Direct evidence of the feedback between climate and weathering

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Long-term climate moderation is commonly attributed to chemical weathering; the higher the temperature and precipitation the faster the weathering rate (1). Weathering releases divalent cations to the ocean via riverine transport where they promote the drawdown of CO2 from the atmosphere by carbonate mineral precipitation (2,3). To test this widely-held hypothesis, we performed a field study determining the weathering rates of 8 nearly pristine north-eastern Iceland river catchments with varying glacial cover over a span of 44 years. The mean annual temperature and annual precipitation of these catchments varied by 3.2 to 4.5 °C and 80 to 530%, respectively during the study period (4). Significant linear positive correlations were found between mean annual temperature and chemical weathering in all 8 catchments and between mean annual temperature and mechanical weathering and runoff in 7 of the 8 catchments. The runoff, mechanical weathering flux, and chemical weathering fluxes in these catchments are found to increase from 6 to 16%, 8 to 30%, and 4 to 14% respectively, depending on the catchment for each degree temperature increase. In contrast, significant positive correlations between annual precipitation runoff, mechanical weathering and chemical weathering were only found in 3 of the least glaciated catchments.
References


