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Ultraviolet absorption cross sections of isotopically substituted carbonyl sulfide species: $OC^{32}S$, $OC^{33}S$, $OC^{34}S$, and $O^{13}CS$

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Carbonyl sulfide (OCS), a relatively inert tropospheric sulfur compound is thought to play an important role as a source of background stratospheric sulfate aerosols (SSA). The main sink for OCS in the stratosphere is photolysis which reaches 80% of the total chemical sink at above 20 km; other sinks include reactions with $O(^3P)$ and OH. In order to investigate the wavelength dependence of the photolytic kinetic isotope effect the absolute ultraviolet (UV) absorption cross sections of OCS isotopologues $OC^{32}S$, $OC^{33}S$, and $OC^{34}S$ were measured using labeled samples prepared in the laboratory. The observed cross section of $OC^{32}S$ is consistent with previous reported cross sections of natural abundance samples. The peak positions for labeled samples were shifted in a systematic way. Isotopologue absorptions cross sections were not only shifted in energy but in intensity. In particular, the $OC^{33}S$ isotopologue had the largest cross section of the measured OCS isotopologues. This finding indicates that OCS photolysis may have a positive mass-independent effect on sulfur in the stratosphere. Since OCS photolysis occurs in the lower stratospheric region, integrated photolysis rates of each OCS isotopologues at 20 km are also discussed.