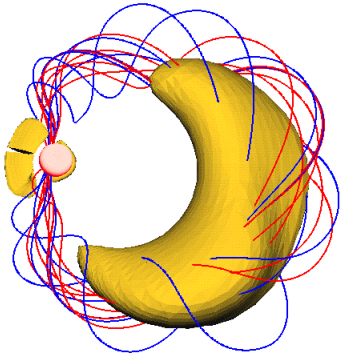

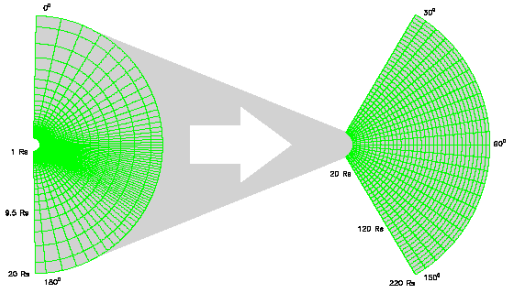

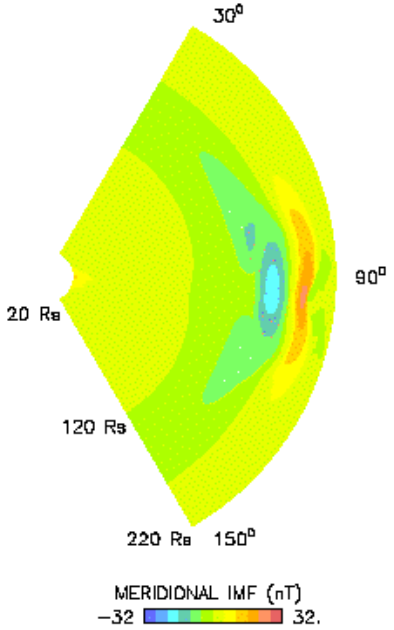

CME Computations with Coupled Coronal and Solar Wind Models*

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Numerical Models and Simulations

Coronal Model

- 2-D ideal MHD equations, γ=1.05
- semi-implicit finite-difference scheme
- non-uniform grid with staggered values

Heliospheric Model

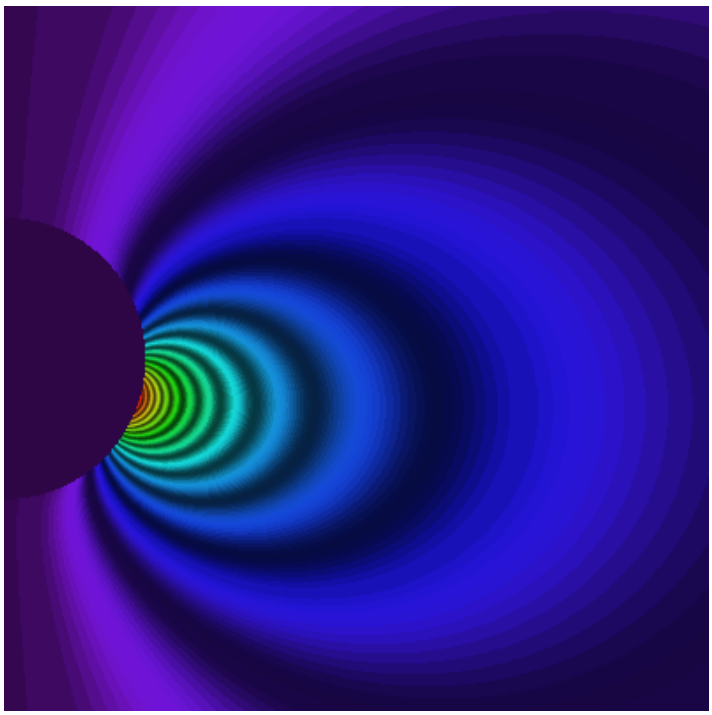
- 2-D ideal MHD equations, γ=5/3
- explicit finite-difference TVDLF scheme
- uniform grid with cell-centered values

