Nonlin. Processes Geophys. Discuss.,
https://doi.org/10.5194/npg-2020-47-AC1, 2021

Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Magnetospheric chaos and dynamical complexity response during storm time disturbance" *by* Irewola Aaron Oludehinwa et al.

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Received and published: 5 March 2021

Response to Reviewer's comments (Reviewer 1)

Comment 1: Major Comments in reading the article from the beginning, I had assumed that the authors have separated CMEs from CIRs and sheaths. It is only later, reading further into the article that I found out that they have not. Thus, the Introduction section must be rewritten to include other interplanetary causes of magnetic storms.

Reply: We sincerely thank the anonymous reviewer. The above suggestion have been effected in the revised manuscript in Line: 29-39 as: A prolonged southward turning of

interplanetary magnetic field (IMF,Bz), which indicates that solar wind-magnetosphere coupling is in-progress was confirmed on many occasions that such geomagnetic storm was driven by Corotating Interaction Regions (CIRs), or by the sheath preceding an interplanetary coronal mass ejection (ICME) or by a combination of the sheath and an ICME magnetic cloud (Russell et al. 1974; Burton et al.1975; Gonzalez and Tsurutani, 1987; Tsurutani et al. 1988; Cowley, 1995; Tsutomu, 2002; Yurchyshyn et al. 2004; Kozyra et al. 2006). Storm Time (Dst) index (Sugiura, 1964; Sugiura and Kamei, 1991) unveil the quantitative measure of the total energy of the ring current particles. Therefore, the Dst index remains one of the most popular global indicators that can precisely reveal the severity of a geomagnetic storm (Dessel and Parker, 1959).

Comment 2: Sheath generated magnetic storms and CIR generated magnetic storms are generally weaker than ICME/MC generated storms. So, this may be an explanation for some of your results? Please consider adding this to your Discussion Section.

Reply: Thank you for this useful suggestion. The above suggestion has been included in the revised manuscript in Line 331-338 and 344-347 as: This increase in chaotic behaviour for Dst signals during minor geomagnetic storm may be as a result of asymmetry features in the longitudinal distribution of solar source region for the Corotating Interaction Regions (CIR) signatures responsible for the development of geomagnetic storms (Turner et al. 2006; Kozyra et al. 2006). CIR generated magnetic storms are generally weaker than ICME/MC generated storms (Richardson and Cane, 2011). Therefore, we suspect that the increase in chaotic behaviour during minor geomagnetic storm is strongly associated with the asymmetry features in the longitudinal distribution of solar source region for the Corotating Interaction Regions (CIR) signatures. Line 344-347 as: The reduction in chaotic response during moderate and its further declines at major geomagnetic storm may be attributed to the disturbance in the interplanetary medium driven by sheath preceding an interplanetary coronal mass ejection (ICME) or combination of the sheath and an ICME magnetic cloud (Echer et al. 2008; Tsurutani et al. 2003; Meng et al. 2019).

Comment 3: Please also consider separating these three different types of storm sources and write a second paper.

Reply: We are grateful for this insight opening. Our next research will be based on the sources of the three different types of sources.

Comment 4: Minor Comments Title: “Disturbances”? Line 31. Here you could add sheath causes of magnetic storms. Some pertinent references are JGR, 93, A8, 8519-8531, 1988; JGRSP, 124, 3926-3948, 2019; NPG, 27, 75-119, 2020. You should also add references and comments on CIR magnetic storms. The discovery and naming of CIRs is in paper GRL, 3, 2, 137-140, 1976. There is a whole book of articles on CIRs and geomagnetic activity: AGU monograph volume 167: “Recurrent Magnetic Storms: Corotating Solar Wind Streams”. Some pertinent articles are: JGR, 100, 21717-21743, 1995; JGR, 113, A05221, https://doi.org/10.1029/2007JA012744, 2008; https://doi.org/10.1029/167GM24, 2006; https://doi.org/10.1029/167GM11. 2006.

Reply: The comment have been corrected as: such geomagnetic storm was driven by Corotating Interaction Regions (CIRs), or by the sheath preceding an interplanetary coronal mass ejection (ICME) or by a combination of the sheath and an ICME magnetic cloud (Russell et al. 1974; Burton et al.1975; Gonzalez and Tsurutani, 1987; Tsurutani et al. 1988; Cowley, 1995; Tsutomu, 2002; Yurchyshyn et al. 2004; Kozyra et al. 2006; Echer et al. 2008; Meng et al. 2019; Tsurutani et al. 2020).

Comment 5: Line 33. I suggest deleting the phrase “Irrespective of what causes the geomagnetic storm. . .”. The above 2008 paper showed that for all 90 magnetic storms, all were caused by IMF Bz southward fields.

Reply: The above statement has been removed in the revised manuscript:

Comment 6: Line 35: Dessler

Reply: The above reference name has been corrected in the revised manuscript line: 39

Comment 7: Line 51: “Lower auroral electrojet (AL)”? I have never heard it called this before.

Reply: In the revise manuscript in line 55. The statement has been corrected as: Amplitude Lower (AL)

Comment 8: Line 104: Chapman-Ferraro

Reply: The statement has been corrected in line 108-109 as “Chapman-Ferraro Magnetopause currents”

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