This paper presents an analytical magnetosheath model for the Mercury environment. The model is built on existing bricks that were published in the literature for the Earth and were adapted for Mercury, notably the models for the bow shock and the magnetopause. The procedure is well described and the code (in IDL) is given in reference such that the user can easily adapt the model to any other particular use. I have a number of non-blocking comments below that should be addressed by the authors before publication. The paper deserves publication.

Discussions points

- Do the authors foresee specific applications for their model at Mercury ?
- I would like to see a longer discussion on the limitation of constant density in the magnetosheath. As this hypothesis implies a constant velocity along a given flow line, it produces (Figure 3) a very different velocity patterns that the previous models (Spreiter et al., 1966; Génot et al., 2011, Soucek & Escoubet, 2012) and will likely underestimate propagation timing in the magnetosheath.

Solar wind at Mercury

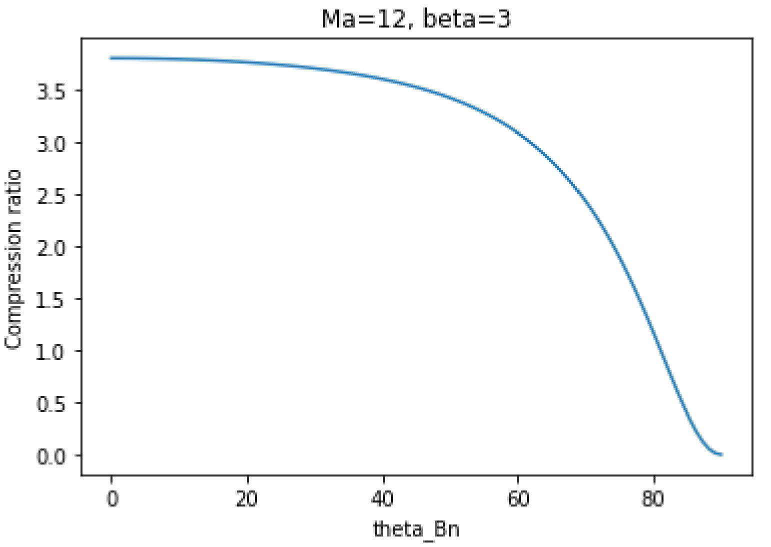
I don't find the explanation on how the solar wind parameters at Mercury are computed very well described. It could be specified that the model is 1D MHD and takes OMNI as input to compute propagation at all solar system objects including Mercury. Then I don't understand what are the average theta_Vn and theta_Bn ? It does not make sense as these values depend on the position on the shock (and on the shock model itself). A note could be added on the average Parker angle at Mercury. From the Tao dataset one finds 23° which is also the value for Mercury at an average position of 0.4UA and solar wind velocity of 400 km/s. Note that the Tao Bx value is computed from the model By value and an hypothesis of Parker field line which is consistent with the identical 23° values above. I confirm the average values given in the paper (n=40 cm-3, T=18 eV, v=400 km/s, b=20 nT) for the ~1500 days of observations of the Messenger mission. As |v^u| is a magnitude I would indicate 400 instead of -400 km/s. Please compute the corresponding M_A and beta values and indicate them on Figure 3.

Orbital motion

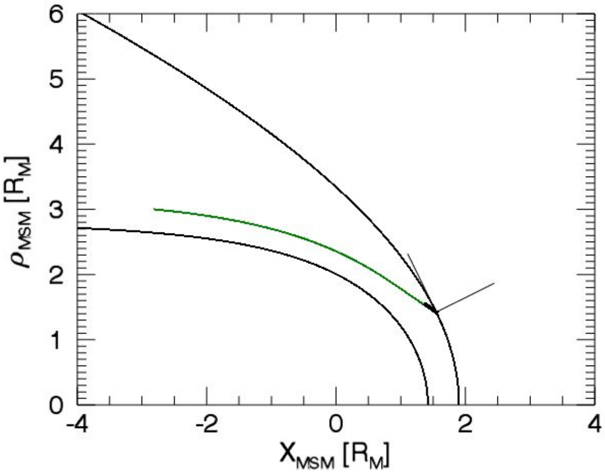
Please explain the procedure for the orbital motion correction briefly described at L147. The exact transformation should be given, perhaps in a short appendix.

Equation 11

I'm grateful to the authors for bringing my attention to Anderson, 1963 that I had overlooked. I checked Equation 11 of the paper that is equivalent to Equation 2.43 of Anderson et al., 1963 although the notations are different. However, I have a problem with its solution. I ran the piece of code given by the authors, and I also used an independent method (Cardan for 3^{rd} degree polynoms) in Python; both approaches give the same solution for the compression ratio as a function of theta_Bn and it is reproduced on the figure below for nominal solar wind conditions (Ma=12, beta=3). The curve tends towards zero for perpendicular shocks. Entropy considerations preclude compression ratio below 1. So I'm wondering if the equation, hence the model, always leads to a physical solution for all solar wind inputs.



IDL code available at the OSF page
I was able to run the code satisfactorily and trace a low line from a point in the magnetosheath (see below). The code is well commented. This may be outside of the scope of this review though, but it shows that the work complies with reproducibility principles.



Minor points
Figure 2 : please specify the parameters (M_A, beta, …) for which the figure is drawn

Figure 3 : same comment

L123: reference of frame → frame of reference

L130 : the upstream magnetic field ; the shock normal

L131 : why adding the last part “w.r.t. the shock normal” ? it is unnecessary here.

L138 : Equation 4 → Equation 11

L158 : a word is missing in front of the reference