A COMPILATION SYSTEM FOR VENUS RADAR MISSION (MAGELLAN)

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A synthetic aperture radar (SAR) compilation system has been developed for extraction of topographic information of Venus from stereoradar imagery to be obtained from the Magellan mission. The system has been developed for an AS-11AM analytical stereoplotter (Wu et al., 1986). During fiscal year 1986, extensive tests were made on this compilation software by using stereo-images from various radar systems, both spacecraft and airborne (Table 1). Maps were compiled and the precision of planimetry and contour measurement was evaluated. Digital data of some models were also collected for processing orthophoto or perspective views by using the original radar images.

From the Seasat radar images (Wu et al., 1986), a planimetric map was compiled from the New Orleans model and a contour map from the Los Angeles model. Because of strong geometries, i. e., large base-to-height ratios (0.99 and 0.85), 0.9-m and 1.2-m repeatability elevation measurements were obtained from these two models.

A contour map of Mt. Shasta (Fig. 1) was compiled on the AS-11AM analytical stereoplotter from SIR-B stereoradar images (same-side mode). Because the average residual of elevation measurements in this area is about 8 m, the contour interval could have been as small as 25 m. Residuals of elevation measurements vary, however, depending on the combination of look-angles of the pair of stereo-images.

Three stereomodels of the SIR-B images have been compared. Their respective average elevation residuals are 7.3 m, 8.7 m, and 33.9 m, and their respective combinations of look angles are 29.5° and 60.1°, 29.5° and 53.5°, and 53.5° and 60.1°.

The two models of stereoradar images taken by the NASA 102A airborne radar system cover part of Mt. St. Helens. Both models have a repeatability elevation measurement of about 5 m. A contour map was compiled from each model, but the geometry of the model having an opposite-side mode (Fig. 2) is stronger than the one having a same-side mode.

Also tested with the SAR compilation software were two stereomodels of radar images of the vicinity of Spitsbergen taken by the airborne ERIM X-C-L radar system. The models cover the same ground features, but one model is in ground-range geometry and the other is in slant-range geometry. Geometries of both models are compatible. The model in ground-range geometry was used to compile a contour map at a scale of 1:25,000 with a contour interval of 10 m.

As noted above, stereomodeling from radar images has been proven feasible and thus the mathematical concept of the compilation software is the correct approach. All stereomodels tested were, in general, free of parallax and suitable bases for map compilation. During testing, the software was enhanced and modified to obtain more flexibility. Development of the radargrammetry will be continued to improve measurement precision and map compilation for multiple models. Feasibility studies of map compilation from digital radar data will also be considered.

TABLE 1. RADAR IMAGES USED FOR TESTING THE SAR COMPILATION SYSTEM

Vehicle	Spacecraft			Aircraft		
Mission/Radar System	Seasat		SIR-B	NASA 102A		ERIM X-C-L
Site	New Orleans	Los Angeles	Mt. Shasta	Mt. St. Helens		Spitsbergen
Geometry*	S.S.	O.S.	S.S.	O.S.	S.S.	S.S.
Range**	S.R.	S.R.	G.R.	G.R.	G.R.	S.R. & G.R.

Remarks: * S.S.--Same-side mode; O.S.--Opposite-side mode
          ** S.R.--Slant-range geometry; G.R.--Ground-range geometry

