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Online Library HESS
- Recent Final Revised Papers
- Volumes and Issues
- Special Issues
- Library Search
- Title and Author Search

Online Library HESSD
Alerts & RSS Feeds
General Information
Submission
Review
Production
Subscription
Comment on a Paper

Volumes and Issues | Contents of Issue 5

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The effect of changes in natural and anthropogenic deposition on modelling recovery from acidification

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Abstract. The multi-layer dynamic soil chemistry SAFE model was used to study the dynamics of recovery in the F1 catchment at Lake Gårdsjön, Sweden. The influence of (1) sulphate adsorption, and (2) changes in marine deposition, on model predictions of recovery was studied. Sulphate adsorption/desorption in SAFE is modeled by an isotherm in which sulphate adsorption is dependent on both the sulphate concentration and the pH in the soil solution. This isotherm was parameterised for the B-horizon of F1 for the sulphate concentration range 10–260 m mol^{-1} and the pH range 3.8–5.0. Sulphate adsorption/desorption as the only soil process involving sulphate is adequate to predict sulphate in run-off at F1. Adding the process caused time-delays in sulphate concentration in run-off of only 1-2 years, which was much shorter than previously seen in the adjacent G1 catchment. The location of Lake Gårdsjön, approximately 15 km inland from the Swedish west coast, ensures that the marine deposition to the area is high. Model output showed that the temporal variation in marine deposition has a considerable impact on the run-off chemistry. Such changes in marine deposition are difficult to foresee and their influence on modelled run-off chemistry can be large when soils start to recover as the previously high concentrations of anthropogenic sulphate in the soil solution decrease.

Keywords: climate change, dynamic modelling, run-off chemistry, sea-salt effect, soil and water acidification, sulphate adsorption

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