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## Do soil micro-organisms influence the oxygen isotope composition of atmospheric CO<sub>2</sub>?

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Terrestrial ecosystem processes, such as photosynthesis and respiration play a role in shaping the oxygen isotope composition of CO<sub>2</sub> in the atmosphere ( $\delta^{18}\text{O}_a$ ) (Francey & Tans, 1987; Farquhar *et al.*, 1993). However, global models incorporating these two large and opposing gross fluxes currently fail to capture the seasonal phasing of  $\delta^{18}\text{O}_a$  (Ciais *et al.*, 1997; Peylin *et al.*, 1999; Cuntz *et al.*, 2003). Soil dwelling organisms may have a large influence on  $\delta^{18}\text{O}_a$ . This is because the enzyme carbonic anhydrase (CA) accelerates the isotopic exchange of oxygen atoms between CO<sub>2</sub> and soil water, thereby amplifying the contributions of "atmospheric CO<sub>2</sub> invasion" to the oxygen isotope composition of the net soil CO<sub>2</sub> flux ( $\delta^{18}\text{O}_R$ ). This influence of soil microbial physiology on  $\delta^{18}\text{O}_a$  has been largely ignored because of conflicting findings within the literature. Here, using several datasets containing  $\delta^{18}\text{O}_R$  measured in soil chambers and depth-resolved profiles of soil water oxygen isotope composition ( $\delta^{18}\text{O}_{sw}$ ) from a range of different ecosystems, we show that accelerated isotopic exchange may be a general phenomenon. As the oxygen isotope signals of soil CO<sub>2</sub> exchange are thought to have a larger influence on the spatial and intra-annual variability of  $\delta^{18}\text{O}_a$  than biosphere photosynthesis (Ciais *et al.*, 1997) the influence of microbial carbonic anhydrase activity should be examined in future simulations of  $\delta^{18}\text{O}_a$  at the global scale.

### References

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