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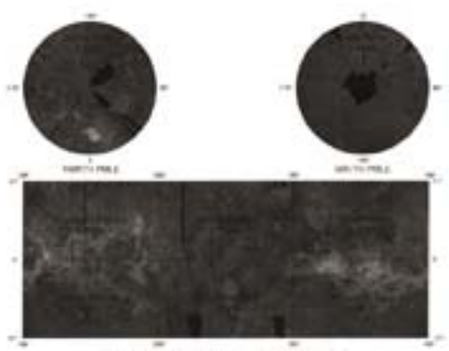
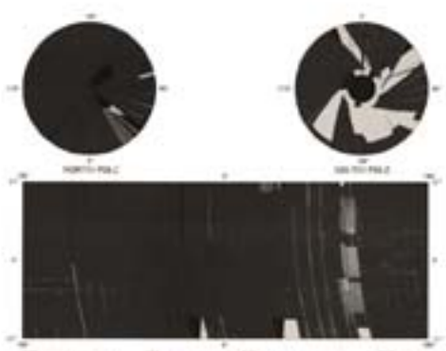
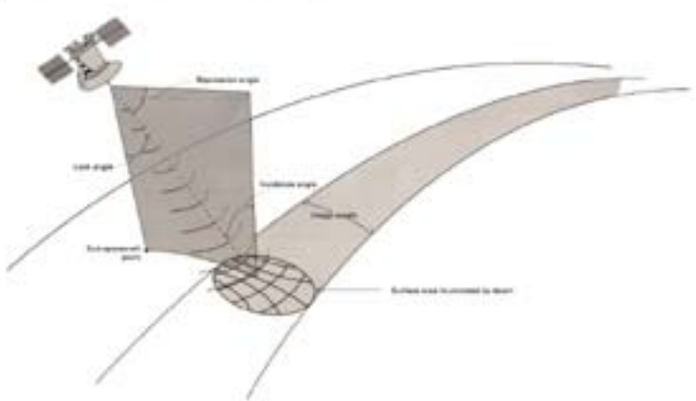
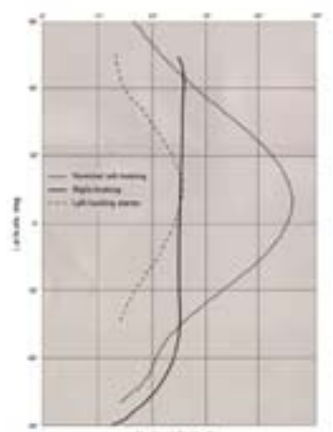
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ATLAS OF VENUS
1:10 000 000 SERIES
V 10M 30/240 CM, 1998
I-2437 SHEET 1 OF 4









NOTES ON BASE

This chart is one of a series of maps of Venus at nominal scales of 1:10 000 000 and 1:10 000 000 (Planetary Cartography Working Group, 1983 and 1990; Batson and others, 1990). It is based on data from the Magellan Synthetic Aperture Radar (SAR) instrument. The Magellan Mission was described by Saunders and Pettengill (1991); Magellan radar characteristics were described by Pettengill and others (1991).

ADOPTED FIGURE

The figure of Venus used for the computation of the map properties is a sphere with a mean radius of 6,051.0 km, consistent with the preliminary gravity figure reported by Phillips and others (1979) but not used for previous maps of Venus. Slightly less precise values of the mean radius of Venus have subsequently been reported based on Pioneer Venus (Pettengill and others, 1988) and Magellan (Ostro and Pettengill, 1992).

PROJECTION

The Mercator projection is used for this chart. The scale 1:10,000,000 at 0° latitude, 1:9,749,000 at 15° latitude, and 1:8,784,000 at 30° latitude, is the scale at the latitude of the parallel of tangency (projection). Due to the retrograde rotation of Venus, longitude increases from west to east in accordance with usage of the International Astronomical Union (1971).

GEODESY

Planimetric control is derived from the radio-tracked position of the spacecraft. The first meridian passes through the central peak of the crater Ariadne, at lat 63.8° N, according to current International Astronomical Union conventions. Altimetry replaces the Pioneer Venus datum of the same longitude, originally fixed the location of the prime meridian (Davies and others, 1980). The Venusian cartographic coordinate system was described by Davies and others (1989).

