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Instability of the celestial reference frame and effect on UT1

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Abstract. It was shown that the ICRF radio sources including the defining sources have significant apparent motion that leads to rotation of the ICRF. This rotation is transformed to secular variations of EOP that is decreased or removed if motion of sources is took into account.

Keywords. ICRF, Earth orientation parameters

VLBI is currently the only method available for measuring of the Universal Time (UT). Rotation of the Earth is described as motion of the Earth's axis of figure relative to the International Celestial Reference Frame (ICRF) that is defined by the precise coordinates of extragalactic radio sources. The rotational stability of the frame is based on the assumption that the sources have no proper motion and it means that there is no global rotation of the universe. But analysis of time series of coordinates of the ICRF radio sources shows that many of them including the defining sources have significant apparent motion, Zharov *et al.*, 2009. It is explained by motion of an emission region that is called by the ICRF source inside the jet of a quasar.

Software ARIADNA (Zharov, 2009) was used for estimation of the Earth orientation parameters (EOP) for period 1984–2008. The first solution was obtained for accepted catalog of the ICRF sources (Ma *et. al*, 1998). The second solution was obtained for improved catalog: positions of the sources were corrected and velocities of them were added. It was shown that rotation of the ICRF is due to the motions of sources. The effect of the source apparent motion has an impact on the determination of the EOP. From the first solution we have that drift of x_p-coordinate of pole is $-10\pm1\,\mu$as/year, y_p-coordinate of pole is $+3\pm1\,\mu$as/year, UT1 is $+0.15\pm0.05\,\mu$s/year, of nutation angles $\Delta\psi\sin\varepsilon$ and $\Delta\varepsilon$ are -3.7 ± 1.5 and $-7.5\pm0.7\,\mu$as/year. For second solution next drifts of the EOP were calculated : $-6\pm1\,\mu$as/year for x_p, $+0.5\pm1\,\mu$as/year for y_p, $-0.01\pm0.05\,\mu$s/year for $UT1$ and -3.2 ± 1.5, $-6.2\pm1.5\,\mu$as/year for nutation angles. There is decrease of secular variations of all EOP, specially of UT1.

Conclusions of work are: rotation of the ICRF is transformed to secular variations of EOP; catalog of sources must contain both their coordinates and apparent motion terms.

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