

Recently Detected CFCs: UV Absorption Spectra, Atmospheric Lifetimes, Global Warming and Ozone Depletion Potentials

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Chlorofluorocarbons (CFCs) are ozone depleting substances (ODSs) and potent greenhouse gases. Recent measurements have observed for the first time CFC-112 ($\text{CFCl}_2\text{CFCl}_2$), CFC-112a ($\text{CF}_2\text{ClCCl}_3$), and CFC-113a (CCl_3CF_3) (Laube *et al.*, 2015) in the atmosphere. The current atmospheric abundances of CFC-112 and CFC-112a are ~ 0.4 and ~ 0.06 ppt, respectively, with decreasing abundance since 1995. In contrast, CFC-113a was found to show continuous growth over the past 50 years with a current atmospheric abundance of ~ 0.5 ppt.

The major atmospheric removal process for these compounds is expected to be UV photolysis in the stratosphere. To date there is, however, no UV absorption spectra for these compounds available in the literature. To better determine the atmospheric lifetimes and environmental impact of these CFCs, laboratory measurements of the UV absorption spectra of CFC-112, CFC-112a, CFC-113a, and CFC-114a (Cl_2FCF_3) between 195 and 235 nm and over the temperature range 207 to 323 K were performed. Spectrum parametrizations were developed for use in atmospheric models. Atmospheric lifetimes and ozone depletion potentials (ODPs) were calculated using the Goddard Space Flight Center 2-D atmospheric chemistry model. Infrared absorption spectra of these compounds were also measured and used to calculate their global warming potentials. The results of the laboratory measurements and model calculations will be presented.

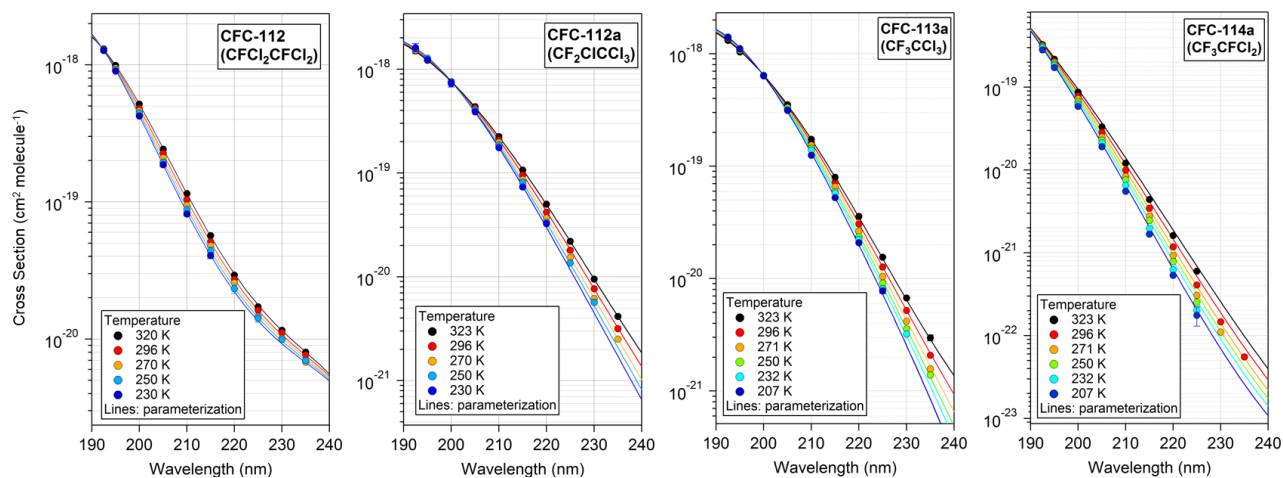


Figure 1. Temperature dependence of UV spectra of CFC-112, CFC-112a, CFC-113a and CFC-114a between 207 and 323 K obtained in this work.