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Hydrol. Earth Syst. Sci., 7, 399-410, 2003

www.hydrol-earth-syst-sci.net/7/399/2003/

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Studies of acid deposition and its effects in two small catchments in Hunan, China

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Abstract. Acid deposition and its effects were studied by analysing the chemistry in precipitation, stream water, soil water and soils in two catchments in Hunan. One site, Linkesuo (denoted LKS), is on the outskirts of Changsha, the provincial capital of Hunan, the other (Bailutang, denoted BLT) on the outskirts of Chenzhou in southern Hunan. Volume-weighted average pH values and sulphate concentrations in wet deposition were 4.58 (BLT) and 4.90 (LKS) and $174 \mu\text{mol}_c \text{L}^{-1}$ and $152 \mu\text{mol}_c \text{L}^{-1}$, respectively. Wet deposition of sulphate has been estimated as $4.3 \text{ gS m}^{-2} \text{yr}^{-1}$ and $3.4 \text{ gS m}^{-2} \text{yr}^{-1}$ at BLT and LKS, respectively. Estimates of the corresponding total depositions (dry + wet) are $6.1 \text{ gS m}^{-2} \text{yr}^{-1}$ and $5.3 \text{ gS m}^{-2} \text{yr}^{-1}$. In precipitation and throughfall, sulphate was the major anion and calcium the major cation. In stream and soil water, nitrate was slightly higher than sulphate on an equivalent basis and magnesium (Mg) not much lower than calcium (Ca). Important soil properties, such as soil pH, soil organic matter (SOM) content, exchangeable acidic cations, exchangeable base cations, effective cation exchange capacity (CECe), base saturation (BS), and aluminium (Al) and iron (Fe) pools, were determined for five forest soil profiles (consisting of four horizons) in each of the two catchments. The soils in BLT are generally more acid, have lower BS and higher Al and Fe pools than the LKS soils. The Al- and Fe-pools were generally higher in the topsoils (i.e. the O and A horizons) than in deeper soils (i.e. E and B horizons) especially at the most acidic site (BLT). There are significant correlations between Fe-pools and the corresponding Al-pools in both catchments except between the amorphous Fe_{ox} and Al_{ox} . Considering the long-term high deposition of sulphate, there is a risk of future ecological damage due to acidification, especially in the BLT catchment, although vegetation damage has yet to be observed in the catchments. This condition appears to be representative of a large part of Hunan.

Keyword: acid deposition, soil acidification, catchment, Al-pools, Fe-pools, Hunan

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Citation: Xue, N., Seip, H. M., Liao, B., and Vogt, R. D.: Studies of acid

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