THE ORBIT ESTIMATION FOR LARETS SATELLITE

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1. INTRODUCTION

The LARETS satellite was launched on September 26, 2004 into a circular orbit at an altitude of 690 km and with an inclination of 98.2 degree. The aim of this study is the computation of the orbit of the satellite LARETS with the highest accuracy possible. The paper discusses the influence of the modelling of different physical effects on the motion of LARETS, in particular in terms of orbit quality. All computations are performed with the NASA program GEODYN II (Eddy et al.,1990).

2. METHOD OF ANALYSIS AND CONCLUSIONS

The study is based on the observations taken by the global network of laser stations during the period from December 30, 2003 to May 15, 2004. Four and half-month period of measurements (5706 normal points) was divided into 18 7.5-day arcs with half day overlaps between successive arcs. In this study three test cases were analyzed.

1. The computation model described in (Rutkowska and Noomen, 2002), gravity field GRGS/ GFZ GRIM-5S1(99,99) (Biancale and Schwintzer, 2000), atmospheric density MSIS 86 with solved for half-day intervals used for LARETS.
2. As above, but atmospheric density MSIS 86 with solved for 8-hour intervals.
3. The computation model which uses the CSR gravity field TEG-4(200,200) (Tapley et al., 2002) and the atmospheric density model MSIS 86 with solved for the 8-hour intervals.

The black triangle represent the estimated rms values for LARETS in this case 1 (Figure 1).The average value of rms-of-fit is equal to 7.05 cm. The plot with white diamonds (case 2) represents rms values solved for 8-hour intervals. The plot with solid diamonds (case 3) represents rms values for LARETS obtained with the gravity field model TEG-4 up to degree and order (200,200) and atmospheric density model MSIS 86 with solved for 8-hour intervals. It has been verified that the modeling of the gravity field up to degree and order (100,100) which gives the same rms-of-fit value. The average rms-of-fit value is equal to 3.73 cm for case 3. Generally, it can be concluded that the best solution obtained here for LARETS is for case 3. The example of residuals for the case 3 are shown in Figure 2. The frequency of solving parameters (atmospheric drag) have a big influence on the accuracy of orbit determination. The changes of the solved parameters for the half-day intervals by the 8-hour intervals is a reason of diminish of rms-of-fit about 0.4 cm for each arc separately. The estimated (for 8-hour intervals) are shown in Fig. 3. For LARETS (case 3), 18 successive data arcs were solved, of 7.5-day length each and with 12-hour overlaps.

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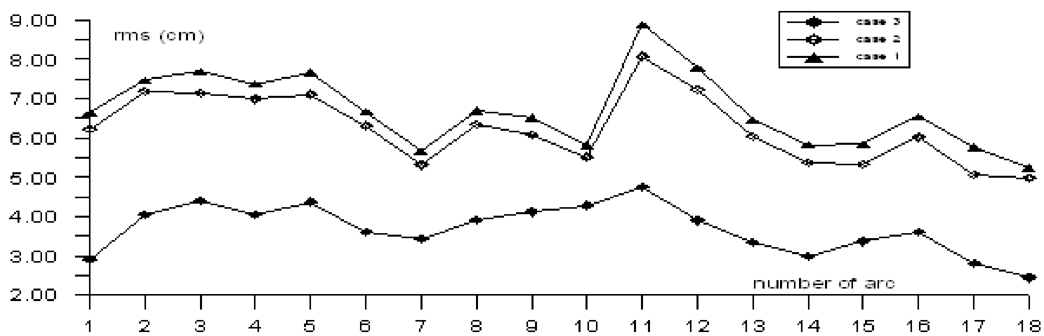

Figure 1: The rms values for LARETS for the total 4.5-month interval.

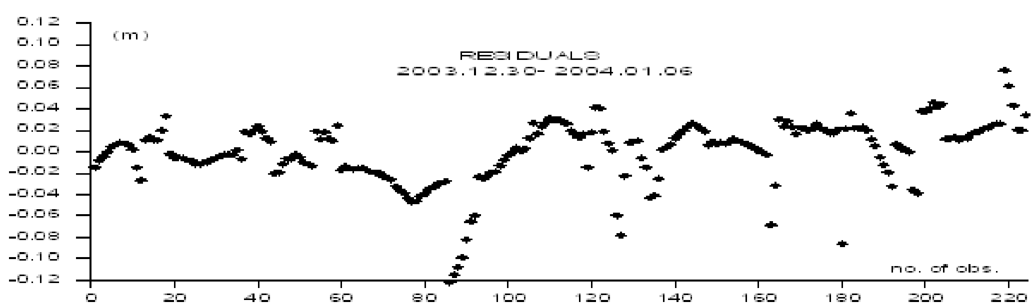

Figure 2: Residuals for 7.5-day arc (example 1).

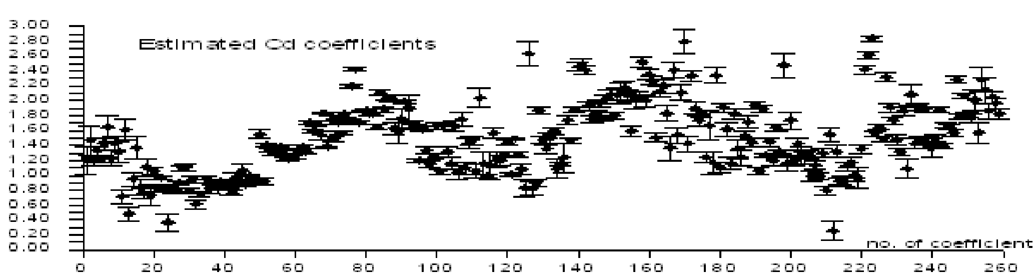

Figure 3: The atmospheric drag coefficients estimated for LARETS (case 3).