



Multi-point observations in the study of space weather

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Multi-point observation is critical for improving our understanding and forecasting skills of space weather events, notably geomagnetic storms and auroras in the Earth's magnetosphere and ionosphere. Multi-point observation and indices offer extensive datasets that are important for researching and forecasting these geomagnetic activities. They also expand our understanding of Earth's space environment and improve our capacity to control and lessen the impact of space weather on technology infrastructure. Our knowledge of the temporal and spatial evolution of geomagnetic storms and auroras is improved by combining data from satellites, ground-based observatories, and numerical models. Geomagnetic storms are measured via indices like the Dst indices, which quantify changes in the Earth's magnetic field induced by solar wind interactions. These indices give continuous recordings of storm strength and severity, which is critical for estimating the possible impact on technological infrastructure. Multi-point observations monitor solar wind characteristics such as speed, density, and magnetic field direction, giving real-time data to help understand storm dynamics and their impact on geomagnetic activity. Indicators such as the AE index are used to study auroras, which are vibrant displays caused by energetic particle interactions in Earth's atmosphere. In this case study, we looked at multi-point observation and employed multi-point data. Understanding how solar activity is interdependent and how it affects Earth through auroras, substorms, and geomagnetic storms is accomplished by analysis of solar, transient, and geomagnetic characteristics. To get a deeper understanding of past space weather events and their consequences, historical data analysis is conducted. This retrospective analysis can provide insightful information about future forecasts and aid in being ready for upcoming occurrences.

Keywords: Space weather, solar activities, solar transients, geomagnetic activity, storm, auroras, indices.