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REVIEWER'S REPORT

Manuscript No.:IJAR-58226

Title: Interplanetary Characteristics and Geoeffectiveness During Recurrent Geomagnetic Activities of Solar Cycles 23 and 24

Recommendation:
Accept as it is .....
Accept after minor revision.....
Accept after major revision .....
Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality	…			
Techn. Quality		…		
Clarity		…		
Significance	…			

Reviewer's ID: JPR- 180

Detailed Reviewer's Report

The paper, "Interplanetary Characteristics and Geoeffectiveness During Recurrent Geomagnetic Activities of Solar Cycles 23 and 24," investigates the relationship between recurrent geomagnetic activity and interplanetary solar wind conditions over the period 1996–2019. The study focuses on 28 recurrent geomagnetic events associated with high-speed solar wind streams originating from long-lived coronal holes. By combining individual event analysis, Superposed Epoch Analysis (SEA), and correlation analysis, the authors aim to identify the solar wind parameters responsible for geomagnetic disturbances and assess their contribution to geoeffectiveness. The study addresses an important aspect of space weather research, particularly the prediction of geomagnetic storms caused by recurrent solar wind structures. The introduction provides a comprehensive overview of the historical development of geomagnetic research and clearly explains the classification of geomagnetic activity into quiet, shock, recurrent, and fluctuating categories. The authors successfully establish the scientific importance of recurrent geomagnetic activity and justify the need for investigating its interplanetary characteristics. The literature review is well supported by classical and contemporary references, allowing readers to understand the evolution of current knowledge. However, the introduction could be strengthened by more explicitly identifying the research gap and emphasizing how this work differs from previous studies.

The methodology is systematic and scientifically appropriate. The authors utilize reliable datasets from the International Service of Geomagnetic Indices (ISGI) and the OMNI database, ensuring the credibility of the analysis. The criteria used to identify recurrent geomagnetic events are clearly described, and the application of Superposed Epoch Analysis provides a robust framework for examining average event behavior while minimizing event-to-event variability. The use of Pearson correlation and cross-correlation analyses further strengthens the statistical interpretation of the relationships between solar wind parameters and geomagnetic response. The methodology is reproducible, although additional information regarding data preprocessing and statistical significance testing would improve transparency. The results are presented logically through representative event analyses and composite profiles. The study demonstrates that recurrent geomagnetic events exhibit characteristic Stream Interaction Region (SIR/CIR) signatures, including increasing solar wind speed, enhanced proton density and dynamic pressure near event onset, recurrent southward IMF Bz intervals, and corresponding decreases in the Dst index. The SEA confirms these consistent patterns across multiple events, while the correlation analysis reveals that solar wind speed is the strongest predictor of geomagnetic activity and that IMF Bz has a direct role in storm development through magnetic reconnection. The inclusion of figures, tables, and statistical analyses enhances the clarity and reliability of the findings.

The discussion effectively interprets the results in the context of existing literature. The authors explain how long-lived coronal holes generate recurrent high-speed solar wind streams and how these structures contribute

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to weak-to-moderate geomagnetic storms. The complementary roles of solar wind speed, IMF Bz orientation, proton density, and dynamic pressure are clearly discussed, providing valuable insight into the physical mechanisms governing recurrent geomagnetic activity. The comparison with previous investigations demonstrates consistency with established scientific understanding and supports the validity of the conclusions. Nevertheless, the discussion could benefit from a more detailed consideration of study limitations, including the relatively small number of events analyzed and the exclusion of longer-duration recurrent events from the SEA. The conclusion successfully summarizes the principal findings and highlights the importance of recurrent high-speed solar wind streams in producing geomagnetic disturbances during Solar Cycles 23 and 24. The study confirms that solar wind speed serves as a valuable precursor for geomagnetic activity, whereas the IMF Bz component directly controls storm initiation, with proton density and dynamic pressure modulating storm intensity. These findings contribute to improving the understanding of Sun–Earth interactions and have practical implications for space weather forecasting.

Overall, the manuscript is scientifically sound, well organized, and contributes meaningfully to the field of solar-terrestrial physics. Its strengths include the use of reliable datasets, appropriate statistical techniques, comprehensive interpretation of results, and clear presentation of findings. Minor revisions are recommended to improve language consistency, correct typographical and grammatical errors, clarify the novelty of the study, provide statistical significance measures, and discuss methodological limitations more explicitly. Subject to these revisions, the manuscript is suitable for publication.