Geophysical Research Abstracts, Vol. 7, 08884, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08884

Subsurface water ice stability on Mars – current and past climates

H.M. Böttger (1), J. Benkhoff (1,2), F. Forget (3), S.R. Lewis (4), P.L. Read (4), B.H. Foing (1) and J. Helbert (2)

(1) ESTEC ESA, Noordwijk, Netherlands, (2) DLR, Berlin, Germany, (3) LMD, Paris, France, (4) AOPP, University of Oxford, Oxford, UK (hboettger@rssd.esa.int / Fax: +31 715654697 / Phone: +31 715655627)

In the current Martian climate water ice is not stable close to the surface at low and mid latitudes [1,2,3,4]. However, The Mars Odyssey Gamma Ray Spectrometer has detected significant amounts water in equatorial regions within a couple of metres of the surface [5]. This subsurface ice must be slowly diffusing back into the atmosphere as it is out of equilibrium with the current climate, and is presumably a relic from a past epoch. The timescales for this diffusion process, certainly at depths of a few metres, can be extremely large and is dependant on regolith properties. When comparing this to the changes in the Martian obliquity, which has varied between 15˚ and 45˚ within the past 10Ma alone [6,7] with a pseudo-period of the order 100,000 years, it is unlikely that any subsurface water ice, present in low-mid latitudes even at relatively shallow depths, ever reaches equilibrium.

Here we use the LMD Mars General Circulation Model (GCM) [8] coupled with the Berlin Mars near Surface Thermal model (BMST) developed at DLR [8], to assess the stability and longevity of subsurface water at different obliquities as well as locally under present climate conditions. Initial simulations have been conducted in 1D on various sites of interest on the planet including the Gusev Crater, Arabia Terra (site of subsurface H_2O enrichment) and high latitudes in the northern and southern hemisphere. Further 3D studies have been conducted at 30˚, 35˚ and 45˚ obliquity with present perihelion and eccentricity values.

[1] Clifford, S.M. and D. Hillel, J. Geophys. Res. 88, 2456-2474, 1983. [2] Mellon, M.T. and B.M. Jakosky, J. Geophys. Res. 98, 3345-3364 1993. [3] Mellon, M.T. and

B.M. Jakosky, J. Geophys. Res. 100, 11781-11799, 1995. [4] Mellon, M.T. et al. , Icarus 169, 324-340, 2004. [5] Boynton, W.V., et al., Science 297, 81-85, 2002. [6] Laskar, J. and P. Robutel, Nature 361, 608-612 1993. [7] Laskar J. et al., Icarus 170, 343-364, 2004. [8] Forget et al. , J. Geophyis. Res. 104, 24155-24175, 1999. [9] Helbert and Benkhoff, J. Geophys. Res. 108, 28-1, 2003.