MARSCRUST3-A CRUSTAL THICKNESS INVERSION FROM RECENT MRO GRAVITY SOLUTIONS.

Gregory. A. Neumann[1] Frank G. Lemoine[1], David E. Smith[1], and Maria T. Zuber[2,1], [1]Solar System Exploration Division, Code 698, NASA-Goddard Space Flight Center, Greenbelt, MD 20771 (Gregory.Neumann@gsfc.nasa.-gov), [2]Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02129 (zuber@mit.edu).

Introduction: Recent Mars Reconnaissance Orbiter gravity solutions from low-altitude tracking of MRO together with previous spacecraft have dramatically improved correlation with MOLA topography [1] at spherical harmonic degrees up to 95. We present several updated models of crustal thickness. These models are calculated to fit the Bouguer potential anomaly following the assumptions in [2], with much weaker *a priori* constraints applied to the topographic corrections applied to the gravity and for filtering the downward continuation to the martian mantle. These models are available via anonymous ftp to ltpftp.gsfc.-nasa.gov in the directory /projects/tharsis/marscrust3. These higher-resolution models improve on those we produced in 2004-2005. They should be appropriate for modeling impacts as small as 300 km diameter, and for processes related to the hemispheric dichotomy boundary.

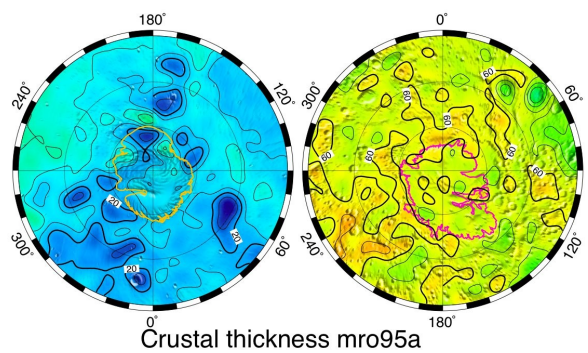
Potential Models: Previous work employed the Goddard degree 90 solution mgm1041c that incorporated some altimetric crossovers from MOLA [3], and the JPL degree 85 and degree 95 potential solutions that incorporated limited tracking of the Mars Odyssey transition orbits, as well as all of the Mars Global Surveyor tracking from 1998 onward. Tracking of MGS continued until its loss in November 2006, with improved fidelity as the fuel expenditure for momentum management was minimized. With the deployment of MRO, a total of 106 arcs in a transition orbit from 2006-08-30 to 2007-04-21, and 80 arcs in a mapping orbit from 2007-04-21 to 2007-08-30 were processed into the GSFC mromgm0023c model. The mro95a model produced at JPL extends the previous MGS95J model by including all of the remaining MGS tracking, more Odyssey mapping data, and MRO Mapping Orbit data to 2007-09-03. Both GSFC and JPL solutions incorporate a new Mars ephemeris and orientation model as described in [4], as well as time-varying terms.

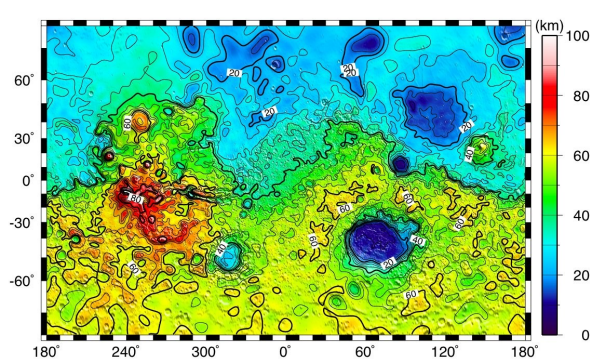
Downward continuation: The previous model applied a filter to the gravitational attraction of topography that is subtracted from the static potential to derive a Bouguer potential. The purpose of this filter was to match the loss of signal in the higher degrees of gravitational potential harmonics arising from the ~400 km altitude of mapping orbits. The current models exploit lower altitude tracking and this filter may be curtailed or even eliminated.

Stabilization of downward continuation. Downward continuation is unstable and amplifies noise. In order to suppress this noise and produce a realistic power spectrum for crustal thickness, *Marscrust2* was tapered commencing at degree 60 with a half-amplitude response at degree 66. The current generation of models applies a half-amplitude response at degree 78, an improvement of nearly 20% in spatial resolution. All terms through degree 88 that contribute to the solution are amplified by the combined filter and downward continuation. The spatial resolution of the model thus approaches ~121 km half-wavelength.

References:

[1] Smith, D.E.et al. (2001), *JGR,*106, 23,689-23,722. [2] Neumann, G.A. et al. (2004) *JGR, 109, E08002*. [3] Lemoine, F.G. et al. (2001) *JGR, 106,23,359-23,376*. [4] Konopliv, A.S. et al. (2006), *Icarus 182*, 23-50.





Crustal thickness model from gravity model mro95a submitted to PDS by A.S. Konopliv, Nov. 2007.