Critical effects of plant growth on mineral weathering and soil acidification in a subtropical forested watershed

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Plant growth has impacts on mineral weathering and soil acidification for the absorption of base cations but its quantitative contribution remains poorly known. To better understand and quantify this contribution, an aggrading forested watershed in subtropical China was selected to study the rates of mineral weathering and soil acidification by means of geochemical mass balance. Atmospheric deposition, runoff, plant growth and litter return were monitored in the watershed. Samples of representative soils and parent rock were collected and determined. There are big variance of element contents among the different plant species. The mean amount of plant absorption are 369 mol ha^{-1} yr^{-1}, 7 mol ha^{-1} yr^{-1}, 434 mol ha^{-1} yr^{-1} and 90 mol ha^{-1} yr^{-1} for K^+, Na^+, Ca^{2+} and Mg^{2+}, respectively. The amount of total base cations occupy about a half of that from mineral weathering inculding the input by air deposition and output by runoff. For silicon (Si), the absorption and return by plant in different species are 25 -3432 mol ha^{-1} yr^{-1} and 0-1761 mol ha^{-1} yr^{-1}, respectively. Clearly, a large amount of Si is cycled by plants with high variance among different species. The net absorption amount of Si is 1006 mol ha^{-1} yr^{-1} based on the area ratio of various plant species in the watershed, taking up about 37% of total Si released from mineral weathering. Because of the imbalance of positive ion and anion by plant absorption, this process could produce 1141 mol ha^{-1} yr^{-1} positive charge. The amount of proton is about 50% among all proton production pathways in the watershed. Obviously, the absorption of base cations by plant is a proton source for soil. Therefore, the plant growth will strongly promote mineral weathering and soil acidification with about 50% contribution in the subtropical area.

Acknowledgements: This study was financially supported by the National Natural Science Foundation of China (Nos. 41877010; 41571130051).