Reference
Wu, S. S. C., Schafer, F. J., and Howington, A. E., 1986, Radargrammetry for
    the Venus Radar Mapper Mission: Report of Planetary Geology and
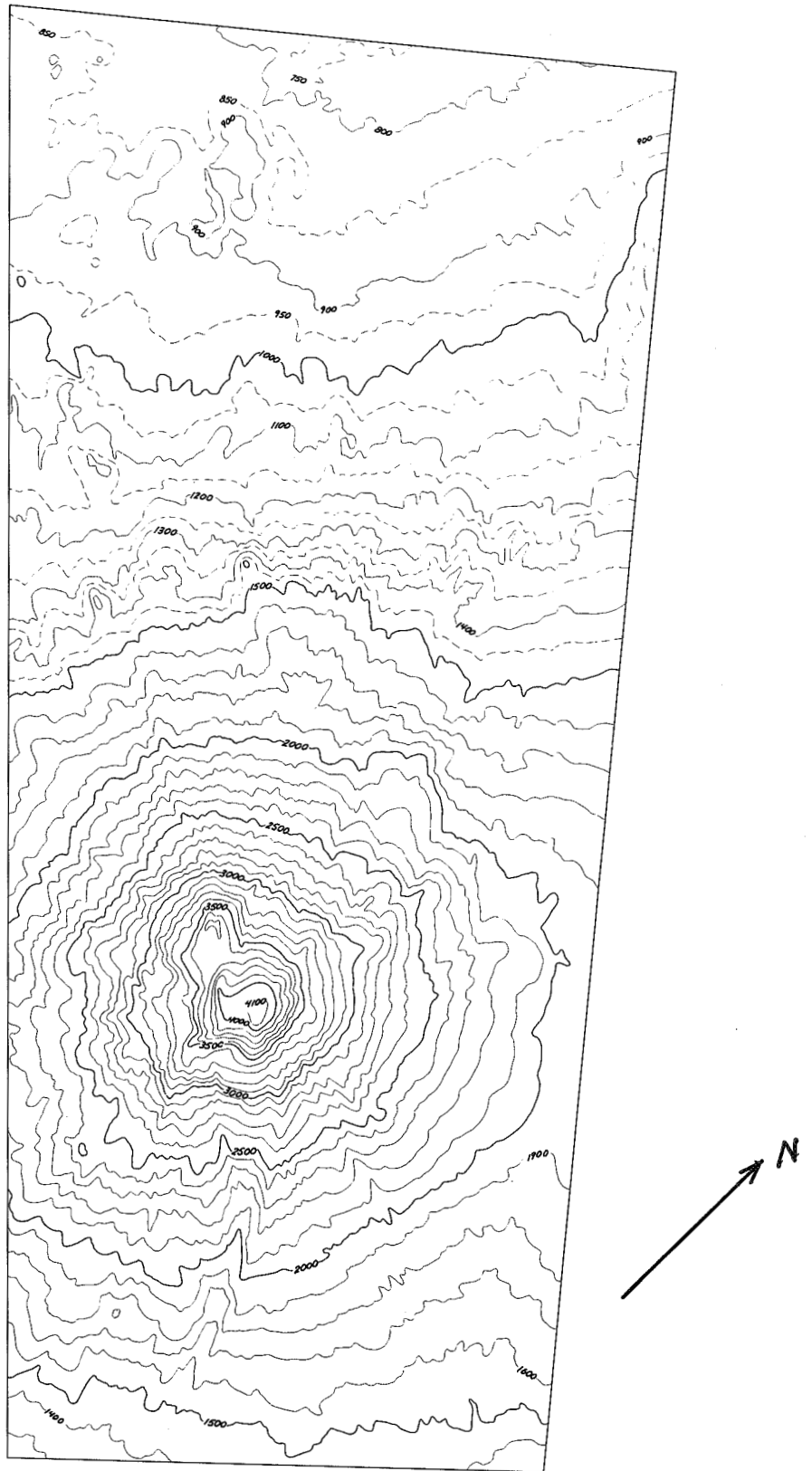   Geophysics Program-1985, NASA Tech. Memo. 88383, 570-573.

