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Non-linear VLBI station motions and their impact on the celestial reference frame and Earth orientation parameters

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Abstract

© 2015, The Author(s). The increasing accuracy and growing time span of Very Long Baseline Interferometry (VLBI) observations allow the determination of seasonal signals in station positions which still remain unmodelled in conventional analysis approaches. In this study we focus on the impact of the neglected seasonal signals in the station displacement on the celestial reference frame and Earth orientation parameters. We estimate empirical harmonic models for selected stations within a global solution of all suitable VLBI sessions and create mean annual models by stacking yearly time series of station positions which are then entered a priori in the analysis of VLBI observations. Our results reveal that there is no systematic propagation of the seasonal signal into the orientation of celestial reference frame but position changes occur for radio sources observed non-evenly over the year. On the other hand, the omitted seasonal harmonic signal in horizontal station coordinates propagates directly into the Earth rotation parameters causing differences of several tens of microarcseconds.

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Keywords

Celestial reference frame, Earth orientation parameters, GRACE, Surface deformation, VLBI