Numerical Simulations

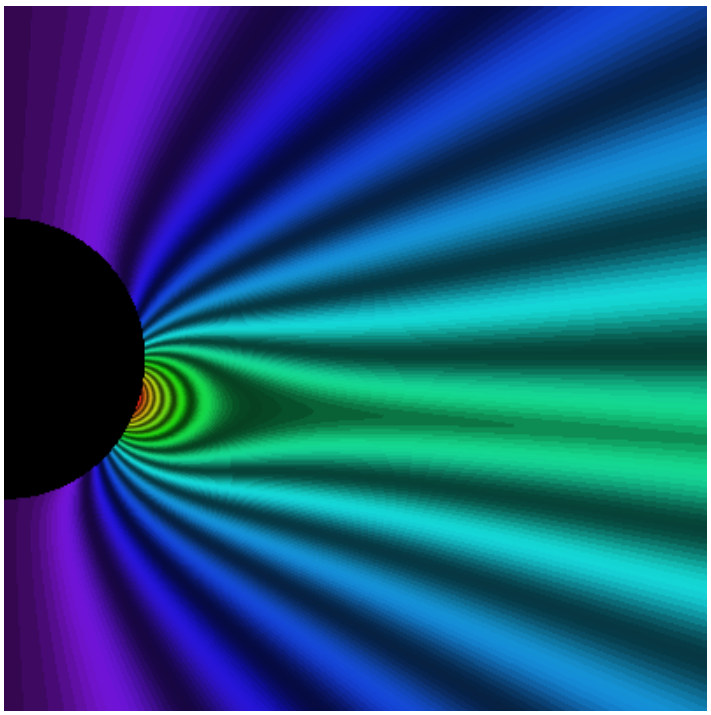
- disruption of a sheared helmet streamer, launching of a CME
- 2-D merging of coronal and heliospheric models
- propagation of disturbances through the inner heliosphere
- input for geoeffectiveness studies