MAPPING TECHNIQUES

Magellan SAR datasets were originally produced by the Jet Propulsion Laboratory (JPL) as compact image strips were compressed and mosaicked to produce 1:5 000 000 (Full-resolution Basic Mosaicked Image Data Record) 225 m/pixel (Pettengill and others, 1991). C1-MIDR's were assembled and reprojected to produce this map. Cycles 1 and 2 left-looking, Cycle 3 and 5 right-looking, and Cycle 3 left-looking with nominal (mean) incidence angle data records used over the image extent. (Cycle 1 radar operations commenced September 15, 1990, and ended May 14, 1991; Cycle 2 began May 16, 1991, and ended January 17, 1992; Cycle 3 began January 17, 1992, and ended September 13, 1992).

Cartographic processing was done by Robert M. Batson.

SYNTHETIC APERTURE RADAR IMAGE INTERPRETATION

Because side-looking radar uses long wave radiation and an imaging geometry distinct from that of viewing camera radar images differ from conventional photographs (Ford and others, 1989, p. 45–56, and Verona, 1998, p. 7). Three differences should be kept in mind when interpreting radar images. Brightness in radar images is dependent on three factors: topography, surface texture, and surface electrical properties.

Topography affects radar images as it affects photographs. Surfaces sloping toward the source of illumination appear brighter and surfaces sloping away appear darker. However, note that the source of illumination for SAR radar images, the radar transmitter, is the same as the one of the observation, the receiving antenna (fig. 2). The geometry gives SAR images a different perspective from most photographs, where the illumination source usually the sun) is independent of the observing position. Radar properties are more effectively seen in SAR images when they are relatively abrupt. Shallow slopes are not shown well on SAR images.

Surface texture strongly affects radar brightness yet may have little effect in photographs images. Surface volume roughness is commonly with the radar wavelength (12.6 cm for Magellan, Pettengill and others, 1991) matter more strongly back to the radar receiver (thus appear brighter) than do smooth, mirror-like surfaces or surfaces composed of very small particles such as sand or silt, which can be transparent to at least sufficient depth. (Much radar waves reached dark) Thus areas that appear dark in a photograph may be bright in a radar image, and vice versa.

The third major influence on radar brightness is due to the electrical properties of the surface materials having higher dielectric constants reflect radar waves more strongly, and hence appear brighter. Rock materials having low dielectric constants. Variations in dielectric constants over most of Venus are subtle, and their influence on image brightness is generally overshadowed by that of radar's roughness on surface.

However, brightness a significantly enhanced planet-wide for materials at elevations above a radius of about 6,052 km (Tyler and others, 1992). The dielectric properties are dependent on frequency; high reflectivity in the radar images does not necessarily correlate with high reflectivity in the optical part of the spectrum.

The side-looking geometry of imaging radar leads to geometric distortion ("layover"), of features with significant relief. Slopes facing the radar appear foreshortened. In extreme cases, where the slope angle exceeds the incidence angle (fig. 2), the radar echo from the base of the slope is received before the echo from the top so that the surface may even appear to be folded back upon itself. Correspondingly, slopes facing away from the radar appear elongated. The amount of layover increases with decreasing incidence angle; the incidence angle used by Magellan as a function of latitude is shown in figure 3. Despite augmented explanations of these effects, as well as summaries of Magellan operations and radiogenic geology, can be found in the Magellan Venus Explorer's Guide (Young and others, 1990) and in the Guide to Magellan Image Interpretation (Ford and others, 1993). The latter is substantially more technical.

NOMENCLATURE

V 10M 30/240 CM Abbreviation for Venus 1:10 000 000 series, center of map lat 30° N., long 240°, normalized cruise (CM)

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INDEX OF THE 1:10,000,000 SCALE MAP SERIES OF VENUS
Numbers preceded by "I" indicate published maps

Nominal left-looking Right-looking Left-looking stereo No data

Figure 3. Magellan left-look-looking, right-look-looking, and left-look-looking stereo radar images used in the mosaic.

Figure 2. Geometry of the Magellan Synthetic Aperture Radar (SAR) footprint and terminology.

Figure 4. Magellan radar incidence angle as a function of latitude. Transmitted look angle was varied during right-looking operations to keep the nominal incidence angle at about 25°. Nominal incidence angle was reduced during part of left-looking operations in positive nominal stereo viewing geometry, in combination with normal left-looking images.

RADAR IMAGE MAP OF THE GUINEVERE PLANITIA REGION OF VENUS

V 10M 30/240 CM

1998

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