Geophysical Research Abstracts
Vol. 13, EGU2011-953, 2011
EGU General Assembly 2011

Peculiar Phenomena of Sublimating Seasonal Deposits During Northern Spring on Mars

Thomas Appéré (1), Bernard Schmitt (1), Yves Langevin (2), Aymeric Spiga (3), Sylvain Douté (1), Antoine Pommerol (4), François Forget (3), Brigitte Gondet (2), and Jean-Pierre Bibring (2)

(1) Institut de Planétologie et d'Astrophysique de Grenoble, Université J. Fourier, CNRS/INSU, Grenoble, France (thomas.appere@obs.ujf-grenoble.fr), (2) Institut d'Astrophysique Spatiale, Université Paris-Sud XI, CNRS/INSU, Orsay, France, (3) Laboratoire de Météorologie Dynamique, IPSL, CNRS/INSU, Université Pierre et Marie Curie, Paris, France, (4) Physikalisches Institut, Universität Bern, Silderstrasse 5, CH-3012 Bern, Schwitzerland

We report on peculiar phenomena occurring during the martian year (MY) 28 spring retreat of the northern seasonal deposits. First of all, OMEGA observations show the vanishing of the CO_2 ice spectral signature at $L_s \sim 50°$ on many regions where a surface temperature of 150K is however indicative of abundant CO_2 ice. We thus conclude that CO_2 ice is progressively overlaid by an optically thick cover, either of dust or of water ice. A water frost layer overlying CO_2 ice is consistent with the observations of both high albedo and strong H_2O ice signature on this region. This water frost layer is likely composed of H_2O ice grains included in the CO_2 ice layer during its winter condensation and released by its spring sublimation [1]. Some water vapor coming from the sublimating water ice annulus at lower latitudes may also be cold trapped on top of the CO_2-rich ice and contributes, from above, to the building of this H_2O ice layer. Radiative transfer modeling in layered media [2] using optical constants of CO_2 and H_2O ices [3, 4] shows that a 200μm thick layer of H_2O ice is sufficient to completely hide the CO_2 ice spectral signature.

The CO_2 ice spectral signature suddenly reappears in the spiral troughs and arcuate scarps of the North permanent cap and in the circumpolar dark dunes field at L_s ranging from 40° to 70°. Winds have been simulated for that range of L_s with the LMD Martian Mesoscale model [5]. It indicates strong katabatic winds on the permanent cap, particularly in regions where the CO_2 ice signature strongly reappears and H_2O ice signature decreases. Reappearance of the CO_2 ice signature on the North permanent cap is thus likely due to the removing of the overlying water frost layer by wind. A different process may be involved in the dunes field, where low friction velocities are simulated. Instead, reappearance of the CO_2 ice signature on dunes may be linked with the host of sublimation-driven features observed by the HiRISE camera [6]. Release of pressurized CO_2 gas could scatter the H_2O ice layer while CO_2 frost may be formed by decompression and adiabatic cooling of that gas, contributing to the reappearance of the CO_2 ice signature as well. Several different processes could be at the origin of these peculiar phenomena and the understanding of their origins can shed some light on the microphysical evolution of ice deposits. These phenomena already witness a very active surface-atmosphere water cycle and strong wind interaction that may lead finally to inhomogeneous accumulation rates of H_2O ice over the North permanent cap.

[1] Appéré et al. (2010) *JGR*, submitted

[2] Douté S. and Schmitt B. (1998) *JGR E* 103, 31367-31390

[3] Quirico E. and Schmitt B. (1997) *Icarus* 127, 354-378

[4] Grundy W. and Schmitt B. (1998) *JGR E* 103, 25809-25822

[5] Spiga A. and Forget F. (2009) *JGR* 114, E02009

[6] Hansen C. J. et al. (2010) *LPI Contribution* 1533