Helmet Streamer Configuration for CME Studies

Flux $\Psi(r,z)$

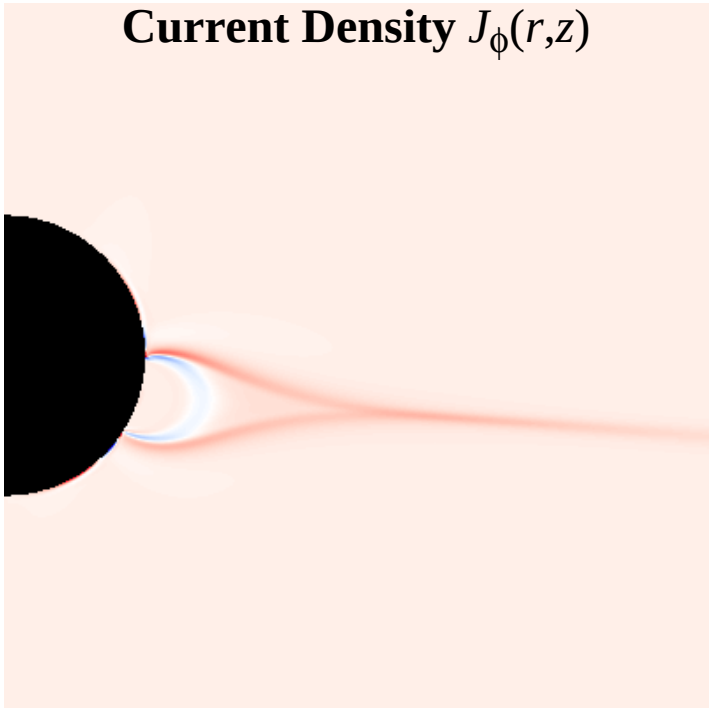


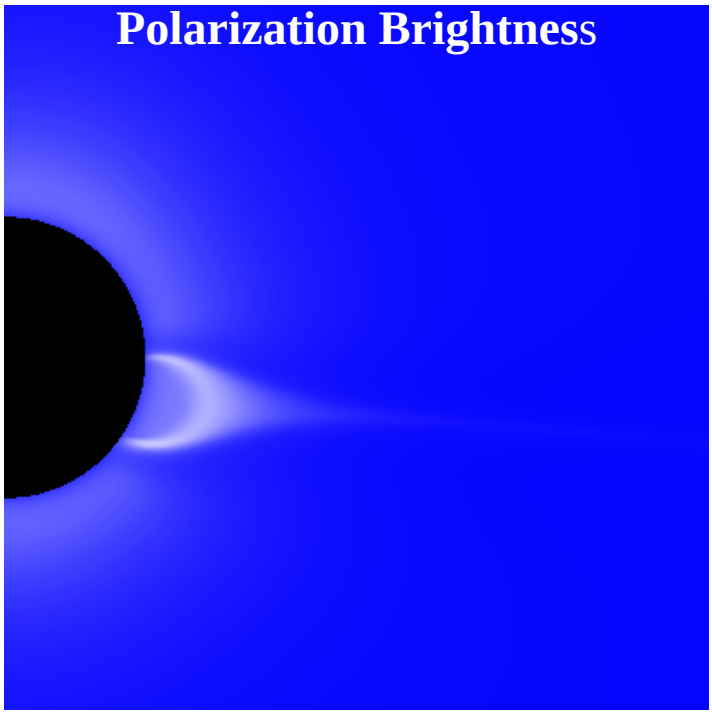
Initial Potential Field



Relaxed Helmet Streamer

