EPSC Abstracts,
Vol. 2, EPSC2007-A-00066, 2007
European Planetary Science Congress 2007

Lithospheric flexure on one-plate planets with non-uniform rigidity

M. Beuthe, V. Dehant

Royal Observatory of Belgium, Brussels Belgium [mbeuthe@oma.be]

One-plate planets are defined by their single global lithospheric shell and include all terrestrial planets other than the Earth as well as large icy satellites. Global lithospheres can be modeled as thin spherical shells deflected by topographic loading or uplift from the mantle; they also undergo bending moments and membrane stresses, the latter being characteristic of single-shell lithospheres. The rigidity of the lithosphere, characterizing its response to loading, depends on the elastic thickness of the lithosphere which is heterogeneous because of spatial variations in the volcanic activity: a good example is the Tharsis volcanic construction on Mars. However lithospheric flexure is always analyzed with lithospheres of uniform rigidity and thickness. We thus derive the equations for the deflection of a spherical shell with variable thickness under arbitrary loading. We prove that the degree-one deflection is isostatic. In example cases, we show that significant deviations occur with respect to solutions assuming uniform elastic thickness. In this way, we can estimate the error in the localized spectral analysis due to variations in the lithospheric thickness.