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Fluxes of radiocaesium associated with suspended sediment in rivers impacted by the Fukushima Daiichi Nuclear Power Plant

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The Fukushima Daiichi Nuclear Power Plant accident which followed the earthquake and tsunami on 11 March 2011 resulted in the release of Cs-134 and Cs-137 into the surrounding environment, where highly elevated levels are reported. There is considerable concern about the redistribution of these radioactive contaminants from the atmosphere to vegetation, soil and aquatic systems. Fluvial redistribution of radiocaesium may contaminate downstream areas that were subject to low fallout and deliver significant quantities of highly contaminated fine sediment to the coastal zone. This study reports on the magnitude of fluvial transfer of Cs-134 and Cs-137 through river networks located across the fallout region. Initially six nested river monitoring stations were established within the Abukuma River basin from June 2011. Subsequently, an additional 23 stations were established between October 2012 and January 2013, which included stations within the Abukuma basin as well as smaller coastal catchments north and south of the power plant. Combined, these 29 sites represent a globally-unique river monitoring network designed to quantify sediment-associated transfer of radiocaesium from headwaters to the Pacific Coast of Japan. The catchments range in area from 8 to 5,172 km2 and span a large range in spatially-averaged radiocaesium inventories. Flow and turbidity (converted to suspended sediment concentration) were measured at each station while bulk suspended sediment samples were collected at regular intervals using time-integrated samplers to allow measurement of Cs-134 and Cs-137 activity concentrations by gamma spectrometry. Preliminary monitoring data showed highly elevated but also highly variable fluxes of radiocaesium in rivers across the fallout region. High magnitude flows in response to typhoon events exported large quantities of radiocaesium. Rivers are an important and continuing source of radiocaesium input to the coastal environment and the Pacific Ocean in addition to direct leakage from the nuclear power plant.