



## Total accumulation of the seasonal south polar cap of Mars

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**Introduction:** About half of the Martian atmosphere, which is mainly composed of CO<sub>2</sub>, is trapped during the winter at the surface near the pole in the form of CO<sub>2</sub> frost. During the spring, the CO<sub>2</sub> is heated up and sublimates. This major Martian climatic cycle has been revealed by the pioneer work of Leighton and Murray [1]. Contrary to the North polar cap, the South polar region is asymmetric around the geographic pole as observed in the visible range [2], thermal infrared range or by OMEGA in the near infrared range [3,4]. One particular region, called the cryptic region [5] sublimates faster than the surrounding, herein called anti-cryptic region. This recession asymmetry can be due to an asymmetry in accumulation, or in the sublimation flux. The CO<sub>2</sub> net accumulation has been estimated using various methods at large scale using the gamma ray spectrometry by GRS [6] and the neutron spectrometry by HEND [7]. Other studies using MOLA data shows no clear evidence of symmetric accumulation [8]. There is a lack of observational evidences about the SSPC accumulation at the scale of the cryptic region. In addition, both observations by TES [9], by PFS [10] and GCM calculations [9] show that there is an asymmetry in snowfall, most probably due to topographic forcing. During the recession phase, the sublimation flux is mainly controlled by albedo of the ice layer [3]. Albedo of the cryptic region is lower than the one on the anti-cryptic region [5] leading to a relative faster sublimation in the cryptic region. We will discuss here if this albedo difference is at the origin of the recession asymmetry or if the accumulation is asymmetric too.

**Method:** We propose to compare the CO<sub>2</sub> accumulated mass measured by GRS/HEND during the polar night, to the sublimated CO<sub>2</sub> mass estimated by our model, using parameters (such as albedo and crocus line [11]) provided by OMEGA. This comparison is done for two sectors: the so-called cryptic sectors (60°E-260°E) and anti-cryptic sector (100°W-60°E). The CO<sub>2</sub> mass balance is related to the radiative balance at the surface [12]. We use here a model based on the parameterization of the "instantaneous" insolation [3] and compute the daily averaged sublimation mass. The date of the beginning of the sublimation is a free parameter; the OMEGA crocus line fixes the date of the end of the sublimation. . We propose to estimate bolometric albedo in a two steps process: (i) estimation of the reflectance at 1.07 microns in the continuum using Vincendon's approach to remove the contribution of aerosols [13].

**Results:** Regarding this study for both sectors, the main conclusion is that the SSPC accumulation is symmetric. At 85°S, the total sublimated mass expected is slightly higher for the anti-cryptic region, where the snow events are more likely. The expected masses are always within the errors bars of the GRS measurements, for both cryptic and anti-cryptic regions.

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