Weathering and mass-balance budgets in small catchments

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Mass-balance techniques have been widely used in investigating the contribution of weathering processes to the export of solutes from small catchments. These studies demonstrate that mineral-water interactions play a major role in determining the chemical composition of waters draining catchments, and in regulating the mass flux of dissolved species from these systems. The chemistry of the waters draining catchments located in the same region, and receiving the same atmospheric deposition inputs, has been observed to vary widely. Waters draining catchments underlain by more reactive bedrock exhibit higher concentrations of dissolved solutes than those draining less reactive bedrock. For this reason, for a unit volume of discharge, the mass flux from catchments on reactive bedrock types will be larger than the mass flux from catchments on bedrock of low reactivity. In this investigation, the solute mass-balances for 5 catchments in the eastern United States, situated on different bedrock types, are compared to explore the role of mineral weathering in determining stream chemistry and solute export. Waters draining siliceous clastic rocks are most dilute, and catchments on these rocks exhibit the lowest annual export of solutes of all of the rock types studied. Waters draining catchments on rocks containing carbonate minerals have the highest concentrations of dissolved solutes, and these catchments have the largest annual export of solutes of the rock types studied. The computer code NETPATH was used to model the geochemical mass-balance in these systems, and to explore the role of mineral weathering in determining the composition of waters in, and the solute export from these catchments. The NETPATH models show that mineral weathering exerts a major influence on both the chemical composition of the waters and the mass fluxes, however, all of the observed changes between the input and export chemistry cannot be solely ascribed to mineral–water interactions.