Sears, Derek W.; White, K.; Chevrier, V. (2007) The Sublimation Rate Of Solid CO2 Under Simulated Mars Conditions And Possible Implications. American Astronomical Society, DPS meeting #39, #17.08

Abstract

In order to better understand the behavior of solid CO2 on Mars we have begun a program to measure the sublimation rate of dry ice under simulated martian conditions. Our objective is to determined theory-guided, experiment-driven, semi-empirical relationships between sublimation rate and temperature that can be applied to problems in martian geology and meteorology. We measured the sublimation rate of dry CO2 ice in a 7 mbar CO2 atmosphere and -10oC in a chamber large enough to provide uniform and steady conditions and minimize wall effects. We measured sublimation of a solid block of CO2, centimeter-sized gravel pieces, a finely ground powder. We found these forms of CO2 evaporated at a fairly constant rate of 22 ± 2 g/h, suggesting that the samples are only sublimating from the cross section facing the atmosphere and that particle size is not important. The rate is then calculated to be 450 mm/h, regardless of particle size. Our own, admittedly approximate, calculation for the rate of sublimation of the northern and southern CO2 cap during spring and summer is 0.12 µm/h for the northern cap (Planum Boreum) and 0.95 µm/h for the southern cap (Planum Australe). It has been suggested that CO2 sublimating occurs as snow in the north as ice in the south. However, our results suggest that particle size is not responsible for this difference in cap recession and we infer that differences in mean temperature are more likely to be responsible. However, some caution is necessary because current work suggests that a major factor is the existence of a boundary layer that results in major temperature differences between the atmosphere and the surface.

Note: There are errors in the units in this abstract that will be corrected in due course.