





# Comparing the heliospheric magnetic fields over several solar cycles

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#### Introduction



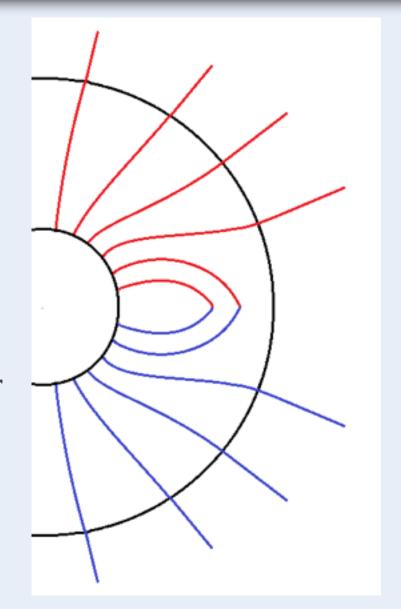
- We make a point-by-point comparison between HMF measured at Earth (hourly OMNI2 data), and coronal field produced by the PFSS model (and CSSS model)
- \* Photospheric maps: WSO, HMI, MDI, SOLIS
- \* WSO dataset gives us a continuos time series, starting 1976



#### PFSS model



- \* Assumption of no electric currents between the photosphere and source surface leads to the Laplacian equation  $\nabla^2 \Psi = 0$ , which can be solved with a spherical harmonic expansion.
- \* For this, we need to calculate coefficients *gnm* and *hnm* from the Br component in photospheric synoptic maps
- We use radial assumption and the LOS measurement

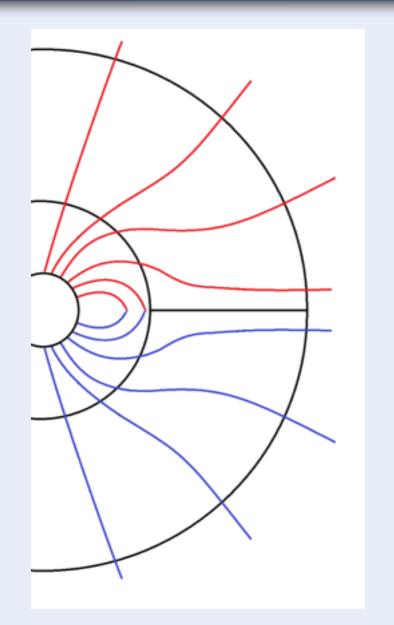




#### CSSS model



- \* Zhao & Hoeksema 1995
- Field becomes open on cusp surface (~ 2-3 R<sub>s</sub>), radial on source surface (~ 10-15 R<sub>s</sub>)
- \* gnm and hnm are calculated both on the photosphere and cusp surface





## Methods

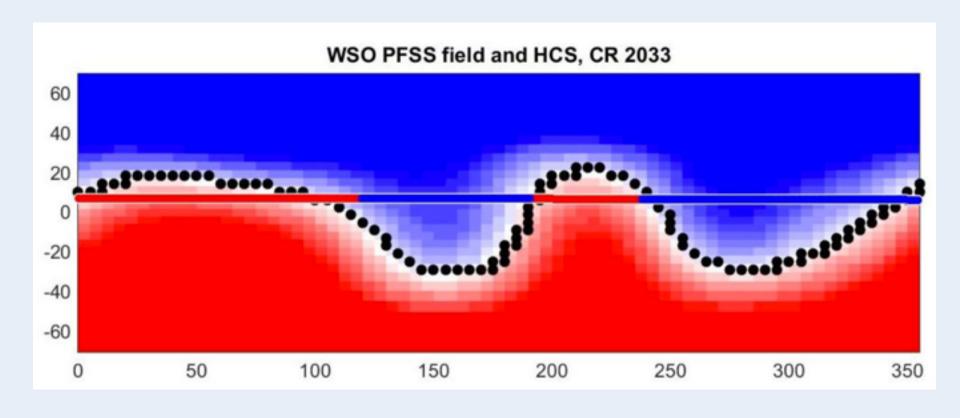


- \* We try to determine the effect of source surface distance and number of multipoles of the spherical harmonic expansion
- We compare polarity and the power of radial decay
  - Polarity comparison is unaffected by the scale of photospheric field! It depicts how well the photospheric observations + model can predict the large scale structure of the HMF



## Polarity match





$$polarity \ match = \frac{number \ of \ matched \ hours}{number \ of \ all \ hours}$$



