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Understanding the effect of catchment characteristics on dynamic and yield of suspended sediments

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Fine sediment from landuse-driven erosion is recognized as a major pollutant of rivers and downstream receiving environments. Effective actions to reduce fine sediment export from catchments therefore requires understanding of their transport behavior and temporal dynamics during flood events. Large sets of high-frequency flow and suspended sediment concentration data allow for comparative analyses to identify features responsible for suspended sediment transport variations during flood events. The aim of this study was to use such high-frequency data sets obtained for 18 catchments across New Zealand to understand the influence of catchment and landscape characteristics on heterogeneity of sediment supply in time and space. This study compares sediment yield and temporal dynamics of suspended sediment concentration in catchments with varying sizes (from 0.5 km2 to 3600 km2), land covers and erosion terrain. The measurements at all sites include continuous flow data record, continuous optical back-scatter turbidity measurements as a surrogate for suspended sediment concentration, and physical sampling of suspended sediment during flood events to compile calibration relationship between turbidity and sediment concentration and then derive continuous suspended sediment concentration records. To determine how different catchments respond to floods in terms of suspended sediment generations, their flood event sediment loads were compared against flow peaks and total runoff. The results indicate that the effect of catchment characteristic variables such as land cover, lithology and landscape will decrease with an increase on size of the flood. Therefore, in large flood events, hydrological parameters will be more dominant and effective factors in generation of sediment loads. In addition, to investigate how different catchments behave in sediment delivery during rising stage and recession of the flow, sediment load in different stage of the flow hydrographs were compared in all catchments. Appropriate normalization was used to remove the effect of catchment sizes in flow and sediment load metrics. The results indicate that the catchments with more erodible sources generate higher sediment load in rising stage of the flow hydrographs than their falling limbs. Therefore, in these catchments sediment will deplete faster after the flood peak. In conclusion, differences in land cover and erosion processes of the catchments can be recognized in features of flood event suspended sediment load at downstream monitoring sites.