Comments to **Merging Fluxgate and Induction Coil Data to produce low Noise geomagnetic Observatory Data meeting the INTERMAGNET Definitive One-second Data Standard** of Heinz-Peter Brunke, Rudolf Widmer-Schnidrig, and Monika Korte

The article presents an approach for improving 1-sec Definitive data, which allows to overcome the
5   problem of the intrinsic noise of fluxgate magnetometer at frequencies above 0.03 Hz. The authors propose to use the data of induction magnetometer, which do not have these limitations (intrinsic noise) at high frequencies, combining them with the data of fluxgate magnetometer. The proposal is very interesting and, as the authors show, can be effective and promising.

I think that the article can be published, however, there are some issues that require more careful
10   consideration:

1) the description of the technology of computing the merged data in Section 3 gives an understanding of the individual steps of the procedure, but, in my opinion, does not allow us to understand the chain of transformations as a whole.

I understand the processing of data as follows: we have daily set of 1-sec values $Xf(t)$ of variations
15   of component X, recorded by fluxgate magnetometer. Also we have similar set of derivation $dXi(t)/dt$ of X-component, recorded by induction magnetometer. We need to calculate the merged values $Xfi(t)$ over all day.

Consider, as example, calculation for time $t0=01:30:00UT$ – we need to get value of Xfi for this time. Authors use the set of both magnetometers with length of 200 sec, i.e. from 01:28:20 to
20   01:31:40 and estimate the parameters C, deltaU and Bx, which are constant over this interval. But next step, i.e. the calculation of $Xfi(t0)$, is not clear. It can be suggested that this value is calculated using equation (3) or this value is value $Bx(t)$ in according to P3,L09. Then we go to text time $t0=01:30:01UT$ and the calculations are repeated.

I think that authors need to explain this question more clearly.

25   2) the authors write about low noise of induction magnetometers at frequencies above 0.03 Hz (P2, L12) and Figure 1. However, this is only about our intrinsic noise. At the same time, a number of factors are known that increase the noise of induction magnetometer in real measurements. For example, this is the sensitivity to mechanical oscillations of the sensors (microseisms, earthquakes, vibrations, etc.) or interference in long lines with an analog signal. The latter can be especially
30   unpleasant, since it gives a noise to differential (measured) signal. In the integration, such noise, even localized in time (spike), can give an effect throughout the entire integration interval, and thus also affect the low-frequency range of the merged signal.

I think that the authors should note these questions in the article, since many observatories are located in areas with increased industrial noise, effected the induction magnetometer records.

35   Also there are some specific questions:

P2,L16 – fits?

P2,L17 – way of writing of "10pT/pHz" is differed from similar text at P2,L04 (normal and Italic

fonts)

P2,L23 – I don't sure, that rule of GI allows to make the reference to Figure 3 before first references to Figure 1 and Figure 2

P3,L08 – may be Ts is half of sample width?

5   P3,L11 - "the start time t0 of the integration" – if t0 is start of integration, then why do we need data before t0? May be two integrals are used, with limits of integration (ts, t0) and (t0, ts) for -N and +N, accordingly?

P3,L13 – perhaps the reference "(blue line in fig. 2)" is best given immediately after "this curve" (P3, L12)?

10   P3,L12 – It is unclear why splines are mentioned

P3,L14 – what is "This"?

P4, Figure 2 – axis of ordinate is signed as deltaF, but in text there is no any mentions about deltaF

P4,L13 – it makes no sense to refer to splines?

P4,L13 – does t(i) need instead of t(1)? Also at P4,L14 and P5,L07

15   P5,L07 - "parameters C, deltaU" – is the Bx(t0) also parameter?

P5,L08 – there is no explanation of r_N

P5,L14 – authors write, that solution is least-square method. Why mention splines at P3,L12 and P4,L12?

P6,L02 – it would be nice to also show a time sets of these records.

20   P6,L04 – what is model of induction magnetometer is used for data?

P6,L04 – authors often write about the model FGE of the fluxgate magnetometer as a general type, but for induction magnetometer this is not. May be it can use "MFS05" similar to "FGE"?

P8, Figure 5 – it would be very useful to see a comparison of spectrograms of fluxgate and merged data for May 3, 2016, in order to estimate the effects of pulsations near 18UT.