We like to thank the referee for the helpful comments to improve the quality of the paper and make it more easily comprehensible for the reader.

Anonymous Referee #2

The paper is a bit unusual in that it deals with magnetometer calibrations rather than scientific results. However other than that it is well written and could be published in Annales Geophysicae after suitable corrections. Major Comments The magnetometer offset correction techniques are applied to Alfven waves and mirror mode waves. The general audience will not understand what these waves are and why they would be useful for calibration purposes.Thus I recommend that the authors show examples of each and give the readership some background about their generation mechanisms and properties and why they are in the solar wind and magnetosheath, respectively. The AG readership should be given some context for why the authors use these two regions of space. The average reader will not know what a mirror mode is.
The critique is well justified. We will add a paragraph about the Alfven wave and the mirror mode, and introduce how these are used as calibration standard on an elementary level for the benefit to the readers. We add sketches of wave measurements and the use of waves for offset calibration

Abstract, lines 11 and 12. A reference should be added for the “mirror mode technique”. Line13. A reference should be given for the “Alfven fluctuation technique”.
We think that the Abstract should not contain references since it should be a document on its own.

Line 65 and following paragraph. Much of what is written in this paragraph could be deleted with-out loss. For example it is not necessary to understand the Rosetta null technique involving diamagnetic cavities.
Based on the other referee’s suggestions we decided to keep this paragraph, also because it shows that there are various other calibration techniques, which have successfully been applied to previous spacecraft missions (3-axis stabilized and spinning).

However the spin technique is necessary to discuss since you are using it to get two components of your magnetospheric spacecraft magnetometer offsets.
We agree with the referee that a more detail description of the Alfven and mirror mode method is beneficial and thus include additional information about these calibration techniques.

Line 74. Give references for the minimum variance method applied to Alfven waves.
In Belcher (1973) the applied minimum variance method is explained in detail. The reference is given at the end of the sentence.

Line 75. Alfven waves are not always incompressive. See JGRSP,123, https://doi.org/10.1002/2017JA024203, 2018. This is a misconception in the literature and should be mentioned in this paper. When they are not incompressive, how will the affect your analyses? Please discuss.

We fully agree with the referee that Alfven waves are not always incompressive. Only pure Alfvenic fluctuations are strictly incompressible. They are characterized by changes in the magnetic field components while the magnitude of the field stays constant. Particularly in inhomogeneous media such simply classifications are found to be impossible (see Tsurutani (2018) for a review; https://doi.org/10.1002/2017JA024203). In fact, oblique propagation angles to the mean magnetic field, electric field polarization in the plane perpendicular to the mean field, and finite parallel electric field make Alfvenic fluctuations of compressible character by exciting magnetic field fluctuations parallel to the mean field [Narita, 2020; https://doi.org/10.3389/fphy.2020.00166]. These parallel magnetic field fluctuations can be explained within the non-ideal MHD treatment where secondary effects like Hall currents and/or diamagnetic currents are also taken into consideration. These currents flow perpendicular to the mean magnetic field and can cause small-amplitude compressible perturbations. However, in the solar wind the fluctuations of the magnetic field strength (compressible part) are weak compared to the strong fluctuations of the magnetic field vector direction (see e.g. Khabibrakhmanov, 1997; https://doi.org/10.1029/96JA03843). By minimizing the changes of the observed total magnetic field of such fluctuations, it is therefore possible to adjust the magnetometer offsets.

To what extent the incompressibility does affect our analyses is difficult to assess, since for the in-flight offset calibration of MESSENGER additional activities had been performed (e.g. Y-axis spacecraft roll maneuver) which are hard to unravel afterwards. Moreover, to our knowledge the effect on the offset determination has so far never been studied in detail and would be an interesting aspect to look at e.g. for the upcoming BepiColombo in-flight calibration.

Line 77. Give references to the mirrormode method here again.

The reference is given at the beginning of the sentence. Plaschke and Narita (2017)

The paper is somewhat repetitive. I suggest deleting duplication and shortening the paper considerable. The readership will understand your techniques even if you express them only once.

We will go through the paper again and delete sections/sentences, which are repetitive.