ANALYSIS OF THE NAVIGATOR ORBIT ESTIMATES RATE INFLUENCE FOR AN AUTONOMOUS ORBIT CONTROL PROCEDURE USING GPS

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In a former study the performance of a procedure for autonomous control of the Equator Longitude phase drift (ΔL_0) of low-Earth phased orbits, based on the use of DIODE (French autonomous orbit determination system, based on the DORIS tracking system) navigator has been analyzed. The obtained results, presented in previous papers, gave the motivation to direct the study to the investigation on the performance of the autonomous control concept considering the use of the GPS (Global Positioning System) to provide the needed autonomous orbit estimates. The GPS system is wide-world spread and its use is increasingly being considered for many future Earth missions as an on-board navigation system. The preliminary results, obtained when the direct feeding of the coarse GPS navigation solution (standard deviations of the order of 100 m and 1m/s for the position and velocity components, respectively) is considered in the autonomous control system, where very promising. Even under worse case conditions in terms of solar activity, the autonomous control procedure maintained ΔL_0 within a range between -1000m and 1700m. This result can be considered very satisfactory once the ΔL_0 excursion range for the CBERS-1 (China-Brazil Earth Resources Satellite, successfully launched on October 14, 1999) is of ±10000m. This investigation, however, considered a very high sampling rate of the orbit estimates via GPS: 1 estimate set every 10 seconds, which is the same sampling rate considered in previous studies, when a DIODE-like navigator was considered. The current work presents an analysis of the influence, on the autonomous control procedure performance, of the GPS orbit estimates generation rate. This analysis has been carried out considering the application of a version of the autonomous orbit control procedure, which considers only the application of semi-major axis corrections with a constant, previously chosen amplitude. Actually, such version was the control procedure that presented the best performance among all the ones analyzed in previous studies. However, some improvements in this version have been implemented: the constant correction amplitude value and some control parameters are maintained constant only between previously tabulated ranges of solar activity. Therefore, during the control process, the corresponding adequate value and parameters are selected in real time, as a function of the current range of solar activity, which is inferred, in an autonomous way, from estimates of the second time derivative of ΔL_0. To assess the procedure, the same worst case conditions, in terms of solar activity as considered in the previous investigations, have been considered. The results of a long-term computer simulation are presented, discussed, and compared with former studies.