

Interactive comment on “Weathering by tree root-associating fungi diminishes under simulated Cenozoic atmospheric CO₂ decline” by J. Quirk et al.

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Received and published: 21 October 2013

Quirk and colleagues present here experimental and modeling results that quantify the effect of atmospheric CO₂ on plant- and mycorrhizal-mediated chemical weathering. This topic is of broad significance to biogeochemistry, and especially the long-term dynamics of carbon and nutrient cycling. The presented results break substantial new ground, particularly with regards to quantifying the role of CO₂ and mycorrhizae on chemical weathering. This paper should serve as an important reference for years to come.

The authors note in their introduction that long-term carbon cycle models like

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GEOCARB include in their parameterization a CO₂ fertilization effect on chemical weathering. The authors now have, for the first time, a quantification of this effect. Given this, it would be useful to cross-check with the (previously untested) parameterization of GEOCARB. In GEOCARB: $f_{BB} = (1 + 0.087 \cdot GCM \cdot \log(RCO_2) - 0.087 \cdot Ws \cdot (t/570) + 0.087 \cdot GEOG) \cdot (2 \cdot RCO_2 / (1 + RCO_2))^{FERT}$ where: f_{BB} is the effect of CO₂ on plant-assisted weathering for silicates and carbonates at time (t) to the present-day; GCM is related to climate sensitivity (ΔT_{2X}), where $\Delta T_{2X} = GCM \cdot \ln(2)$; t is time in Myrs ago; GEOG is the change in land mean surface temperature at time (t) relative to the present-day due only to changes in paleogeography (K); and FERT is the fraction of vegetation whose growth is stimulated by elevated CO₂; it is related to enhanced chemical weathering by the Michaelis-Menton expression $[2 \cdot RCO_2 / (1 + RCO_2)]^{FERT}$.

Holding all parameters other than CO₂ constant, and assuming the standard value of 0.4 for FERT, how close does the GEOCARB response (i.e., $[2 \cdot RCO_2 / (1 + RCO_2)]^{0.4}$) match the measured response by the authors?

Two minor comments:

It would be helpful to cite this paper in the introduction: Andrews, J., and Schlesinger, W., 2001, Soil CO₂ dynamics, acidification, and chemical weathering in a temperate forest with experimental CO₂ enrichment: *Global Biogeochemical Cycles*, v. 15, p. 149-162.

On p.3, line 17: need a reference for this statement.

Interactive comment on Biogeosciences Discuss., 10, 15779, 2013.

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