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Interactive comment on "Precision of continuous GPS velocities from statistical analysis of synthetic time series" *by* Christine Masson et al.

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When assessing trends from GPS (or indeed other) time series it is very hard to understand what competing factors have the most influence of the trend and especially its uncertainty. These factors can be such things as the amplitude and severity of the time-correlated noise in the series, the presence of periodic signals, the influence of offsets, whether detected or not, or simply the length of the time series. Many of these influences have been dealt with separately but very few, if any, have attempted to capture the combined effects from all the factors and derive a metric/methodology for categorizing the severity of each effect. This paper attempts to do this using synthetic series, which have the same characteristics as real GPS time series derived from previous papers that have looked at the various effects individually. The authors have come up

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with quite a reasonable and simple set of metrics to categorize a time series. Overall I think this paper is a worthwhile addition to the “error analysis” body of evidence in GPS time series estimation and will help steer other groups to understanding the limits of their GPS time series in order to be neither over optimistic or pessimistic in their assessment of the uncertainties of their results. The only real question I have is in simulating the offsets did the authors choose a minimum time span of 200 days? They could have followed the same methodology as in Gazeaux et al [2013] and chosen a binomial distribution with a probability of 1 in 950 which will give about the same number of offsets per number of years but will not restrict the offsets to occur more than 200 days apart.

> Effectively, Gazeaux’s approach is more detailed than ours and allows for a more complete coverage of possible offset positions. However, in contrast with the study of Gazeaux et al (2013), our primary objective is not to study offset detection and characterization, but their impact on the velocity estimation. A random generation of offset dates can result in series with several offsets separated by only a few days or weeks. In our analysis, tests showed that such series are treated as an equivalent series with a single offset that corresponds to the combination of the 2 or 3 nearby offsets. As a result, such series will bias the general statistics by assigning single-offset statistics to multiple-offset datasets. Thus, we chose a separation of 200-days or more as a simple approach to both see the effect of offsets over short periods (a few months) and without disrupting the statistics with consecutive offsets (a few days). More detailed analyses with more random offset position distributions could be performed, but we are quite confident that the overall patterns and statistics would be similar. This is illustrated indirectly by our offset detection method, which shows that the exact offset date (within $\pm$ 10 days) does not significantly impact the results.

Page 5 Line 6: years. We use a minimum time lapse of 200 days between two consecutive offsets. Although not realistic, this lapse of time avoids distorting the overall statistics with consecutive offsets that are treated to a single offset in our detection method (cf. section 4).

In addition the DOGEX dataset is a great dataset that has been used by many authors to check their offset estimation algorithm against other solutions. Since this dataset also has very similar properties to the those created in this paper it would have been good for the authors to have tried their method out on the DOGEX dataset just as a standard against which to compare.

> Indeed it would be a very good idea to apply our methods to the DOGEX dataset. We did not do it because the offset detection method is not the core of our study and article. Even though the taking into account of offsets is a major aspect in the determination of the long-term velocity, our main objective is to quantify the importance of each factor and to obtain an estimate of the possible bias according to the characteristics of the series. The offset detection method that we developed here has many possible improvements as well as developments that are currently under consideration for future work (at which time we would like to have the chance to use the DOGEX dataset to compare and understand the results). In parallel, the French RENAG working group is working on a comparison of different time series analysis methods (including the one developed here). The preliminary results show that our offset detection method performs as well as others. More detailed discussion could be considered with the group from Gazeaux et al. (2013).

Technical issues. There are a few places in the paper where the authors say serie instead of series.

> We made the necessary changes.

Figure 3: Examples of synthetic time series. Black dots represent daily positions. Green, red, and pink links show modeled seasonal signal, velocity and offsets. The 3 examples illustrate the quality of the data used in our study. Top: a slightly noisy series (k = -0.3, D = 1.2 mm) without offset. Middle: a moderately noisy series (k = -0.4, D = 2.3 mm) with 1 offset. Bottom: a noisy series (k = -0.7, D = 3.5 mm) with multiple

offsets.

Also I am not familiar with the notation used in the regression tree plots but I guess I understand what <> and >< mean but it would probably be good to mention somewhere what they mean.

> We added an explanation of this notation:

Page 6 Line 22: . . . from left to right. The comparison signs (> <) or (<>) are relative to each tree separation, with the sign on the left corresponding to the left branch and the sign on the right corresponding to the right branch. Hereafter,...

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