

Polar cap arcs correlated with solar wind entry at the high latitude magnetosphere

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Abstract

Polar cap arcs are sun-aligned aurora structures occurring during northward turnings of the Interplanetary Magnetic Field (IMF) B_z component. At the same time, a new region of solar wind entry at the high latitude magnetosphere, tailward of the cusp region, was found recently at the periods of northward IMF B_z . We propose a study to see the relationship of these entry events with the transpolar arc formation. Data of Global Ultraviolet Imager (GUVI) onboard TIMED mission is examined to see the transpolar aurora arcs during the given time periods of the solar wind entry. Initial results show that in approximately 20% of cases transpolar arcs occur related to the solar wind entry processes.

1. Introduction

Polar cap arcs observed decades ago (see [1] and references therein) and recently discovered solar wind entry at the high latitude magnetosphere, at the lobes tailward of cusp region, [2] both occur during time periods when IMF B_z is directed northward.

Transpolar arcs are sun-aligned structures, which can be elongated from midnight to midday sectors connected to the aurora oval from the both sides [3], such arcs are named as theta auroras. Theta auroras are not symmetric in both hemispheres as it was thought before the discovery of non-conjugate theta auroras by [4]. There are several models of transpolar arc formation, such as plasma sheet thickening, auroral oval expansion and others [1]. To prove one or another model further analysis of the transpolar arc data is necessary.

In this work, we analyze polar cap arcs occurring in correlation with solar wind entry events found by Shi et al. in 2013 [2]. We present a case study when a theta aurora is observed by several imagers onboard spacecraft, when Cluster detects an entry event at the high latitude magnetosphere during northward IMF B_z .

2. Observations

Cluster FGM, CIS [5, 6] data is used to identify the solar wind entry events [2]. The criteria for the entry event selection are described by Shi et al., (2013) in details.

GUVI onboard TIMED [7] mission due to its high resolution data allows to easily distinguishing polar cap arcs on the aurora maps. After the identification of the transpolar arcs, we will analyze the same aurora by other aurora imagers such as

onboard IMAGE [8] satellite to see the dynamics of the aurora arc formation and possible symmetries and asymmetries between southern and northern hemispheres.

In Figure 1, an example of the solar wind entry event is shown. Plasma data, as well as, magnetic field data measured by Cluster are presented along with IMF data taken from coordinated data analysis web (cdaweb.gsfc.nasa.gov). The entry event lasted from 08:48 to 09:36 UT on August 1, 2002 at the north hemisphere. At the same time, GUVI onboard TIMED mission has detected a theta aurora at 08:58 UT in the southern hemisphere. The aurora map for that day is presented in Figure 2. GUVI doesn't allow to study the time evolution and to see the transpolar arc on the opposite hemisphere, however, IMAGE data can be useful for that purpose. This is just an example of an aurora activity correlated with the solar wind entry event at the high latitude magnetosphere, there are also many more cases, which require further study.

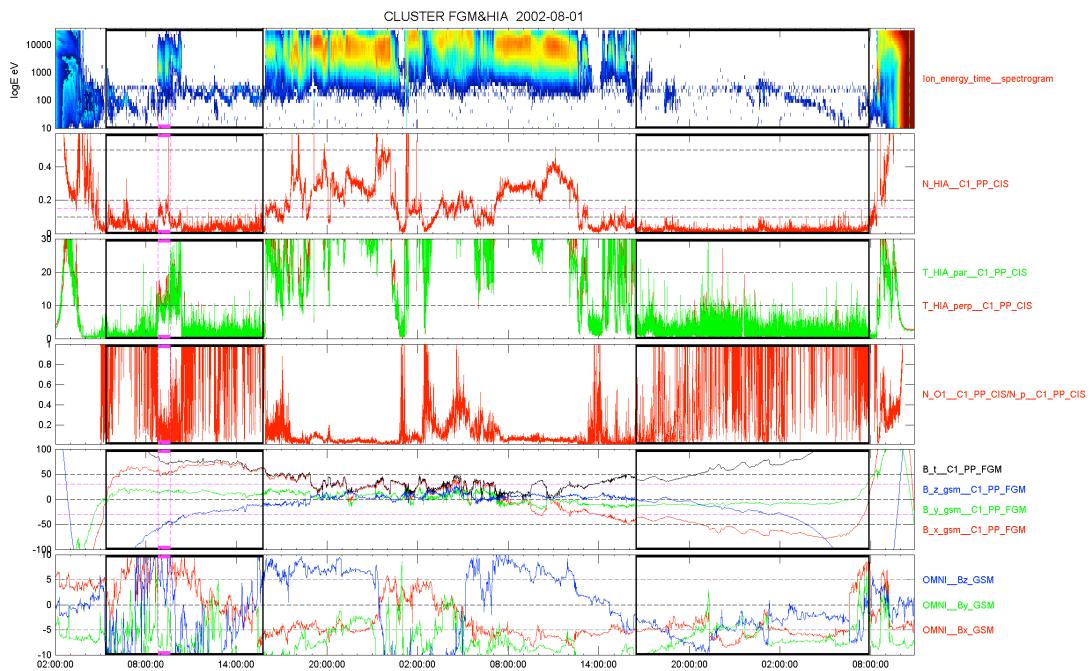


Figure 1. Isotropic plasma entry observed by Cluster on August 1, 2002.

August 1, 2002 DOY:213 Orbit: 03504

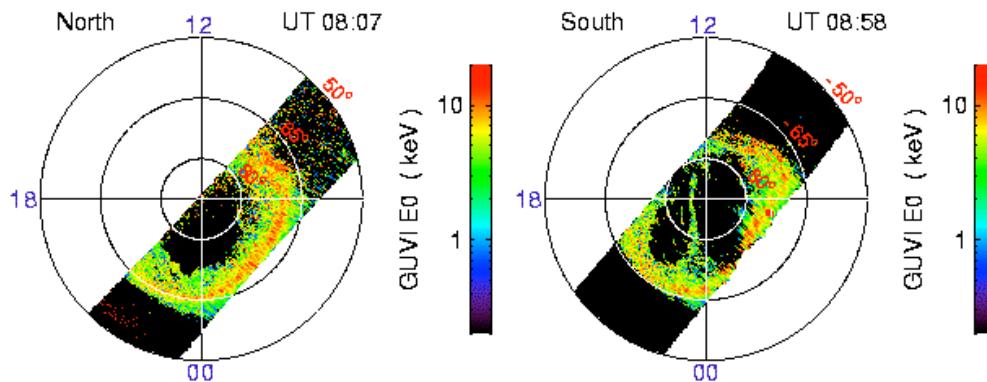


Figure 2. Theta aurora observed by GUVI/TIMED correlated with the entry event.

3. Conclusion

We have done an analysis of transpolar aurora arcs correlated with solar wind entry processes in the new region at high latitude magnetosphere. GUVI onboard TIMED observational data showed that many of entry events also generate transpolar auroras. About 20 events from 100 were found to have a relation with polar cap arc formation. The details of the work will be presented during the meeting.

4. Acknowledgments

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