Effects of L5 magnetic field measurements on investigations into global coronal magnetic topology

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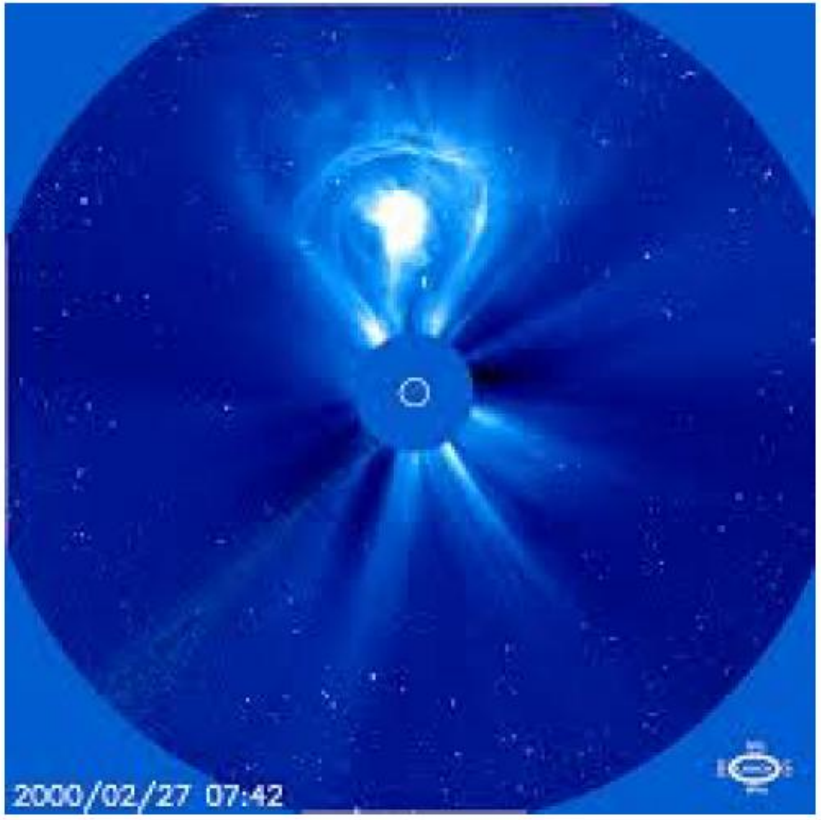
Outline

The solar magnetic field: why do we care?

- The solar magnetic field is responsible for many dynamic processes on the Sun such as
  - Solar flares
  - Coronal Mass Ejections (CMEs)
- Certain structures are also important for the solar wind



The magnetic skeleton: 3D null points

- In a magnetic field $\nabla \cdot \mathbf{B} = 0$. There are no sources or sinks
- Null points in 3D have a spine-fan structure

