Paper ID: 4679
student

38th STUDENT CONFERENCE (E2)
Student Conference II (2)

Author: Ms. Marie-Ève Gagné
University of Toronto, Canada, megagne@atmosp.physics.utoronto.ca

A NEW TECHNIQUE TO MEASURE TEMPERATURE PROFILES IN THE MARS' MIDDLE ATMOSPHERE

Abstract

Measuring temperature in CO_2-rich atmospheres like those of Mars and Venus is challenging. As CO_2 absorbs most of the incoming radiation in the IR spectral region, spectra recorded by conventional instruments that use remote sensing in the thermal infrared (IR) region become saturated over a short distance. This renders measurements of temperature in the middle atmospheric region difficult. In fact, the temperature profile in the middle atmosphere of Mars about 40 to 120 km above the surface is poorly characterized [1]. A better knowledge of the temperature profile and its variations is not only needed to improve our understanding of the atmosphere of Mars, but it is critical for better forecasting of the entry-descent-landing phase of any lander mission.

One alternative is to use airglow measurements to derive temperature profiles. On Mars, daytime airglow was first detected by Mariners 6 & 7 in 1969, followed by Mariner 9 in 1971. More recently, Mars Express provided high resolution spectra of airglow, and the first observation of nighttime airglow. There is a long history of using this approach on Earth, where airglow emissions from O_2 and OH have been used as a proxy to temperatures in the mesosphere [2]. It is a cost-effective technique, since relatively simple photometers are used to measure the selected emission rates. This technique has not yet been exploited on Mars or Venus.

Our study aims to develop a technique that uses airglow emissions from O_2 in the UV spectral region to measure the temperature of the Martian neutral atmosphere in the aerobreaking altitude region. Ultimately, the findings of the study will support the development of an instrument that can be used to derive temperature measurements from airglow detection. This paper presents our results of the airglow simulations and the work towards the development of an airglow detector. The focus is on explaning the differences between the possible instruments. We also discuss the choice of a lander or an orbiter mission for the purpose of our study and present our recommendations on this subject.

[1] Forget, F., et al. (2009), *Density and temperatures of the upper Martian atmosphere measured by stellar occultations with Mars Express SPICAM*, J. Geophys. Res., V.114, E01004.

[2] Melo, S. M. L., R.P. Lowe and J.P. Russell, (2000), *Double-peaked hydroxyl airglow profiles observed from WINDII/UARS*, J. Geophys. Res., V.105, No.12.