

# Enhanced weathering and BECCS – are carbon dioxide removal technologies complements or substitutes?

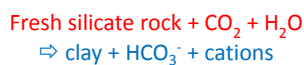
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16.11.2015 – Enhanced weathering of rocks could be an alternative option for carbon dioxide removal from the atmosphere, especially when CCS is not available.

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## What is enhanced weathering of rocks?

Weathering of silicate rocks consumes atmospheric CO<sub>2</sub>:



The natural process is only efficient on geological time scales to balance the atmospheric CO<sub>2</sub> content. It can be enhanced by increasing the surface area, i.e. using very small grain sizes.

Enhanced weathering needs three steps:

1. Mining of suitable rocks (dunite (olivine-rich), basalt)
2. Grinding to small grain sizes (< 100µm)
3. Spreading on crop lands in warm and humid regions

## Potential side effects

Positive

- Increase of coastal zone water pH
- Supply of nutrients to croplands

Negative

- Environmental costs of mining
- Potential mobilization of trace metals

## Results I: Global supply curve

We derived supply curves for 26 world regions for olivine with a mean grain size of 20 and 50 µm, respectively. The carbon removed is not per year, but the integral over time until all of the olivine has weathered (halftime ~ 7 and 14 years).

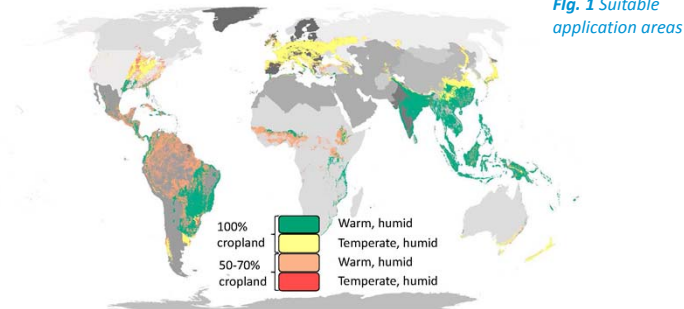


Fig. 1 Suitable application areas

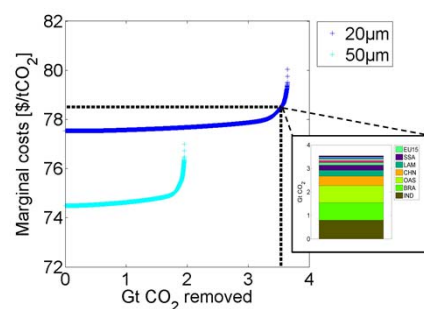


Fig. 2 Global partial supply curve for negative CO<sub>2</sub> emissions with enhanced weathering. The subplot shows regional contributions.

## Why do we need enhanced weathering?

Scenarios in AR5 show that negative emissions are crucial for achieving the 2° C target. They were criticized for relying heavily on BECCS. EW is an alternative option to generate negative emissions.

## Results II: Model results

Enhanced weathering is used in REMIND as a mitigation option starting in the middle of the century. If BECCS is limited (by limiting the availability of bioenergy or restricting CCS) EW is used earlier, thereby partially substituting BECCS.

The cumulated carbon budget remains almost unchanged. EW allows for more CO<sub>2</sub> emissions early in the century which are compensated by negative emissions later on. A given climate target can be achieved at lower costs – at given costs, lower climate targets can be achieved.

## KEY RESEARCH QUESTIONS

- / When and to which extent is enhanced weathering deployed in integrated assessment models?
- / How does enhanced weathering interact with the energy system?
- / How does enhanced weathering interact with other mitigation options, especially other CDR technologies?

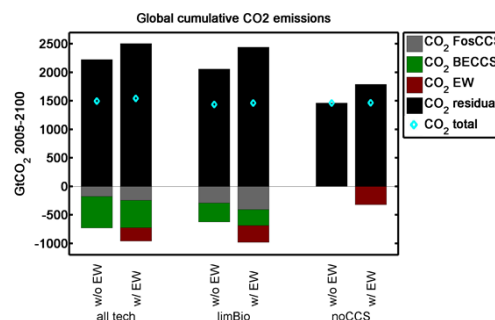


Fig. 3 Change of global carbon pools until 2100 for different technology options. Scenarios reach a total radiative forcing of 2.6Wm<sup>-2</sup> in 2100 and assume a grain size of 20µm.