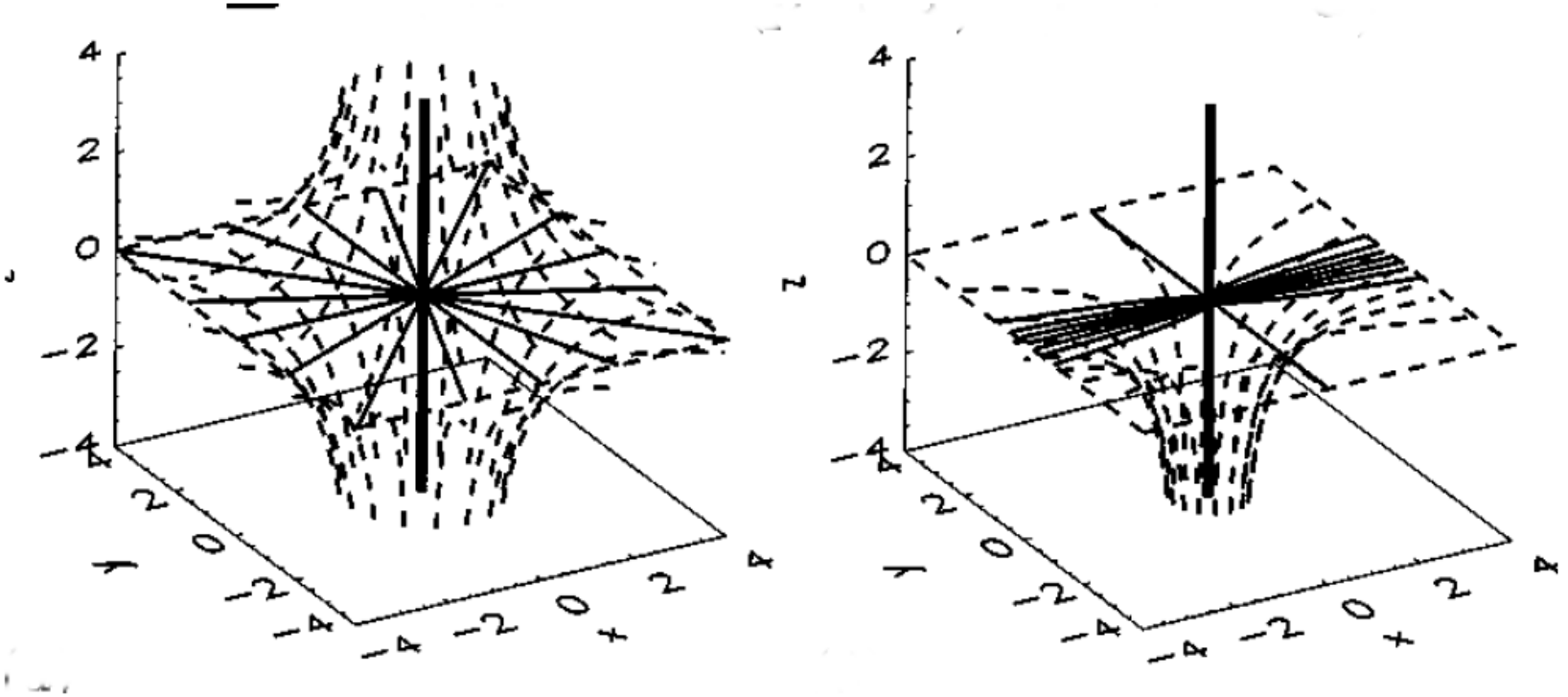
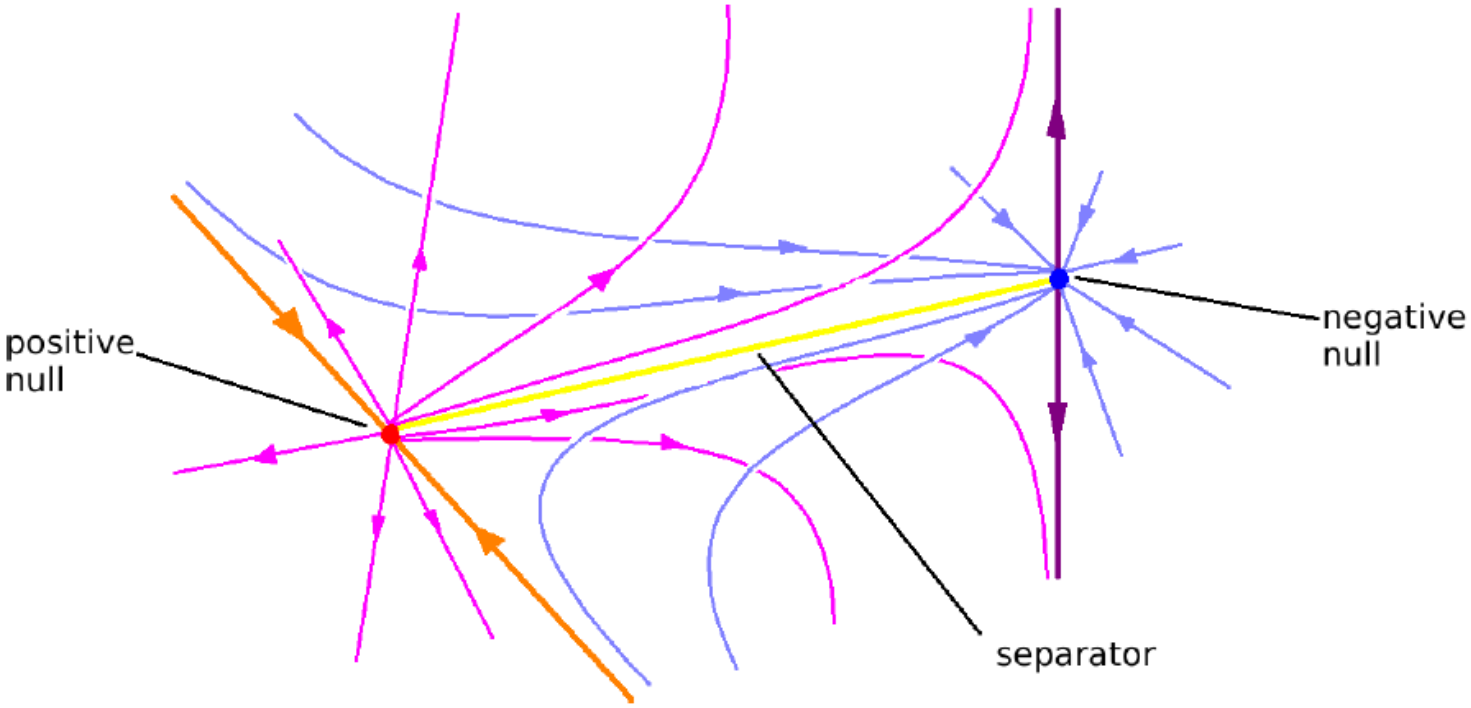


Figure taken from Parnell et al 1996

The magnetic skeleton: Magnetic separators

- Fan plane → separatrix surface
- Intersection of two separatrix surfaces → separator



Potential field source surface model

- We have observations of B_r on the solar surface (photosphere, $1R_\odot$)
- At $2.5R_\odot$ the field is assumed to be purely radial
- Potential field is solved in this volume using spherical harmonics

