



A field measurement perspective on the current and future use of carbonyl sulphide as a carbon cycle tracer

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Carbonyl sulphide (COS) is gaining increasing traction as a tracer to constrain gross terrestrial biosphere-atmosphere CO₂ fluxes, due to the close coupling between photosynthesis and COS uptake by plants. Results from laboratory, field and atmospheric measurements, combined with modeling analyses, have all confirmed the potential of COS, but as with any new approach, many details still remain to be resolved. Drawing on results from our field campaigns that include component (branch and soil) and ecosystem COS flux measurements in a range of environments, I will provide a view on what we have learned about using COS as a carbon cycle tracer. These measurements support the view that ecosystem COS fluxes are typically dominated by canopy uptake, and have provided insight into carbon cycle processes not available from CO₂ measurements alone. They have also provided some interesting surprises that suggest COS data may also provide information on other biogeochemical and plant processes such as phenology. Our results support the addition of COS to our measurement arsenal to improve our understanding and monitoring of the terrestrial biosphere, but moving forward will require addressing some key uncertainties. These include the role of the soil and the variation in the leaf-level COS to CO₂ uptake ratio in different environments. Combining COS with stable isotope tracers, particularly CO₂, can provide a powerful way with which to both improve our understanding of COS biogeochemistry and constrain our estimates of terrestrial CO₂ fluxes.