

## Maximum Entropy Production and Biotic Enhancement of Rock Weathering

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The Earth is dynamic system far from thermodynamic equilibrium. The principle of Maximum Entropy Production (MEP) suggests that such systems, given sufficient degrees of freedom, maintain steady states at which the production of entropy is maximized. Previous studies have applied the MEP principle to photosynthetic activity and its feedbacks to Earth system functioning. Since photosynthetic activity requires the absorption of solar radiation, a minimum planetary albedo would lead to a maximization of entropy production. Earlier studies also indicate that the biotic enhancement of rock weathering has led to drastic changes in atmospheric CO<sub>2</sub> levels on a geological timescale accompanied by a substantial decrease in planetary surface temperatures in comparison to an abiotic world. Biotic activity, through photosynthesis, respiration, and the enhancement of rock weathering, affect the atmospheric concentration of carbon dioxide and therefore the strength of the Earth's greenhouse effect and the planetary albedo. These in turn affect the productivity of terrestrial productivity. In this study, we improve upon an earlier box model of the climate-carbon cycle by including biotic enhancement of rock weathering and a more sophisticated representation of the constraints on terrestrial productivity. The MEP principle is applied to a simple box model to observe whether it leads to results that are reasonably consistent with the general suggested pattern of atmospheric and biospheric evolution.