



The response of sulphate in Icelandic rivers to the decline in global atmospheric SO₂ emission into the North Atlantic region

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This study presents the changes in dissolved sulphate concentration and isotope composition of Icelandic river waters between the peak of SO₂ emission in the USA and Europe and the present. Chloride concentration in Icelandic rivers has not changed much since 1972. The overall average change from 1972-1973 to 1996-2004 was -3%, indicating insignificant sea-salt contribution changes. More than 99% of the river dissolved sulphur was in the form of sulphate. There are 3 main sources for dissolved sulphate in the rivers: rocks, sea-salts and anthropogenic. Total dissolved sulphate, $_{td}SO_4$ and non-sea-salt-sulphate, $_{nss}SO_4$, decreased in all of the rivers, from the early seventies to 1996-2004. The percentage decrease varies from 13% to 65%. The decrease is smallest in rivers where there is considerable rock derived dissolved SO₄. The overall average decrease was 39% for $_{td}SO_4$ and 46% for $_{nss}SO_4$. The anthropogenic sulphate fraction has declined making most of the river waters $\delta^{34}S$ values of sulphate higher through time. The overall decline in river sulphate and increase in $\delta^{34}S$, while SO₂ emission from Iceland has been increasing, demonstrates the response of river chemistry in the remote North-Atlantic to the decline in man-made emission of SO₂ in North America and Europe.