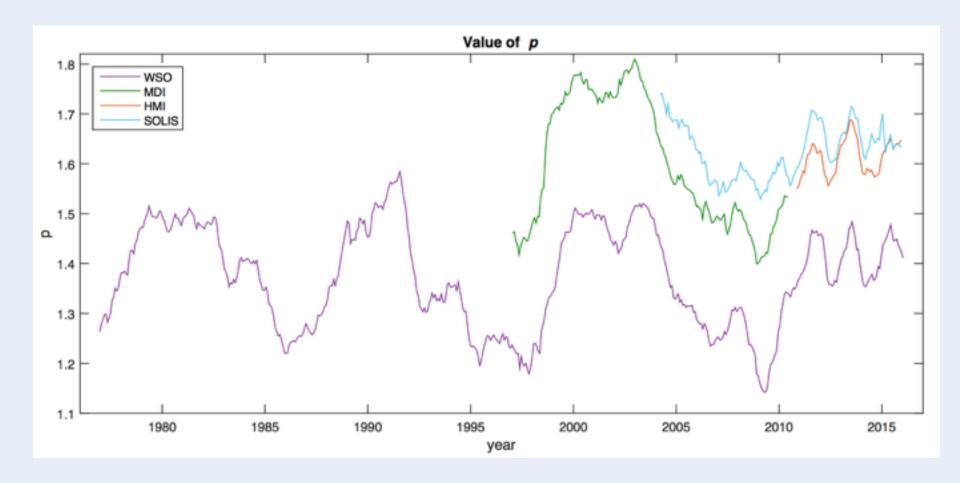


- \* Power of radial decay:
- \* If we don't take into account superradial expansion and other such effects, *p* should be 2 (according to Maxwell's equations).
- \* However...



# Results - p

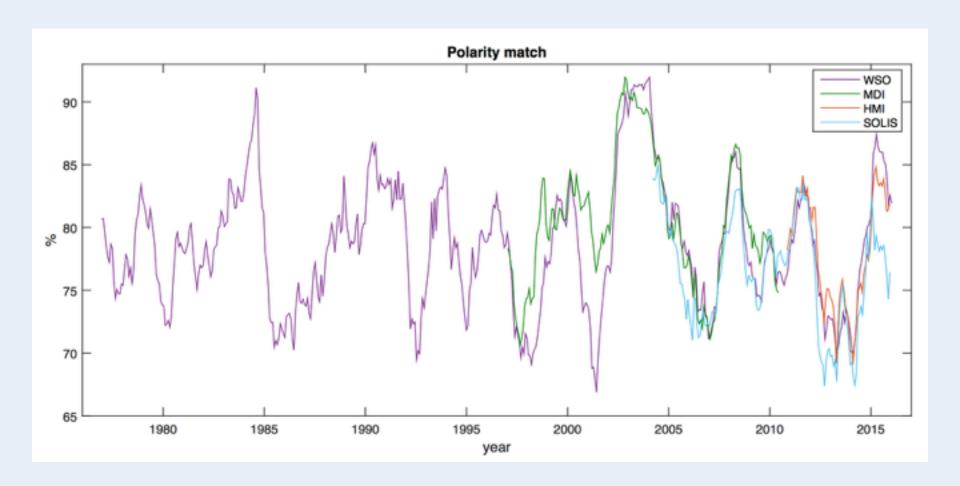






# Results - polarity match

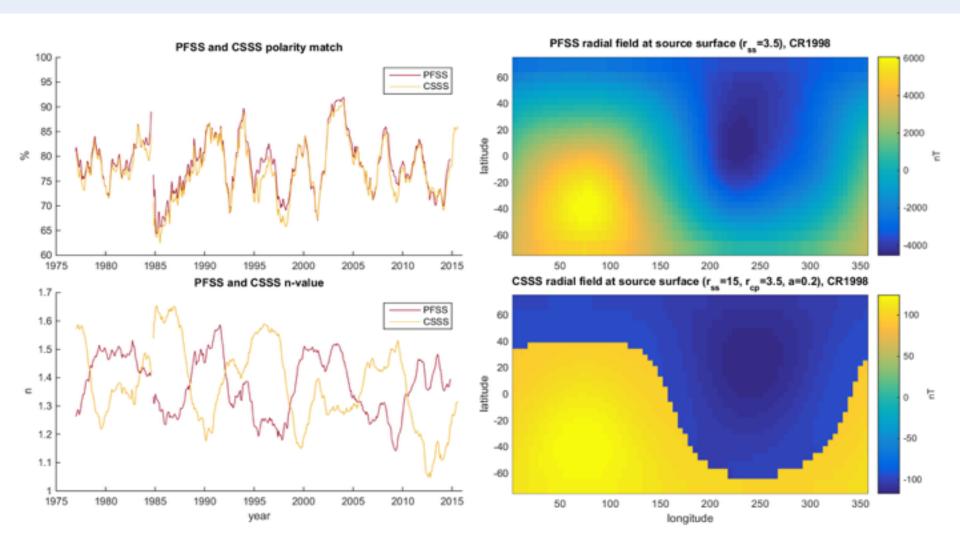






### Results - PFSS vs CSSS







## Conclusions



- \* PFSS and CSSS models can both predict the large scale structure of the HMF fairly well.
- \* During the time there is overlap between different magnetograms, they agree very well