

Dayside magnetospheric interactions inferred from dayside diffuse aurora and throat aurora

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Abstract

Optical aurora can be classified into two broad categories, i.e., diffuse and discrete auroras. Recent studies based on optical observations obtained on the dayside reveal some important processes occurred in the dayside magnetosphere and are reviewed in this paper. Dayside diffuse auroras (DDAs) are classified into unstructured and structured DDAs. Unstructured DDAs predominantly occur in the morning but structured ones are mainly observed near magnetic local noon (MLN). Because structured diffuse auroras have been suggested to be associated with cold plasma structures in the magnetosphere, distribution and generation of cold plasma structures in the dayside outer magnetosphere are discussed based on the detailed observational properties of DDAs. A particular discrete auroral form, i.e., throat aurora, is defined during study on DDA. Detailed observational properties of throat aurora are presented, which suggest that throat auroras are ground signatures for localized magnetopause indentations that are most likely caused by localized high-speed jets impacting on the magnetopause. Studies on throat aurora reveal that the transient structures locally generated in the magnetosheath can frequently cause indentations on the subsolar magnetopause, trigger reconnection, result in a serial of responses in geospace, and thus will play important role on solar wind-magnetosphere coupling.

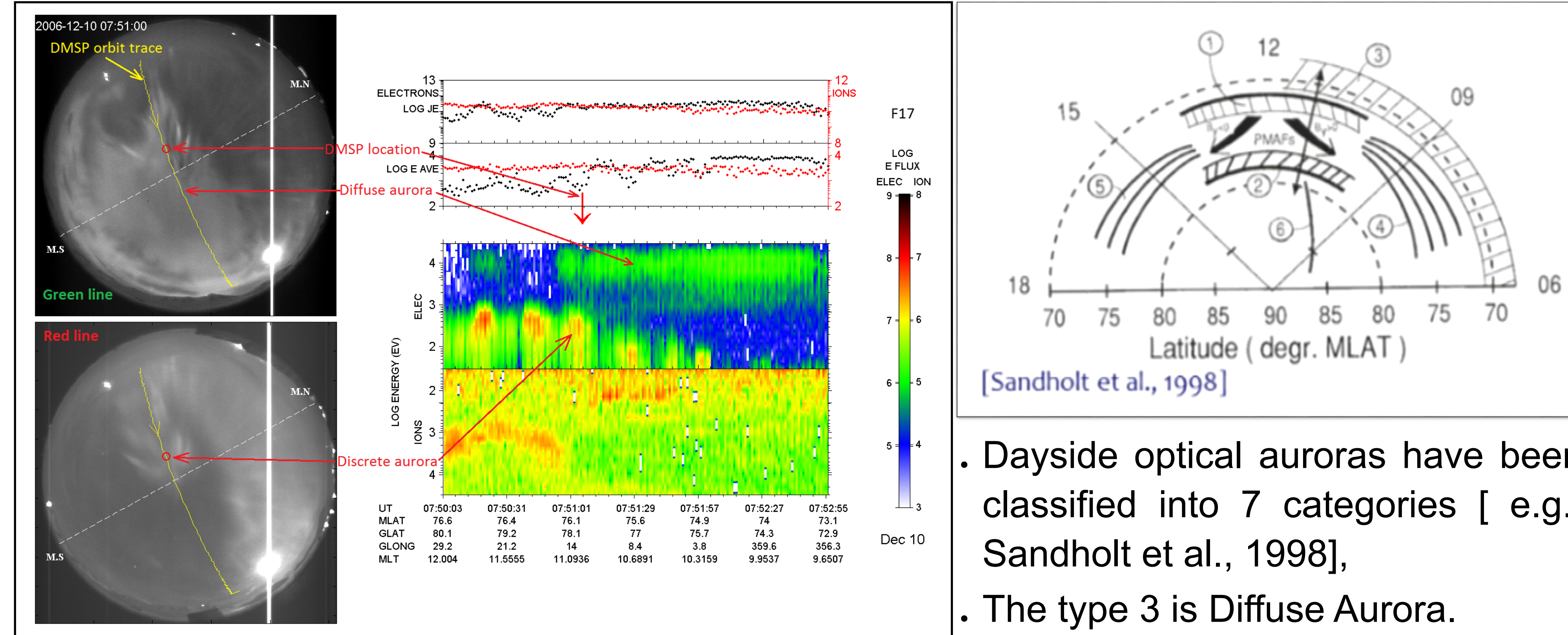
Dayside magnetospheric interactions inferred from dayside diffuse aurora and throat aurora

