THERMAL STATE OF VENUS INFERRED FROM ITS GRAVITY AND SURFACE TOPOGRAPHY

J. Arkani-Hamed, Department of Geological Sciences, McGill University, Canada

The close correlations of the long wavelength components, specified by spherical harmonies of degree 3 to 18, of the surface topography and gravity of Venus, and the fact that the gravity field produced by the topography is greater than the observed gravity, suggest significant lateral variations in the density distribution inside the Venus. Several models are calculated for the lateral variations of density in the mantle and the lithosphere of Venus based on the observed gravity and surface topography. The models are constrained to minimize the total shear strain energy arising from the deformation of a self-gravitating Venus due to the density perturbations. Lateral variations of about 200 and 50 kg/m^3 are plausible values for the density in the lithosphere and in the upper 500 km of mantle, respectively. Introduction of a soft layer at the base of the lithosphere enhances both the density perturbations and the resulting stress differences in the lithosphere strongly. The models suggest that the lithosphere of Venus is thicker than that of the Earth. Stress differences of about 300 bars in the lithosphere imply that either the lithosphere is strong or the surface topographic features are young.