**Annales
Geophysicae**
Discussions

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comment

Interactive comment on "On the magnetic characteristics of magnetic holes in the solar wind between Mercury and Earth" *by* Martin Volwerk et al.

Anonymous Referee #2

Received and published: 24 October 2019

General Comments

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The article by Volwerk et al. discusses the observations of magnetic holes in the interplanetary magnetic field observed using MESSENGER cruise phase data. The authors present a detailed examination of the magnetic holes observed within the inner solar system, making important conclusions about the evolution and decay of such events with radial distance from the Sun. Their work is presented clearly and is discussed fluently; the figures and sections are organised in a logical way which suits the explanation in the paper. Other work done in this field is well cited, and their own

contribution is clearly stated. This is a valuable contribution, and as stated in their conclusion, could eventually be extended using data from the BepiColombo mission during its cruise phase.

Specific Comments

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line 80: What is the advantage of using this particular method over the others which may have been used in past studies of these events?

line 85: Why do they have to be separated by 300 s? Figure 3 shows two magnetic holes, but it only counts as a single one due to this criterion - are many events missed out because of this?

Figures 3 and 4: A little more description of these figures (i.e. what parameters are plotted in each panel) should be included both in the caption and where they are first mentioned in the text (lines ~95-100).

line 125: Is the increase in occurrence past Earth meaningful? The gradient of the decrease in occurrence moving away from Mercury's orbit could possibly be quantified.

line 129: There are very few events in the bins past the orbit of Venus - this should be commented upon here, I think you have a fairly comparable number of events and width bins in the left panel Figure 7 which makes the statistics harder to trust than those from between Mercury and Venus.

lines 135-135: Again, could the erratic distribution outside of the orbit of Venus be attributed to a small number of events?

Section 4.2: It's a bit difficult to visualise any trends in the PMHs using the stacked histogram in Figure 6 - maybe this either warrants its own figure, or at least a separate panel on Figure 6

Figure 8: While I agree that the events are much more spread out in terms of their width

outside the orbit of Venus, the two bins within 0.8 < R < 0.9 contain relatively few events observed during relatively little dwell time - one width bin in particular (at around 25 s) appears to dictate the range of your colour bar, would it be worth adjusting the colour bar range to make the other columns easier to see? It would improve the visibility of the more statistically significant columns at the expense of the lesser ones.

line 160: How many events fall into the significantly higher width bins mentioned here? It could be argued that the spread of the widths at higher (>15 nT) field strengths are more difficult to gauge because there appears to be relatively fewer events spread across many width bins, whereas those with B < 15 nT seem to exhibit a fairly continuous distribution. The hypothesis that there is a trend in the widths of the LMHs could be made more obvious in some way using the B < 15 nT section of the left panel of Figure 9, for example by overlaying some lines indicating percentiles, or the standard deviation.

line 178-180: Are these numbers from the top panel of figure 7 of Sperverslage et al., 2000? If so, it looks to me like there is actually an increase in width from ∼6 or 7 s at 0.3 AU, to about 9 or 10 s at ∼1 AU (granted - the figure is difficult to read with much precision). To me, it looks like this trend is visible in in your figure 7 - maybe using the mean or mode of your radial bins, you might be able to confirm this by plotting them over the current figure 7, alongside the Sperverslage et al. numbers.

Technical Corrections

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line 3-5: There are some weird issues with the spacing between characters on these lines in the PDF (I'm not sure if these are actually typos - they are probably just problems with the PDF itself) e.g. "a s a m aximum o f 1 0 âŮę r otation o f"

line 6: "increas" -> "increase"

Figure 2: Please mention the units in the bottom panel on the axis label and/or the

caption.

Figure 5: It would be nice if the R^{-1} dependence was shown over the top of the histogram.

Figure 6: Please make the dashed magenta lines a little more obvious (maybe another colour, or thicker lines). The magenta asterisks could also be made a little more obvious by changing the colour.

line 142: This sentence doesn't make seem to make much sense - in particular the bit "As in the LMHs the occurrence rate near Earth 4.7 and 4.1 %/hr", could you clarify the meaning of this please?

line 162: "exponetial" -> "exponential"

Interactive comment on Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2019-127, 2019.