Soil solution response to experimentally reduced acid deposition in a forest ecosystem

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In order to measure and predict reversibility of soil solution acidification under experimentally reduced acid input, a manipulation study with artificial 'preindustrial' throughfall was established. A roof was installed underneath the canopy in a Norway Spruce stand (Picea abies [L.] Karst.) of the German Selling area. Water falling onto the roof was adjusted to clean rain concentrations before redistribution. Soil solutions were collected with suction cup lysimeters at various depths and were analyzed for major ions. The response of soil solution chemistry in the upper soil (10 cm depth) to a reduction of N, SO4, and H input was rapid. While NO3 concentration in deeper soil layers reached input levels after 2 yr of treatment, SO4 concentration in the seepage water at Im depth remained high relative to the reduced input due to a release of formerly stored S from the soil. Aluminum concentrations followed a similar pattern as the SO4 concentrations. The ion concentrations in soil leachate were predicted reasonably well using the MAGIC model (Cosby et al., 1985) with the measured SO4 sorption Isotherms and the throughfall fluxes as model input. Although the parameters of the Langmuir isotherm had no significant influence on the prediction of SO4 concentration in the upper soil layer, they were crucial for the prediction of SO4 dynamics in deeper soil layers. The model predicted that the reversibility of soil acidification at the Selling area is delayed for decades due to the release of soil SO4.

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