A biogeochemical model of acidification: MAGIC is alive and well

Magnus Norling\textsuperscript{1}, Øyvind Kaste\textsuperscript{1}, and Richard Wright\textsuperscript{1}

\textsuperscript{1}Norwegian Institute for Water Research

September 28, 2023

Abstract

For 40 years MAGIC has been used to simulate the acidification of soils and waters due to acid deposition. The original model has now been updated and re-implemented in the C++ Mobius platform and is available as open source. New features include multipoint calibration, forest growth, and a soil carbon module. The Mobius platform facilitates automatic optimisation of calibrated parameters and multiple-calibrations using Monte-Carlo routines. The usefulness of MAGIC is demonstrated by application to the 50-year data series for deposition and runoff at Birkenes, a small, calibrated catchment in southern Norway. Acid deposition has declined dramatically at Birkenes since the peak in the 1970s. Sulphate is 90\% lower. Stream water has recovered strongly. Decreased concentrations of sulphate have led to increased acid neutralising capacity, pH and reduced concentrations of toxic aluminium. These changes are well-simulated by MAGIC. The new features added as part of Mobius improve the simulations. The MAGIC-Mobius modelling tool is now available for applications to scenarios of land-use and climate change.

Hosted file