MARTIAN CLOUDS DISTRIBUTION OBTAINED FROM SPICAM NADIR UV MEASUREMENTS: PRELIMINARY RESULTS.

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Introduction:

Clouds play an important role in martian climate. They are closely related to martian atmospheric circulation and water vapor cycle and play an important role in the removal of dust particles from the atmosphere through the condensation on them and subsequent precipitation. Here we present some preliminary results of cloud distribution as it was observed from SPICAM.

Measurements:

SPICAM is two-channel (UV and IR) spectrometer onboard Mars Express. Here we consider measurements of its UV channel which covers 118-320 nm range of wavelengths.

Detection of clouds. The martian ice clouds in most cases are quite prominent in UV due to the low albedo of the martian surface in the considered wavelength range. The main problem in cloud detection is due to the dependence of UV reflectivity not only from the albedo but also from the surface pressure. This causes a decrease of reflectivity above the mountains and an increase above the valleys (Fig 1a, 2a). Since clouds also manifest themselves by an increase of reflectivity (Fig.3a) there is a problem in cloud detection above deep valleys. But if we consider the ratio between the "red" and "blue" part of the spectra (hereafter called color ratio) we clearly see that clouds have quite different spectral signatures than valleys (Fig 2b, 3b). Namely, they show maxima in the red/blue color ratio while the reflectivity above valleys show minima.

Results: The most prominent cloud structure is an equatorial cloud belt (Fig. 4) which starts to develop at about L_s=90° above the Tharsis region and above the Chryse Planitia. At L_s=100-110° it is already well developed and prominent clouds appear also above the Tempe Terra, Amazonis Planitia, the region of Elysium Mons and Arabia Terra. It continues to be very prominent up to L_s=130° adding significant cloudiness above Syrtis Major Planum and starts to decay at L_s=130-140°. We should also mention very prominent clouds above the Hellas basin in L_s=120-130° which disappear later. In period L_s=140-170° there are mostly some particular clouds in the Tharsis region and around Elysium Mons. After L_s= 170° the martian atmosphere changes to northern winter mode and clouds appear mostly at the high latitudes (Fig.5). We should mention the Alba Patera region, the Elysium Mons region and the western part of Acidalia Planitia as the most active cloud formation areas. In the period L_s= 200-365-90° we see mainly clouds which are connected with major volcanoes and only a few clouds connected with the north polar hood. Although this period covers the period of the north polar hood presence we do not see it well due to the geographical distribution of the orbits.

Conclusion:

SPICAM measurements give a significant contribution to other existing datasets in the description of the martian clouds. The measurements clearly detected an equatorial cloud belt and the beginning of the north polar hood formation. Fig 4 shows also that cloudiness in the part of the belt which covers Amazonis Planitia and Elysium Planitia is connected with the border between the south highland and the north lowland clearly indicating upwelling movement of air on this border. The topography also plays some role in the beginning of the north polar hood formation showing strong cloudiness in Alba Patera and Elysium Mons regions.

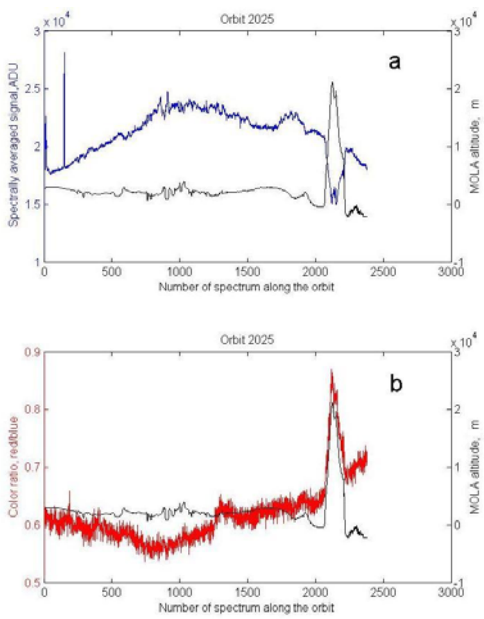

Fig.1 (a) Spectrally averaged signal shows minimum above Olympus Mons. Maximums in the left part of the figure indicate ices of the North Pole. (b) Color ratio red/blue shows maximum above Olympus Mons.

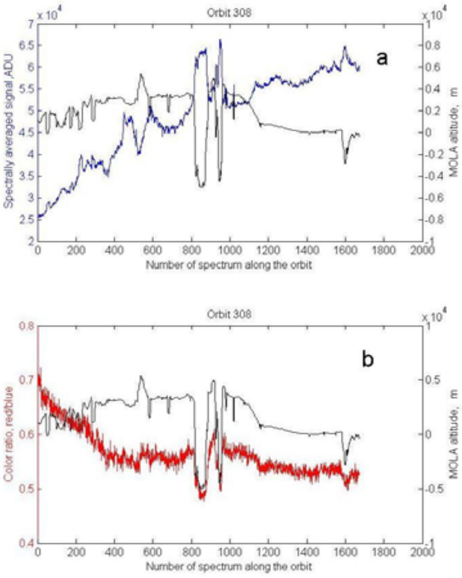

Fig. 2 (a) Spectrally averaged signal shows maximum above Valles Marineris. (b) Color ratio red/blue shows minimum above Valles Marineris.

