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Discussions

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Interactive comment on "Characteristic study of double substorm onsets in response to IMF variations" *by* Ching-Chang Cheng et al.

Anonymous Referee #2

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This paper is to prove the model for double substorm onsets which is thought to occur when the IMF turns from southward to northward, through the analysis of the data of the magnetic field and plasma obtained by THEMIS spacecraft, and those of aurora, geomagnetic field and geomagnetic pulsations on the ground, together with the solar wind data. However, it seems that the characteristics and variations in each data reported in this paper are considerably biased by the Russell model for double substorm onsets. Since the interpretation of the observational data are incomplete and misleading, it is a pity but I cannot recommend this paper for publication. I hope that the authors revise the paper taking the following comments into account, and submit it again.

P4, L6 - P5, L8: I do not understand the reason why the detailed explanations on the

event described in other paper are given here. You should explain the events during disturbed period in more detail here.

P4, L20-22: I'm not sure whether the timing for E2 is correct. Besides there are similar variations in the observed data other than E1 and E2.

P4, L23-25: You do not show any data for AL index for this example in the text.

P4, L32-33: Similarly to the above comment, any data for AL index for this example is not given.

P5, L10-22: The C2 onset does not look like a substorm. I don't understand the reason why you draw a line here. The bay-like variation is also understood as a variation simply associated with a recovery phase.

P5, L23: I cannot see the two-stage dipolarization as described in Fig. 3a.

P5, L24: The auroral expansion starting at the timing of C1 continues to C2, and it seems to disappear immediately after C2.

P5, L28: In any of the spacecraft data, there are no clear indications of dipolarizations for C1, C2.

P6, L4-6: Flow burst does not seem to occur in association with the # 1 onset.

P6, L11: What is the relationship between pseudosubstorms and IMF Bz?

P6, L16-21: The quality of the panels should be improved. The auroral variations described here are difficult to be read from the figure.

P6, L21-24: I understand that the aurora for the second onset develops more in the west, but I'm not sure it occurs on the higher latitude than the first onset aurora.

P6, L24-32: The quality of Fig. 7 is better than Fig.6, but still it should be improved to increase the contrast of the image and make your point clearer. What I noticed by looking at the present version of the figure is that the auroral arc brightened due to the

first onset seems to move to higher latitudes, and the same arc brightened again at the second onset. According to the Russell model, I think that the first onset arc brightens in a given latitude and the second onset arc should newly appear in higher latitudes.

P7, L2-20: It is more important to consider the location of the westward electrojet (or the wedge current) based on the distributions of H and D component variations rather than to describe the detailed geomagnetic field variations at various locations.

P7, L11-12: I don't see any intensification of the magnetic bay variations at the C1 onset.

P7, L22-P8, L19: Throughout the time of interest, the value of |By (OMNI)| is comparable to |Bz (OMNI)|. Don't you need to consider its effect in the present analysis?

P7, L31-32: It is true that the IMF turned to northward, but shortly after it turned to southward. Can you apply the Russell model to such a case?

P8, L11: Bz (OMNI) has turned to northward well before the #2 onset.

P8 L21 - P9, L4: The characters of the geomagnetic pulsations described here are not necessarily clear. Also, it should be noted that, since the authors compare the data obtained by induction magnetometer, they must divide the output from the wavelet analysis by wave frequency to obtain the wave intensity.

P10, L22-24: I do not understand the reason why the authors show the result of the correlation analysis here.

Additionally, I have the following general questions:

* Isn't it possible to show the precise timings of the auroral breakup, flow burst, dipolarization, geomagnetic bays and geomagnetic pulsations, etc. relative to the polarity change of the IMF within the time resolution of the employed data.

* I don't think that the IMF changes from southward to northward always results in double substorm onsets. What is the other conditions that cause the double substorm

onsets?

* If you want to show the validity of the Russell model, it is more appropriate to obtain the evidence that shows the quenching the magnetic connection at the DNL in the magnetotail when the IMF turns to northward and the associated decrease in plasma density in the lobe. Furthermore, it is useful to show the occurrence of the reconnection of the plasma sheet magnetic fields at the NENL for the first onset, and the reconnection of the lobe magnetic field in the second onset through the analysis of the spacecraft data.

There are also some minor comments:

P3, L30: The dates shown here seem to be incorrect.

P4, L1-4: Both LETH and FSI are not shown in Fig. 1.

P4, L7-9: The locations of the THEMIS spacecraft should be given.

P5, L16: The time shown here seems incorrect.

P21, Fig. 8a: Isn't it "CHBG" rather than "CHNG"?

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