CHARACTERISTICS OF THE SMALL-SCALE ROUGHNESS IN THE PROPOSED LANDING SITES ON VENUS, E.V. Zabalueva, M.A. Ivanov, and A.T. Basilevsky, Vernadsky Inst., RAS, Moscow.

Introduction: Despite the similarity in the mass, size, and bulk density between Venus and Earth, the surface environments on Venus are very different from those on our planet. The reasons for these differences are still mysterious and require more data for understanding. The key type of data in this problem is the one that provides the ground truth by the mean of landers. That is why the now formulating concepts of the future exploration of Venus (e.g., Venera-D) include landers. Landing on any planetary body faces the problem of safety. In order to assess the suitability of potential landing sites to the safety requirements, the small-scale roughness of the surface (centimeters-meters) has to be estimated.

Results: Recently, several potential landing sites on Venus have been proposed [1]. These sites have been selected to sample a variety of terrain types and include (Fig. 1): (1) tessera (t, 9 sites), shield plains (psh, 2 sites), lobate plains (pl, 3 sites), and regional plains (pwr, 2 sites). In order to acquire estimates of the surface roughness in these areas, we have used he global RMS-mosaic (from GSDR volume by MIT/JPL/UCLA), gridded and resampled to the resolution ~4.6 km/px. A box 2x2^o was chosen to surround the center of each site and the RMS data were collected in this area. Each box contains about 2100 pixels of the global mosaic. Table 1 summarizes the results. The mean values of the RMS slopes for the selected landing sites vary from 1.2^o (lobate plains, Mylitta Fluctus) to 5.6^o (tessera terrain, near crater Frida) and approximately correspond to such terrestrial landforms as gently undulating plains (Fig. 2, RMS is ~2.7^o) and rolling hills (Fig. 3, RMS is ~6.5^o) [2].

Caveats and Conclusions: Three considerations should be kept in mind interpreting the RMS values for the selected landing sites. (1) The RMS slope is not an exact estimate of the roughness of the surface at the centimeters-meters bases. Instead, it gives the most probable value in a distribution of slopes based on a chosen model of radar return. Thus, within an area that is characterized by a specific value of RMS, the slopes vary and may reach high values. The probability of encountering of steeper slopes, however, becomes larger as the RMS increases. (2) The reported RMS data for Venus were collected from the map with the resolution ~4.6 km/px and, thus, characterize the regional situation. There is the possibility to encounter high slopes (up to vertical) at local scales. For example, the regional plains surrounding the Venera-9 landing site have rather low RMS value (a few degrees). The landing happened, however, on a rocky talus on the ~30^o steep slope of a fault which cut the relatively smooth plain. (3) The distribution of slopes on Earth is strongly depends on maturity of a landform and, on the average, the fresh surfaces possess the higher RMS values. The virtual lack of erosion on Venus suggests that the majority of surfaces there should be considered as fresh ones by the Earth' standards. This situation also favors the presence of higher slopes at the scale of a lander.

Even if the local slopes within the selected areas may be high, the average values of the RMS slopes there do not approach the higher values that characterize some terrestrial landforms such as high sand dunes (RMS = ~16.5^o) or eroded sandstones (RMS = ~16.5^o) [2]. This suggests that a careful photogeologic analysis of the proposed regions [1] will result in selection of a number of areas where the relatively safe landing is expected.

References: 1) Basilevsky, A.T., et al., PSS, 55, 2097–2112, 2007; 2) McCollom, T. M. and B.M. Jakosky, JGR, 98, 1173-1184, 1993.

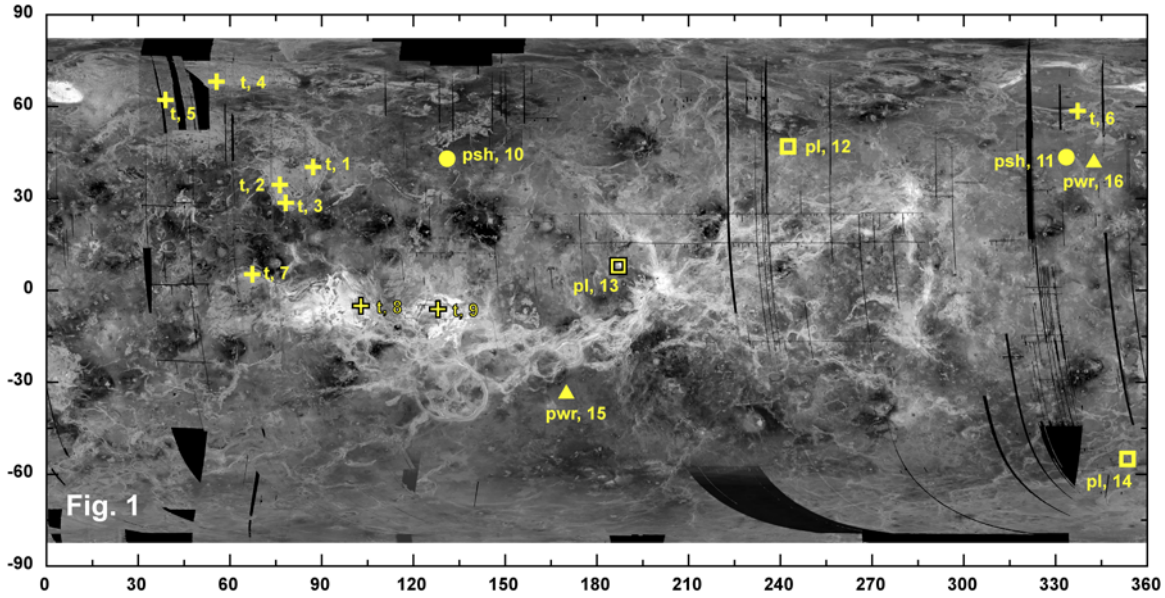

Fig. 1: Location of the proposed landing sites. Numbers in the figure correspond to numbers in Table 1

Fig. 2 and 3: examples of terrestrial landscapes where the RMS slopes have been measured

Table 1. RMS values for the proposed landing sites on Venus

Site	Lat.	Lon.	RMS values: MEAN, deg	Min, deg	Max, deg
Tellus Tessera					
1) Khatun	40.3	87.2	3.7	0.5	9.8
2) Tseraskaya	34.5	76.3	4.1	0.7	10.1
3) Merian	28.6	78.2	3.3	0.6	9.8
Fortuna Tessera					
4) Frida	68.2	55.6	5.6	2.7	10.1
5) Roptuna	62.2	38.9	3.6	1.0	9.2
Clotho Tessera					
6) Magnani	58.6	337.2	3.5	0.4	10.4
Ovda Tessera					
7) Carter	5.3	67.3	4.0	0.6	10.1
8) deBeausoleil	-5.0	102.8	5.0	0.6	11.5
Thetis Tessera					
9) Whiting	6.1	128.0	3.3	0.4	11.9
Shield plains					
10) Vellamo Planitia	43.0	131.0	2.6	0.8	9.7
11) Sedna Planitia	43.5	333.5	3.1	1.0	5.4
Lobate plains					
12) Sekmet Mons	47.0	242.5	3.1	1.1	11.6
13) Sapas Mons	8.0	187.0	3.4	0.5	10.4
14) Mylitta Fluctus	-55.0	353.5	1.2	0.4	5.3
Regional plains					
15) Zhibek Planitia	-33.0	170.0	2.1	0.6	3.5
16) Sedna Planitia	42.5	342.5	2.2	0.8	3.2