Time-dependent space-dependent precise acceleration model of earth radiation pressure

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Satellite acceleration models are considered as one of the error factors in satellite-based global geodesy along with atmospheric delay modeling and systematic instrumental anomalies. The behaviour of residuals does not show any apparent hints about the error cause. In this study, we focus on acceleration due to earth radiation pressure, which is the sum of the sunlight (short-wave) reflection and the infrared (long-wave) reemission. Knocke et al. (1988) presented an easy-to-use average model of the reflectivity and the reemission, which allows annual time-variation and 2nd-degree-zonal space-variation.

We find it today possible to precisely model the earth radiation pressure acceleration at a specified time and at a specified place, using the reanalysis global data set such as MERRA (Rienecker et al, 2011) and MERRA-2 (Gelaro et al.,, 2017). Their HDF/NC4 files are very large and it is not realistic to directly access them during the orbit generation/determination process. We therefore design and develop a software tool 'MerraToPres' to compute the time series of short-wave and long-wave 3-dimensional radiation pressure at a given interval for a given satellite.

We will present the procedure of earth radiation pressure modeling, and the outcome of orbit fits with satellite laser ranging data using our own orbit determination software ‘c5++’.

Keywords: Earth radiation pressure, Precise orbit determination, Reanalysis models, Satellite laser ranging, Global geodetic observing system