Figure 1. Topographic contour map of Mt. Shasta. Scale 1:200,000. Contour
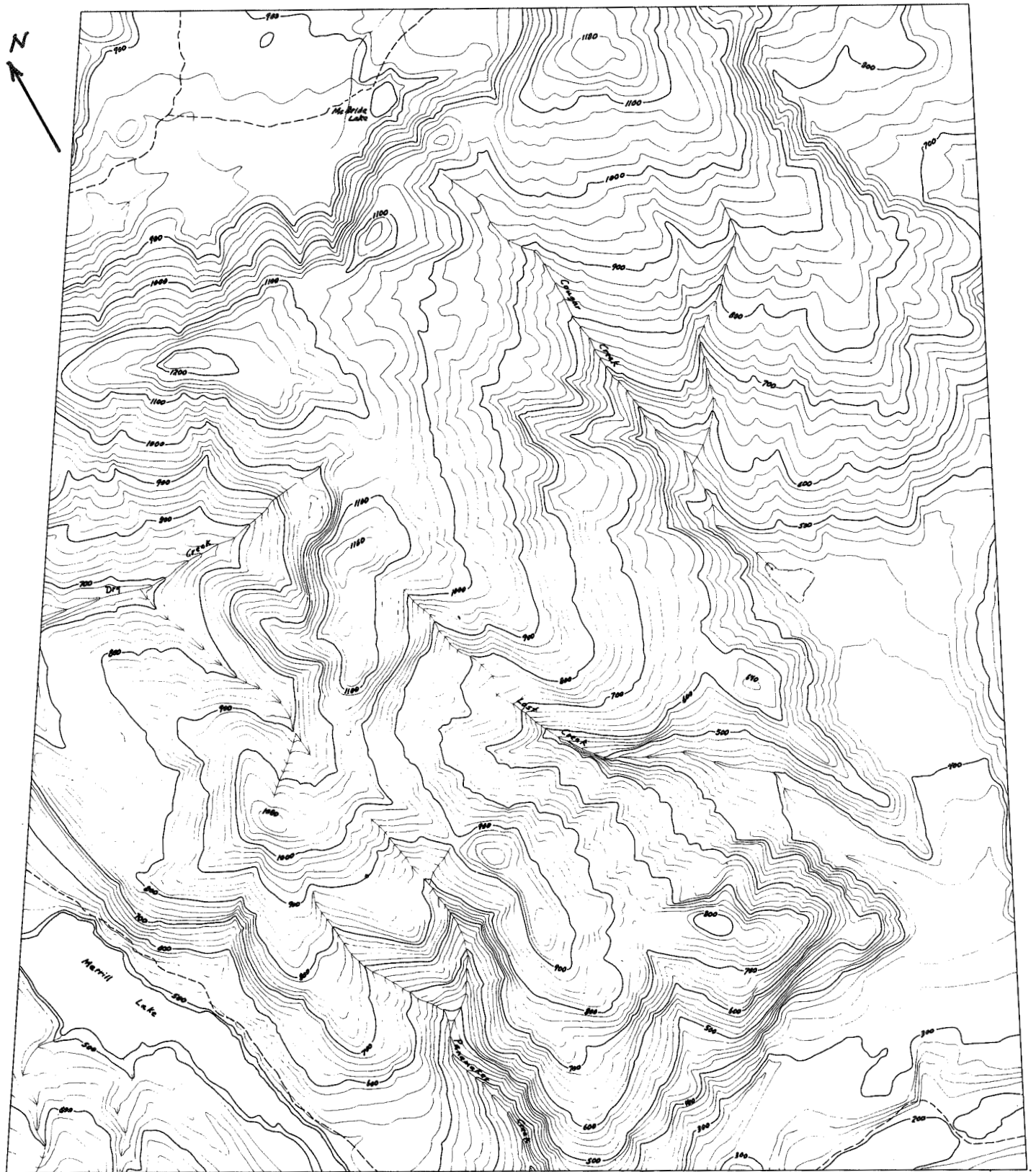interval 100 m; 50-m intermediate contours in northern part.

Figure 2. Topographic contour map of part of Mt. St. Helens compiled on the AS-11AM analytical stereoplotter. Scale 1:41,700; contour interval 25 m.