LONG–TERM GNSS SATELLITE CLOCK OFFSET PREDICTION

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ABSTRACT

The behaviour of GLONASS and GPS clocks are studied using linear model, quadratic polynomial model, first order one variable grey model and 560 different models using linear combinations of 3 functions out of 16 basis functions. With these models clocks are predicted for 5, 10, 15, 20, 25, 30 day–long intervals using previous 5, 10, 15, 20, 25, 30 day–long fit intervals respectively. More than 30 satellites are considered. Two different data sets of clocks, both of which are clock products of magicGNSS, are used in the project. The first data set spans from 27 November 2011 until 25 February 2012 and the second data set spans from 1 February 2013 until 2 May 2013. For clock predictions a MATLAB graphical user interface named `clockFitGUI` is developed. Finally using `clockFitGUI` the accuracy of models and the behaviour of cesium and rubidium atomic clocks are discussed and a new model is generated for clock offset predictions.

RESULTS

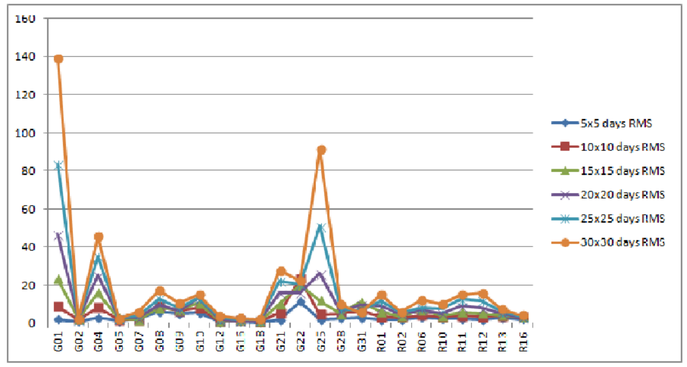

Fig. 1: Minimum prediction RMS, first data set

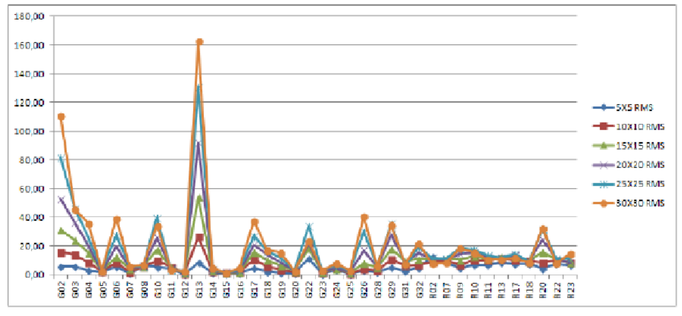

Fig. 2: Minimum prediction RMS, second data set.

Most of the satellite clocks are predictable for long–terms with an accuacy of 60 ns.

It has been shown that GLONASS cesium clocks have linear behaviour. The grey model can also be used to predict the GLONASS clocks even though it may be less stable than the linear model. Although GPS satellite clock offsets are given in the form of coefficients of a quadratic polynomial model, the linear model can also be used to predict clocks for long–terms, especially satellites with cesium clocks. Moreover, for short–terms an alternative model to quadratic polynomial model is found. The model is the linear combination of $\arctan, \arcsin, \log$ functions.

As a conclusion, cesium clocks have linear trend and rubidium clocks have quadratic polynomial trend.

REFERENCES

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[2] Bernhard Hofmann–Wellenhof, Herbert Lichtenegger, and Elmar Wasle. *GNSS: Global Navigation Satellite Systems: GPS, GLONASS, Galileo, & more*. Springer, 2008.