

Comparison of Photospheric Foot points of Open Magnetic Field Regions using CSSS and PFSS models

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Abstract: The Current–Sheet Source Surface (CSSS) model developed by Zhao and Hoeksema (1995) assumes a cusp surface at the cusp point of coronal streamers at around 2.5 R_{sun}, which divides the corona into three regions, one bounded by the photosphere and the cusp surface, the second, between the cusp surface and the source surface, and the third, the region beyond the source surface. In this model the source surface can be placed closer to the Alfvén critical point which is a great advantage over the traditional Potential Field Source Surface (PFSS) models, where it is at 2.5 R_{sun}. The source surface magnetic field obtained by CSSS model exhibits little latitudinal variation, which is consistent with the Ulysses observation of the interplanetary magnetic field (IMF). On the other hand, the source surface field computed using the PFSS model shows a latitudinal structure. We have carried out a comparative study of the photospheric foot points of open magnetic fields obtained using the two models. The magnetic neutral line was found to be coinciding in the two cases, as expected. There are significant differences in the locations and sizes of the open field regions on the photosphere, and they are not always consistent with the observations of coronal holes. We present the results of the comparison.

Potential Field Source Surface Model

Schatten, Wilcox and Ness 1969 and Altschuler and Newkirk 1969, independently developed the PFSS model of the Solar Corona based on the following assumptions:

- little current flows between photosphere and source,
- surface coronal magnetic field can be derived from a potential obeying Laplace's equation,
- at the source surface all field lines are radial.

Here we present the preliminary results of a study of comparison of the computed photospheric foot points of open field regions using these two models. Figure 2 shows the He 1080 nm coronal holes. Figures 3 and 4 show the CSSS and SS models, respectively.

Preliminary Results

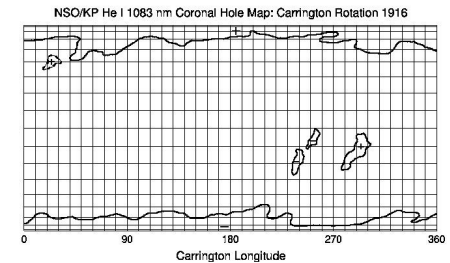


Figure 2

Current Sheet Source Surface Model

Improvements over SS model

- cusp surface: field lines are open but not necessarily radial; includes effects of streamer current sheets.
- source surface: placed near the Alfvén critical point.
- uses source surface technique to include effects of volume current beyond source surface.

Figure 1 shows the geometry of the model

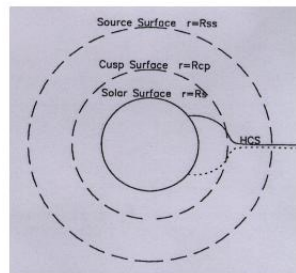


Figure 1

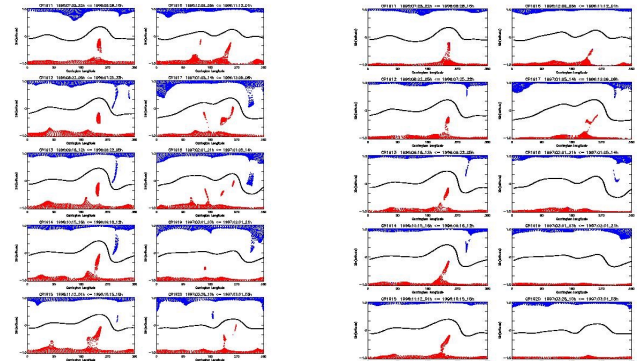


Figure 3

Figure 4