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Scaling the fluxes of carbonyl sulphide (COS) between soils and the atmosphere from the microcosm to the globe

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Recent interest in the seasonal and spatial variability of atmospheric COS concentrations has intensified as its use as an atmospheric tracer of global primary productivity has been proposed. This is because the enzyme carbonic anhydrase (CA), present in plants, catalyses both the hydration of CO_2 and the hydrolysis of COS during leaf gas exchange. Consequently the terrestrial biosphere is estimated to be a strong sink for COS. However, as CA is a widespread enzyme, soil micro-organisms can also take up COS from the atmosphere. So far COS budgets were based on scarce datasets of soil COS fluxes restricted to just a few biomes and land uses. Here we present results from a large-scale survey of soil COS fluxes collected from a wide range of biomes and soil properties. We found that soil microbial biomass and inorganic nitrogen (N) were the strongest predictors of soil COS fluxes. These microcosm experiments provided a novel modelling framework for scaling soil COS fluxes to the global scale providing constraints on the contribution of soils to the COS mass budget.