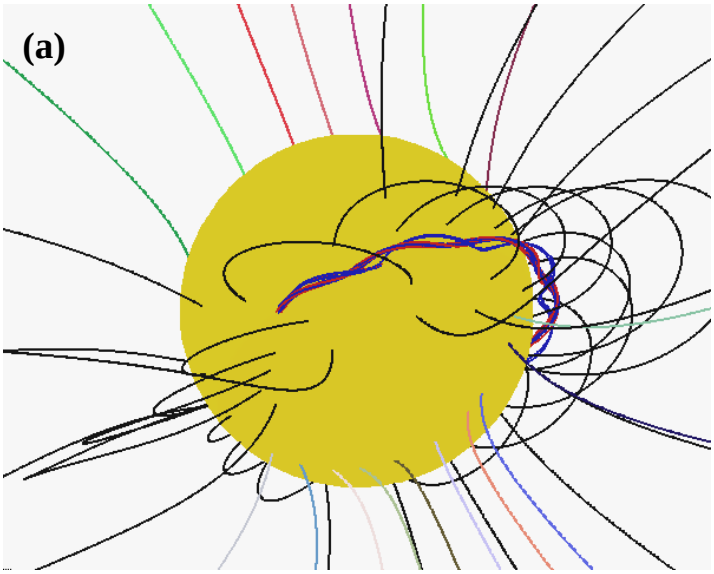
Current Density $J_\phi(r,z)$



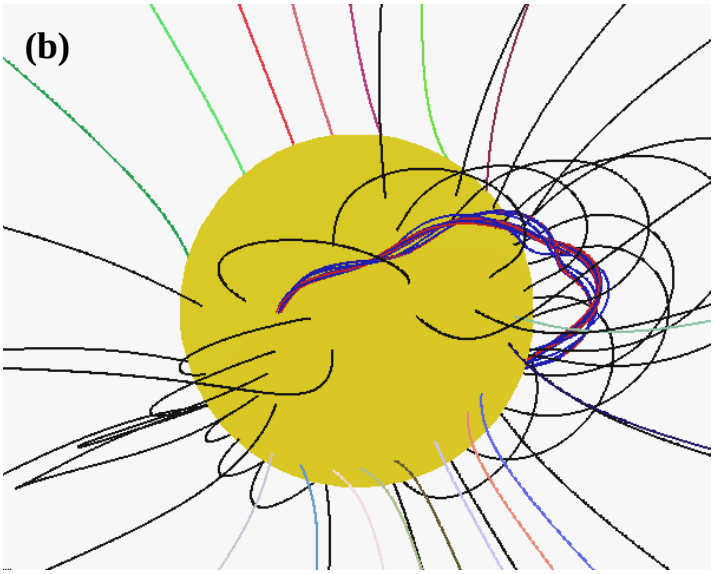


Relaxed Helmet Streamer

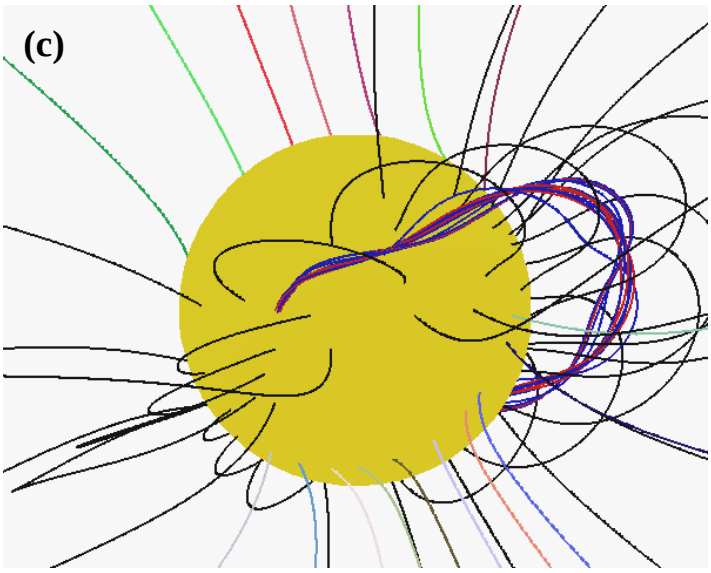
Eruption of a 3D Flux Rope



