VENERA - 15,16 SPACECRAFT: AN EFFICIENCY OF JOINT EMPLOYMENT OF SAR AND RADAR ALTIMETER FOR EXPLORATION OF VENUS SURFACE; Yu.N.Alexandrov, I.L. Kucheryavenkova, G.M.Petrov, O.N.Rzhiga, A.I.Sidorenko, V.P.Sinilo and A.I. Zakharov; Institute of Radioengineering and Electronics, Academy of Sciences of the USSR, Prospect K.Marxa 18, Moscow 103907, USSR.

Radar investigations of Venus surface were made in 1983-1984 by means of Venera - 15,16 on - board SAR and radar altimeter. The records of radar echoes, registrated in everyday's radar survey during spacecraft passing near planet, being transmitted to the Earth, where after digital processing radar imaging swathes and measurements of height profiles along spacecraft track were generated.

At the bottom of fig.1 a fragment of radar swath, mapped from Venera - 16, is placed. A length of this fragment is 600 km, width is about 120 km, spatial resolution is 1 km. A track of spacecraft in this survey lies over the swath (at 0 degree in vertical axis). A track of two days earlier survey is marked on the image by the white line. During this period of time Venus was rotated on 3° angle relatively to orbit plane and this track intersected image. At the stage of track drawing perspective distortions of the image were taken into account. The nature of those distortions is that radar data were put on the sphere of constant radius (6051 km), so the local relief was not taken into consideration.

A processing of radar altimeter backscattered signals allowed to estimate an altitude of spacecraft above mean surface in a spot of 40 km in diameter. Selection of reflected signals according to Doppler shift of frequency allowed to narrow the altimeter spot till 6 km along the track. The spacing of altimeter measurements is about 2.5 km, so practically continuous height profiles were obtained. The error of altimeter measurements in smooth areas was about 30 m.

A fragment of radar swath, presented in fig.1, is an image of southern part of Fortuna Tessera. A spacecraft was moving from north to south. Height measurements allowed to decode structures, visible in the image. On the left side at the distance of -1.7° from the pericenter there is a dark feature, crossing the image. Just at the same place one may see a gap in height profile, possibly connected with canyon. According to altimeter measurements a depth of canyon in this area is 1 km, a width is 4 km. In the right direction (from -0.7° to 0° relatively to pericenter) one can see unnamed round structure with smoothed contours. The height profile of this structure is similar to profile of Cleopatra Patera, situated in Maxwell Montes Region (1). According to height profile the diameter of external crater is about 90 km, the depth is 1.5 km at the left part and 1.0 km at the right part relatively to surroundings. Internal crater is 50 km in diameter, 1 km deep (relatively to a bottom of external crater) and displaced to the right and down with respect to a center of external crater (a longitude of external crater is 40.5°, latitude is 62.5° on Venus globe).

The results of experiment display an efficiency of joint employment of SAR and radar altimeter for exploration of planet's surface.

References: Alexandrov, Yu.N., Crymov, A.A., Kotelnikov, V.A., Petrov, G.M., Rzhiga, O.N., Sidorenko, A.I., Sinilo, V.P., Zakharov, A.I., Akim, E.L., Basilevski, A.T., Kadnichanski, S.A., and Tjuflin, Yu.S. (1986); Venus: detailed mapping of Maxwell Mons region. Science 231, 1271-1273.

Figure 1. Bottom: the fragment of the radar image of Venus surface, taken 11 February 1984 by Venera 16 spacecraft. At the horizontal axis there is an angular distance relatively to pericenter of orbit, which is situated at the 62° N in latitude; at the vertical axis there is an angular distance relatively to orbit plane (to track), measured in degrees from the planet center.

Top: height profile of Venus surface taken 9 February 1984 along the track of spacecraft, drawn by white line. The vertical scale is 32 times enlarged in comparison with horizontal one.

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