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Validating geochemical models for enhanced rock weathering: an assessment of model inputs and comparability of model results to experimental data

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The application of crushed mafic rock to agricultural land, one method of enhanced weathering (EW), is widely considered a promising carbon dioxide removal (CDR) technique. As such research into cropland-based EW has boomed in recent years, spanning geochemistry to social sciences, and several start-up companies (including UNDO Carbon Ltd) have been founded and have begun spreading crushed rock on large areas of land.

A wealth of experimental data has been generated in recent years, assessing enhanced weathering under specific soil, rock and climatic conditions. These experiments are typically short in duration (usually less than one year, but up to three years), whereas EW is hypothesised to continue removing CO_2 from the atmosphere along multi-year to -decadal timescales. Therefore geochemical modelling has been an important research avenue to assess the potential for EW over longer timescales and under varied soil conditions to assess the country- and continental-level potential of EW.

Geochemical modelling is continually being improved, but there are still uncertainties in the efficacy of geochemical models to replicate CDR via EW. There are very few published studies which have compared geochemical models with experimental data - with only a handful of EW papers integrating experimental data with geochemical modelling.

From a range of experimental papers, we will present data-modelled CDR generated by inputting published model parameters including: (1) rock characteristics (rock mineralogy, mineral chemistry, surface area), (2) climate conditions (temperature and rainfall), and (3) soil characteristics (soil pH, cation exchange capacity) into a published geochemical model that has assessed CDR from a soil column experiment. These model results are then compared to published CDR results to assess gaps and uncertainties in EW geochemical modelling.