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Quantifying and identifying the sources of fine sediment input in a typical Mongolian river basin, the Kharaa River case study

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Mongolia is facing a tremendous change of land-use intensification due to expansions in the agricultural sector, an increase of cattle and livestock and a growth of urban settlements by migration of the rural population to the cities. With most of its area located in a semiarid to arid environment, Mongolia is vulnerable to climatic changes that are expected to lead to higher temperatures and increased evapotranspiration. It is expected that this may lead to unfavorable changes in surface water quality caused by increased nutrients and sediment bound pollutants emissions. Increased fine sediment load is associated with nutrient, heavy metal and pollutant input and therefore affects water quality. Previous studies using radionuclide fallout isotope sediment source fingerprinting investigations identified riverbank erosion as the main source of suspended sediment in the Kharaa River. Erosion susceptibility calculations in combination with suspended sediment observations showed strong seasonal and annual variabilities of sediment input and in-stream transport, and a strong connection of erosional behaviour with land-use.The objective of this study is to quantify the current water quality threats by fine sediment inputs in the 15,000 km2 Kharaa River basin in Northern Mongolia by delineating the sources of the fine sediments and estimating the sediment budget.To identify the spatial distribution of sediment sources within the catchment, more than 1000 samples from the river confluences at the outlet of each sub basin into the main tributary were collected during 5 intensive grab sediment sampling campaigns in 2009-11. The fine sediment fraction (<10μm) has been analysed using geochemical tracer techniques for spatial source identification, based on major elements (e.g. Si, Al, Mg, Fe, Na, K, P) and trace elements (e.g. Ba, Pb, Sr, Zn). The contribution of suspended sediment of each sub basin in the main tributary has been evaluated with help of a mixing model. To asses sediment sources the RUSLE based sediment budget model (SedNet) was employed to estimate surface erosion and sediment budget. The spatial origin of the fine sediment in the catchment could be identified by geochemical fingerprinting techniques. This shows that only some subcatchments contribute considerably to the fine sediment load, especially areas with high grazing intensity and degraded riparian vegetation. The estimated average soil loss in the catchment is 0.2 t$\times$ha-1$\bullet$a-1. The model results reveal a strong influence of the landuse in the catchment on surface erosion and fine sediment input, which will increase with the intensification of agriculture in the catchment.