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Comparing the silica pathways through small agricultural and forested catchments.

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Imbalances of nutrient concentrations (N:P:Si) determine the water quality of aquatic systems. Recent research pointed out that land use change can exert a strong influence on the Si-fluxes through terrestrial ecosystems. These ecosystems store a large amount of amorphous, biogenic Si (SiO2nH2O, ASi), a fraction which was not accounted for when constructing previous Si budgets. However, changes in mechanisms and pathways of Si mobilisation due to land use changes have hitherto not been studied.
We measured dissolved (DSi) and amorphous Si fluxes (ASi) within two small (order) catchments (100-300ha) similar in soil and morphological characteristics but with a contrasting land use (agricultural vs. forest). Based on our measurements we are able to compare yearly ASi and DSi fluxes for the main pathways in both catchments.
Under agricultural land use peak discharge events with abundant surface runoff contribute significantly to Si mobilisation and export as ASi:DSi ratios reach 50:50. ASi transport is closely related to suspended sediment transport (R^2=0.94). Under forest, DSi transport dominates base-flow periods while ASi transport becomes more important while DSi concentrations decrease. Two mechanisms explain the observed trade-off. First, ASi fluxes increase during peak flows due to the association of ASi with suspended sediment. Second, DSi concentrations simultaneously decrease as result of a dilution-flushing effect: DSi rich pore-water is diluted and flushed by Si-poor precipitation. The dilution-flushing effect does not only occur during peak events under forest but can also be observed under arable land and seasonally.
The total Si flux can be separated in two Si-components which are intrinsically correlated with their main pathway: the ASi component corresponds with overland flow and the DSi component with subsurface flow. Change in land use leading to significant changes in hydrological pathways will therefore have an important effect on Si-dynamics of a catchment.