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Production of HCHO and CO by Antarctic Snow

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Observations in both the Polar Regions and mid latitudes show photochemistry occurring in the snow-pack is an important source of reactive trace gases to the boundary layer. Indeed, snow photochemistry can dominate the atmospheric chemistry of background polar boundary layer. However, snow emissions must be better-identified and quantified in order to understand the atmospheric composition over, and downwind of, snow-covered areas. In a warmer world a significant decreases in snow coverage of the Arctic are predicted. Thus, characterizing the impact of snow on the present day atmosphere is necessary for an understanding of future atmospheres, on both regional and global scales. In addition, before complete information on past atmospheres can be unlocked from ice cores, photochemical post-depositional processes in snow must be understood.

We irradiated blocks of Antarctic surface snow (λ = 200nm – 2500nm) in an isolated chamber and investigated the simultaneous release of reactive gases HCHO and CO as a function of temperature and wavelength. From full lamp irradiance (approximately 10x the intensity of the sun at the relevant wavelengths) we found net fluxes of both HCHO and CO to be on the order of 10^{12} molecules/m^2/s. In the dark, HCHO emissions showed a temperature dependence of $\sim$1x10^{12} molecules/m^2/s/10^{o}C at –25^{o}C. No temperature dependence was found for CO. The relative contribution of photochemistry and temperature effects on the diurnal cycles of atmospheric HCHO and CO at Halley, Antarctica will be discussed.