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Sediment loading processes in a geologically active and forested catchment

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Exploring fluvial sedimentary processes on catchment scale is useful for studies on the forest management, material cycle and ecosystem of short time scale and topographic evolution of long scale. The fluvial transportation of sediment is also related to sedimentation, material cycle and ecosystem in coastal regions. Erosion and sedimentation process decline soil fertility and decrease agricultural yields. A considerable portion of suspended sediment discharging into a costal lagoon, the Oikamani Lagoon, Tokachi, Hokkaido annually is contributed by the forested Oikamanai River catchment with many tectonic faults. It is important to find out the sediment source in such forested catchments. Here, we have tried to find how sediment load occurs by rainfall and snowmelt runoffs in the forested (ca. 90% area) catchment. Grain size and mineralogy of catchment soil and stream sediment, survey techniques, and turbidimeters provide the information that allows us to understand fluvial sedimentary processes and the sediment source and its availability. Here, a semi-distributed model, ArcSWAT2012, was applied to time series of discharge and sediment load, which were obtained in 2011 to 2013. In ArcSWAT2012, the total basin area (62.48 km2) was divided into 3 sub-basins, as subbasin into hydrological response unit (HRU) based on soil type, land use and slope classes that allow a high level of spatial detail simulation. In this study we have used the data of discharge, Q (m3/s), suspended sediment concentration (SSC; mg/L) and sediment load, L (kg/s) of April 2011 to November 2013 on non-frozen period of these three years, weather data of 2008 to 2013, and soil data. Every year soil water content and water storage in soil are different because the amounts of snowfall and snowmelt are different, so we have utilized our model at seasonal base. The semi-distributed SWAT model is applied to model discharge and spatially distributed soil erosion/sedimentation processes at daily time step. The simulations of sediment load time series indicate that most of the sediment input is coming from sub-basin 2. Hourly sediment load time series indicates that most of the time except at pick discharge sediment load at upstream (R3) is greater than of downstream, main outlet of watershed (R1), it suggests that the most of the sediment is deposited between R1 and R3. At present, the interpretation of the quantitative results is not yet satisfactory, because of lack of model parameterization at a local scale in the SWAT model. This results from the fact that the information on hydrological structures of soil and bedrock is not sufficient. Thus, a comparison with the other modelling is essential to understand the sediment loading processes on catchment scale.

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