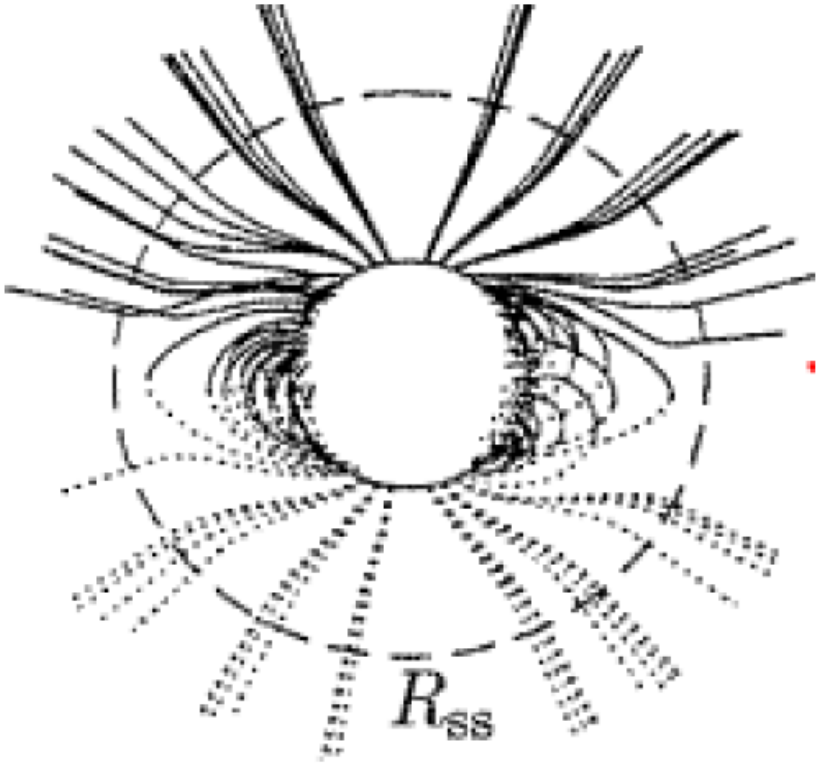
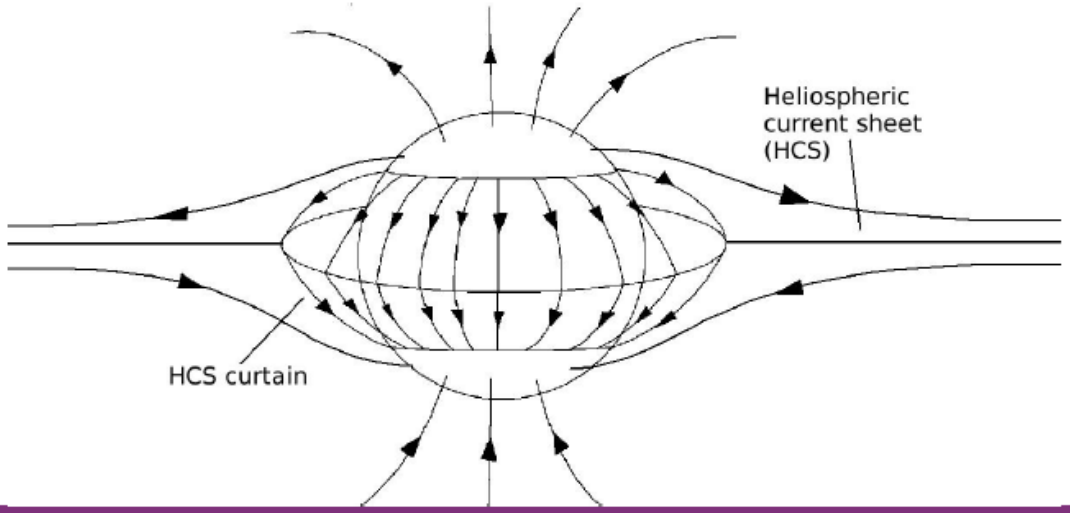


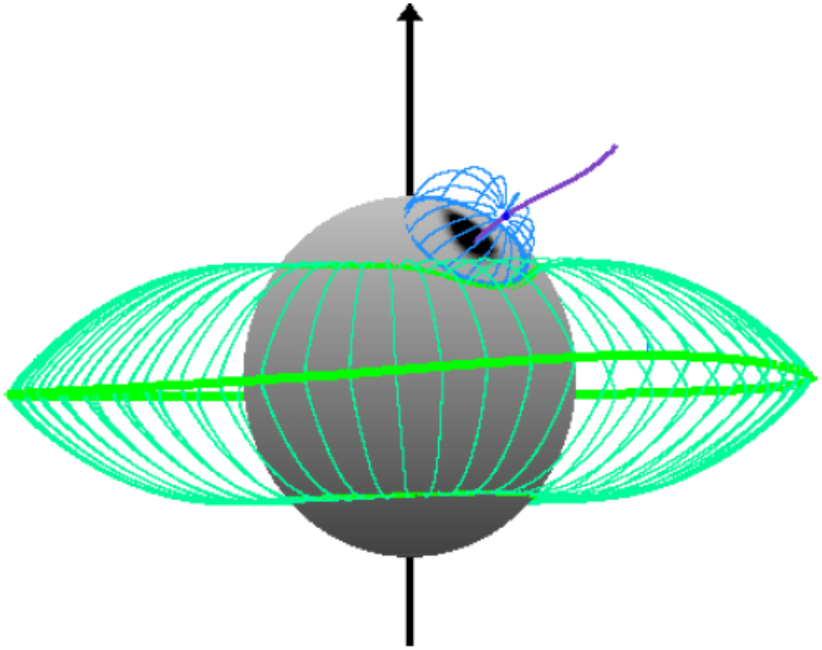
Figure taken from Zhao and Hoeksema 1994

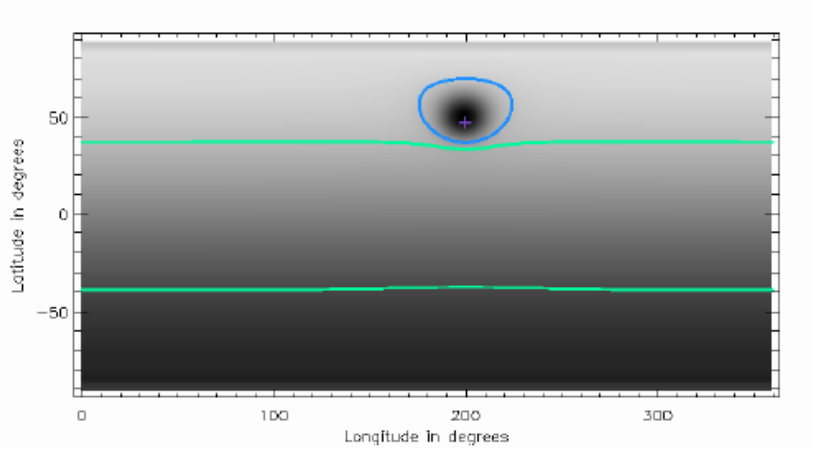
Potential field source surface model: Heliospheric Current Sheet curtains

- Any reversal in the field at the source surface will become a null-line on the outer boundary.
- This is considered to be the base of the Heliospheric Current Sheet (HCS).
- Separatrix surfaces can be traced down from this to enclose regions of closed field on the Sun associated with the global dipole.
- We refer to these as the HCS curtains.

