Geophysical Research Abstracts
Vol. 14, EGU2012-14463, 2012
EGU General Assembly 2012

Improvement of the ephemerides of the Martian moons from the amelioration of the Martian spacecraft orbits: Investigating a data-arc splitting method

M. Kudryashova (1), P. Rosenblatt (1), V. Lainey (2), S. Le Maistre (1), and J. C. Marty (3)

(1) Royal Observatory of Belgium(ROB), Brussels, Belgium, (2) IMCCE-Observatoire de Paris, Paris, France, (3) CNES/GRGS, Toulouse, France

Phobos and Deimos ephemerides have been recently improved, using numerical modeling of their motion and astrometric observations of their positions from images taken by both Earth-based telescopes and cameras onboard spacecraft. In order to compute moon ephemerides from the spacecraft images, the spacecraft position on the orbit has to be known as precisely as possible.

We propose to investigate a data-arc splitting method, consisting of computing precise orbit of spacecraft using suitable data-arcs encompassing each astrometric observations instead of successive data-arcs disregarding the occurrence of these observations as usually done for spacecraft navigation orbits.

In this study, we test our method on Phobos' photographic observations taken by the Mars Express (MEX) Super Resolution Camera (SRC). We especially investigate the impact of the data-arc length (2, 4 or 10 days) and of the position of photographic observations inside the data-arc (from near the starting epoch to near the ending epoch of the data-arc) on Phobos' positions. We first compute new MEX orbits from fitting a dynamical model of MEX motion to Doppler and ranging tracking data for these different data-arcs (using the GINS software developed by the French space agency CNES and further adapted at Royal Observatory of Belgium for planetary geodesy applications). Then, we compute the positions of Phobos as seen from our new MEX orbits and compare it with the positions obtained from astrometric observations in order to assess the improvement expected from our method.

Once validated on the MEX data, we plan to apply our method to older spacecraft data (Mariner-9, Viking 1-2, ...) in order to provide better spacecraft positions to derive better Phobos' positions. These new positions will then be used to re-compute a better Phobos' ephemeris. In fine, the goal of this new ephemeris is to improve the knowledge of several geophysical parameters of the Martian system (such as the secular acceleration of Phobos' orbit, Phobos second-order gravity field, Martian J2 gravity coefficient seasonal changes) from Phobos' orbit.

This work is a part of the European Satellite Partnership Computing Ephemerides (ESPaCE), funded by the European FP7-project, aiming at strengthening the collaborative activities in the domain of the development of ephemerides and reference systems for natural satellites and spacecraft.