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Using sediment particle size distribution to evaluate sediment sources in the Tobacco Creek Watershed

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Lake Winnipeg has recently brought attention to the deteriorated water quality due to in part to nutrient and sediment input from agricultural land. Improving water quality in Lake Winnipeg requires the knowledge of the sediment sources within this ecosystem. There are a variety of environmental fingerprinting techniques have been successfully used in the assessment of sediment sources. In this study, we used particle size distribution to evaluate spatial and temporal variations of suspended sediment and potential sediment sources collected in the Tobacco Creek Watershed in Manitoba, Canada. The particle size distribution of suspended sediment can reflect the origin of sediment and processes during sediment transport, deposition and remobilization within the watershed. The objectives of this study were to quantify visually observed spatial and temporal changes in sediment particles, and to assess the sediment source using a rapid and cost-effective fingerprinting technique based on particle size distribution. The suspended sediment was collected by sediment traps twice a year during rainfall and snowmelt periods from 2009 to 2012. The potential sediment sources included the top soil of cultivated field, riparian area and entire profile from stream banks. Suspended sediment and soil samples were pre-wet with RO water and sieved through 600 μm sieve before analyzing. Particle size distribution of all samples was determined using a Malvern Mastersizer 2000S laser diffraction with the measurement range up to 600μm. Comparison of the results for different fractions of sediment showed significant difference in particle size distribution of suspended sediment between snowmelt and rainfall events. An important difference of particle size distribution also found between the cultivated soil and forest soil. This difference can be explained by different land uses which provided a distinct fingerprint of sediment. An overall improvement in water quality can be achieved by managing sediment according to the identified sediment sources in the watershed.