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Introduction

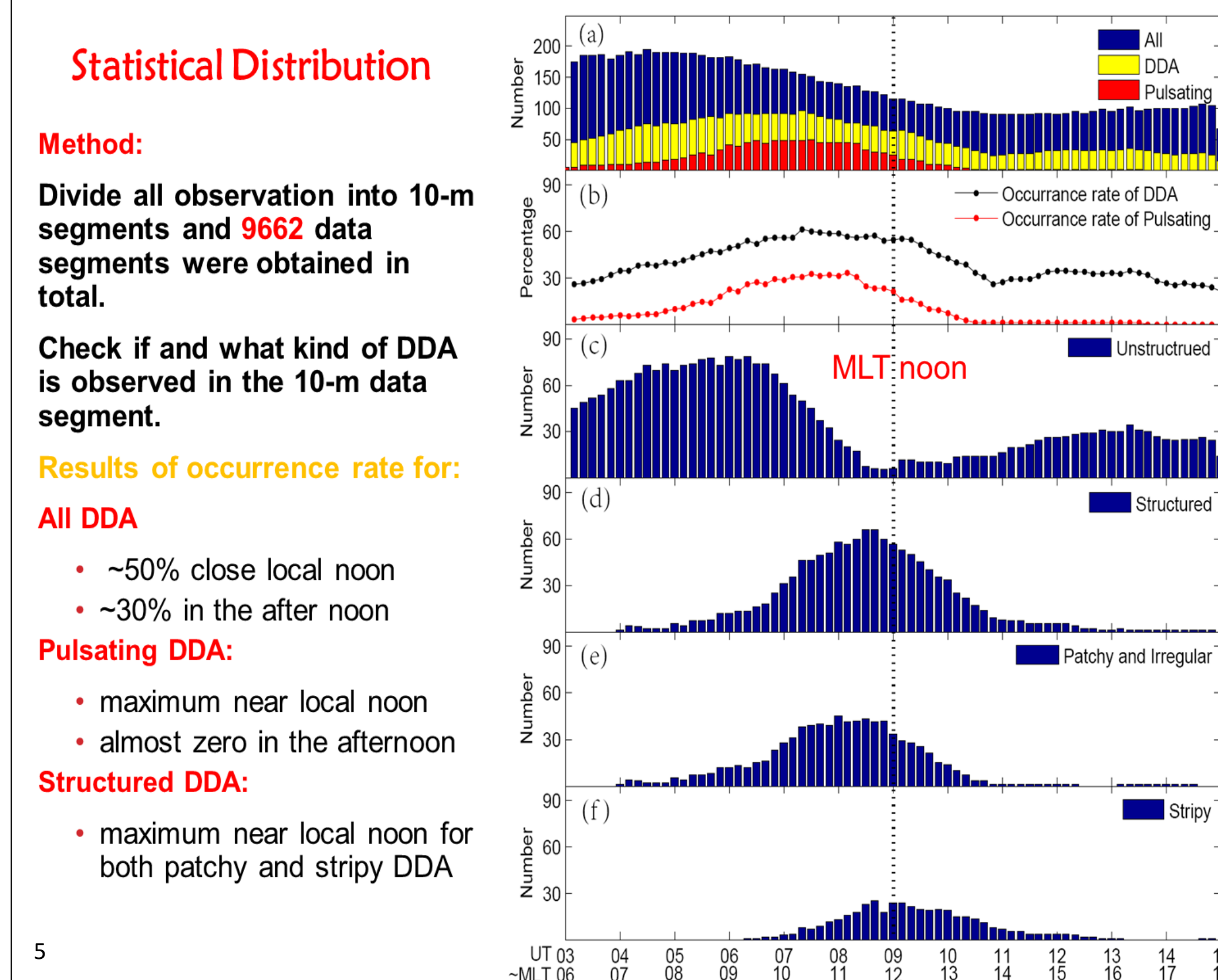
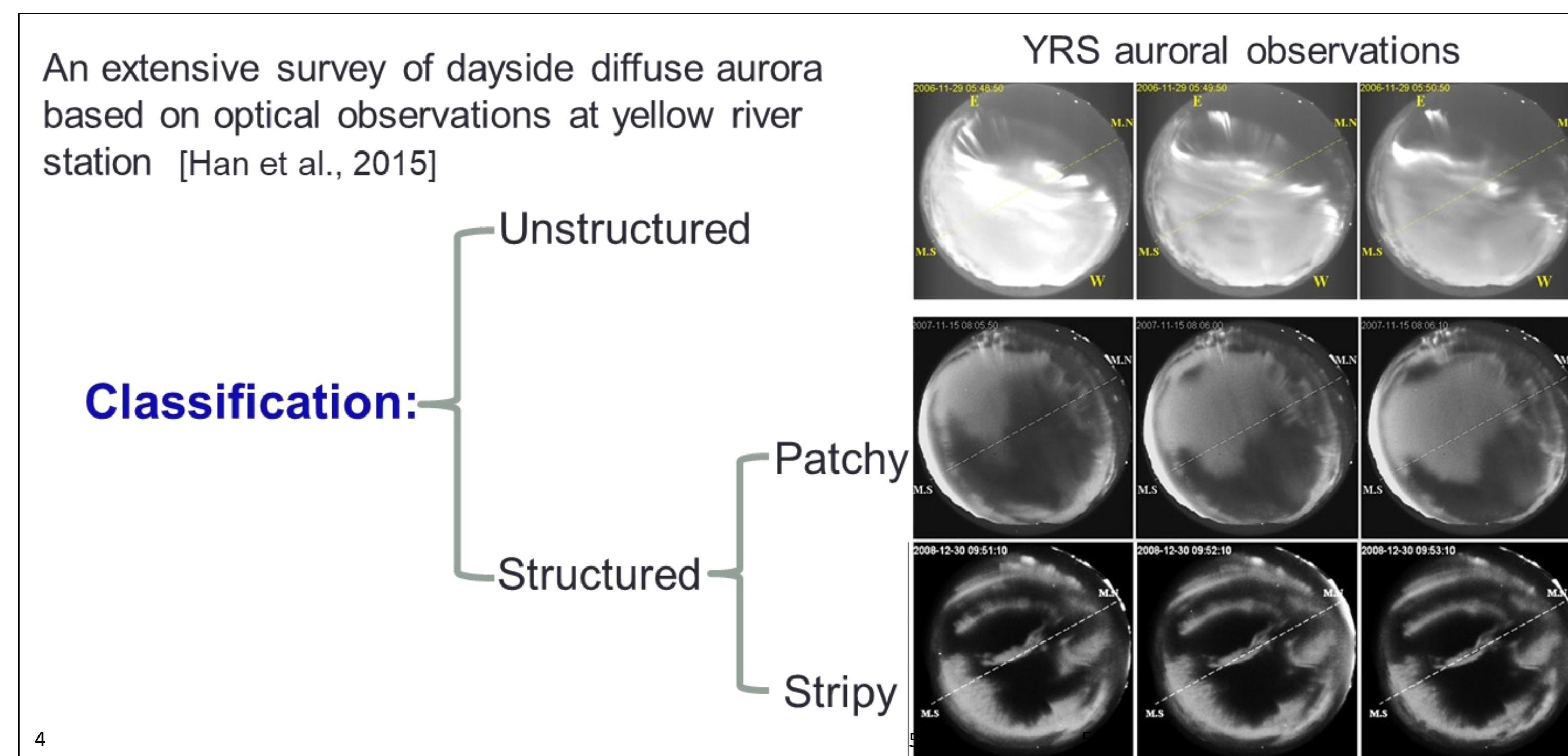
- Optical aurora can be classified into **discrete** and **diffuse** auroras.
- Diffuse aurora mainly occur on the nightside. Occurrence of diffuse aurora on the dayside has been early noticed, but detailed studies on **Dayside Diffuse Aurora (DDA)** are rare.
- We carried out a systematic study on DDA and classified them into **unstructured** and **structured** DDAs, which reflect important physical processes in the dayside outer magnetosphere.
- During study on DDA, we defined a new auroral form, called **Throat aurora**.
- We found that throat auroras correspond to localized magnetopause indentations and have high occurrence rate, so they are important for understanding solar wind-magnetosphere coupling.
- Studies on throat aurora suggest that magnetosheath high-speed jets may frequently impact on the magnetopause and cause the magnetopause indentations by triggering reconnections.

Background for dayside diffuse aurora (DDA)



Data: All-sky camera observations at Yellow River Station from 2003

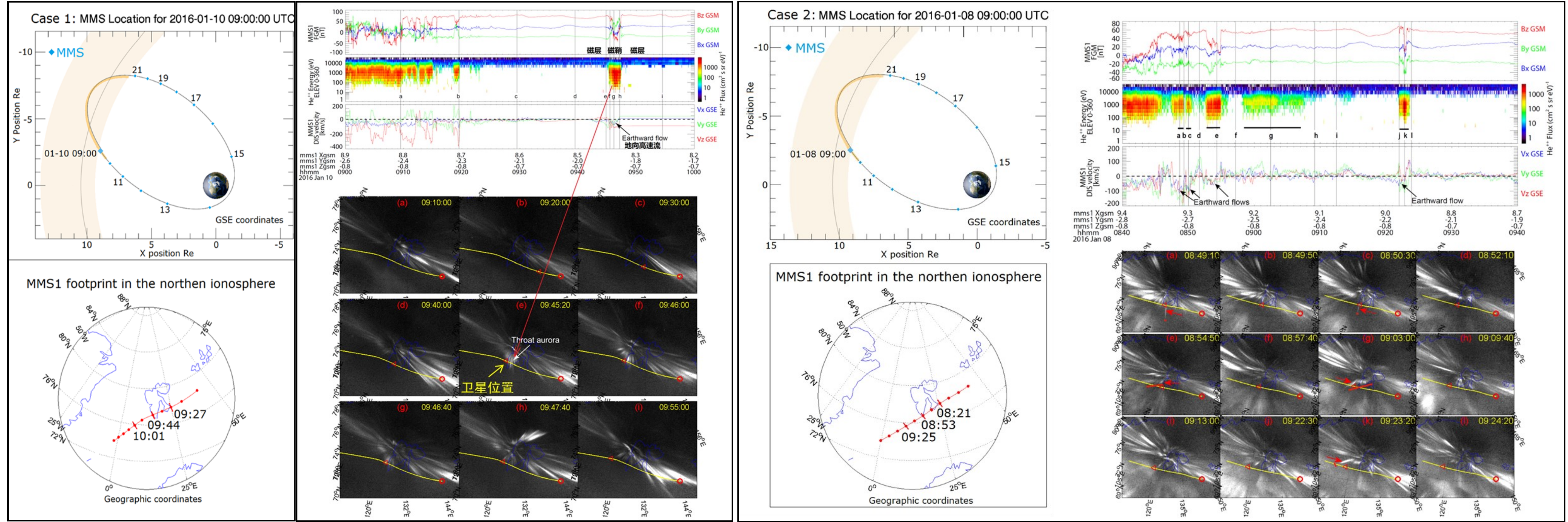
Classification



Summary:

- Classification:** Dayside diffuse aurora can be classified into: unstructured and structured.
- Distribution:** Unstructured DDAs predominantly occur in the morning and afternoon. Structured DDAs predominantly occur near local noon.
- Implications:** DDA structures reflect cold plasma structures in the dayside outer magnetosphere.

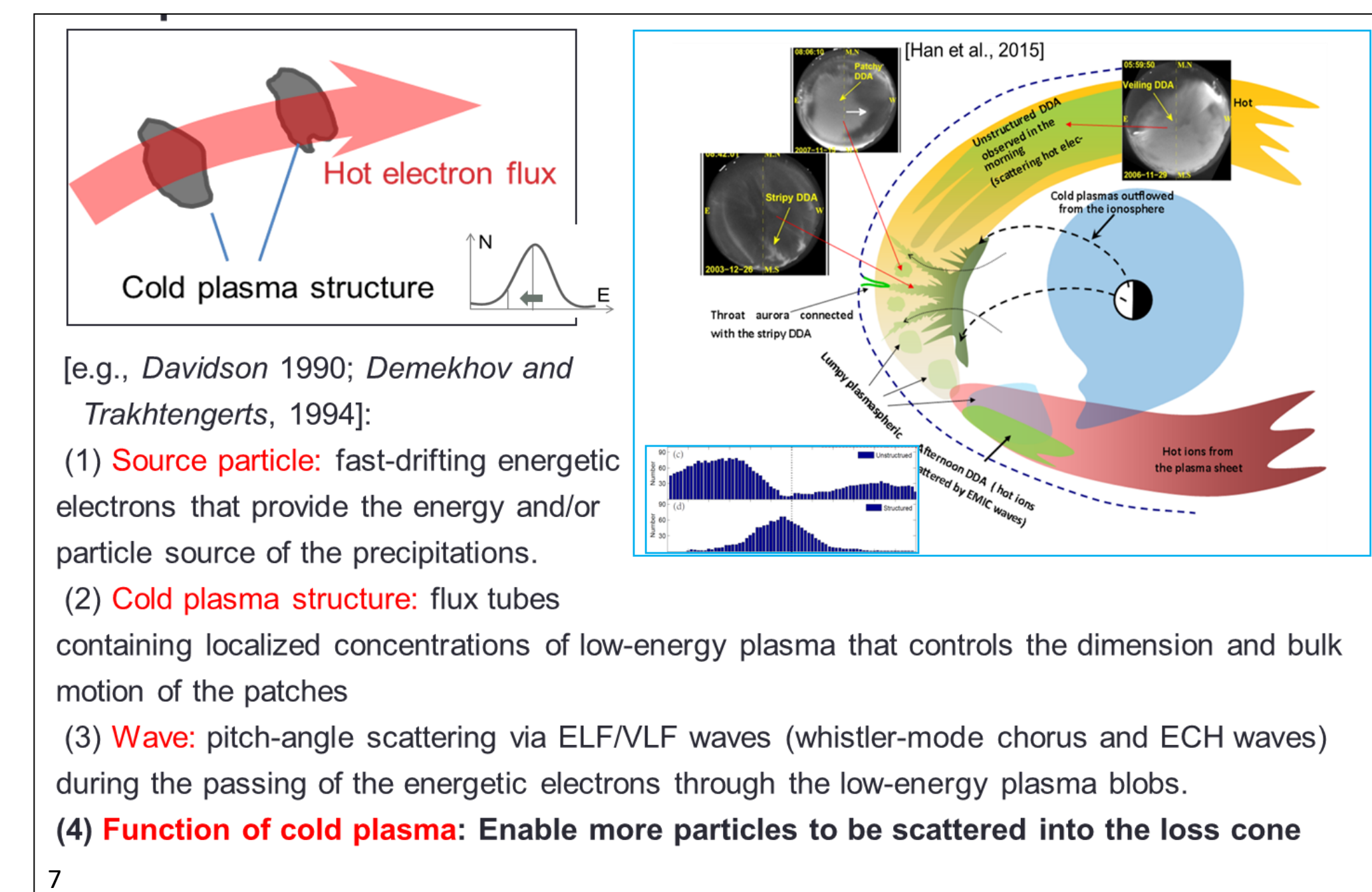
Direct evidence for throat aurora corresponding to magnetopause indentations [Han et al., 2018]



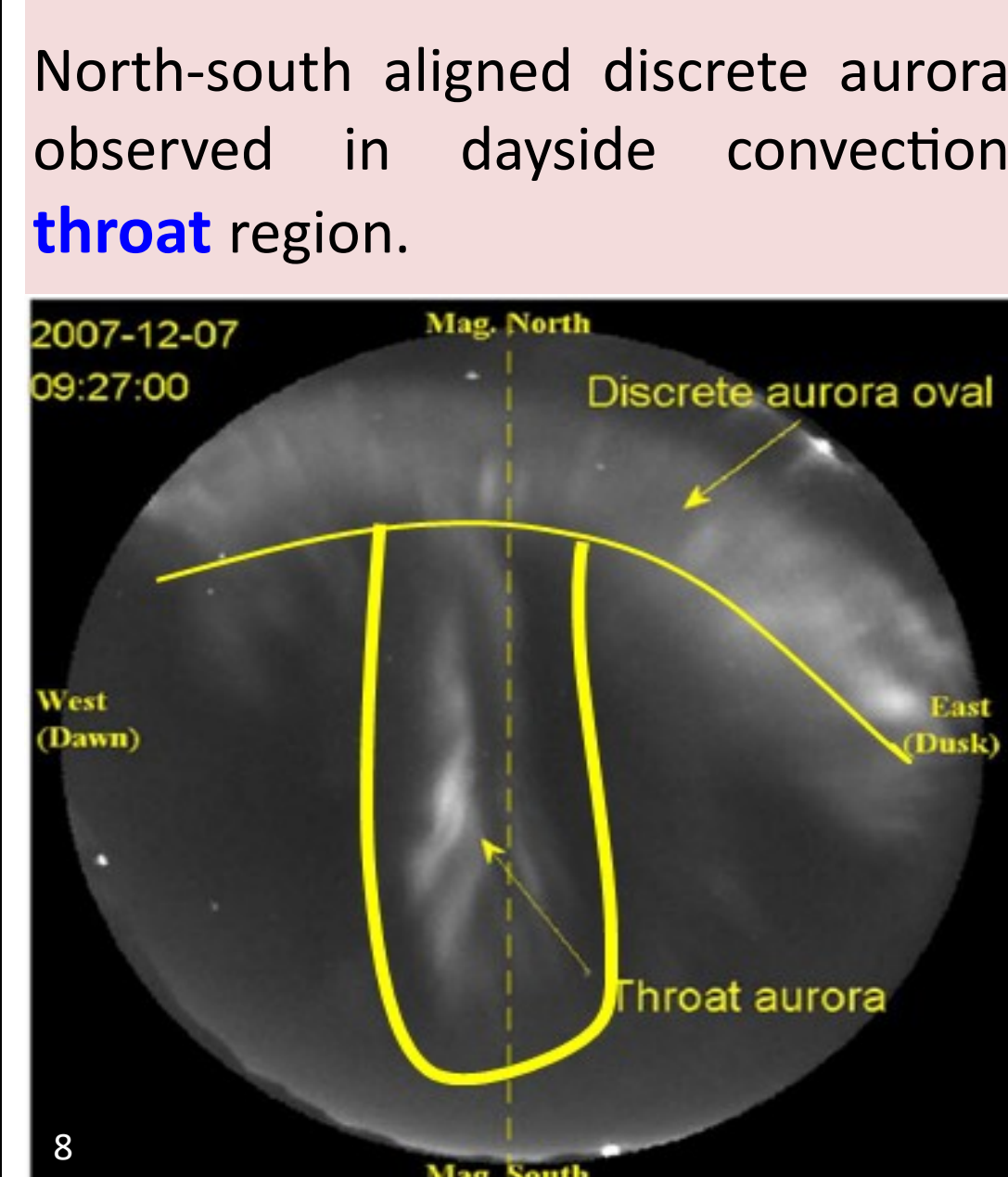
Summary:

- Throat auroras **correspond to magnetopause indentations**.
- Throat aurora has **high occurrence rate and can be in large scale**.
- Observational results of throat aurora imply that: Some transients, such as high-speed jets, locally generated in the magnetosheath (but not from the solar wind), may frequently impact on the subsolar magnetopause, cause magnetopause indentations, trigger reconnections, and lead to a series of effects in Geospace.
- How the throat auroras are generated is not clear yet.**

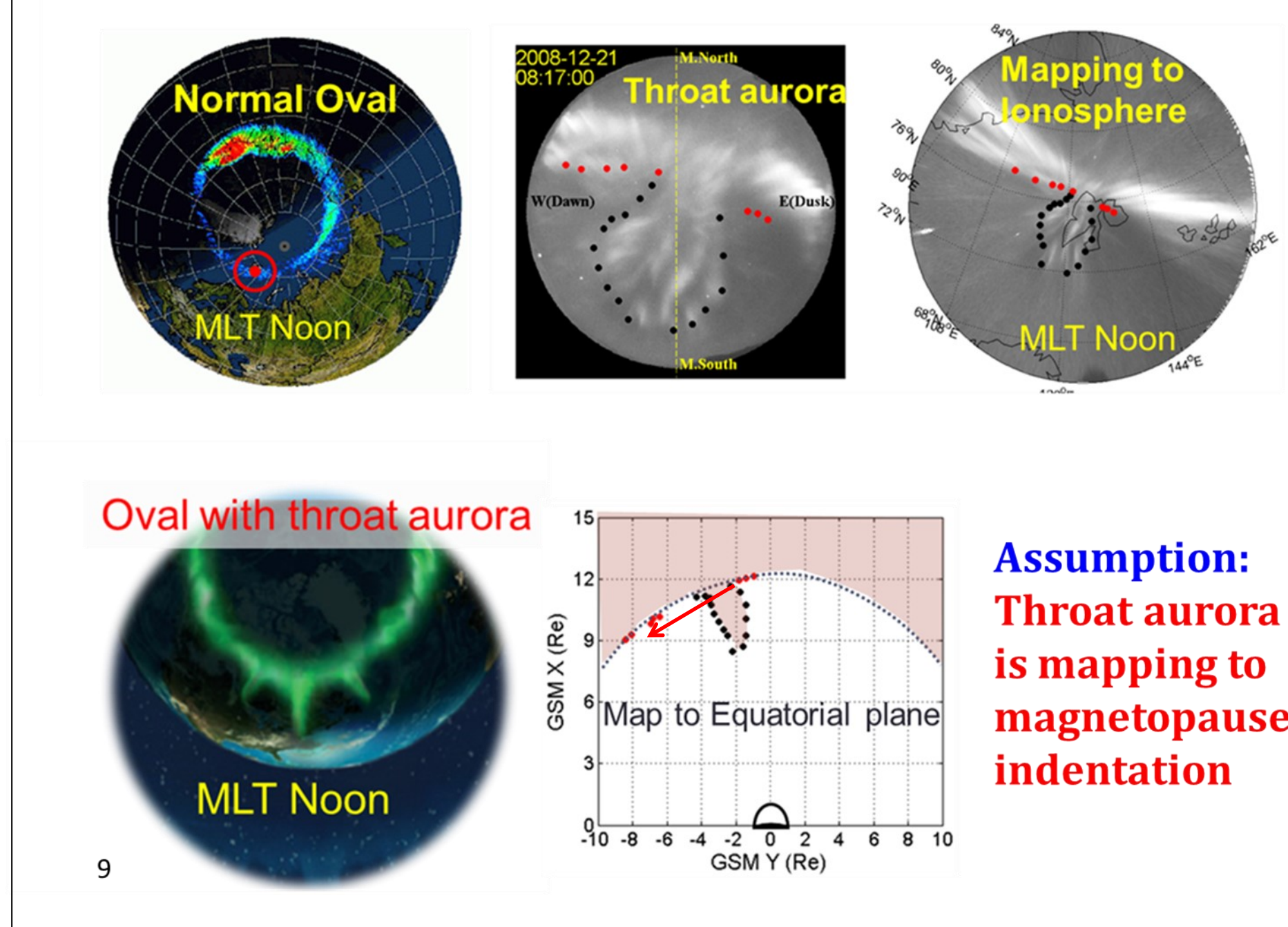
Explanations



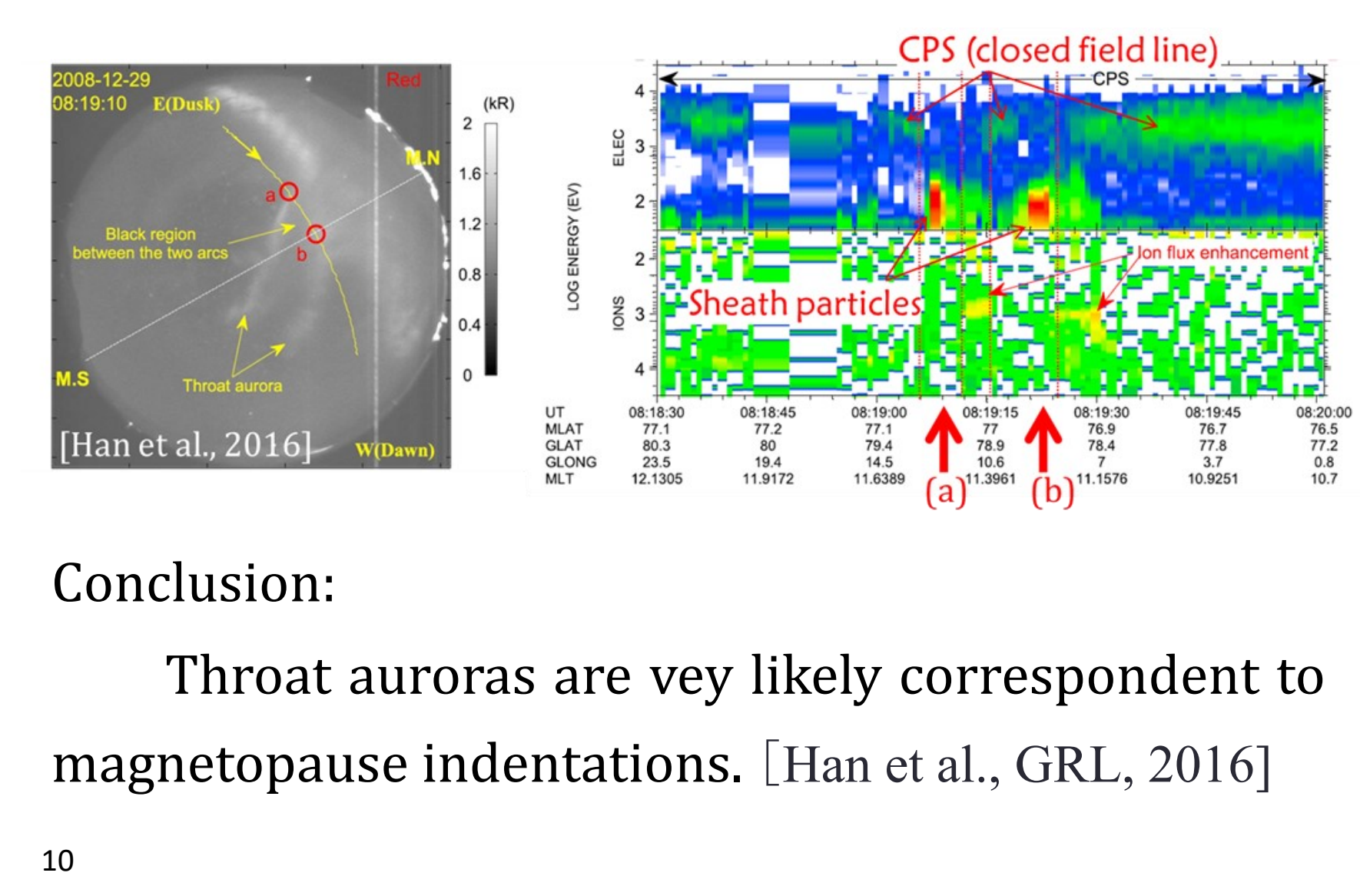
A New Finding Throat aurora



What's new about throat aurora?



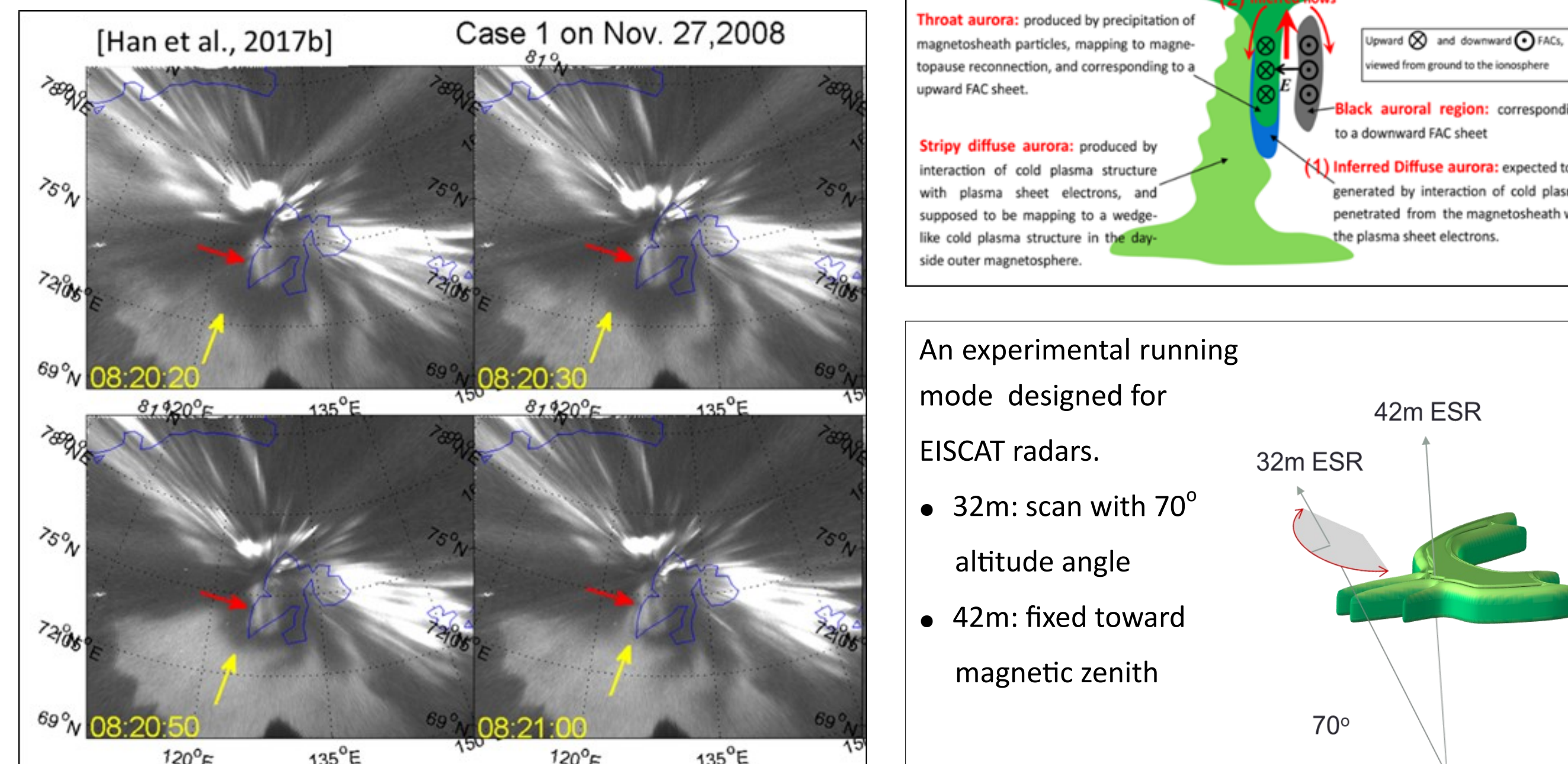
Indirect Evidence for throat aurora corresponding to magnetopause indentation