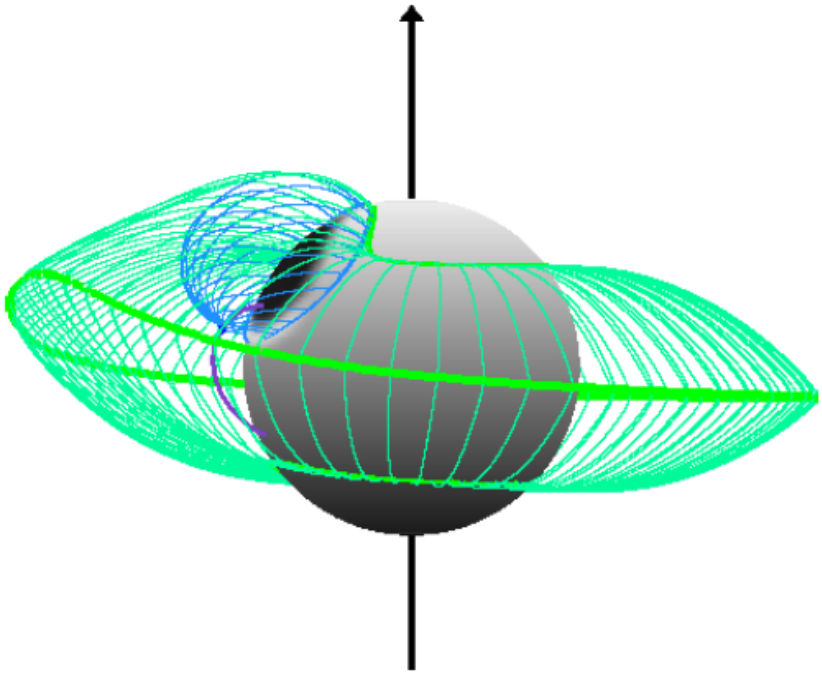


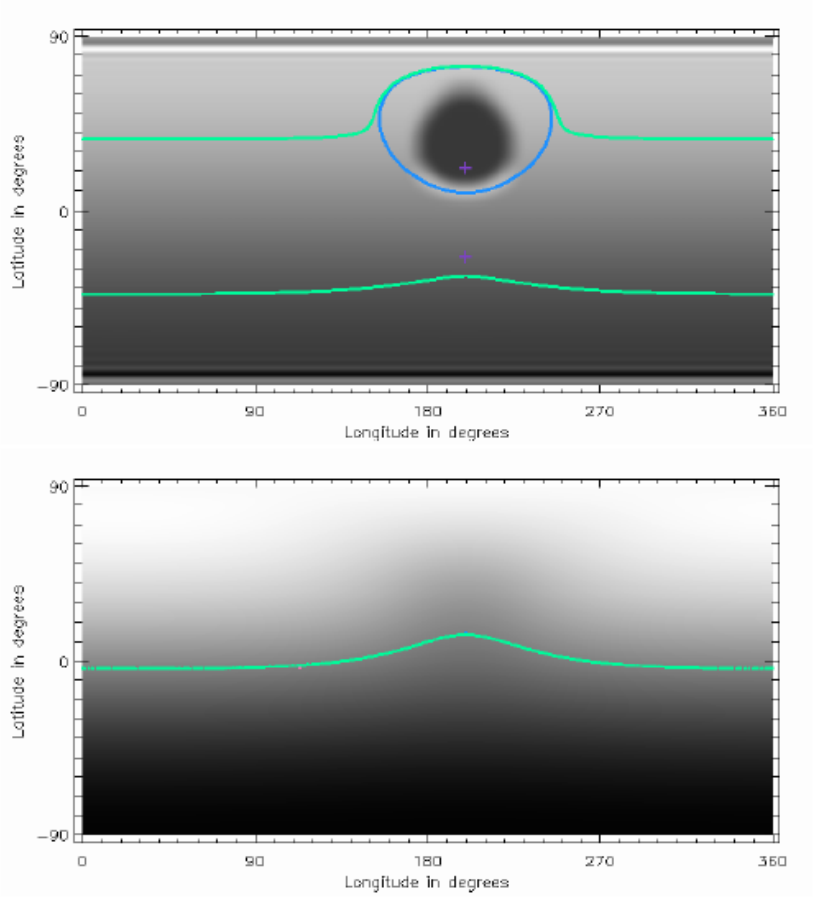
3D topology example cases: Separatrix dome