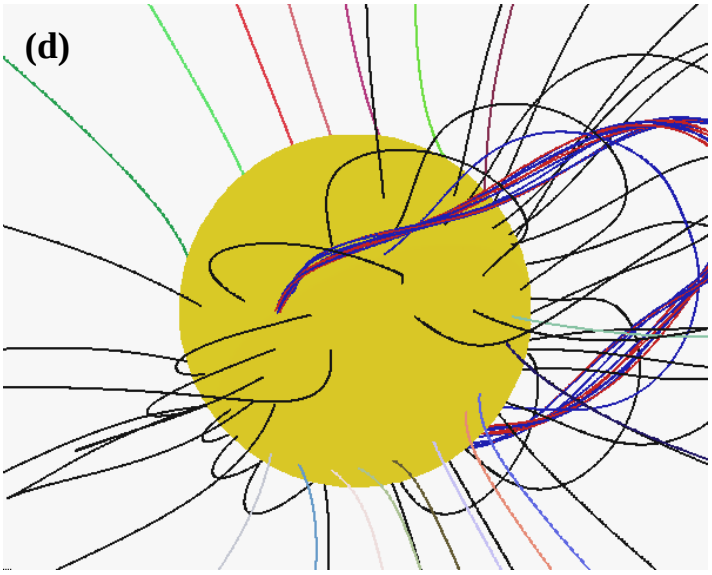
$t = t_0$



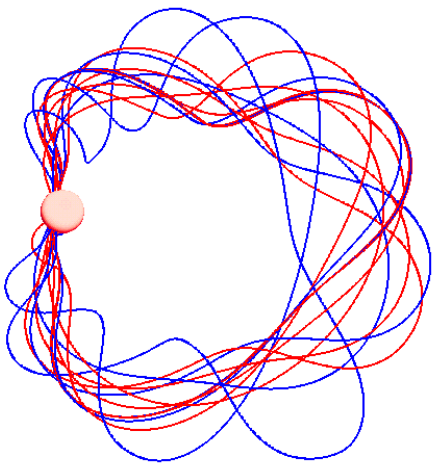
$t = t_0$ + 4 hours

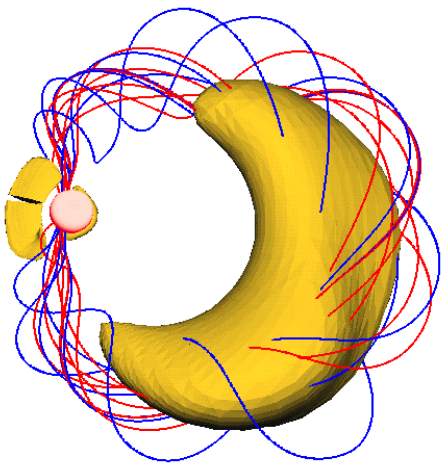


$t = t_0$ + 6 hours



$t = t_0$ + 8 hours



