Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24142

Validation of an Enhanced Weathering Model for estimating CDR and its uncertainty with in-field data from Brazil

JUNYAO KANG[1], CHRISTINA LARKIN[1], MATTEO B. BERTAGNI[2], SALVATORE CALABRESE[3], MARIANE CHIAPINI[1], PHILIPP SWOBODA[1], MAYRA MANIERO RODRIGUES[1], JESSICA FERRAREZI[1], LETICIA SCHWERZ[1] AND MATTHEW CLARKSON[1]

[1]InPlanet GmbH
[2]Princeton University
[3]Texas A&M University

Presenting Author: junyao.kang@inplanet.earth

Enhanced weathering (EW) involves the acceleration of natural weathering via the deployment of crushed silicate rocks on soils. EW is a promising carbon dioxide removal (CDR) technique that has the potential to remove CO_2 at the gigaton scale [1]. Multiple geochemical models simulating EW have been developed to quantitatively evaluate CDR during feedstock dissolution. However, validations of these models with real-world data, especially those from EW deployment sites, are limited.

In this study, we address this critical gap by evaluating an Enhanced Weathering Model with in-field data from InPlanet's EW deployment site in Brazil.

The primary model used here is an ecohydrological and biogeochemical EW model developed by Bertagni et al. (2024) [2], which focuses on the temporal dynamics of average physical and chemical quantities within the upper soil layers. Compared with other reactive transport models (e.g., SCEPTER [3]), the depth-averaged EW model has significant practical advantages for computational requirements when focusing on the feedstock dissolution dynamics. The model uses local hydroclimatic and soil-related parameters from direct in-field measurements to calculate potential and effective CDR. Since the mineral dissolution kinetics have major effects on CDR estimates but are highly uncertain, the EW model provides a pragmatic tuning approach where in-field observations can be used to constrain modeled rates. Given spatial and temporal variations related to in-field measurements, we also assessed the uncertainty of CDR predictions related to variability in soil parameters using Monte Carlo simulations. While further observations are needed to tune the dissolution rates and refine some modeling components, this study demonstrates the model ability to capture the soil-system dynamics and give a first estimate of CDR through EW.

References:

[1] Beerling, David J., et al. (2020), *Nature* 583.7815, 242-248.

[2] Bertagni, Matteo Bernard, et al. (2024), *Authorea Preprints*.

[3] Kanzaki, Yoshiki, et al. (2022), *Geoscientific Model Development* 15.12, 4959-4990.