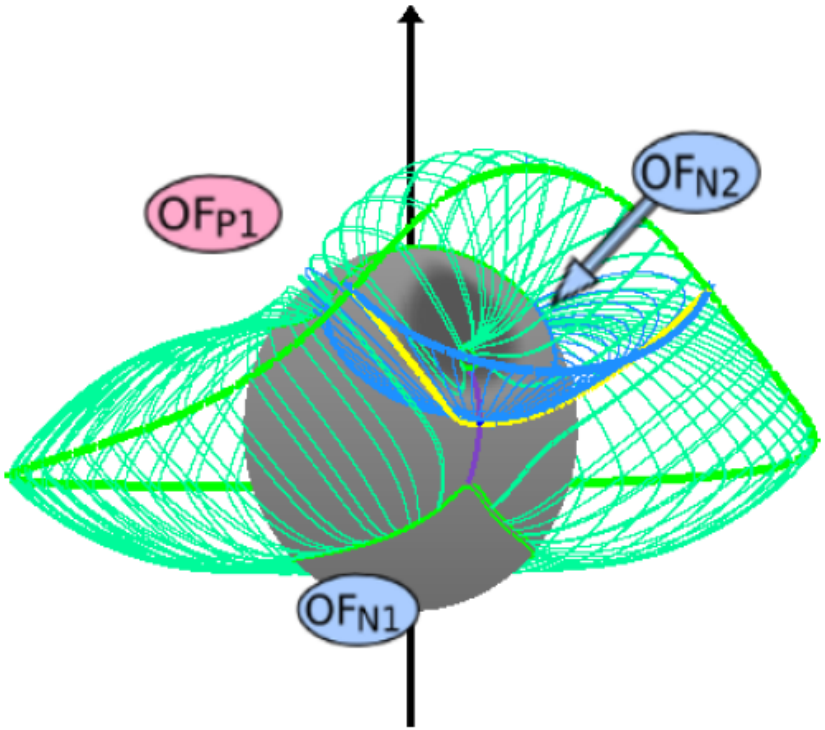


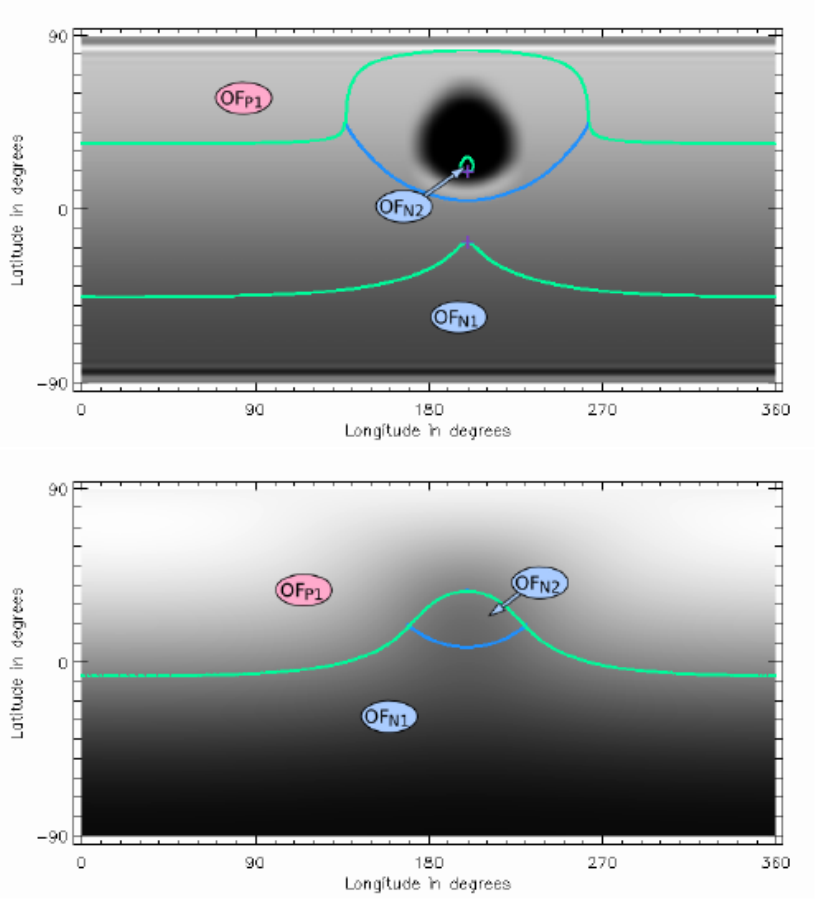
3D topology example cases: Separatrix dome under HCS curtains