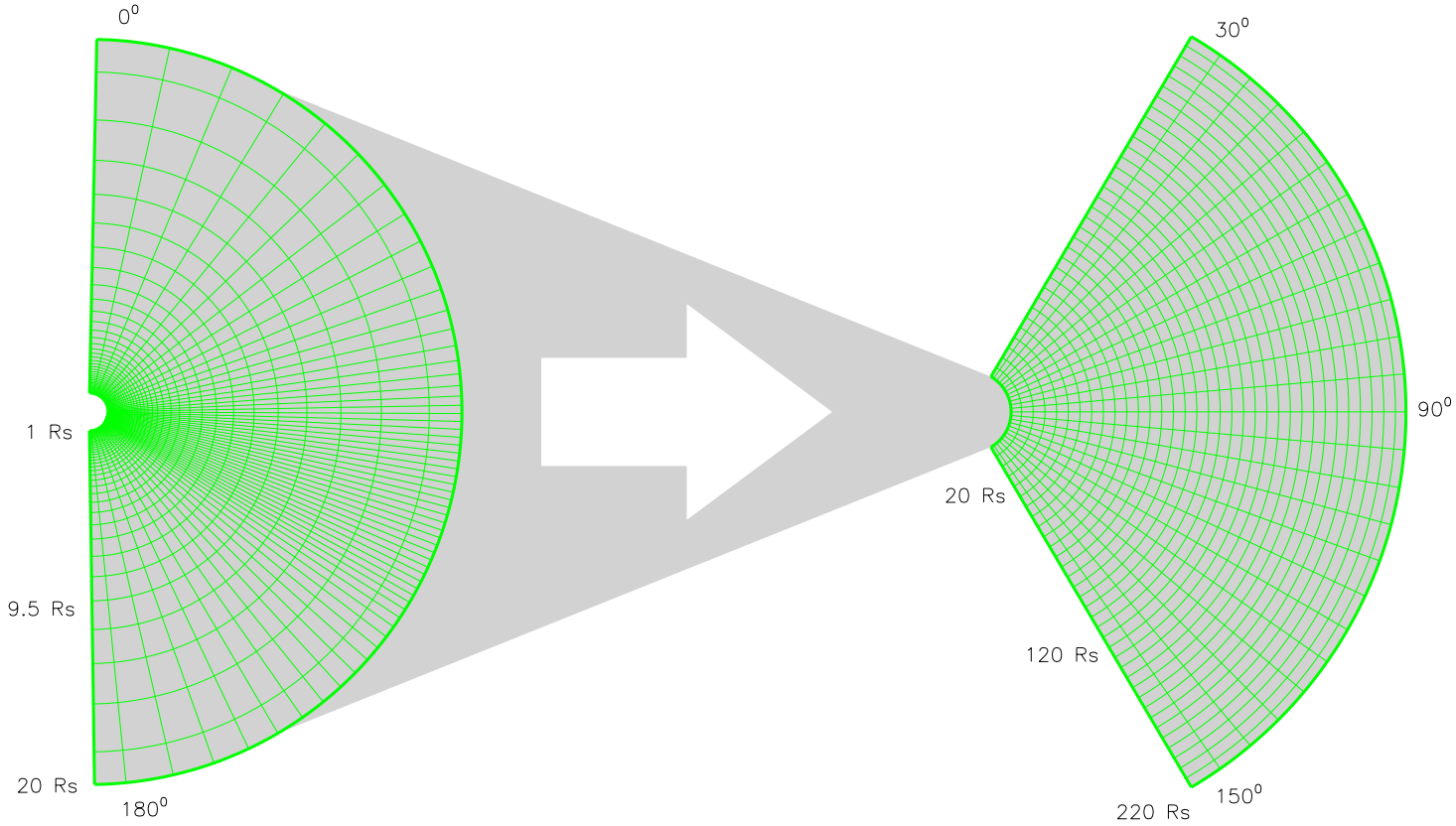


ISWM

Merged Numerical Grids

Coronal Model (1 Rs - 20 Rs)

Heliospheric Model (20 Rs - 220 Rs)



SAIC (San Diego, CA): 200x300 grid points
Δr = 0.0053-0.59 Rs, $\Delta\theta$ = 0.24-2.4^0

