Is Solar Cycle 23 Minimum Different?
Kalamazoo College & University of Colorado

Phillip Dietrich, Tom Woods and Marty Snow
Laboratory for Atmospheric and Space Physics, University of Colorado – Boulder
1234 Innovation Drive, Boulder CO 80303  k06pd01@kzoo.edu

Abstract

To explain the weaker polar magnetic field (PMF) of solar cycle (SC) 23 by modeling the interaction and surface transport of active region sunspots (SS) to the poles. This model is then used in comparison with solar cycle 22 to determine if solar cycle 23 is behaving differently, and if so, why.

We use polar magnetic field data from WSO, sunspot data from Mount Wilson and USAF SOON sites, and solar coronal hole area data from “An Analysis of Polar coronal hole evolution” by Marvilla, Lara, Galicia, and Mendoza, 2001.

The final model accurately correlates the sunspot contribution to the polar magnetic field data by parameter fitting the surface transport equations. The parameters have different values for each solar cycle, implying why solar cycle 23 is behaving differently.

From these parameter values, we conclude that solar cycle 23 had (by about a factor of 10) less sunspot interaction with the poles before reaching solar maximum than solar cycle 22 did. We also conclude that solar cycle 23 had faster meridional flow than solar cycle 22. These factors account for the weaker polar magnetic field of solar cycle 23.

Analysis/Conclusion

• f1 and f2 are similar at each hemisphere for the same SC
• f1 is ~10 times greater for SC22 than for SC23. This implies that SC22 had 10 times more SS interactions with PMF before reaching maximum than SC23 did
• Meridional flow velocity is greater for SC23 than for SC22. This is consistent with a faster meridional flow for SC23 than SC22. (David Hathaway, 09)
• For SC23, I visually achieved the PCH data, which may account for some error in the parameter values
• Currently working on modeling SC21. Hoping that it correlates with SC22, giving a solid foundation for SC23 comparison
• So, SC23 is different, but more consistent PCH data is needed as well as SC21 comparison to say for sure how different it is and why it is different

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