COMPARISON OF RMS SLOPS OF TERRESTRIAL EXAMPLES AND TESSERA TERRAIN, VENUS, M. A. Ivanov, Vernadsky Institute, RAS, Moscow, mikhail_ivanov@brown.edu.

Introduction: The roughness at the 1-10 m scale is the characteristic of the surface that is important for selection of potential landing sites. The new program of exploration of Venus (e.g., Venera-D) includes landers. One of the primary targets for them is tessera terrain, the nature of which remains mysterious.

Morphology of tessera is very complex and its surface does not seem to be an appropriate place for safe landing (Fig. 1). Enhanced roughness at the centimeters-meters scale characterizes the surface of tessera and this terrain appears as bright regions on the radar images provided by Magellan. How does the centimeters-meters roughness of the surface of tessera correspond to the roughness of some terrestrial surfaces? Here I compare the RMS slopes of several large tesserae on Venus with examples from Earth where the distribution of slopes at the base from 12 cm to ~2 m were measured [1].

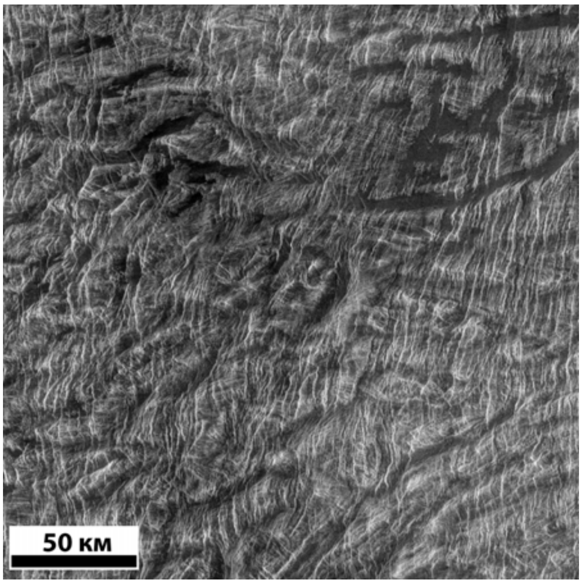

Fig. 1. Typical morphology of tessera terrain. Fragment of Thetis Tessera, RMS value is ~6-8^{o}.

Results: In order to collect the necessary data for tesserae I used the global RMS-mosaic (from GSDR volume by MIT/JPL/UCLA), gridded and resampled to the resolution ~4.6 km/px. The locations of tessera massifs were taken from the global geological map of Venus that was re-projected into the sinusoidal projection and co-registered with the global RMS-mosaic. The tessera regions were masked and the RMS data were collected within the tessera boundaries. Table 1 summarizes the RMS data for the tesserae and the areal distribution of the RMS slopes for one of the largest tessera region is shown in Fig.2. The mean values of RMS for tesserae vary from ~3.5^{o} (Ananke Tessera) to ~6.4^{o}. (Eastern portion of Ovda Tessera) and the largest fraction of the tessera surfaces falls within the interval of RMS 2-4^{o}. These values correspond to such terrain on Earth (Table 2 [1]) as gently undulating plains (Fig. 3) and rolling hills (Fig. 4). The maximum RMS value for Venus shown in the GSDR mosaic is ~12.8^{o}, which approaches the value typical of the eroded cinder cones on Earth (Table 2 [1]).

Caveats and Conclusions: Three considerations should be kept in mind interpreting the RMS values for tessera. (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 the low RMS value (a few degrees). The lander itself, however, is on a rocky talus that is ~30^{o} steep. (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 in tessera may be high (as well as within all other terrains on Venus), the average values of the RMS slopes in broad areas within this terrain (Fig. 2) do not approach the higher values that characterize some terrestrial landforms (Table 2). This suggests that a careful photogeologic analysis of regions of tessera where the RMS slopes are small will result in selection of a number of areas for the relatively safe landing.

