

An attempt for the spectrophotometry of two "barges" on Jupiter

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Abstract

During the cycles of the spectral observations of Jupiter we had the unique opportunity to study the absorption of methane in some special and rare local formations in the planet's cloud cover - so-called "barges" - dark-brown colored convective details. We found that in both "barges" the absorption of methane enhanced in comparison with the surrounding cloud cover. However, these differences from the nearest areas of clouds are very low. Increased absorption of methane may indicate a reduced level of the upper boundaries of the "barges" or on the lower density of the cloud layer within them. This does not contradict the data of infrared measurements.

1. Observations

Upon receipt of zonal CCD-spectrograms (as described in [1]) while scanning the disk of Jupiter in October of 2011 there was recorded area of the northern hemisphere with two "barges" at latitude +16.2 degrees with longitudes in the system II 220 and 256 degrees (Figure 1)

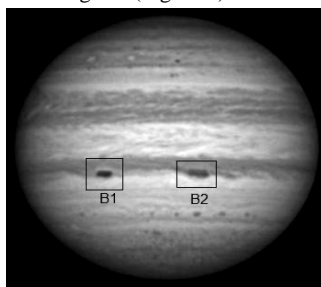


Figure 1: Image of Jupiter with two "barges" B1 and B2 at October 20, 2011 [2] Longitude of the central . meridian $L_2 = 246$ degrees.

The brightness profile compiled from the scanning spectra is shown on Figure 2 where a position of the "barges" zone is noted by red square. Spectroscopic observations were carried out exactly in this location "barges" on the night of 21 to 22 October 2011.

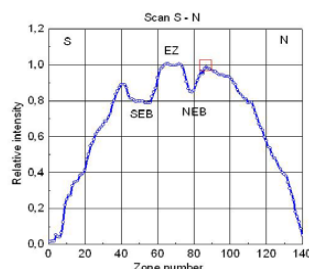


Figure 2: The brightness profile of CM, compiled from scanning spectra.. Zone with "barges" is noted by square.

2. Results

Computer photometric processing of zonal spectrograms was made in three ways: the estimates of equivalent widths and depths of the absorption bands, comparing of relations the spectra "barges" and the neighboring regions to the spectrum of the zone at the central meridian, and by calculating the cross sections of the spectrograms in the absorption bands and in the continuous spectrum. The latter method allows to compare the absorption of methane in the strong CH_4 band 890 nm by ratio intensity in the continuous spectrum (C835nm) to the intensity at the medium part of this band (M880nm). It is located on the long end of the spectrum and, therefore, measurement of entire contour and calculation the equivalent width are difficult.

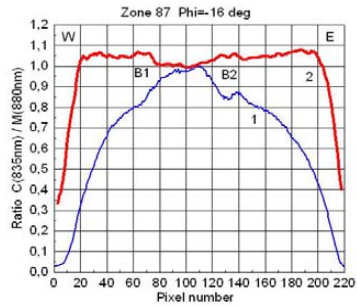


Figure 3: The brightness profile (1) and normalized ratio of the intensities (2) in continuum (835 nm) and in the central part of the methane band (880 nm)

The ratio of profiles yet reveals a slight but noticeable increase in the absorption of CH_4 in the "barges" as from zonally averaged spectrum (zones 85-89) as from the individual spectrogram of zone 87 (Figure 3) For shorter wavelength and less intense absorption bands the equivalent widths were measured. The variation of the CH_4 619 nm band equivalent width along the zone with "barges" shows small increased absorption in the "barge", but it is difficult to assess because it is lost in the "noised" estimates for other areas of the zone. The band of medium intensity CH_4 725 nm (Figure 4) reveals amplification in the areas of "barges", but more diffuse in longitude as compared with 890 nm band.

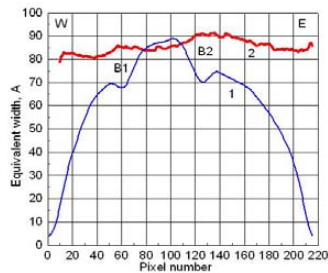


Figure 4: Longitudinal variations of the equivalent width of the CH_4 725 nm absorption band along the "barges" zone.

3. Conclusion

Increased absorption of methane may indicate a reduced level of the upper boundaries of the "barges" or on lower density of the cloud layer within them. In a recent publication [3] there were apparently the first time presented the measurements of thermal infrared radiation of the "barge" lying also at latitude of about 16 degrees but in the southern hemisphere of Jupiter. It turned out that the "barge" have some increased brightness at 4.8 microns, which may indicate a smaller optical thickness of clouds, probably associated with low-density concentrations of cloud particles. Thus, our measurements of the absorption bands of methane and infrared measurements are not in contradiction but the further study of these formations on Jupiter would be important.

References

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- [2] Poupeau J.-J. ALPO Japan, 20.10.2011- <http://alpo-j.asahikawa-med.ac.jp/indexE.htm>
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