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On the prediction of the Free Core Nutation

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Consideration of the Free Core Nutation (FCN) model is obliged for improved modelling of the Celestial Pole Offsets (CPO), since it is the major source of inaccuracy or unexplained time variability with respect to the current IAU2000 nutation theory. FCN is excited from various geophysical sources and thus it cannot be known until it is inferred from observations. However, given that the variations of the FCN signal are slow and seldom abrupt, we examine whether the availability of new FCN empirical models (i.e. Malkin 2007; Krásná et al. 2013; Belda et al. 2016) can be exploited to make reasonably accurate predictions of the FCN signal before observing it.

In this work we study CPO predictions for the FCN model provided by Belda et al. 2016, in which the amplitude coefficients were estimated by using a sliding window with a width of 400 days and with a minimal displacement between the subsequent fits (one-day step). Our results exhibit two significant features: (1) the prediction of the FCN signal can be done on the basis of its prior amplitudes with a mean error of about 30 microarcseconds per year, with an apparent linear trend; and (2) the Weighted Root Mean Square (wrms) of the differences between the CPO produced by the IERS (International Earth Rotation and Reference Systems Service) and our predicted FCN exhibit an exponential slow-growing pattern, with a wmrs close to 120 microarcseconds along several months. Therefore a substantial improvement with respect to the CPO operational predictions of the IERS Rapid Service/Prediction Centre can be achieved.