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FALLOUT RADIONUCLIDES IN CRITICAL ZONE STUDIES, FRONT RANGE, COLORADO

OUIMET, William B.[1], DETHIER, David P.[2], MONDRACH, Hannah[1], SHEA, Neil[3], KASTE, James[4] and BIERMAN, Paul[5], (1)Center for Integrative Geosciences, University of Connecticut, Storrs, CT 06269, (2)Dept. Geosciences, Williams College, 947 Main Street, Williamstown, MA 01267, (3)University of Connecticut, Center for Integrative Geosciences, Storrs, CT 06269, (4)Geology, The College of William and Mary, McGlothlin-Street Hall, Williamsburg, VA 23188, (5)Geology Department, University of Vermont, 180 Colchester Ave, Delahanty Hall, Burlington, VT 05405, william.ouimet@uconn.edu

Fallout radionuclides meteoric ^{10}Be, ^{137}Cs and ^{210}Pb adhere strongly to mineral and organic matter and are useful for studying sediment transport on hillslopes. Different half-lives and depth-dependent distributions of these isotopes make them useful over different timescales in critical zone studies. Meteoric ^{10}Be is a tracer for late Pleistocene to Holocene processes whereas ^{137}Cs and ^{210}Pb are useful for measuring sediment movement over the past century. Given that these nuclides have different affinities for soil organic material near the soil surface, different depth dependent processes can be evaluated. Here, we discuss meteoric ^{10}Be, ^{137}Cs and ^{210}Pb analyses from over 20 hillslope pits and valley deposits in the Boulder Creek Critical Zone Observatory, Front Range, Colorado. Inventories of meteoric ^{10}Be, ^{137}Cs and ^{210}Pb along steep, hillslope catenas in forested, unburned areas highlight the mobility of soil at both short and long timescales. Meteoric ^{10}Be inventories on hillslope transects increase downslope and highlight the redistribution of the entire mobile regolith column (40 cm, on average) over the last 21 ka. ^{137}Cs and ^{210}Pb data exhibit lower concentrations and inventories within the steepest or foot-slope locations on individual hillslope transects, indicating surface erosion of the upper 5 cm over the last 50 years. The sensitivity of ^{137}Cs and ^{210}Pb concentrations and inventories to shallow soil disturbance is well illustrated by examining soil profiles on burned hillslopes and valley deposits associated with post-fire erosion and flooding of the 2010 Fourmile Fire. A pair of adjacent, steep hillslope pits, where one represents a location protected from post-fire erosion, shows ~3 cm of truncation in the ^{137}Cs and ^{210}Pb profile and removal of ash-rich surface material enriched in these isotopes. Furthermore, analysis along Fourmile Canyon below these hillslope sites demonstrates that overbank fine grained, ash-rich organic material within post-fire floods deposits is enriched in ^{137}Cs and ^{210}Pb indicating that high levels of these isotopes are being washed far downstream. While the short-lived radionuclides demonstrate that fires trigger sediment transport over the last century, we will use meteoric 10Be analyses to evaluate the role of wildfires in longer-term hillslope evolution.

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