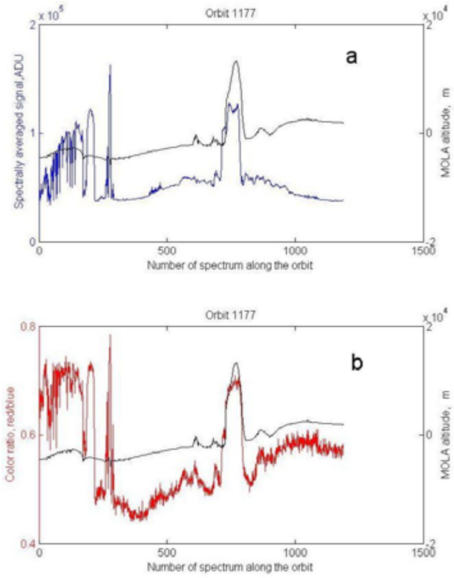

Fig 3. Spectrally averaged signal shows maximum above Olympus Mons in presence of cloud. Maximums in the left part of the figure indicate ices of the North Pole. (b) Color ratio red/blue also shows maximum.

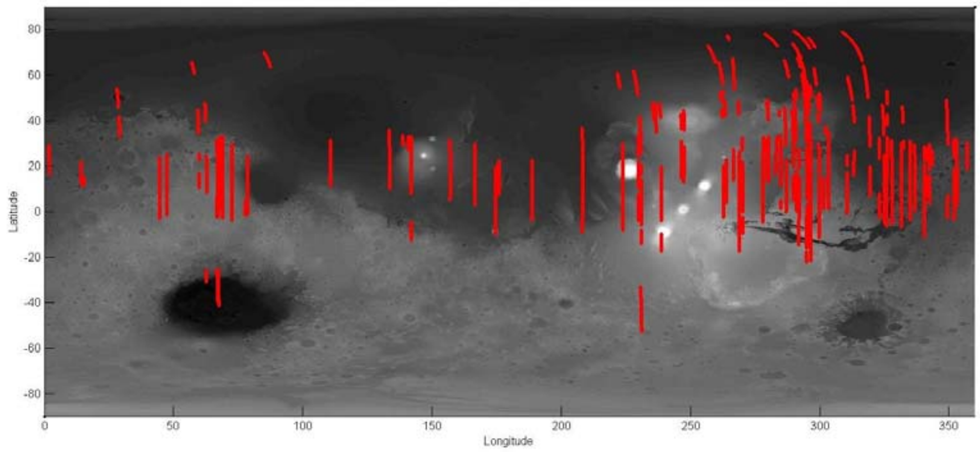

Fig. 4 Cloudiness for the period L_s=90-140°. Red lines represent parts of orbits where clouds there detected. The background image is the MOLA topography map. Eastern longitudes are used.

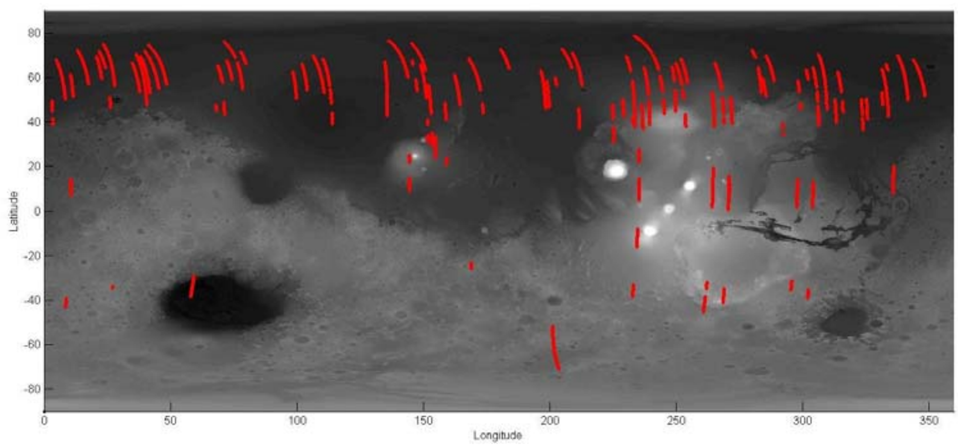

Fig.5 The same as Fig. 4 for the period L_s=150-200°.