NOTE: Only every 5th grid line is shown

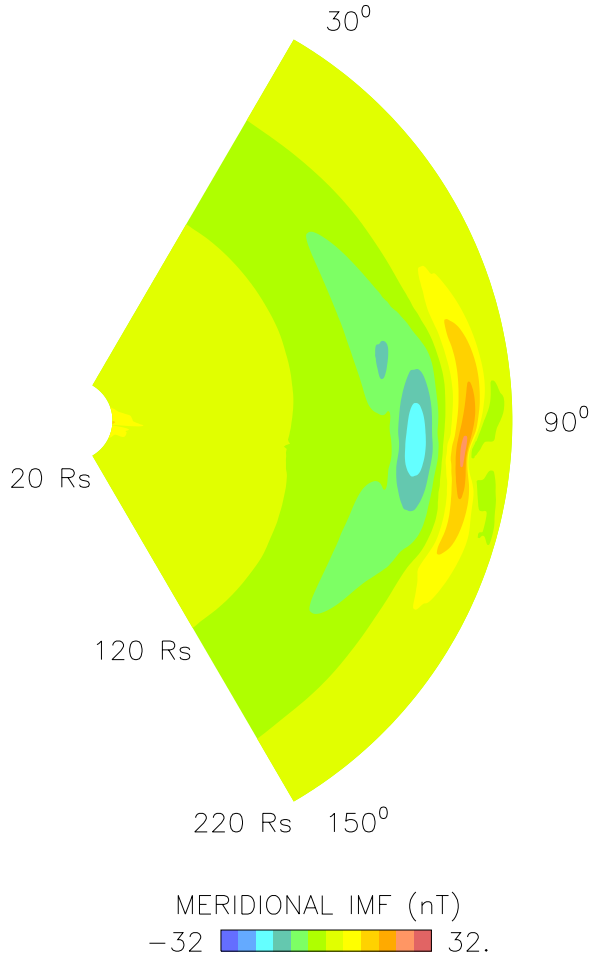
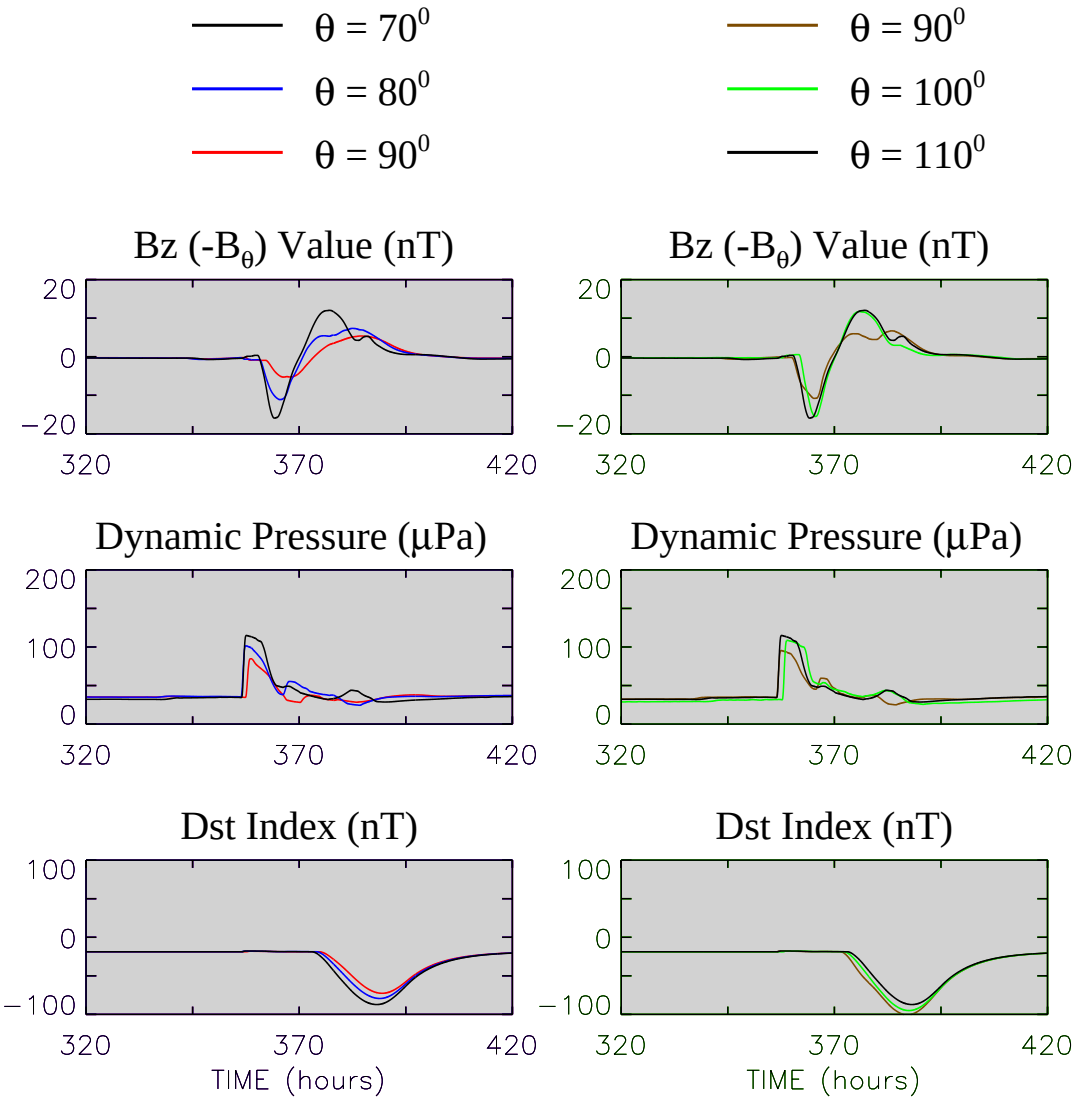
CIRES/SEC (Boulder, CO): 340x240 grid points
Δr = 0.5 Rs, $\Delta\theta$ = 0.5^0

NOTE: Only every 10th grid line is shown

I S W M

Geoeffective Parameters

Radial-Meridional Distribution of the Meridional IMF at 360 h



Evolution at 1 AU