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Quantifying carbon dioxide removal in an enhanced rock weathering field trial in Queensland, Australia: a soil-based mass balance approach

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Enhanced rock weathering (ERW) is a carbon dioxide removal (CDR) strategy that can potentially be scaled rapidly at relatively low cost. A barrier to scaling of ERW has been the ability to monitor in-situ rates of weathering and thus CDR in the field. One solution to this problem is to use a mass-balance approach to calculate the loss of mobile cations from weathered ERW feedstock in the solid soil phase. This approach has been shown to closely match CDR estimates from more time- and labor-consuming reaction-product-accounting techniques in a laboratory study [1]. We applied this method – TiCAT – in a major multiyear ERW field trial in Queensland, Australia. In this trial, crushed basalt was added at rates of 20 t ha^{-1} y^{-1} and 50 t ha^{-1} y^{-1} to sugarcane fields, with different soil types and irrigation regimes in a tropical climate. We find that we are able to resolve a clear signal for high rates of weathering of basalt at different rates of application. Our results demonstrate the efficacy of soil-based mass balance approaches to ERW monitoring, with implications for the scalability of field-based ERW; and demonstrates the importance of determining in-situ ERW rates in a range of climates and geographies in order to predict the global potential of ERW as a CDR technology.

[1] Reershemius, Kelland et al. (in prep.) https://doi.org/10.48550/arXiv.2302.05004