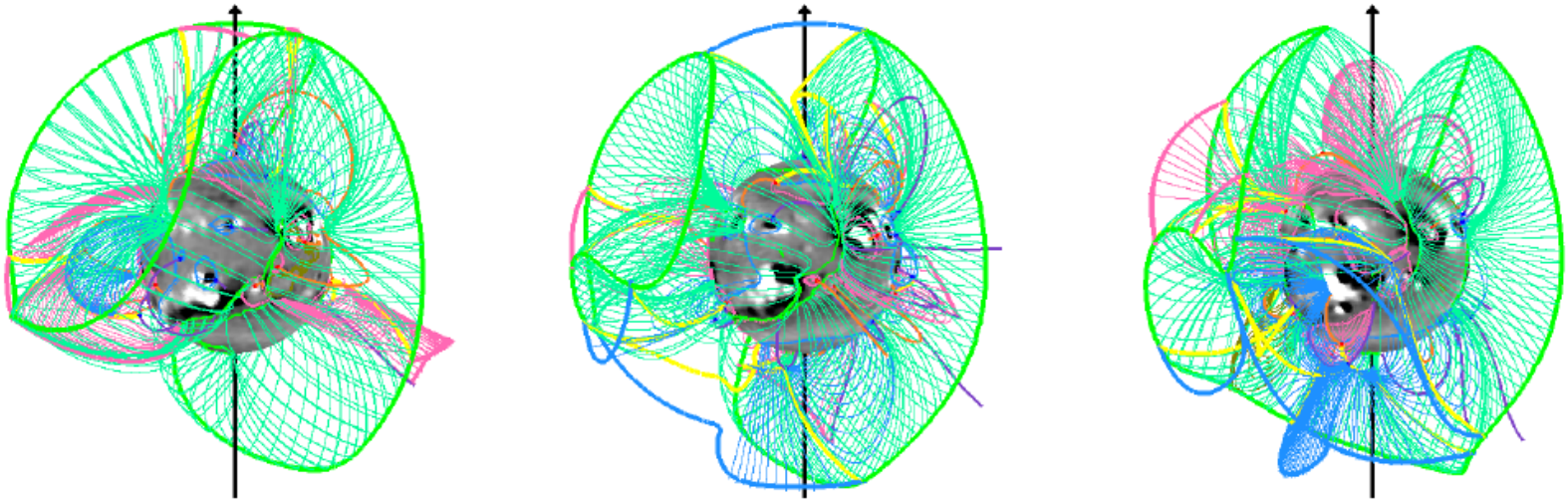


3D topology example cases: Separatrix curtain

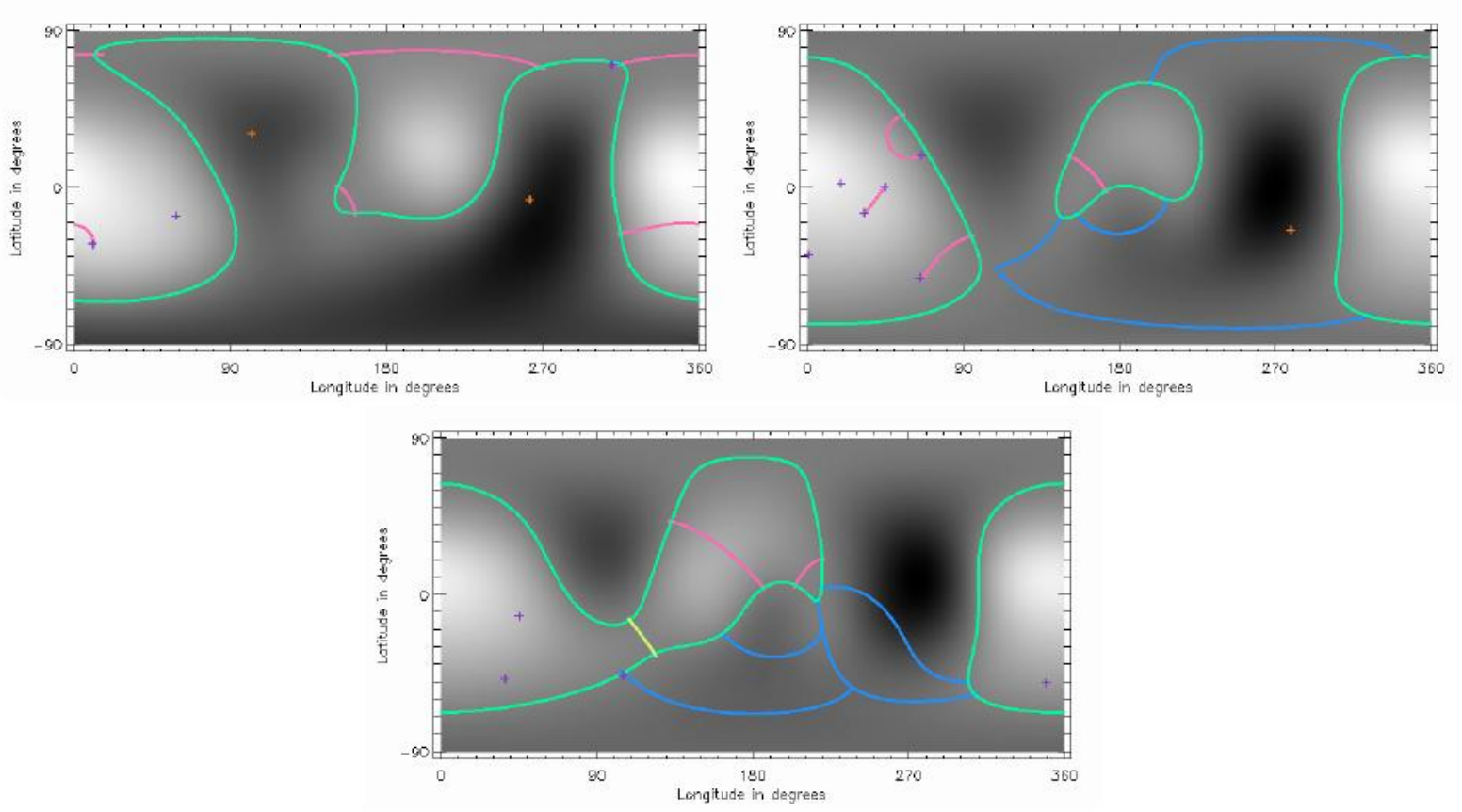




Time series 1999 (CR1955, CR1956, CR1957)



Time series 1999 (CR1955, CR1956, CR1957)



