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Three virtual globes of Mars: topographic, albedo and a historic globe

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Abstract

A set of virtual globes of Mars - a topographic, a photomosaic (albedo) and a historic globe - has been made as the extension and continuation of the map series "Multilingual Maps of Terrestrial Planets and the Moon" coordinated by the Commission on Planetary Cartography of the International Cartographic Association (ICA) [1] (Fig 1).

Figure 1: Virtual maps of Mars home page at http://planetologia.elte.hu/vrml

Introduction

A virtual globe of a planet have several advantages over printed maps. To name a few of these: (1) they can provide a distortion-free view of the entire surface, (2) they can give more "realistic" views from planetary - spacecraft-based - perspective, and are best suitable for a "whole-planet" perspective (3) they can be used for better visualizing antipodal effects (4) the most abundant objects are craters: circular object which can be better visualized throughout the entire planet using distortion free globes, and (5) much studied polar areas and their extent are better visualized.

Sources

The goal of this series is to provide easily accessible planetary globes to the general public which include full nomenclature. Topographic Globe of Mars has been made using MOLA topographic data. It was color-coded to yellowish-brownish colors, unlike NASA/USGS maps, to better resemble the natural colors of Mars and avoid colors of blue (with association to water) and green (with association to vegetation) [2]. Colors range from white (-8 km) to yellow to orange to brown for the mountains.
Photomosaic Globe of Mars has been made using MGS MOC panchromatic images, photographed during 1999, therefore reflecting the albedo features as they were seen in 1999. The greyscale images has been coloured to a brownish hue.
The third globe has been created from a hand drawn black and white albedo map published with Hungarian nomenclature in 1878, after the map published by Flammarion in 1876 [3]. This map was "upside-down" oriented (south up) in order to help observation therefore to make it comparable to today's maps, it had to be rotated 180 degrees, and consequently, all names had to be rotated back to normal and move slightly.
A special online feature makes it possible to compare the old albedo map to the photomosaic map of 1999.

Nomenclature

The topographic globe displays the international (Latin, IAU) nomenclature and - unlike other planetary maps - also include informally used names in English for both small and large features. Our basic principle is that one of the main task of a map is to help find and identify objects that are named. Many professional papers and outreach publications use informal names, therefore we consider them having an equal importance as officially adopted IAU names.

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Informal names include ancient Basin names that are not named as crater or chaos (for example: Ladon Basin, Prometheus Basin) and other names that are used frequently in literature (Cryptic Region, Inca City, Thaumasia Plateau, Tharsis Rise etc.) but have no official status. These are shown in English.

The albedo globe has a secondary nomenclature layer: the albedo feature names displayed in addition to the topographic nomenclature. Albedo names are partly officially adopted, but due to various oberver practices and continuous changes of the surface of Mars, several informal names proved to be necessary to be shown, because they refer to real features that have no official albedo name.

Fonts used on the topographic and albedo globes are using the same typefaces that had been used for Earth Globes made by Central European cartographers in the late 19th - early 20th Century. Thus, for valleys (outflow channels, valley networks), we have used Left-leaning Kursivschrift (Linkskursiv); for crater names, Kursivschrift italics, for fossae we have used Venus. For other feature names we have used Oxtail, a modern form of Kursivschrift.

Cartographic base

The maps have been converted to fit on a virtual sphere using VRML language. The VRML code used for displaying globes have been originally developed for the Virtual Globes Museum [4] at Eötvös University, Budapest. The sphere is represented by these six sub-surfaces: two for the polar regions in Azimuthal Equidistant Projection stretching to the 50° latitude, and four segments in Equirectangular Projection for the remaining equatorial areas. Each surface has its own texture in the appropriate projection. On the map segments the map script and longitude lines of the grid network had to be “pre-distorted” horizontally in accordance to their latitude value in order to get a distortion-free projection later on the globes.

Interactive features

The globes can be rotated (“examine” function) and zoomed in (“explore” function). Several locations of interest are pre-set as "viewpoints"; and can be selected to jump directly to a particular named area.

Several resolutions can be chosen: 5, 2.5 and 1.3 km/pixel true versions. Since the VRML method had to pre-load the whole globe to the computer memory, video card memory limits the highest displayable resolution. A special "split mode" offers to display both topographic or the historic and albedo globes at the same time. The globes may also be printed on a sphere by the users themselves. A downloadable jpg file (fig. 5.) offers the raw materials for this. Few hand-made printed globes have been created for use at university classes [5].

"Marginal notes"

Online explanatory pages accompany the virtual globes. These serve as an introduction (review) to the Geography of Mars, illustrated by various views of the globes. A set of the most characteristic areas of Mars have been selected, some of which are albedo features. Descriptions and geologic interpretations of the feature are cited from professional journal articles. All notes are referenced. The accompanying orthographical views (albedo, topographic; whole globe views and detailed magnifications) also show how the globes can be used for outreach (for example in a geography class at high school) and if someone can not use a virtual reality player, he or she can also display selected views of the virtual globes as standard image files.

Conclusions

The surface of Mars is best visualized in a 3D virtual reality which, in global scale, can be realized as virtual globes. Together with a detailed nomenclature and specially selected comments "printed" on the globes, they provide a good way of discovering these planetary surfaces. The globes are available at http://planetologia.elte.hu/vrml.

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