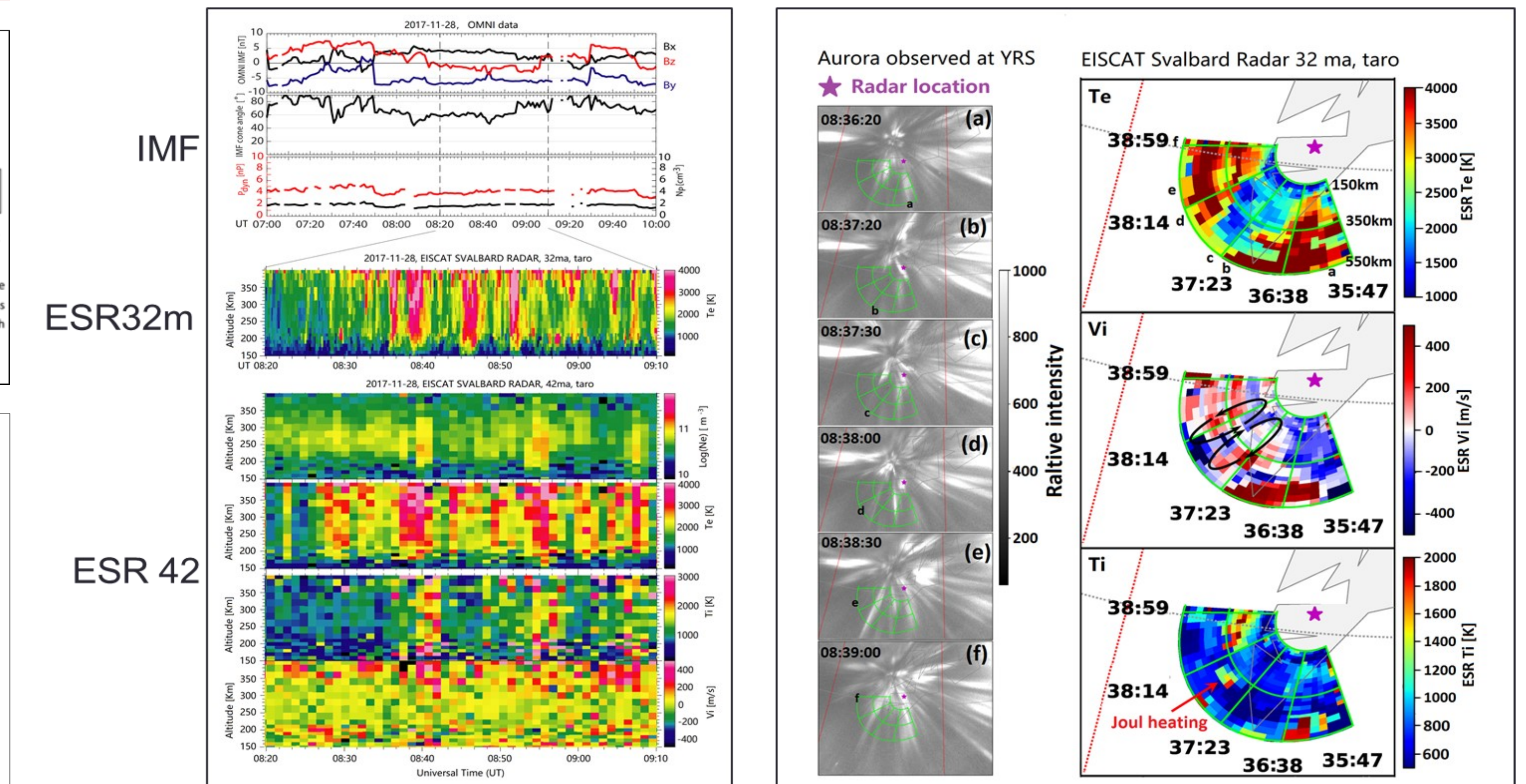
Conclusion: Throat auroras are very likely correspondent to magnetopause indentations. [Han et al., GRL, 2016]

Some other works about throat aurora

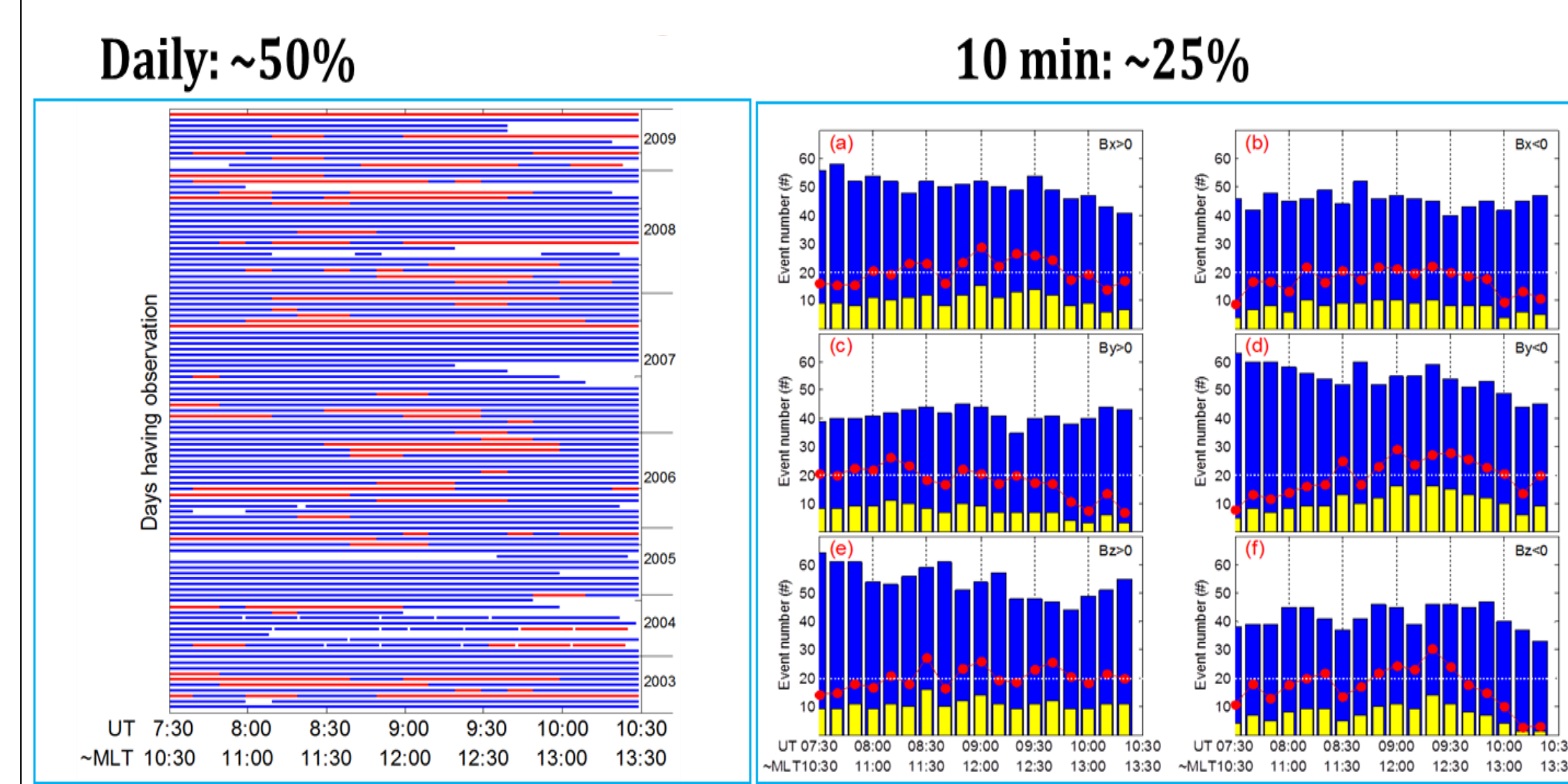
- A new type of diffuse aurora that is associated with throat aurora