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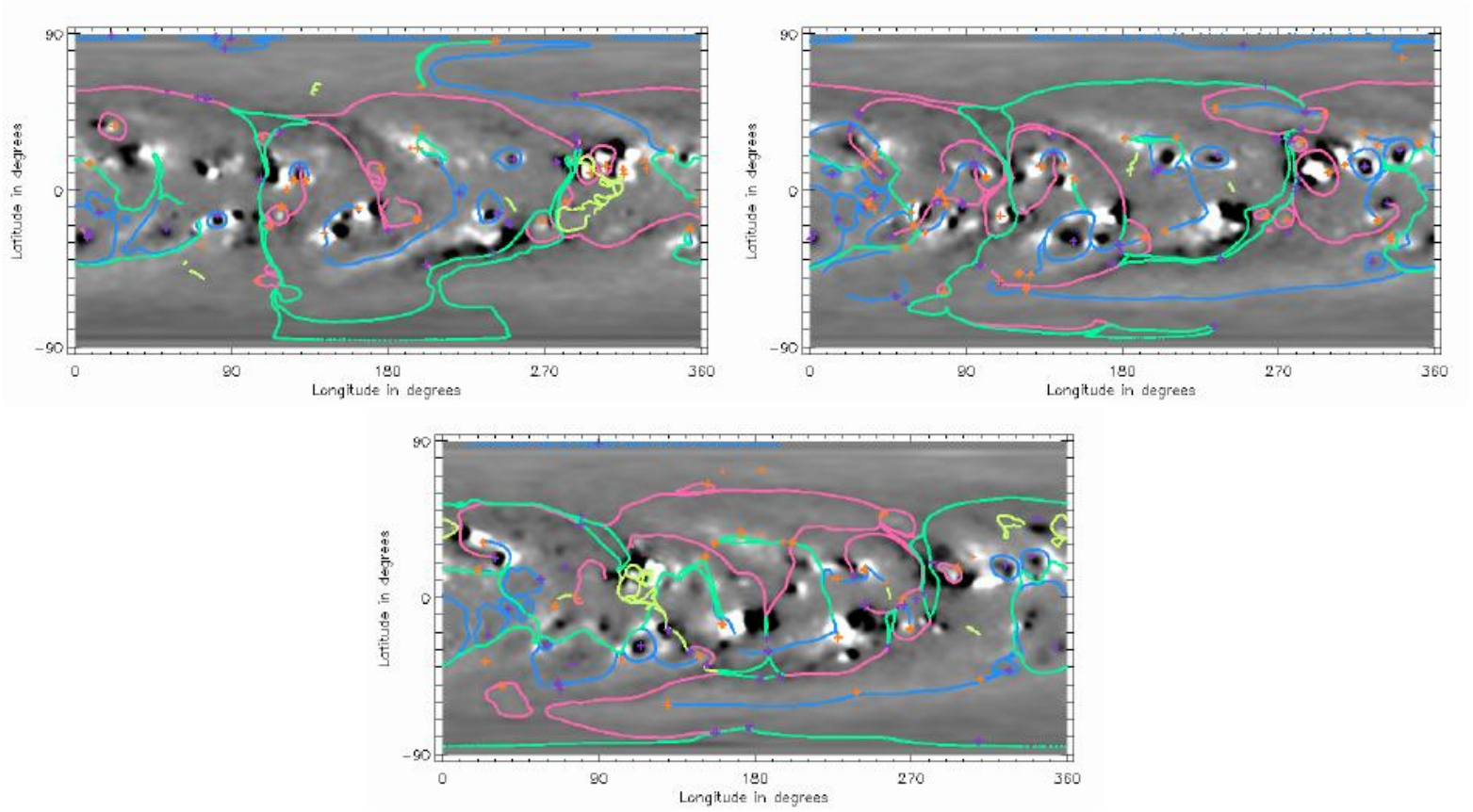
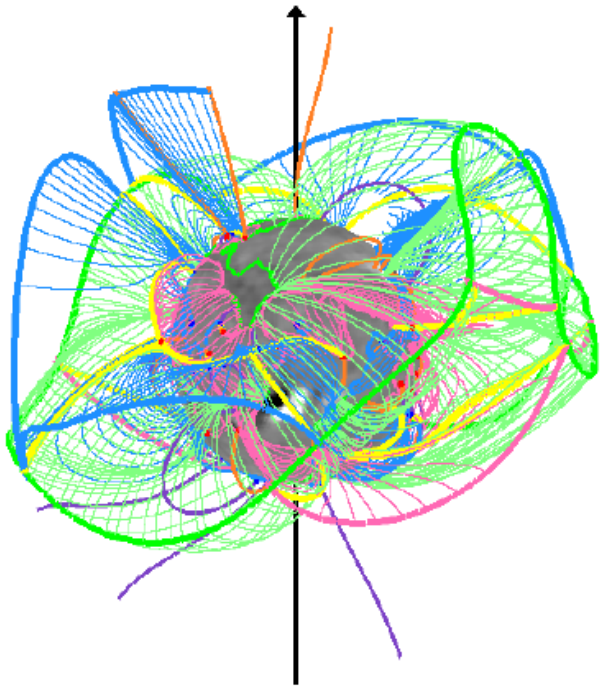
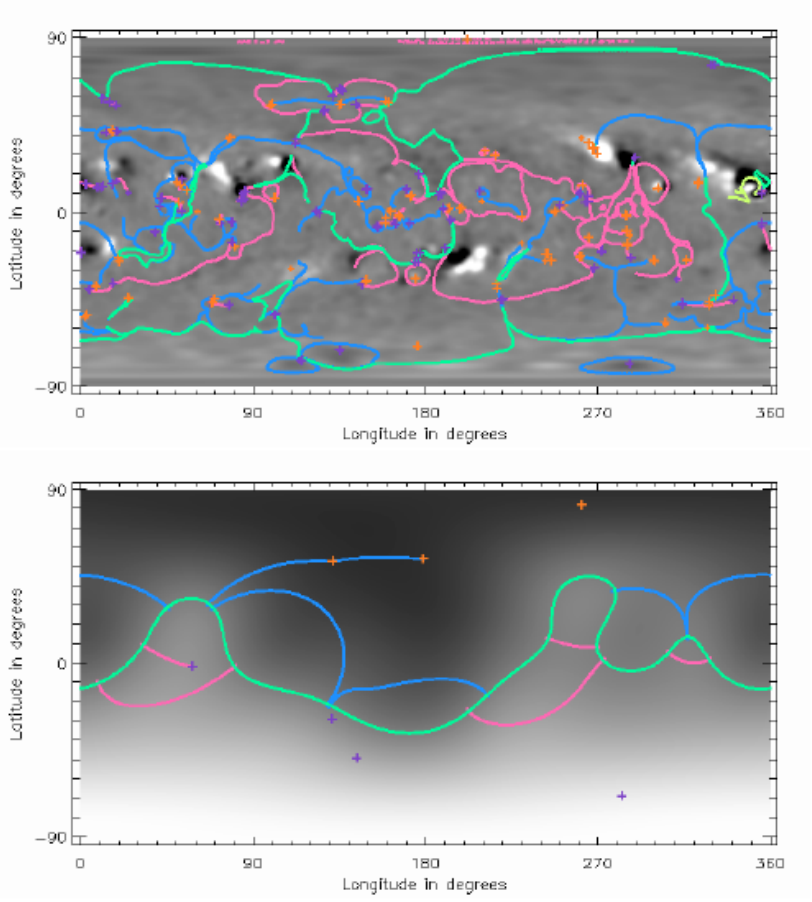


