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Assessing the Contribution of Oceanic Fluxes to the Global Budget of Carbonyl Sulfide

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Accurate quantification of the global budget of atmospheric carbonyl sulfide (COS) is needed given its role in atmospheric chemistry and the global carbon cycle. COS is the most abundant atmospheric sulfur gas. In the stratosphere, COS is photodissociated to provide a significant source of sulfate aerosol, a key agent of stratospheric ozone depletion. In the troposphere, measurements of the COS variation have the potential to provide constraints on the rates of CO_2 assimilation by terrestrial plants and hence on primary productivity. Accurate knowledge of the global budget of COS and of its respective source and sink fluxes is therefore needed to understand its impact on ozone depletion and on the carbon cycle. Recent estimates of the global COS budget, however, reveal discrepancies between known sources and sinks. In particular the magnitude of the oceanic flux (the largest known source to the atmosphere) remains uncertain. The ocean provides a source of COS to the troposphere through direct emission, and potentially through emission of COS precursors such as carbon disulfide (CS_2). Here we assess the role of the ocean in the global COS budget using a global atmospheric transport model (GEOS-Chem) in combination with recent estimates of COS source and sink fluxes, and with available oceanic and atmospheric measurements of COS. We compare different realizations of oceanic COS fluxes taken from ocean biogeochemistry models and from recent data syntheses, and assess their ability to reduce the uncertainty in the current global budget of COS.

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