PLANETARY WAVES IN THE MARTIAN ATMOSPHERE OBSERVED WITH PFS/MEX DATA

G. Sindoni (1) *(giuseppe.sindoni@ifsi-roma.inaf.it)*, **M. Giuranna** (1), **A. Geminale** (1), **D. Grassi** (1).
(1) *Institute of Physics of the Interplanetary Space (IFSI-INAF), Rome, Italy*.

The general circulation of Mars is characterized by strong eastward winds in the fall-winter hemisphere. The interaction of this flow with zonally varying topography excites quasi- stationary waves, which take the form of planetary waves for forcing at the largest horizontal scales. [1]. The stationary waves can influence the stability of the atmosphere, enhancing the formation of disturbances at certain longitudes and impeding their formation at others [2]. An indirect yet efficient way to detect and characterize such a complex dynamical process is to study the effects on the atmospheric temperatures [3]. This effect can also be observable in the distribution of minor gasses.

The Planetary Fourier Spectrometer (PFS) on board the ESA Mars Express (MEX) mission [4] can probe the Mars atmosphere in the infrared spectral range between 200 and 2000 cm^{-1} (5-50 μm) with the Long Wavelength Channel (LWC) and between 1700 and 8000 cm^{-1} (1.2-5.8 μm) with the Short Wavelength Channel (SWC).
We study the water vapour and carbon monoxide atmospheric distribution. Although there are several H_2O and CO absorption bands in the spectral range covered by PFS, we use the 3845 cm^{-1} (2.6 μm) and the 4235 cm^{-1} (2.36 μm) bands for the analysis of water vapour and carbon monoxide, respectively. The gaseous concentrations are retrieved by using an algorithm developed for this purpose [5].
The thermal profiles are retrieved using the approach described in Grassi et al. (2005) [6].
The PFS/SW dataset used in this work covers more than two and a half Martian years from Ls = 62° of MY 27 (orbit 634) to Ls = 203° of MY 29 (orbit 6537).

Our data show the sinusoidal behaviour of the gaseous concentration as a function of longitude, for latitudinal strips. The wave numbers observed are s = 1 for CO and s = 2 for H_2O, prevalently. The same waveform can be observed also in the corresponding thermal profiles. The relation between their wave numbers and the altitude in which they occur can give us some indication about the vertical distribution of the involved gasses. Moreover, the study of the amplitude of planetary waves as a function of the variable Martian conditions can be useful for a better understanding and modelling of the atmospheric dynamics of Mars.

References

[1] Hinson, D. P., Wilson, R. J., Smith, M. D., Conrath, B. J., 2003. Stationary planetary waves in the atmosphere of Mars during southern winter. *Jour. Geoph. Resear.*, 108, 5004.

[2] Banfield, D., Conrarh, B. J., Smith, M. D., Christensen, P. R., Wilson R. J., 2003. Forced waves in the Martian atmosphere from MGS TES nadir data. *Icarus*, 161, 319-345.

[3] Giuranna, M., D. Grassi, V. Formisano, L. Montabone, F. Forget, L. Zasova, 2008, PFS/MEX observations of the condensing CO2 south polar cap of Mars, Icarus, 197, pp. 386–402.

[4] Formisano V., Angrilli, F., Arnold, G., Atreya, S., Bianchini, G., Biondi, D., Blanco, A., Blecka, M.I., Coradini, A., Colangeli, L., Ekonomov, A., Esposito, F., Fonti, S., Giuranna, M., Grassi, D., Gnedykh, V., Grigoriev, A., Hansen, G., Hirsh, H., Khatuntsev, I., Kiselev, A., Ignatiev, N., Jurewicz, A., Lellouch, E., Lopez Moreno, J., Marten, A., Mattana, A., Maturilli, A., Mencarelli, E., Michalska, M., Moroz, V., Moshkin, B., Nespoli, F., Nikolsky, Y., Orfei, R., Orleanski, P., Orofino, V., Palomba, E., Patsaev, D., Piccioni, G., Rataj, M., Rodrigo, R., Rodriguez, J., Rossi, M., Saggin, B., Titov, D., Zasova, L., 2005. The Planetary Fourier Spectrometer (PFS) onboard the European Mars Express mission, Planet. Space Sci., Vol. 53, pp. 963–974.

[5] Sindoni, G., Formisano, V., Geminale, A., 2010. Observations of Water Vapor and Carbon Monoxide in the Martian Atmosphere with the SWC of FS/MEX. Planet. Space Sci., submitted.

[6] Grassi, D., Ignatiev, N. I., Zasova, L. V., Maturilli, A., Formisano, V., Bianchini, G. A., Giuranna, M., 2005. Methods for the analysis of data from the Planetary Fourier Spectrometer on the Mars Express Mission. Planet. Space Sci., 53, 1017–1034.