M. A. Kolosov, O. I. Yakovlev, T. S. Timofeeva, E. V. Chub, A. I. Efimov, S. S. Matyugov, A. G. Pavel'ev, A. I. Kucheryavenkov, and I. E. Kalashnikov. *Results of radio sounding of the neutral atmosphere of Venus and bistatic radar study of its surface with the aid of the satellites "Venera-9, 10."* From October through December 1975, as well as in March 1976, some 50 radio soundings of the Venus atmosphere were made and five special experiments were performed on bistatic radar study of its surface with the aid of satellites of the planet.[1] Investigations of the nighttime atmosphere in the southern hemisphere of Venus and of the daytime atmosphere in the nothern hemisphere were performed at the Venus phase angle 90–70°. The method of radio sounding has made it possible to obtain information on the atmosphere on the nighttime and daytime sides as well as in the polar regions of the planet. For each of these regions, extensive experimental material was obtained concerning the height dependences of the density, pressure and temperature, and made it possible to get an idea of the layered formations and of the turbulence of the atmosphere.

Three regions were distinguished in the nighttime atmosphere, with a constant temperature gradient in each. The temperature gradient at heights 76–86 km is characterized by an average value 2.3 deg/km, in the height interval 60–75 km the gradient is 3.7 ± 0.5 deg/km, and at heights 43 0–59 km it is 9.8 ± 0.3 deg/km. The temperature-gradient value 9.8 deg/km is close to the dry adiabatic gradient for a CO_2 atmosphere. The region of the transition from the dry-adiabatic to the humid-adiabatic state of the atmosphere is located at a height 59 ± 1 km at a pressure 0.3 ± atm and a temperature 270 ± 5 °K. The temperature profiles on the nighttime side of the planet reveal regularly a temperature minimum $T_m = 166 \pm 15$ °K located at an approximate height of about 88 km. The temperature increases above this level.

In the height dependences of the temperature on the day time side of the planet one can also distinguish three regions with different temperature gradients. In the height interval 52–62 km the plot of $T(h)$ is close to the temperature profile on the night side of the planet. The average temperature gradient in this region is 9.5 ± 0.7 deg/km. At heights 62–72 km, temperature inversions are observed. The atmosphere in the height interval 72–83 km is characterized by a temperature gradient 4.4 ± 0.6 deg/km at a sun's zenith angle $z = 15°$. With increasing z, the temperature profile approaches the isothermal profile in this region.

Figure 1 shows a plot of the temperature at heights 60 and 70 km against the Venus latitude. Comparison of the results for the night- and daytime sides shows that the temperature on the day side, at $h > 60$ km, is 15–20° higher than on the night side. At heights 62–72 km the temperature profiles on both the day and night sides have singularities that attest to the presence of layered formations in the atmosphere. These formations are permantly present at the same heights in the day time and night time atmosphere. O. I. Yakovlev has advanced the hypothesis that primitive life forms exist in the observed layers.

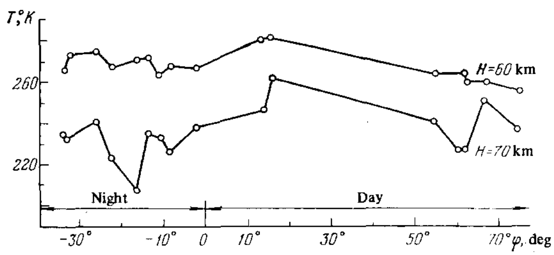

FIG. 1.

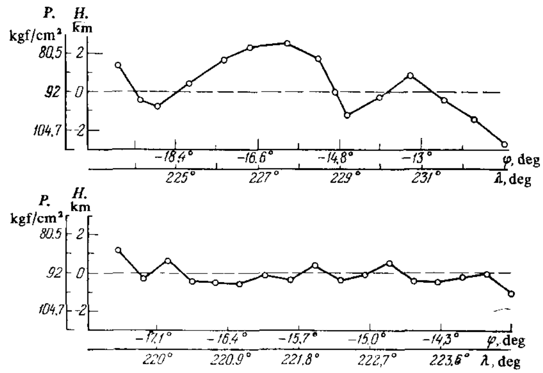

FIG. 2

When the antenna on board the Venus satellite is aimed at the planet, and also during the atmosphere radio-sounding runs, the radio waves emitted by the satellites are reflected from the surface towards the earth. The reflected radio waves carry information on the surface relief. Sounding of the atmosphere layer below the level of the critical refraction takes place simultaneously. Figure 2 show the distributions of the relative heights of the relief and of the pressure at the surface for the two investigated regions of Venus. The ordinates of Fig. 2 are the excess of H over the average radius $a = 6050$ km of the planet and the surface pressure P in kgf/cm^2. The abscissa axes show the latitudes φ and the longitudes λ of the investigated regions. Investigations of the relief and of the near-surface pressure by bistatic radar location have shown that the surface of Venus have sections with height differentials ± 2 km, in which the surface pressure varies in the range 80–105 atm (upper plot of Fig. 2). More typical of the Venus relief are plains (lower curve of Fig. 2) in which no height changes are observed within the limits of the measurement accuracy.

[1]M. A. Kolosov, O. I. Yakovlev, B. P. Trusov, E. P. Molotov, N. M. Antsibor, A. I. Efimov, V. M. Razmanov, T. S. Timofeeva, E. V. Chub, V. K. Shtrykov, and G. D. Yakovleva, Radiotekh. Élektron. **21**, 1585 (1976). O. I. Yakovlev, A. I. Efimov, T. S. Timofeeva, G. D. Yakovleva, E. V. Chub, V. F. Tikhonov, and V. K. Shtrykov, Kosm. Issled. **14**, 722 (1976). A. G. Pavel'ev, M. A. Kolosov, O. I. Yakovlev, A. I. Kucheryavenkov, S. S. Matyugov, V. I. Kaevitser, and I. É. Kalashnikov, Dokl. Akad. Nauk SSSR 230, 1059 (1976) [Sov. Phys. Dokl. **21**, 540 (1976)] M. A. Kolosov, O.I. Yakovlev, A. G. Pavel'ev, V. I. Kaevitser, I. É. Kalashnikov, F. I. Kozlov, A. I. Kucheryavenkov, S. S. Matyugov, E. P. Molotov, and V. I. Rogal'skiĭ, Radiotekh. Élektron. **21**, 1808 (1976).