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The study of the influence of the composition and structure of Martian surface on detection the spectral features of atmospheric trace gases in IR spectra of Mars

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Abstract

The presented work is connected with the measurements of the stereoscopic camera CASSiS (The Colour and Stereo Surface Imaging System) a part of payload of *ExoMars Trace Gas Orbiter* (TGO) of the ESA mission in which researchers from SRC – PAS are engaged. The Cassis camera give the opportunity of analysis the structure of the possible sources of trace gases on the surface of Mars. Identification of minor species in the atmosphere are performed from orbiter by spectrometric instruments (e.g. NOMAD, ACS).
There are various types of features on Martian surface that could be associated with trace gases release e.g methane . The good examples are: volcanos in Utopia, Gusev Crater, Arabia Terra and Valles Marineris . In various locations the processes making possible emission of methane were probably created in different ways among others the production from serpentinized rocks.

In general the way of production of trace gases depends on the structure and composition of the soil and on physical state of the atmosphere.

In the paper the common influence of optical spectral features of the surface and atmosphere contains trace gases on radiance spectra were analyzed. The elaborated model provides estimates of the spectral reflectance/emittance and total radiance from Martian surface and atmosphere in the Mid-infrared spectral range. The examples of diverse shapes of the surface with various subtle structures of the soils were selected from the pictures done by HIRISE instrument . These various kinds of surfaces were spectrally described by presumable reflectance or emissivity of minerals and rocs (e.g. the serpentinized rocks) appropriate for selected locations. Spectral reflectance or emissivity of the modelled regions were calculated from *n,k* with Mie and Hapke theories or measured. The physical properties of the atmosphere were characterized by its thermodynamical parameters and absorbing or scattering properties.

The performed analysis of Mid-infrared spectral signatures of the surface and the atmospheric trace gases in various physical conditions on total radiance is shown. The conclusions related visibility of spectral features of trace gases (methane) in radiance spectra are discussed.

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