EUV Summary Plots

EUV summary plots are in three formats, TIFF, JPEG, and EPS.

Files are named by event:

yyyy_mm_dd.xxx

(1) DATE OF EVENT

yyyy = 4-digit year
mm = 2 digit month
dd = 2 digit day

the yyyy, mm, and dd are representative of a single event.

For example, the Bastille Day storm is "2000_07_16"

(2) TYPE OF FILE

The "xxx" extension is the 3-digit string indicating file type.

"tif"	for TIFF file
"JPG"	for JPEG file
"eps"	for EPS (encapsulated post-script)

PLOT DESCRIPTION

Bottom Plot shows all the plasmapause L and phi values for the entire event. Each dot is one manually-extracted point. The plot is of the equatorial plane, with the Sun to the right. Dotted circles are drawn at L=2,4,6, etc. The solid circle is at geosynchronous orbit.

Top Plot gives minimum and average plasmapause values, versus decimal day of year.

- **Blue/black dots**: Each dot is the minimum plasmapause L value *PER IMAGE.*
- **Blue Line**: The blue line is the minimum L value *PER EVENT.* This value is indicated in text at the top of the plot.
- **Green dots**: Each green dot is the average (mean) plasmapause L value *PER IMAGE.*
- **Green Line**: The green line is the average L value *PER EVENT.* This value is indicated in text at the top of the plot.

TEXT DATA FILES

Associated with each summary plot is an ASCII text data file (in "ASCII" subdirectory). The header text in the ASCII file should hopefully be self-explanatory.

Plasmapause Data

The following is a very brief description of the individual plasmapause L,phi data points.

They contain multiple points that represent the plasmapause as manually extracted from global snapshots of the plasmasphere obtained by IMAGE EUV.

Not Always Just "Plasmapause" Data.
It's worth noting that these points are not always purely "plasmapause" data. In most cases, the points do indicate a best guess for the outer edge of the plasmasphere. But there are two exceptions.

(1) No Steep Outer Gradient. If there is no clear outer boundary (e.g., the plasmasphere density has a gradual roll-off rather than a single steep well-defined density gradient), an attempt was made to represent the plasmasphere shape by clicking. ***It is often the case that the plasmapause is not represented by a steep, well-defined density gradient.*** In cases where there was no sharp density gradient, the click points do not define a single curve, but rather make up a scattered "band" (intended to represent the thickness of the poorly-defined outer edge), or in some cases, the click points indicate some degree of structure to the outer boundary.

(2) Multiple Edges or Interior Structure. In cases where there are multiple sharp edges, or some kind of interior structure, the click points do not define a single curve.

Noise, Sunlight Contamination, Instrumental Effects.
I did my best to avoid misinterpreting the images, but in some cases, very high background noise (believed to be caused by direct penetration into the instrument by energetic particles), sunlight contamination, etc., may have contributed to some extra uncertainty in the plasmapause location found in the .ppa file. It is probably a good idea for you to take a look at the corresponding EUV mapped movie before using the extracted plasmapause for a given event.

Notes on Manually-Extracted Plasmapause Location: "Click Points"

<u>SUBJECTIVE ERROR</u>

Something to keep in mind is that the (L,phi) points have been manually extracted. There is inescapably some subjectivity to the extraction, although comparison with in situ data has shown that the manually extracted plasmapause is reasonably accurate (within a few tenths of an RE) under most circumstances.

Many extractions show not a single well-defined plasmapause, but rather a "band" of scattered or staggered points. In these cases, the error can be crudely estimated as the radial thickness of the band, or as the scatter in plasmapause location within some given range of MLT, say 0.5 hours to 1 hour of MLT. If a well-defined plasmapause does exist, it probably has 0.3-0.7 RE uncertainty, due to the high background noise in this 2003 Halloween event.

Why are we still using manual extractions?

A common question raised is, "Why hasn't anyone devised a routine for automated plasmapause extraction? Wouldn't an automated routine be better? One argument is that the automated extraction might be described as "not subjective" (since a computer isn't usually thought of as subjective). Another is that the automated routine would be quicker, not so labor intensive. The answer to this question is that the human eye does as well, or better, at recognizing the plasmapause location, when compared to any automated routine developed at the present time. It's a challenging problem to design an automated routine that can ignore shadows, noise, sunlight contamination, etc. So for now, the best we have is manual extraction, and we do our very best to minimize the subjectivity.

IMPORTANT NOTE ON USING PLASMAPAUSE DATA

In cases where a well-defined plasmapause edge existed, single plasmapause location points can be trusted. However, in cases where the click points were intended to represent a gradual density gradient, or interior features, care must be exercised in interpreting single points. In fact, the best way to use the EUV extracted "plasmapause" data is to plot the data and do a global "by eye" assessment of the overal plasmapause shape and size.

If you have any **questions** about how to use EUV plasmapause data, *please contact* ***Jerry Goldstein (jgoldstein@swri.edu).***

References

Goldstein, J., R. A. Wolf, B. R. Sandel, and P. H. Reiff, Electric fields deduced from plasmapause motion in

IMAGE EUV images, *Geophys. Res. Lett., 31*(1), L01801, doi:10.1029/2003GL018797,386, 2004.

Roelof, E. C., and A. J. Skinner, Extraction of ion distributions from magnetospheric ENA and EUV images, *Space Sci. Rev., 91*, 437, 2000.