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Calcium carbonate dissolution in coastal and shelf sediments

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The balance between calcium carbonate ($CaCO_3$) precipitation in the surface ocean and dissolution in the deep ocean and seafloor regulates atmospheric carbon dioxide (CO_2) levels on thousand-year timescales. $CaCO_3$ precipitation removes alkalinity and releases CO_2 to the atmosphere, whereas dissolution produces alkalinity, driving atmospheric CO_2 uptake. Most research focuses on $CaCO_3$ dissolution in the deep-sea water column and seafloor, or in high carbonate environments such as reef sands. Coastal and shelf environments on the other hand have received less attention, even though these shallow regions equilibrate rapidly with the atmosphere and could provide a CO_2 feedback on decadal timescales.

Here, I present a compilation of $CaCO_3$ dissolution rates from coastal and shelf sediments. Data suggests that the $CaCO_3$ content of the sediment itself was of minor importance, but instead the rate of aerobic respiration, which acidifies the porewater, determined the $CaCO_3$ dissolution rate. As such, oxygenated coastal sediments that receive a high organic matter input, such as those found in reef and seagrass systems, exhibit the highest dissolution rates per surface area. My updated $CaCO_3$ budget shows that $CaCO_3$ export from shelves to the deep sea is much higher than previously estimated. Accordingly, an important fraction of $CaCO_3$ produced on the shelf is subsequently transferred from the short-term to the long-term CO_2 feedback.