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ORBIT DETERMINATION USING GROUND-BASED OPTICAL OBSERVATIONS IN LAUNCH AND EARLY OPERATIONS PHASE OF EDRS-C

Abstract

In the launch and early orbit phase of a satellite mission, reliable information on the spacecraft's position is of vital importance for the success of the whole mission. Especially for spacecraft targeting on geostationary positions, orbit information is necessary for planning and calibrating the required maneuvers to transfer the satellite in it's dedicated target orbit.

State-of-the-art orbit determination techniques make use of tracking data based on angle, range, and range-rate measurements, which are provided by a subset of globally distributed tracking antennas. The availability and quality of data provided influences the resulting orbit quality and therefore the success of the whole mission. Within the present study, optical observations are additionally employed during the Launch and Early Orbit phase of the spacecraft European Data Relay Satellite C (EDRS-C) in August 2019, as well as in ongoing routine operations phase. The optical observations are provided by the optical ground network SMARTnet(TM), which has been build up by the Deutsches Zentrum für Luft- und Raumfahrt (DLR), Germany, and the Astronomical Institute of the University of Berne (AIUB), Switzerland. The mission EDRS-C is supported by two telescopes, which primarily serves for monitoring and cataloging of objects in space.

The study shows the method of combining all tracking techniques and assesses the resulting orbits as well as calibrated maneuvers with- and without usage of optical tracking data. In addition, a performance evaluation of all employed tracking techniques is presented. In comparison to the standard tracking data, which required detailed knowledge on the measurements and pre-processing, the optical observations do not require any interaction with the spacecraft and are of robust nature. The additionally employed optical observations substantially improve on the orbit determination and all related products during the critical mission phase of EDRS-C.