**AN ATMOSPHERIC HOT RING AROUND OLYMPUS MONS - COMPARISON WITH MESOSCALE MODELS (LMD AND MRAMS).**
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**Introduction:** We report about a recent discovery made with PFS-MEX data at Mars using the retrieved temperature profiles in the atmosphere. When passing over Olympus in certain particular seasons and local times, we observe two temperature increases, one located to the north of the volcano and one located to the south, extending from the surface up to 15 km altitude (depending on longitude and season). This hot atmosphere occurs mostly between LT = 10.00 and 15.00 and during the northern summer. Analyzing data from many different orbits at different longitudes, it appears that these thermal enhancements are isotropic and have the shape of an hot ring around the volcano.

In Fig.1 we observe the hot atmospheric ring at 5 km up to 10 km above the areoid around the volcano in the distance about 10 degrees in latitudes from the centre. Atmospheric temperatures can increase even up to 30 K there. The atmospheric circulation over an area of 40 x 40 degrees (latitudes and longitudes) is affected by the topography and the presence of Olympus Mons certainly up to 50 km altitude. Olympus Mons on Mars, with its 25 km altitude has a strong impact on the atmospheric circulation, specially when we consider scale heights H for a temperature variability is of the order of 10 – 11 km.

For the first time, some form of thermal circulation around Olympus Mons and Ascreus Mons was remarked by Grassi [1] from PFS measurements. This circulation is a result of an inclination, solar insolation and low thermal inertia of volcano flanks [2]. A Martian air parcel moves upward due to the heating of the volcano slope starting from the morning until the afternoon. Then downward motion along the flanks of volcano is expected during the night. This atmospheric behaviour around Olympus Mons is predicted by the Mars Regional Atmospheric Modeling System (MRAMS) [3], [4]. Thermally-driven slope flow is likely an influential component of a vertical motion [5], although other distinct types of atmospheric circulations (i.e., mountain waves, "barrier" uplift) may also have significant roles [4]. Some of these volcano-induced circulations are strong enough to affect the large-scale atmospheric flow. The perturbations caused by the volcano may be felt quite far away depending on the altitude and time-of-day according to the model results [6]. Therefore with the help of the LMD Martian mesoscale model and Mars Regional Atmospheric Modeling System (MRAMS) we can interpret the observations in terms of mesoscale circulation : the air is adiabatically compressed and therefore heated as result of local downwelling induced by the topography. Work is ongoing to understand the difference in local time at which the phenomenon is observed between the simulations and the observations by PFS, and to study the impact of the position of the sub-solar point. First results of simulations by two mesoscale model LMD and MRAMS are presented in Fig.2 and in Fig.3, respectively.

**Conclusions:** The hot circular region is situated $10^0$ away from the top of Olympus Mons and is present as a hot ring with $5^0$-$7^0$ of width. At 5 km altitude above the areoid, the temperature increase can be up to 30 K with respect to the temperatures of the surrounding area. The cross-section of the thermal field at 10 km shows less prominent temperature differences than at 5 km. The possible explanation for the origin of the circular hot region around at 5 km above the areoid can be the following: the air moves upward on the top of the volcano because of the strong quasi perpendicular insolation (illumination), going up it cools by expanding, and falls down at some distance from the volcano. The temperature increase could result from an adiabatic compression due to downward motion. We present two Martian mesoscale models to compare with observations.

**References:**

[1] Grassi, D., et al. (2005) *Planet. Space Sci.*, *53*, 977 - 992. [2] Benson, J. L. et al. (2003) *Icarus*, 165 (2003), 34 – 52.[3] Rafkin S. C. R., et al. (2002) *Nature*, 419, 697 – 699. [4] Michaels T. I., et al. (2006) *Geophys. Res. Lett.,* 33, L16201, doi:10.1029/2006GL026562. [5] Clancy, R. T., et al. (1996) *Icarus,* 122, 36-62. [6] T.I. Michaels, personal communication

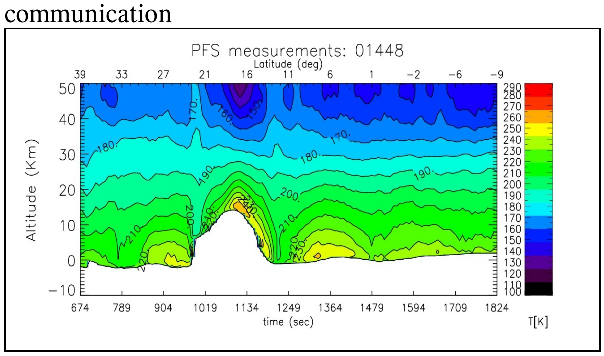


Fig.1. The thermal field over Olympus for Orbit 1448. Isothermal contours are shown versus altitude ( km) on the vertical scale and observation time ( in sec , bottom scale) or latitude ( in degrees top scale). The bottom line profile is the MOLA altimetry. Our atten-

tion goes to the hot regions at 7 and 25 deg latitude: they are cross sections of the hot ring.

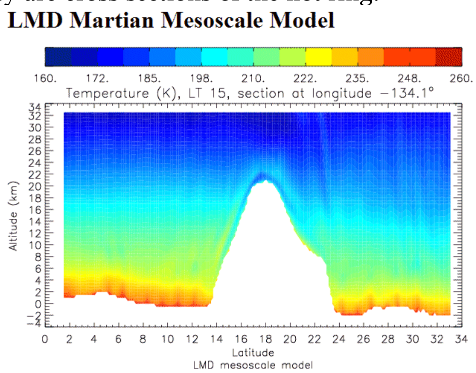


Fig.2. Model thermal fields by LMD around Olympus Mons.

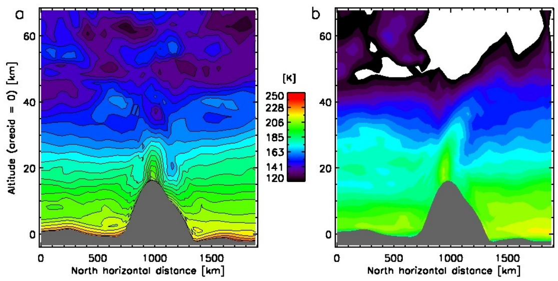


Fig.3. Thermal fields in south-north vertical cross-sections about 100 km west of the Olympus Mons summit by MRAMS model at LT = 13.00 and $L_s$~100 deg, on the right side during the night.