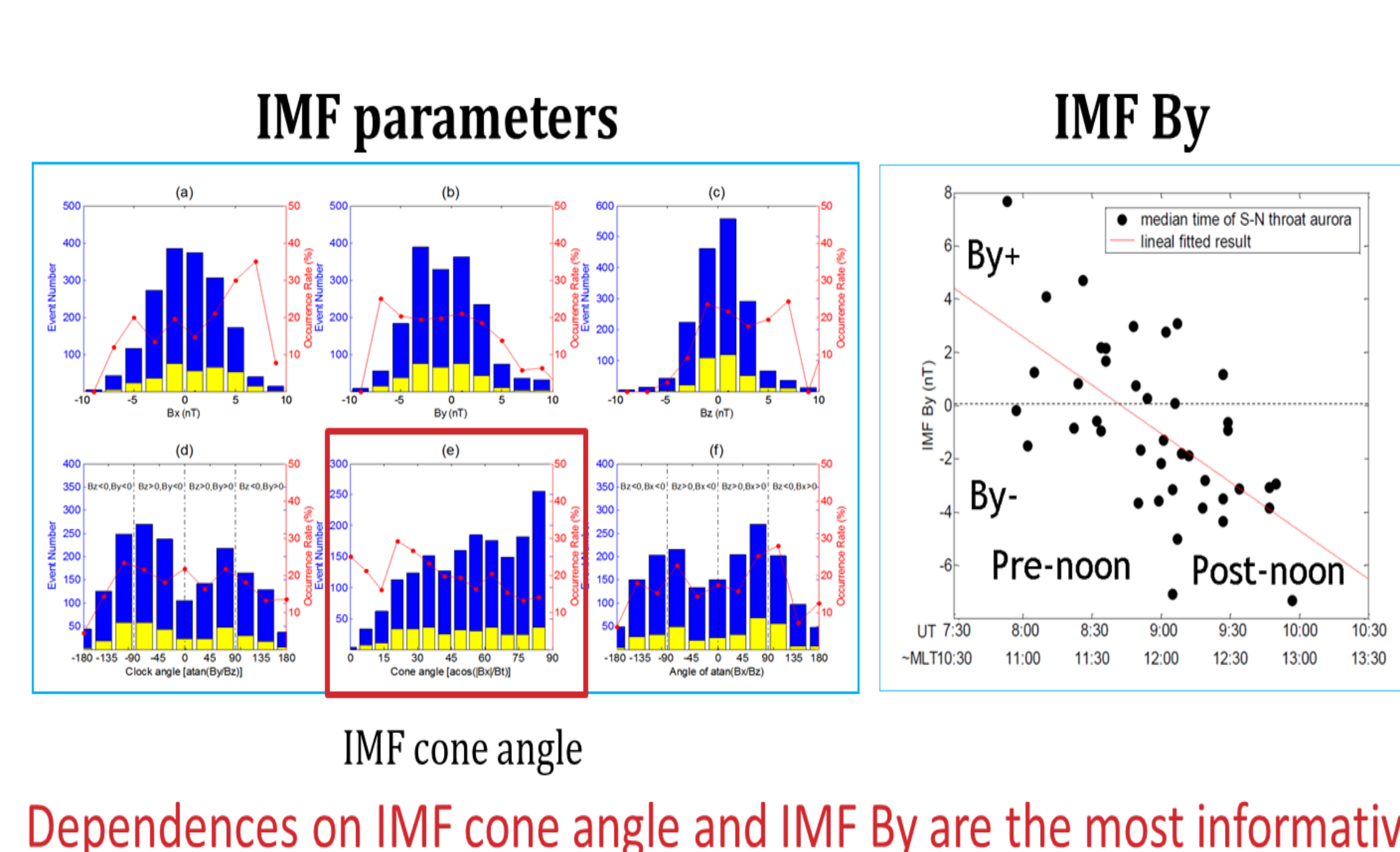
- Ionospheric flow cells, Joule heating, and ion upflow associated with throat aurora that confirmed by experimental EISCAT observations.



