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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "In-situ Calibration of Offsetting Magnetometer Feedback Transients on the Cassiope Spacecraft" *by* David M. Miles et al.

Anonymous Referee #2

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Contents

1 General

- The paper investigates on a scheme to in-flight fix a bug in the dynamics of the sensors in vector field experiment MGF (ePOP project) on the satellite CASSIOPE. The in-flight re-calibration problem occurs after an update in the MGF sensor operations to fix a timing bug uncovered after launch. The described basic laboratory solution to adopt the dynamic behaviour was applicable at the spacecraft only during special conditions. The paper reports on the achievements and shortcomings.
- Due to the significant inference by the attitude controlling wheels, the on-site determination of the required correction of the dynamic behaviour was, unfortunately, initially possible only on special occasions: when the satellite is running in save mode for a while, without the attitude control wheels operating. Some of this save-mode periods during recovery without wheels in operation were used to fit new corrections to the misbehaving transients.
- Ironically, just the fail of one of the attitude control wheels changed their impact on the MGF readings and subsequently allows to apply the correction of the transients for a wider span of temperature bins. The temperature span available was the major drawback on the application of the transient correction to all data beforehand.
- Even the constrictions of the applied method narrows the applicability, the description may well fit into the scope of the journal and may be useful to know for the community, in particular for users of ePOP MGF data.

2 Detailed comments:

- Figure 1 and it's descriptions, page 2, need a bit more information:
  - The earlier of both 'orange circle'-marks do not show something **very** disturbed to me, at least not in the printed version I'm looking at. This may be worth an additional short note to highlight the different characteristics.
  - What is that fairly monochromatic signal of the *De-trended Bx* we are looking at in frames 'c' and 'd'?
  - What is causing the varying amplitudes of the vertical strips? Is it the same effect as it's shown in Figure 3, where the characteristic of the irregular ticks are changing with some systematic as well. Seems to depend on sign and slope. Please add a short explanation.

- Timing, together with Figure 3, page 4:
  - Mentioned in the label is the 'engineering spare' magnetometer, but shown are data, presumably, for only one (arbitrary) **sensor** component. Otherwise the unspecified B may suggest to be the total field.
  - As the 'transient' behaviour is the main focus of the paper, some more early general information about the design decisions of the MGF 'offsetting' layout are missing: as the (fairly high) sampling rate and what is triggering the updates in detail. That the updates are not given on a fix time raster is deducible by the last sentence of page 4.
  - That the transient behaviour is stable in a slowly and linear drifting laboratory offset is shown in the top panel of figure 3, but is it also repeatable in nonlinear, i.e. in turbulent environments or with more erratic fields from field aligned currents (FACs) at polar regions? That may be important, if the

    ePOP MGF data may be used in calculating Small Scale FACs or such (as the example of figure 8 may claim. . .).

    The piece wise linearity seems to be important, as on page 5, line 5, it is stated there: 'The sinusoidal trend created by the spacecraft spin can be approximated as linear over the 32 sample (200 ms) interval'. Please add a comment.

- Timing, Figure 4, page 5:
  - Are that horizontal ticks on the plotted line in figure `4d` error-bars? That may be obvious from Figure 5, but should be stated here as well.

- The major improvement after the fail of one attitude control wheel was possible because of (page 6, line 15): 'wheel's spin speed slow enough that their magnetic signatures can be fitted and removed on the timescale of the transients'. This finally crucial, now possible preprocessing step is neither described in a bit more detail nor supported by an illustrative example.

- To Figure 6 and descriptions:
  - Where is the temperature measured? Inside or outside the magnetometer? Is it a temperature sensor placed on the magnetic field sensor or at the electronic box? I'm surprised, that temperature induces such a large impact on the transients at the sensor itself.

- To Figure 8:
  - For completeness: As the label states, that it's B_y in S/C system – which sensor is shown?

- Code availability, page 9

  – The mgftools downloadable zip-archive file for Linux do contain a 'sav' file with 'compiled' IDL routines only, which gives no deep insight into the code itself.

    On the ePOP website the downloadable mgftools_v3.2.zip is declared for **visualizing** level 0 data products and this promised functionality is matched. But that is not what the term data processing software (in the paper page 9 line 14) suggest to me.

3 Summary:

Some clarifications are recommended to increase the readability and lucidity of the scheme and it's application.