



## **Accurate MEX Orbit Calculations from MaRS Radio-Tracking Data: New Constraints on Mars' Time-Variable Gravity Field from a Joint Inversion of MGS and MEX Data.**

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The orbit of Mars Express (MEX) is highly eccentric compared to the nearly circular orbit of Mars Global surveyor (MGS) (eccentricity of 0.6 and 0.01, respectively), and thus offers a unique opportunity to improve solutions of the time-variable gravity field of Mars (mainly) obtained from MGS and Mars Odyssey orbiter tracking data. By using one Martian year of radio-tracking data of the radio science experiment MaRS on MEX, a precise MEX orbit is calculated over several data-arcs. In this calculation the non gravitational force model is adjusted to accurately take into account the perturbations that these forces generate on the orbital motion of Mars Express. The accuracy of the resulting orbit solution is assessed through orbit overlaps which give

the RMS error on the spacecraft position, and by comparison with orbits provided by the ESOC navigation team. The MEX tracking data are also stacked with MGS tracking data to obtain new solutions of the variations in the gravity coefficients J2 to J5. This new solution is compared with estimates from the LMD (Laboratoire de Meteorologie Dynamique) and the NASA Ames Global Circulation Models and from the HEND experiment onboard Mars Odyssey. This will bring new constraints on the seasonal variations of CO<sub>2</sub> mass deposits at Mars' polar caps.