Reference: 1) McCollom, T. M. and B.M. Jakosky, 1993, JGR, 98, 1173-1184

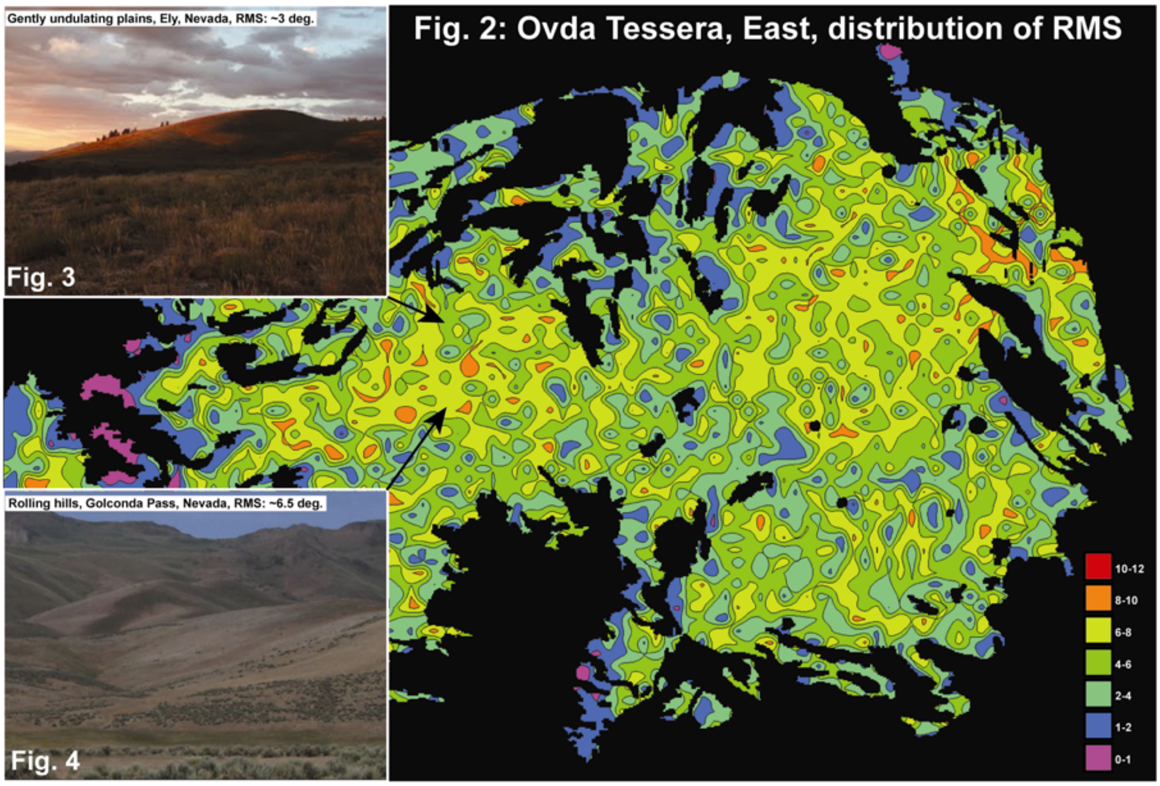

Table 1. RMS values for some tesserae and percent of area within specified interval of RMS values

NO.	Tessera	Mean RMS, deg	Percent of tessera area within specified interval of RMS values					
			0-2, deg	2-4, deg	4-6, deg	6-8, deg	8-10, deg	10-12, deg
1	Alpha	4.1	13.5	**50.2**	28.9	5.8	1.6	0.1
2	Fortuna	4.5	9.1	**40.5**	39.3	8.6	2.2	0.4
3	Laima	3.7	17.0	**56.0**	23.1	3.2	0.6	0.2
4	Ovda, west	4.5	21.9	**35.8**	19.6	13.3	8.1	1.3
5	Ovda, east	6.4	4.7	22.7	**22.9**	22.8	21.9	5.0
6	Thetis	5.7	9.7	**28.6**	23.0	18.8	15.3	4.7
7	Haasttse-baad, west	5.4	10.4	**33.7**	22.9	16.0	12.9	4.1
8	Haasttse-baad, east	4.5	17.2	**41.5**	21.3	12.1	6.2	1.7
9	Gegute	3.7	32.0	**40.8**	14.4	8.1	3.7	0.9
10	Shimti	4.8	17.8	**34.8**	20.7	13.8	10.8	2.0
11	Tellus	4.3	14.7	**44.1**	26.7	10.4	3.8	0.4
12	Ananke	3.5	16.4	**63.7**	16.7	2.3	0.6	0.2
13	Phoebe Regio	4.8	7.3	**42.1**	28.6	15.5	6.0	0.4
14	Hyndla Regio	4.6	9.5	**46.2**	26.9	12.1	4.7	0.6
15	Beta Regio	4.8	8.1	**43.8**	25.1	14.6	7.9	0.4

The maximum percentage of area is shown in bold.

Table 2. RMS values for some terrestrial surfaces (modified from [1])

NO.	Terrain	Site	RMS, deg
1	Evaporite basin	Bonnevile Salt Flats	0.0
2	Gently undulating hills	Ely, Nevada	2.7
3	Rolling hills	Golconda Pass, Nevada	6.5
4	King's Bowl lava flow	Moon National Park, Idaho	8.4
5	Lower sand dunes	Great Sand Dunes, Colorado	11.0
6	Eroded cinder cones	Lunar Crater, Nevada	13.8
7	North Crater lava flow	Moon National Park, Idaho	14.9
8	Main sand dunes	Great Sand Dunes, Colorado	16.5
9	Eroded sandstones	Slickrock, Utah	16.5