylindrical shadows versus well-defined, cylindrical shadows distinguished standing trees with foliage in clusters from those without, respectively termed foliage patches and stripped patches. Stripped patches began after 40% runout and represented where the peak dynamic pressure detached from the PDC body but was still low enough to strip trees. Foliage patches began after 70% runout and represented where the peak dynamic pressure ballistically lofted above the treetops. The average tallest tree for each patch type, 31±18 m for stripped patches and 20±11 m for foliage patches, was inferred to be the maximum and minimum lift off heights for the peak dynamic pressure, respectively. Patch type progression with runout distance indicated that the peak dynamic pressure was momentum based and topography dependent.



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