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Transport, dynamics and temporal trends of very fine suspended sediment in boreal rivers

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Quantifying of suspended sediment fluxes from rivers is essential to understand land-fluvial systems linkages. Further, current knowledge for transport of very fine suspended sediment, its dynamics and affecting biogeochemical factors is only theoretical in boreal riverine systems with little published long term data. We address this gap through a series of long term data by providing new insight on the suspended sediment transport and annual fluxes with two different fractions (1.2 μm and 0.4 μm) at the rivers at northern Finland. We analyzed long and short-term hydrological and sedimentological data together with biogeochemical factors and compared spatial and temporal patterns within and across a range of catchment and river types. Our results highlight important linkages between physical and biogeochemical processes that are controlled transport, dynamics and temporal trends of suspended sediment. We found that: i) there is fraction of very fine suspended sediment, which is depended not only on temporal trends in hydrology but also from biogeochemical processes in catchment soils and fluvial systems; ii) temporal variation of metal humate colloids especially in peatland covered catchments affected notably to suspended sediment fluxes iii) difference between fraction affected notably on calculated transport fluxes. Our analysis raise questions from importance of small and medium rivers with high peatland coverage in transport of very fine suspended sediment. Flocculation processes of metal humate complexes is well acknowledged and natural process, however only few studies have showed importance of these colloids on suspended sediment transport and none have demonstrated effect of colloid to long term fluxes. Therefore, our analysis gives new important knowledge to sediment transport dynamics and affecting biogeochemical factors. Long-term records of constituent fluxes provide insights into the functioning of the boreal river systems and help to identify ongoing or future changes and challenges caused by natural variation or anthropogenic sources.