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Station coordinates from observations of DORIS system TOPEX/Poseidon satellite

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The satellite system DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellites System) is the effective means of space geodesy and geodynamics. The system designs mainly for monitoring station coordinates (beacons) and investigating the coefficients of the gravity field of the Earth. Along with SLR, GPS observations of DORIS system are used also for EOP parameters determination. The main teams for measurements process are NASA, GSFC (USA) and CNES (France). The main software for DORIS measurements process are GEODYN developed by JPL and GYPSY [1]. In IAA RAS the software is developed in the frame of ERA system [2] as alternative software for precision orbit determination and monitoring of positions of the observational stations (beacons). For testing the new software the T/P satellite observations have been taken from website: ftp://cddisa.gsfc.nasa.gov/anonymous.

The first results of the processing by ERA system of Doppler observations of the satellite system DORIS T/P are presented. The short arc orbit technique has been used for the process of Doppler observations and the first values of the determination of the station coordinates are presented. The three days sessions have been used for the results received. The results are shown to be in a good agreement with the results of other authors.

Now ERA system contains special software for calculation the motion of artificial satellites but it has to be changed and adopted for satellites with complex shape and at low orbits (800–1300 km) similarly to satellites of DORIS system. For this purpose it is necessary to change the radiation pressure model, and to take into account the thermal emission of satellite. One also cannot consider the satellite as cannonball any more and neglect its rotation, and so on . At present for the force model of satellite DORIS system for example as T/P we take into account all necessary forces mentioned in publications of IERS report 2000 [3]. Nowadays almost all features of the model are realized in frame of ERA system, according to demands of IERS Standards, but for T/P satellite with very complex shape and altitude control special software of taking into account the shape and radiation pressure as well as atmospheric drag must be developed [4]. Model of density variation now is almost adopted for ERA. The solar geomagnetic indexes are collected for ERA table.

For receiving the different parameters the Kalman filter procedure was developed too. Kalman filter is realized in ERA system. It is shown that in the case of Kalman filter the representation of observations is by two times better than in the case received by polynomial approximation of clock error. The application of stochastic approach permitted to receive rather small residuals increasing the reliability of parameters under consideration.

At present for processing the Doppler satellite observations the short arc orbit technique is used very often. The general requirements of dynamical model satellite motion are rather modest as compared with the case of big arcs processing. At each 6 hours interval during the every one day we determined 6 coordinates and velocities of satellite, two parameters of light pressure and 5 power polynomial coefficients of clock behaviour at every passage above the station. The coordinates of all stations have been determined at three daily intervals. In this way we processed three days. The results of the determination of the station coordinates are presented in the paper in table as the residuals after fitting . The uncertainties of the corrections to the station coordinates are no more than ± 3 cm, that is adequate to all processing of other authors. Further, after introducing in the satellite model new forces (atmospheric drag, light pressure with taking into account the shape of satellite) we are going to process the observations using full model. The processing of observations at long intervals (1 month and more) using full model can give us all parameters of EOP and gravity field coefficients.

References

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