Geophysical Research Abstracts
Vol. 18, EGU2016-4026, 2016
EGU General Assembly 2016

Global sediment fluxes during the last millennium

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Soil redistribution plays an important role in the transport of carbon and nutrients between terrestrial ecosystems. However, quantification of soil redistribution and its effects on the global biogeochemical cycles is currently unknown. This study aims at developing new tools and methods to represent soil redistribution on a global scale, and contribute to the quantification of anthropogenic disturbances to the biogeochemical cycles. We present a new large-scale coarse resolution sediment budget model that can simulate spatial patterns and long-term trends in soil redistribution in floodplains and on hillslope, resulting from external forces such as climate and land use change. First, we validated the model for the Rhine catchment using observed Holocene sediment storage data and observed scaling behavior between sediment storage and catchment area. Then, we applied the model on 20 large river catchments globally, using climate and land cover data from the Max Planck Institute Earth System Model (MPI-ESM) for the last millennium (850 - 2005AD). We show that the model can reproduce current observed sediment yields if uncertainty in the observations is taken into account. Furthermore, we find that the change in erosion rates during the last millennium resulted in a significant increase in sediment storage for different global catchments. We identify land use change as the main driver behind this change in sediment storage. Finally, catchments characteristics, such as area and slope, play an important role in buffering or amplifying the effect of land use and other external forces on the change in erosion and sediment storage.