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Interactive comment on "The asymmetric geospace as displayed during the geomagnetic storm on August 17, 2001" *by* Nikolai Østgaard et al.

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First, we will thank the referee for carefully reading our manuscript and for providing very useful comments. We will respond to the comments one by one, and also indicate the changes (how and where) we will make to the manuscript. At this point we are asked to only provide response, not a marked-up new version, so we will point to where in the original version we suggest to make the changes

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Discussion paper

1 Major comments

1) Determination of convection pattern.

(i) We are not using any ”in-fill” data to cover regions with little data, but we take advantage of the SuperMAG data that can be used in the sunlit part, and as can be seen the green dots (SuperDARN) and brown arrows (SuperMAG) gives us quite good coverage, see also Figure 14. Several places we emphasize that the patterns are derived ”entirely from data”. To make it even more clear, we suggest to use ”entirely from measurements” instead of ”entirely from data” when we refer to the model. We will also make explicitly statement: ”To estimate the global plasma flow pattern (in a coroating frame), we adopt a novel purely data based multi-instrument approach, without using any empirical model to fill in regions with data gaps.”

(ii) It is true that sometimes DMSP data show very large values which can not be trusted, but this is not the case here. We are only using validated data as input for the convection model. The SSIES data are provided with quality flags in both directions (along and cross track). We assign a common quality flag to each vector which is equal to the poorest quality component. We then assign a weight to the data point which depends on this quality flag, down-weighting poor quality data points in the final inversion.

(iii) Yes, you are right, it is not needed to draw Figure 11C by hand. We will fix that.

(iv) SuperDARN convection map for the Southern Hemisphere is available on their webpage and supports our regions of dayside and nightside reconnection in the Southern Hemisphere. However, there are no data for the entire dawn cell and the superDARN map of that cell is not consistent with the auroral imaging data in the dawn. We suggest to add in Section 4.2.7: ”We should mention that there exists a SuperDARN convection map (see their web page), which supports the locations of dayside and tail reconnection. However, there are no data in the dawnside and the convection reversal in this

map is not consistent with the poleward edge of the auroral in this hemisphere."

2) Scaling between WIC and SI13. As a general rule, as long as the auroral features are larger than the pixel size, the area covered by a pixel increases by r^2 whereas the luminosity from the source decreases by r^2, which means that these two effects cancel. Having said that, we are not claiming that we have the scaling correct, and we have emphasized several places that we are not comparing absolute intensities, but only shapes and relative intensity increases. (see Page 3 line 17 and page 6 line 1).

2 Minor comments

1) Thanks for pointing out the Grocott paper. We will reference this result both in the introduction:

"Reduction of the BY dependent dawn-dusk asymmetry in convection pattern after substorm onset has also been reported by Grocott et al. (2010)"

and at the end of Section 4.6:

"Reduction of IMF BY related asymmetries during substorm expansion phase has been observed both in conjugate auroral images (Østgaard et al., 2011a) and in convection patterns (Grocott et al., 2010)."

2) In the Data section we will specify the different coordinate systems that has been used: APEX for IMAGE, Polar and DMSP, and AACGM for SuperDARN. We also point out that the difference between these coordinate systems is negligible for the results presented in this paper. Two sentences will be added:

"For all the imaging data presented in this paper APEX coordinates are used."

"For SuperMAG and DMSP we have used APEX coordinates, while for SuperDARN AACGM coordinates are used. The APEX and AACGM coordinate systems are almost

identical (Laundal and Richmond, 2016) at high latitudes and is negligible for the results presented in this paper."

3) We will add instrumental references for SuperDARN, SuperMAG, DMSP and CHAMP:

SuperDARN (Greenwald et al., 1995) , SuperMAG (Gjerloev, 2012) DMSP (Rich and Hairston, 1994) CHAMP (Reigber et al., 2002)

4) Symbols in Figure 7. We have tried without success to find a different color that would display better, so we keep it blue (a color that is not in color scale for the aurora). Then they are consistent with the blue in panel B and C. We have added in the figure caption: "The blue symbols are at the same locations in all panels"

5) Yes it is true that modeling indicates larger asymmetry at the poleward edge than at the equator ward edge. in Figure 3A one can see that the features marked 1 and 2 is bent dawnward at the poleward edge. However, it is not possible to determine from SI13 how bent they are in the north. So we decide to keep it as is. The main point here is that the asymmetries are only 0.5-1 hour MLT.

6) In Figure 11A OCB is identified by the poleward edge of the aurora. The colors in Figure 12 only indicate time and the purpose is to show that the OCB does not move, which tells us that flux is indeed transferred across the OCB. It is correct that there may be reconnection also beyond 22.5 MLT in the north, but the contours indicate a much weaker flow. We will add that 18-22 MLT is where the most intense flows are observed, and that there are weaker flows across the OCB dawnward of this.

7) This is an excellent comment, and we also believe that we have a split reconnection line. This is what one would expect if the reconnection site at the magnetopause in the Southern Hemisphere is also included. This location would have its magnetic footprint around 11 MLT in the northern hemisphere. We will make a comment about that. "Since the flow between 11 MLT and 13 MLT is mostly along the OCB, the flows seen

within the green and blue circle indicate split reconnection X-lines, similar to what was reported by Chisham et al., 2002 during similar IMF conditions." NB: In response to the other reviewer, green and blue circles have been added in Figure 14 to point out where the flow across the OCB on the dayside are observed.

8) Instead of huge regions we will state: "Mapped into the plasma sheet (not shown) they cover huge regions (ΔY: 4-5 Re and ΔX: 10 Re)"

3 Other comments and typos

1-17: thanks and they will all be changed according to the suggestions

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