Response to Review Comment 1

We thank the reviewer for the time spent on this manuscript. We respond to each of their comments below (in italics) indicating how we intend to revise the manuscript.

- *Adrian LaMoury, on behalf of the co-authors*

The paper presents some initial results from the J-MAG experiment during the JUICE Earth Flyby.

What is shown is mainly that a J-MAG measurements are largely in-line with expectations during the passage through the generally well-understood terrestrial magnetosphere - no new understanding is developed beyond this, with the exception of some initial indications as to the instrument behavior. This is to be seen within context of the other papers of this LEGA special issue. The bigger loss is the lack of deep-tail measurements that would otherwise have been possible given the JUICE trajectory, but were not operationally feasible, as such measurements are very rare and could have lead to genuinely new science.

The discussion regarding discrepancies between the constituent sensors is cursory, reflecting the early stage of the analysis. However, data quality should not be judged in this paper, as the data are not yet subject to conclusive calibration. The analysis shown demonstrates the performance of the instrument tentatively, without the data having undergone "the final calibration process" (whatever that may mean in practice - we are not told). The text makes this point consistently.

The reviewer is correct that the data presented here are not the final calibrated data product, and will be updated following further tests and operation periods. We will revise the manuscript to clarify what remains to be done. This includes offset refinement once longer periods of in-flight data have been accrued, temperature-dependent gain adjustment, timestamp shifting, and alignment refinement based on JACS operation and future Earth flybys.

Annales Geo. publication policy is clear that the data comprising the figures should also be available. The JUICE project presented a possible repository for such un-calibrated data; others also exist. The current statement given in the paper is however not compatible with Annales' policy as it stands in my interpretation.

We thank the reviewer for pointing this out. Following discussion in the J-MAG team and with ESA colleagues, we have agreed to deposit the data in a citable LEGA-specific repository managed by ESA. We will make this change in the revised manuscript.

More detail would be interesting surrounding the discrepancies seen between the IBS and OBS sensor:

It is stated that "These axes were determined to be roughly perpendicular to the axis of the magnetometer boom during this period. It is therefore believed that a current source along the boom harness may be responsible for the signal seen by IBS, which would also explain why it was not seen by OBS, which is mounted further along the boom."

"Roughly perpendicular" could presumably be easily quantified? Because, what would be the alternative? A current through the plasma would presumably be insignificant and not manifest in this way in the J-MAG sensors, and larger currents flowing elsewhere on the S/C bus would also not have such an appearance?

We agree with the reviewer that this is currently a bit vague. We will add more specific details on this investigation and the geometry of sensors on the boom with respect to cabling and other instruments.

Many readers will not be familiar with the scalar magnetometer technique. A brief elaboration would be a courtesy to the reader.

We thank the reviewer for pointing this out. We will add more background on the scalar sensor to the manuscript introduction.

Line 143: "By performing a minimisation, we determined that a small rotation of less than 1º in each axis can reduce the maximum difference between the measured and modelled field at any point to 20 nT, which we consider very good agreement in this high field environment."

In my reading, this is ambiguous when stated so. Have the data shown in the figure (and subsequently) had this rotation applied or not?

The data shown in the manuscript have had the rotation applied. We will clarify this point in the manuscript.

A potential temperature sensitivity is mentioned, but without reference to any similar effects known to affect previous missions in the same environment. Is there something here specific to JUICE/J-MAG in terms of susceptibility to this in this design?

Fluxgate sensors are well-known to experience calibration drift as a result of temperature changes. We will add context to this point both in terms of J-MAG specifics and fluxgate magnetometers in general, with reference to literature from other missions. We will also clarify the significance of this point within the context of J-MAG operations during the LEGA and in future.

OMNI data are used, but a statement is made that "No timing adjustments have been made to either dataset". OMNI data are as a matter of routine, time shifted to make them relevant to the sub-solar bow shock. This is the "algorithmic propagation" referred to earlier. It would also be very easy, for example, to calculate and display the GSE-x displacement of JUICE relative to this point. One could also argue that, for the specific purpose of comparing individual instruments and sensors, it might be relevant to know which of the OMNI spacecraft are being used at this specific time in order to produce their B-field product.

We thank the reviewer for pointing this out. We will calculate the displacement and add detail as to the provenance of the OMNI data.

Around Line 240, the usefulness of these data for space weather are discussed. This is a little far fetched, given the data are not calibrated often (as in exactly this case). The bigger loss, however, is that the relevant instruments including most importantly J-MAG where not operated continuously during the long passage through the Earth's magnetotail, which is a very poorly explored region of the magnetosphere, particularly at large distances, and on such quasi-radial trajectories. This argument could also be made.

Regarding calibration for space weather purposes – if it were possible that the data are relayed in near real time, only a very minimal (and fully automated) calibration would need to be applied, as we would only be interested in significant signals (i.e., strongly negative Bz). This has been successfully demonstrated with low latency magnetometer data from Solar Orbiter.

It is also worth noting that while real-time forecasting with Juice may not always be possible, having more continuous measurements across the cruise phase can help in the reconstruction and post-event analysis of space weather, providing observations in areas of which we do not usually have coverage. This includes space weather experienced at other planets and spacecraft. We will clarify these points in the manuscript. We very much agree about the unfortunate loss of deep magnetotail science, however this was beyond the control of the J-MAG team. We hope that this opportunity may arise in a future flyby.