

Glacial rock flour as an agent for soil improvement

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The Greenland Ice Sheet (GRIS) produces large amounts of fine-grained mineral particles by erosion of the bedrock. This glacial rock flour (GRF) is deposited in a number of proglacial and near-coastal environments such as lakes, deltas and tidal flats, as well as in a number of Holocene raised marine and deltaic deposits. Medial diameter of GRF particles range between 2 - 11 μm , and on a volumetric basis, 10 - 30% of the particles are below 1 μm . Furthermore, GRF is chemically very immature, so the deposits are not affected by extensive re-equilibration at earth-surface conditions. These two features impart a high reactivity to the material and suggest that it is an excellent candidate for combined arable land improvement and CO₂ capture. GRF is already available in a powdered state and in large quantities at the coastal locations. Therefore, there are significant economic advantages compared to other proposed schemes for crushed rock cropland additives.

We evaluate the efficacy of GRF in changing soil geochemical environments and capturing atmospheric CO₂ using a combined macroscopic and microscopic approach. These include measurements of chemical reactivity of GRF based on the results of leaching experiments and grain size analysis, and the effect of dissolution as a function of time in nanoscale using atomic force microscopy (AFM).