

# Phanerozoic CO<sub>2</sub> and O<sub>2</sub> evolution under rapid recycling as forced by dynamic sea-level and uplift changes

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Atmospheric CO<sub>2</sub> and O<sub>2</sub> variability through the Phanerozoic is thought to be fundamentally influenced by weathering induced rapid recycling of matter and weathering-uplift of fresh silicate rocks, as explored by Berner and co-workers.

## Rapid recycling

A large fraction of buried matter escape long term storage in deep sedimentary basins under the weathering influence of rapid recycling forced by sea-level changes and basin uplift. Early on, Berner and Canfield recognized the need for rapid recycling in dampening in particularly excursions in O<sub>2</sub>. Incomplete silicate weathering during glacial times and subsequent rapid recycling have received little attention despite its potential influence on CO<sub>2</sub> and climate. Despite the fundamental importance of the rapid recycling parameterization little has been done toward exploring more mechanistic modelling of rapid recycling and its dynamic interaction with climate change. In this tribute toward Bob's legacy I explore rapid recycling with a mechanistic model of the dynamic interaction between climate, sea-level and weathering and its influence on CO<sub>2</sub> and O<sub>2</sub> in a model building on Berner's GEOCARBSULF model.

## Weathering-uplift

The parameter for weathering-uplift of fresh rocks results in fundamental amplification of the carbon cycle changes diagnosed from carbon isotope changes. In GEOCARBSULF and similar models the weathering-uplift variable is based on very early compilations of sedimentary rock abundances. In the model presented, I further explore a dynamic parameterization based on the convolution of changes in seafloor spreading rates, sea-level and continental freeboard as influencing the sedimentary rock abundance and zircon-age distributions through the Phanerozoic.

The new additions to the family of GEOCARBSULF models allow us to begin modelling the Proterozoic-Phanerozoic evolution but also diagnosing important areas to be included in more pure process based feedback models.