Adding and extra active region - CR2100





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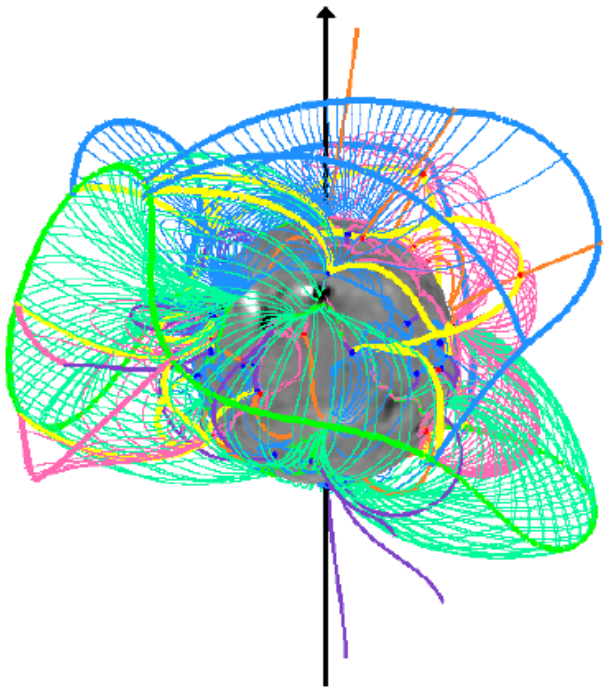

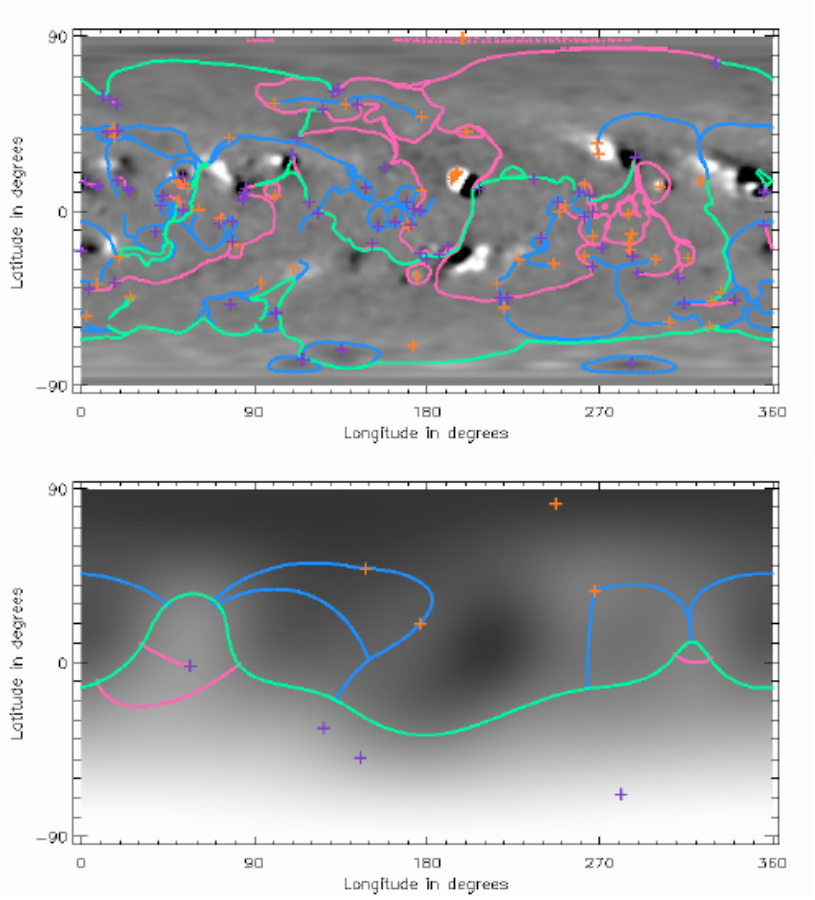

Summary and Conclusions

- Small magnetic field changes can have large effects on PFSS models
- L5 magnetic field measurements could give us more up-to-date magnetic field information