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Influence of source structure instability on EOP estimated from geodetic VLBI observations

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VLBI observations provide Terrestrial and Celestial Reference Frames (CRF and TRF) and Earth orientation parameters (EOP). The EOP can be estimated from VLBI observational data when the position of the observed radio sources is fixed to certain positions specified in International Celestial Reference Frame (ICRF) catalog.

Current ICRF2 catalog includes 3414 radio sources. The ICRF is obtained from geodetic and astrometric VLBI data. 295 radio sources were selected to determine a reference frame and are known as defining sources of ICRF. The selection of these sources is based on source position stability and its structure compactness.

The signal arrival time delay, a primary VLBI observable, is affected by the source structure, and thereby, the source structure has impact on the estimated geodetic parameters. We investigate this influence for several defining radio sources. Despite the fact that the defining sources were selected on the basis of their stability, many of them still have considerable extended structure. Among the defining radio sources, we selected ten that have noticeable variable extended structure. These sources were regularly observed in the geodetic VLBI sessions during the time period 2000-2013. We analyzed the sessions, in which a selected radio source was observed, and estimate EOP. Then, the source was excluded from the selected observation, and the session was re-analyzed again. Such analysis was performed for all successful sessions containing each of the selected sources during the time period of 2000-2013. The discrepancy in obtained EOPs was then compared versus the parameter that characterizes the source structure. It was found that the influence of source structure variations on the estimated EOP could be detected, since noticeable correlation between the discrepancy in EOP and source variations was found.