LANDFORM IDENTIFICATION - LUNAR RADAR IMAGES

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Three sets of polarized radar-echo images of the Moon are being examined to establish the relation between radar resolution and landform-identification resolution [1-4]. The wavelengths, radar resolutions (cell sizes), and approximate number of real or apparent landforms for the sets are as follows:

Set #	Wavelength	Cell sizes	Number of landforms
1	3.8 cm [5]	1-2 km	1,553
2	70 cm [6] (high resolution)	2.5-5 km	1,594
3	70 cm [7] (low resolution)	10-20 km	983

The results of the study should be valuable to those planning to acquire or interpret radar images of the Earth or other planetary bodies.

After comparison with lunar maps and photographs, real and apparent landforms on the radar images are grouped into one of seven classes [1-4]: (1) resolved and clearly identified; (2) resolved and would probably be correctly identified; (3) resolved, but interpretation is uncertain; (4) detected, but elements are not resolved; (5) not detected; (6) array of landforms is resolved, but interpretation of the array is uncertain; and (7) radar portrays a fictitious landform.

Data recorded for each real or apparent landform for each set of images includes the following: (1) a name, (2) selenographic coordinates, (3) diameter and relief obtained from lunar maps and photographs, (4) the class, (5) diameter measured on the radar image, (6) background terrain, (7) geologic age, and (8) the Lunar Aeronautical Chart number. A computer program sorts and orders the data by diameter or relief, computes the percent of each class in frequency bins of 100, and computes the geometric mean of the landform diameter or relief for each frequency bin. Calculations are made in frequency steps of 10.

Current results show strong relations between radar resolution and diameter or relief of landforms that are

clearly identified and those that would probably be correctly
identified (class 1 + class 2), as shown in table 1. Current
results are not depicted; they are similar, but not identical,
the those in previous abstracts [e.g. 1, figure 1].

Table 1. Percentage of resolved and identified landforms
portrayed in lunar radar images.

Percentage of class 1+2 landforms	Mean diameters of landforms (km) corresponding to the indicated percentage.		
	3.8 cm	70 cm high	70 cm low
10	5	12	35
20	6	16	56
30	7	25	--
40	9	35	--
50	11	44	--
60	16	--	--
70	20	--	--
80	35	--	--

Percentage of class 1+2 landforms	Mean relief of landforms (km) corresponding to the indicated percentage.		
	3.8 cm	70 cm high	70 cm low
10	0.5	1.0	2.7
20	0.6	1.7	---
30	0.8	2.6	---
40	1.1	2.8	---
50	1.4	3.1	---
60	2.0	---	---
70	2.2	---	---
80	2.6	---	---

Landforms are not detected (class 5) at all diameters and
reliefs, but the percentage of undetected landforms decreases
with increasing mean diameter and increasing mean relief.
Landforms are simply detected (class 4) at most mean diameters
and reliefs. Ambiguous arrays (class 6) portrayed by the
radar constitute up to about 16, 22, and 15 percent of the
landforms at various diameters and relief values for the 3.8
cm, 70 cm high resolution, and 70 cm low resolution images,
respectively. Only a few percent of the landforms portrayed
by the radar images at various diameters and relief values are
fictitious (class 7).

When data acquisition is complete, the data will be
analyzed as functions of angle of incidence (lunar-scattering
function) [6], background terrain, and geologic age [7].

Preliminary comparisons of the actual observed crater

size-frequency distributions with those obtained from the radar images show increasing departures with increasing resolution. For the 3.8 cm radar images, the cumulative frequency of craters greater than 22.6 km across agree to within 21 percent of the actual cumulative frequency, and the population indices (slope of the distribution) are similar and near -2. Here, the crater frequencies from the radar image lie below the observed ones. Comparisons for the other radar images are less satisfactory at this time.

References

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