FK5 Catalogue corrections from combined radar and optical data of near-Earth asteroids

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Abstract

The usage of combined radar and optical observations of several near-Earth asteroids (NEAs) - (1862) Apollo, (4179) Toutatis, (1620) Geographos, (3908) 1980 PA, (4769) 1989 PB and unnumbered 1990 MF - in order to determine the equinox and equator of a celestial reference frame showed us that these data can be successfully applied to solve the problem. It is well known that even few radar measurements, when added to optical ones, significantly improve asteroid's ephemerides and reduce errors of corrections to the orbital elements. Orbit determination process for each minor planet was made on the basis of both optical and radar measurements. The analysis of optical residuals for all asteroids mentioned above was fulfiled to estimate corrections to the catalogue equinox and its secular variation. It was obtained the preliminary value ($0.305'' \pm 0.047''$) of the FK5 equinox correction, its secular variation ($-0.3''$/cy $\pm$ $0.3''$/cy), and ($0.086'' \pm 0.044''$) as the FK5 equator. Results of zero-point corrections determination were proved to be more reliable with radar data involved.

The simulation was also completed for obtaining an influence of a number and properties of NEAs on the process of determination the equinox and equator corrections. Recomendations for the choice of asteroids to be included in this investigation are formulated.