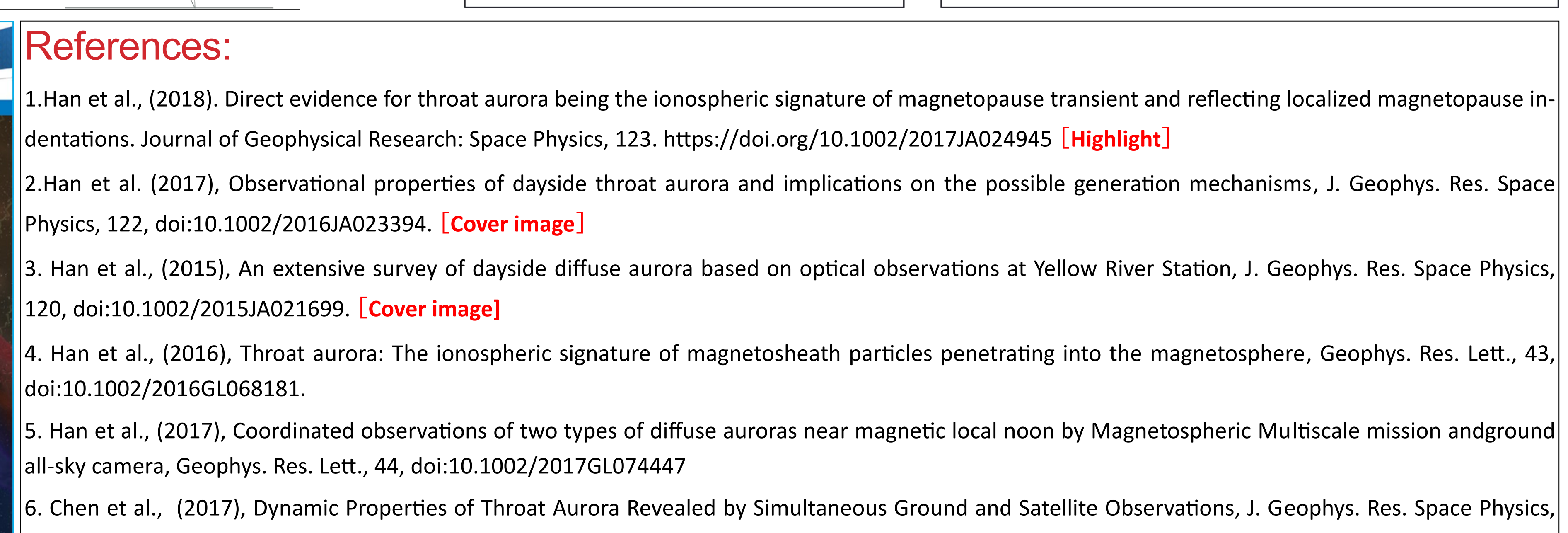
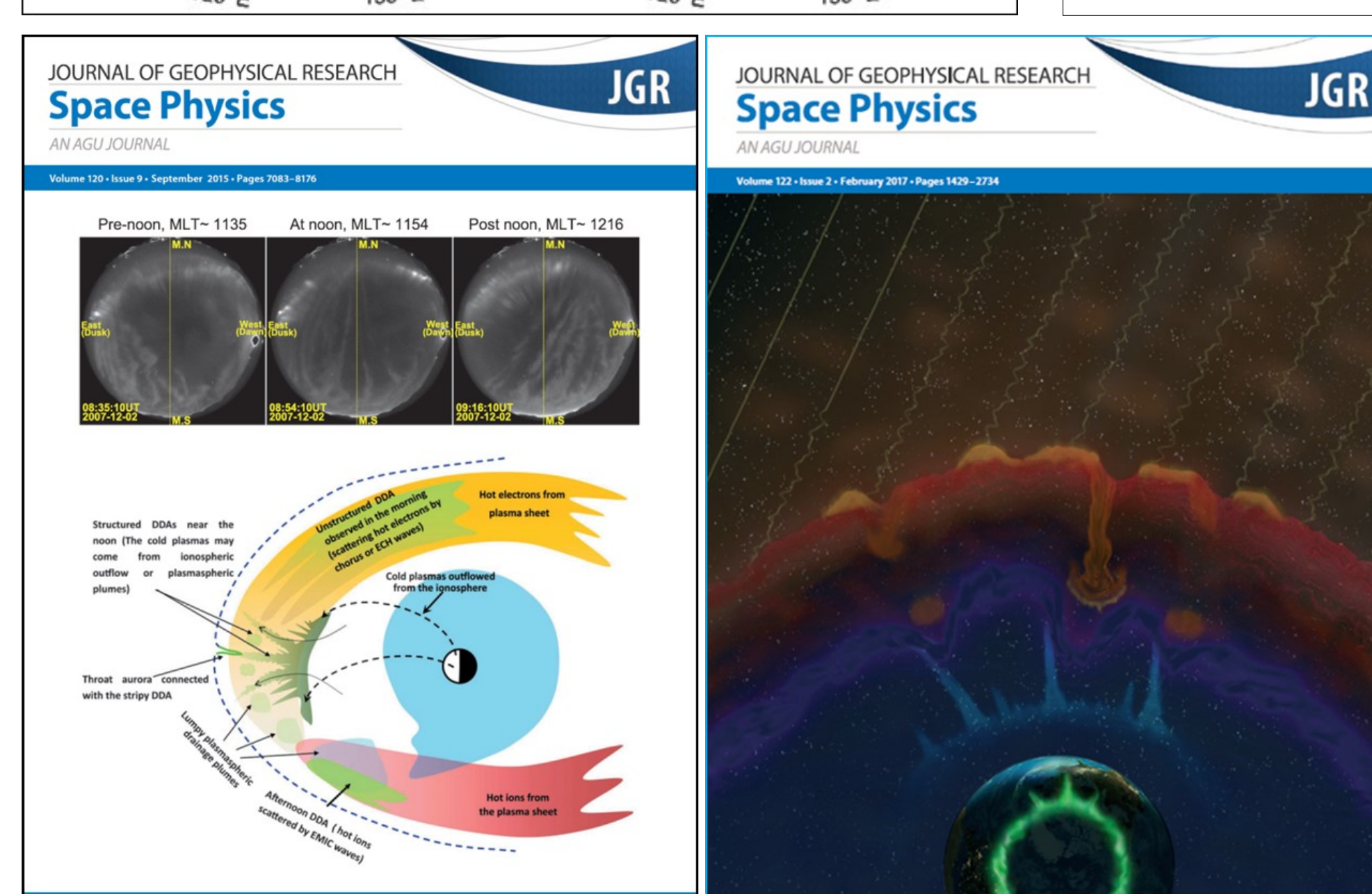
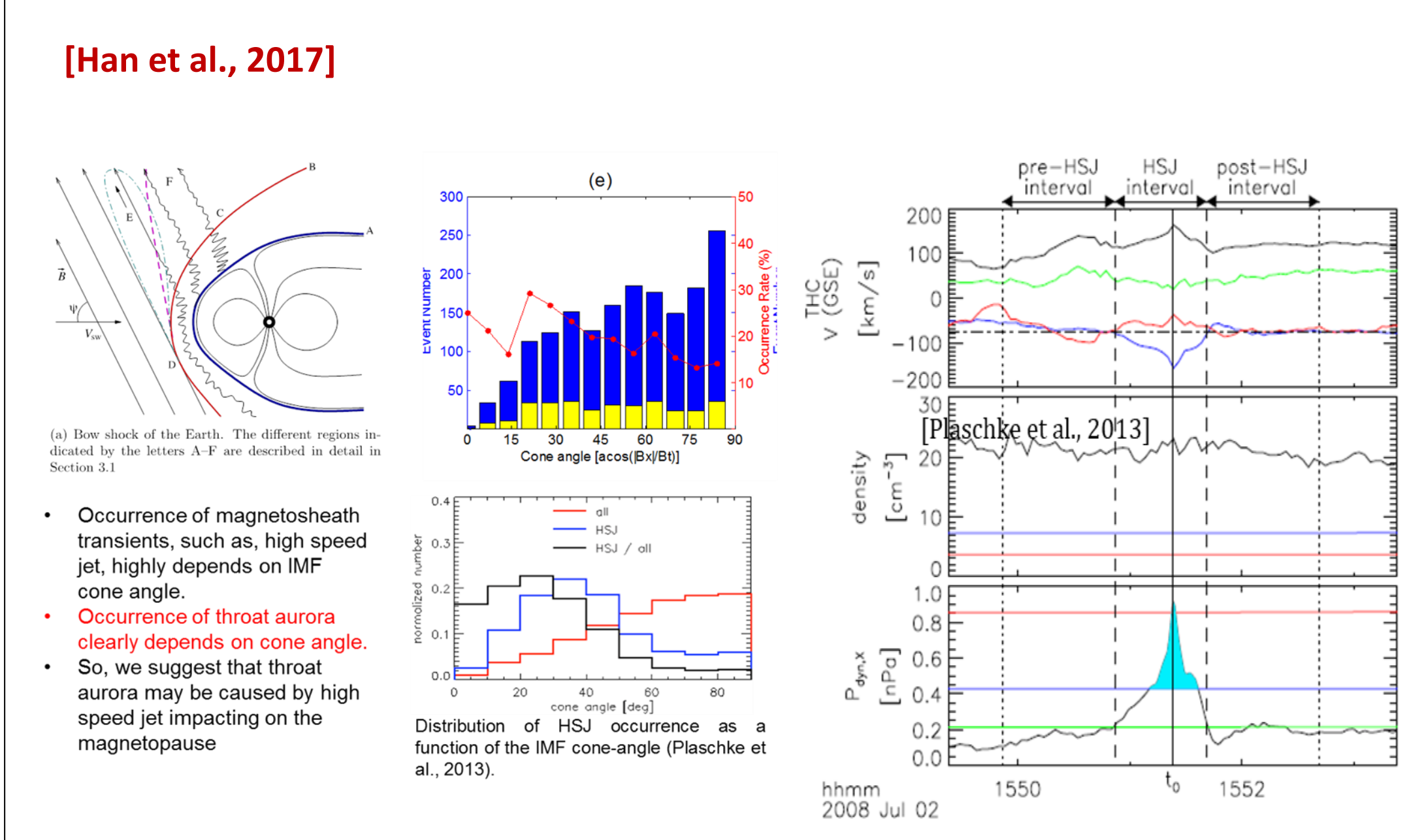
Do they often occur?



How do they depend on the IMF?



Generation of throat aurora should be related with high-speed jets impacting on the magnetopause



The occurrence rate is rather high.

Dependences on IMF cone angle and IMF By are the most informative.