Abstract. Using newly available regional data sets we examine the potential for future changes in stream acid neutralizing capacity (ANC) for the Southern Blue Ridge Province (SBRP) of the U.S. as related to (1) levels of S deposition, (2) retention of S within watersheds, (3) current surface water SO4, and (4) potential historical changes in surface water chemistry. We conclude that, although (1) little change in surface water chemistry (as affected by acidic deposition) likely has occurred in the region to date, and (2) soils are currently retaining a majority of atmospherically deposited S, it is likely that marked increases in surface water SO4 will occur. Such increases could be accompanied by significant surface water acidification (loss of ANC).

1. Introduction

To date, the primary concern over the long-term (years-decades) effects of acidic deposition on surface water chemistry in the U.S. has focused on effects of S deposition in the Northeast (NE) region of the country (Likens and Bormann, 1974; Galloway and Likens, 1976; Cronan and Schofield, 1979; Baker and Schofield, 1982; Driscoll and Newton, 1985; Galloway et al., 1983; NRC, 1983). The NE, however, is only one region of the U.S. that has experienced, or is likely to experience, adverse effects of acidic deposition.

Findings from the U.S. Environmental Protection Agency’s (EPA) National Surface Water Survey (NSWS) indicate that streams of the Southern Blue Ridge Province (SBRP) are predominantly of low ANC and circumneutral pH, with median values of 120 μeq L⁻¹ and 7.03, respectively (Messer et al., 1986, 1988; Eshleman and Kaufmann, 1988). No streams sampled in the SBRP during the NSWS were found to be acidic (ANC < 0); the lowest measured pH was 6.4. An analysis of
historical chemical change in SBRP streams estimated 'worst case' median declines in stream ANC and pH potentially attributable to atmospheric S deposition of 23 μeq L⁻¹ and 0.09 units, respectively (Eshleman and Kaufmann, 1988). Similarly, 10% of the stream reaches might have experienced chronic pH declines greater than 0.20 units.

Emissions to the atmosphere of S-containing compounds in the southeastern U.S. have increased dramatically in recent years (NRC, 1986) and the SBRP now receives S deposition at levels comparable to the NE. Available estimates indicate wet SO₄ deposition in the SBRP is 20-30 kg ha⁻¹ yr⁻¹ (NRC, 1986; Wampler and Olsen, 1987; Olsen and Watson, 1984) (Figure 1) and dry S deposition in the region is of comparable magnitude (Lindberg et al., 1986). Sulfate concentrations in streams of the SBRP, however, are low relative to sulfate concentrations in lakes in the northeastern U.S. (Linthurst et al., 1986; Landers et al., 1988). For example, at