Reanalysis of the Viking Control Point Network: Implications for Global Shape and Coordinate Systems of Mars

J. Oberst (Juergen.Oberst@dlr.de) & W.Zeitler
DLR Institute of Planetary Exploration, Berlin, Germany

We recomputed the Viking Mars Control Point Network and derived Mars-fixed 3-dimensional coordinates of 3739 selected, globally distributed landmarks. The Mars Pathfinder coordinates and data from spacecraft occultation measurements were used as fixed control information in the analysis. The analysis benefitted greatly from recently restored Viking Orbiter trajectory data and new planet rotational parameters derived from Pathfinder lander tracking. In our attempt to predict the coordinates of the Viking Lander 1 site from given Pathfinder coordinates, we find an offset of approx. 4-5 km of this lander location with respect to what was previously reported. With a revised lander location, our landmark coordinates have an intrinsic precision of 740 m anywhere on Mars. This network thus removes previously noted severe offsets between Mars-fixed coordinates and cartographic products. The fact that coordinates are available in 3 dimensions allows us to study the global shape of Mars. We find that the best-fit sphere about the planet's center of figure has a radius of 3390.4 km, whereas the best-fit spheroid axes are given by a=b= 3396.4 km and c = 3376.9 km. The data points, interpolated to form a gridded DTM, greatly exceed the vertical precision and spatial resolution of any current global shape model. They clearly show that the character of topography in the Northern and Southern hemisphere differ in terms of mean elevation and surface roughness. The "dichotomy boundary", estimated to be at an elevation of approx. 1500 m above the 6 mbar Geoid level, is sometimes -but not always- marked by steep slopes.