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High resolution spectra of CO₂ ice based on SPICAM/MEX observations

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1. Introduction

CO₂ cycle on Mars defines fundamental processes both on surface and in atmosphere. On poles condensation of a large part of the atmosphere (up to 30%) results seasonal growth and retreat of polar caps [1], changing reflectance and emissivity of surface, that has dramatic consequences for energy budget [2] and changes local and global climate on the planet [3]. IR spectroscopy is one of the ways to measure abundance of carbon dioxide ice on Mars. CO₂ ice has narrow features in NIR that allows to distinguish it from gaseous absorption in atmosphere. These features allowed to map distribution and seasonal evolution of condensation and sublimation of CO₂ ice on polar caps [4]. Meanwhile, spectrum of carbon dioxide ice in NIR still hasn't been studied in details yet, because low resolution spectrometers cannot resolve weak sharp lines.

2. Observations

Since 2004 SPICAM IR spectrometer on Mars-Express has been carrying out measurements of the Martian atmosphere and surface in near-infrared range from 1 to 1.7 μm with the spectral power about 2000. The observations collected information about ices distribution on the surface for Martian years from MY27 to MY34. The analysis of SPICAM dataset related to surface features had not been made before. To process surface spectra of SPICAM and clean them from atmospheric signatures algorithm was developed based on the latest spectroscopic databases HITRAN2016 and Martian general circulation model v5.3. Here we present accurate high resolution spectra of Martian poles (figure 1) and seasonal maps for multi-annual distribution of carbon dioxide ice on surface of Mars.

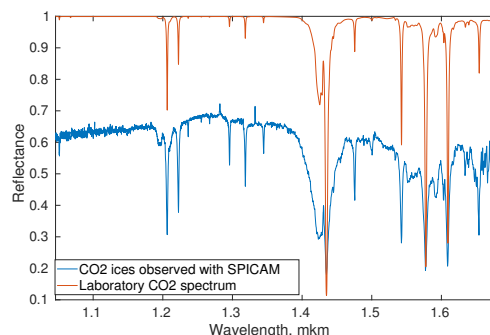


Figure 1: Comparison of SPICAM data and laboratory measurements by Hansen et al. (2005)

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