

Reply to Reviewer #1 for the manuscript "Interpretation of the Cross Correlation Function of STEREO Solar Wind Velocities using a Global MHD Model" [Paper #2010JA015717] by Riley et al.

We are grateful for the reviewer's insightful comments and we have fully addressed them in our resubmitted manuscript. Below we reproduce the reviewer's entire comments (italics) and provide a complete response to each (regular text). Any significant modifications made to the manuscript are also explicitly provided here (in quotations).

This study examines the cross correlation Function (CCF) of the solar wind velocities between the Stereo A and B spacecraft and compares the results with model results from a global MHD model. The authors find two "lulls" or intervals where the phase lag between the spacecraft is significantly less than would be expected simply by the longitudinal separation of the spacecraft. The authors suggest that some combination of 1) time-dependant evolution of the solar wind structure and 2) spatial inhomogeneities in the solar wind produce the lulls. However, they make no quantitative assessment of the relative importance of these two potential effects. While this study examines an interesting topic, I regret that I can not recommend publication without significant revision and the addition of more quantitative information.

Fortunately, there is considerably more solar wind velocity data available from the SWEPAM instrument on ACE relevant to this study. Strangely, the authors show this data in their Figures 2 and 4, but fail to use it in their analysis. I strongly recommend that the authors calculate and show the CCFs for STEREO-A to ACE and ACE to STEREO-B as well as STEREO-A to STEREO-B. A revised figure 3 could easily show all three CCFs. With ACE in the middle of the three spacecraft, this will provide two measurements with smaller angular separations that should allow the authors to assess the two possible explanations for the lulls that they discuss (or possibly find some other explanation depending on the results of the new analysis). Because the authors clearly already have the SWEPAM data and the processing code to calculate the CCFs, this should be a relatively simple task with potentially major scientific return in terms of actually figuring out what is going on in the solar wind.

Response: We fully agree with the reviewer's suggestion here, and in retrospect, it is something we should have considered from the very beginning. We have performed a complete re-analysis of the STEREO data, but adding in ACE measurements as a third and equally important vantage point. This has resulted in a substantial rewrite several sections of the paper, however, it has not altered our primary conclusions, rather, it has strengthened them.

The title now reads: "Interpretation of the Cross Correlation Function of ACE and STEREO Solar Wind Velocities using a Global MHD Model"

We have re-plotted Figure 1 to include ACE trajectory information. We have also removed the delta-r, lat, and longitude, which complicated the plot too much (after adding the ACE information), and would have required two more curves to show the relationship between the three combinations of spacecraft.

We have re-plotted Figure 2 with the legend reordered as STEREO A, ACE, STEREO B, to

reflect their phasing in heliospheric longitude.

We have added two new Figures (3 and 4) that show the correlation analysis between STEREO B and ACE, and ACE and STEREO A, respectively. They follow the same format as the original Figure 3 (now Figure 5). Although the reviewer suggested adding panels to the existing Figure 3, we felt there would be too much information to convey. Moreover, the appearance of the "lulls" depends on the time of the observation, not on the longitudinal separation of the spacecraft. Thus, for STEREO B/ACE and ACE/STEREO A, they appear at roughly half the longitudinal separation as with STEREO A/STEREO B. Had we plotted the cross correlation analysis as a function of time, we could have included them all on one plot. However, the theoretical linear fall off in the phase is best described as a function of longitude, rather than time.

We have added the following text to describe the new Figures (3 and 4):

"We performed a similar analysis for ACE and STEREO A. The results are shown in Figure~\ref{fig-corr-e-a}. We have scaled the plot to half the maximum values of Figure~\ref{fig-corr-b-a} so that features can be compared directly. In particular, by scaling the longitude to half the maximum value of Figure~\ref{fig-corr-b-a}, the two panels span the same duration in time. In the top panel we can see similar lulls centered at approximately 17° and 29° . These are roughly half the longitudinal separations for the lulls found in the analysis of STEREO A/B, and thus occur at the same time. Concerning the duration of the lulls; while the second one lasts approximately the same duration in time, the first appears to be significantly broader. We also note that the peak cross correlation coefficient is, on average slightly larger for this pair of spacecraft; a predictable result given that the spacecraft are closer to one another.

Finally, in Figure~\ref{fig-corr-b-e}, we summarize the cross correlation analysis for STEREO B and ACE. Here, the first lull is approximately the same duration as in Figure~\ref{fig-corr-b-a}, while the second one is slightly shorter. More strikingly, the second lull shows a steep initial rise from -40 hours to less than -20 hours, with a subsequent slower decay back to the predicted phase lag."

We have re-plotted Figure 3 (now Figure 5) running out along X to 80 degrees rather than the original 100 degrees.

Figure 6 (originally Figure 4) has been re-plotted with 'Earth' replaced by 'ACE' and the relative ordering of the spacecraft changed to reflect their phase in longitude. Figures 8, 10, and 12 (originally 6, 8, and 10) have been modified similarly.

Throughout the text, a number of other, small changes have been made to reflect the fact that this is a STEREO/ACE study, rather than just a STEREO study.

Assuming the authors take the above constructive suggestion, I also think that it would be appropriate to elevate the status of the ACE contributions to this study (they currently show the data but don't even acknowledge its use in their Acknowledgements section). Specifically, I would suggest adding ACE to the title along with STEREO, weaving it into the Introduction,

labeling it explicitly the figures ("ACE", not "Earth"), comparing the three CCFs in the Interpretation section and Summary, adding SWEPAM to the Acknowledgements, and adding the SWEPAM reference to the Reference List.

Response: We have addressed all of these suggestions. Specifically, we added "ACE" to the title, included words about it in the introduction, identified all "Earth" based measurements as "ACE", compared the three CCFs (as described earlier), included "We thank the SWEPAM/ACE and PLASTIC/STEREO teams for providing data." in the acknowledgments, and referenced the SWEPAM instrument paper.

Finally, the figure captions were not included in the version of the manuscript that I reviewed so I had to pull them separately from the JGR website. It would be simpler for the next round if they could also be included directly in the manuscript.

Response: We apologize for this omission. JGR's submission process is not very kind to (or at least confusing for) LaTeX documents. At the time, AGU required uploading figures separately from the main text. This has since changed and, in the current revision, we have included the captions and figures in the main PDF document.

In addition to these changes, and those recommended by the other reviewer, we have made a number of smaller corrections, correcting typos and generally improving the readability and clarity of the manuscript.

Again, we thank the reviewer for taking the time to review the manuscript and provide this constructive criticism.