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Determination of sedimentary fluxes and their comparison with chemical weathering fluxes at the outlet of the granitic Strengbach catchment (Vosges massif, Eastern France)

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Determining the key parameters controlling the weathering and erosion processes is a prerequisite for getting the correct modeling of the response of the Earth Surface to environmental changes. The study of small experimental watersheds, where both physical erosion and chemical weathering fluxes are jointly analyzed, is a good way to progress in this topic. However, in many cases hydrological and chemical weathering fluxes have been determined for a lot of experimental watersheds without the determination of the corresponding erosion fluxes. This is the case for the small (0.8 km^2) Strengbach catchment, where the geochemical budgets have been established in the mid 80's without physical erosion data.

In this study we propose (i) to supply data on the granitic Strengbach catchment in order to assess the physical erosion rate, (ii) to compare the SSL (suspended sediment load) output to the exportation of the dissolved chemical elements by the Steinbach stream, and (iii) hence to compare the chemical weathering rate to the physical erosion rate.

For this work, a water sample of about 2L has been regularly collected at the outlet of the cachment during 6years, at a weekly or fortnightly time step. Each water sample was filtered (through pre-weighted 0.45 μm filter). The filtrated waters were used for determining major element concentrations, while the filters were dried in an oven at 65°C during 24 h and weighed to determine the concentration of the SSL. In addition bed load, accumulated in the flume during the major flood events, has been shovelled up after each event. The resulting extracted sediment volume has been systematically determined since spring 2009 which allows a first estimation of the bed load flux out of the catchment for the 2009-2010 period.

From these data we estimate a mean sedimentary flux out of the Strengbach catchment of about 5 T.km-2.yr-1, which is of the same order of magnitude as the cationic chemical weathering flux determined from the basic cation concentrations of the Strengbach waters. These data also indicate that the main parameter controlling the weathering intensity in the Strengbach cachment remains the intensity of water flux circulating through the watershed. Therefore, the anthropogenic impact, such as "acid" perturbation or forest management, on the intensity of the weathering flux would only be secondary.