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Interactive comment on "Outer Van Allen belt trapped and precipitating electron flux responses to two interplanetary magnetic clouds of opposite polarity" *by* Harriet George et al.

Anonymous Referee #2

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This manuscript compares observations from the inner magnetosphere during two different CME-driven storms. The storms are of a similar magnitude but driven by CMEs with opposite rotations of the Bz magnetic field component. The manuscript describes differences in the timing and features of the solar wind during the chosen storms and compares them with the observations of wave activity from RBSP and GOES, precipitating electron flux at POES, and source, seed, and radiation belt electron fluxes at RBSP. The manuscript concludes that the location and timing of the southward component of the magnetic field is a key factor in driving the differences in the timing of trapped and precipitating flux variations during CME-driven storms. The manuscript is very nicely written and provides new insight, but there are comments which should be

addressed prior to publication.

Main Comment: The manuscript currently needs to take better care addressing the effects of the local time of the spacecraft in their analysis. The RBSP spacecraft have quite different locations in apogee during the two events which are compared. During event 1 RBSP is primarily on the dayside. During event 2 it is near dusk. There is a local time dependency of chorus (e.g. Li et al., 2009; Meredith et al., 2012), source/seed electrons (e.g. Allison et al., 2017; Korth et al., 1999), and potentially a storm phase dependency on the local time of chorus/source electrons (Bingham et al., 2019). As such, one would not necessarily expect to observe the same timings and intensities of lower energy electron flux and chorus wave activity during each storm. While the manuscript has a thorough description of most of the timing of various features observed, this is one part that still needs to be better addressed.

Other comments: Chorus and hiss waves are not necessarily going to be the only waves present between 100–10000 Hz over an RBSP orbit. That is not to say that they will not be the dominant ones. Most of the features shown certainly look chorus-like and hiss-like. However, I think a little more care could be used either in describing caveats of the chorus/hiss observations as they are, or using the wave properties to provide greater certainty that the waves shown are in fact chorus/hiss.

While they will only be from a limited local time, including RBSP observations of the plasmapause location could provide useful context for the events and provide a comparison to the empirical model currently used. Additionally, over plotting the empirical and/or observed plasmapause location on the RBSP electron fluxes would help the reader.

Lines 189-190. "The use of two RBSP satellites over a period of multiple days meant that all MLT were encompassed". RBSP is not able to cover all MLT for all L-shells shown during each event.

Line 297-298. "Dst begins to decrease rather steadily soon after the ejecta leading edge arrives at Earth, reaching a minimum value of −102 nT on June 29, 2013, 07:00 UT." How much of the initial decrease in Dst is due to passing of the sheath region and the end of the sudden storm commencement? After an initial decrease, Dst seems to be at a rather constant value, which is pretty comparable to the prestorm value, for the first ∼8 hours of 28/06/13.

Line 381. Typo: "The source population flux is strongly decreases towards the time of the ejecta trailing edge"

Figures 1-4. Minor tickmarks on the x-axis every few hours would be helpful to the reader.

Similarly, many of the line flux plots with a log y-axis could use more tickmarks on the y-axis for reference.

Allison et al. (2017). The magnetic local time distribution of energetic electrons in the radiation belt region. JGR. doi: 10.1002/2017JA024084

Bingham et al. (2019). The Storm Time Development of Source Electrons and Chorus Wave Activity During CME and CIR Driven Storms. JGR. DOI:10.1029/2019JA026689

Korth et al. (1999). Plasma sheet access to geosynchronous orbit. JGR. DOI:10.1029/1999JA900292 Li et al. (2009). Global distribution of whistler-mode chorus waves observed on the THEMIS spacecraft. GRL. DOI:10.1029/2009GL037595

Meredith et al. (2012). Global model of lower band and upper band chorus from multiple satellite observations. JGR. DOI:10.1029/2012JA017978

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