

Estimating magnetospheric currents and geoeffectiveness of interplanetary CMEs with magnetohydrodynamic simulations

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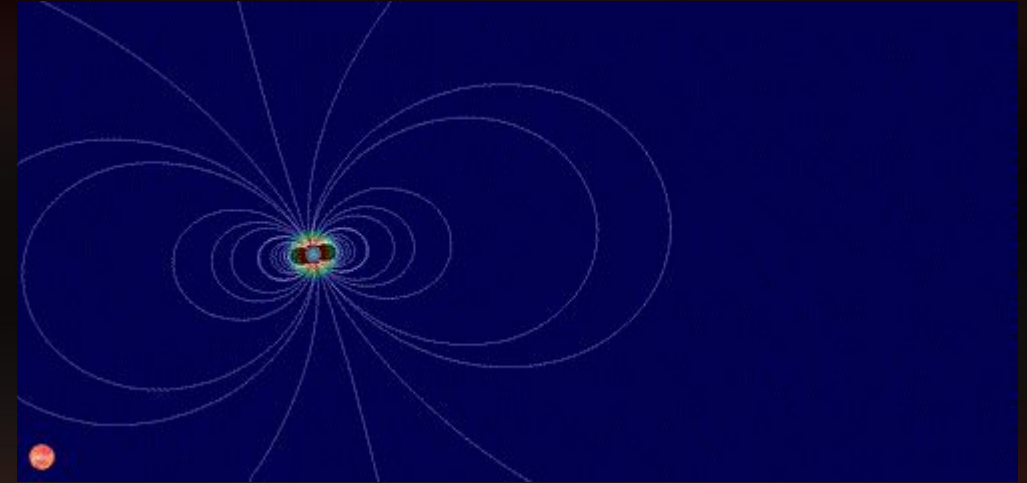
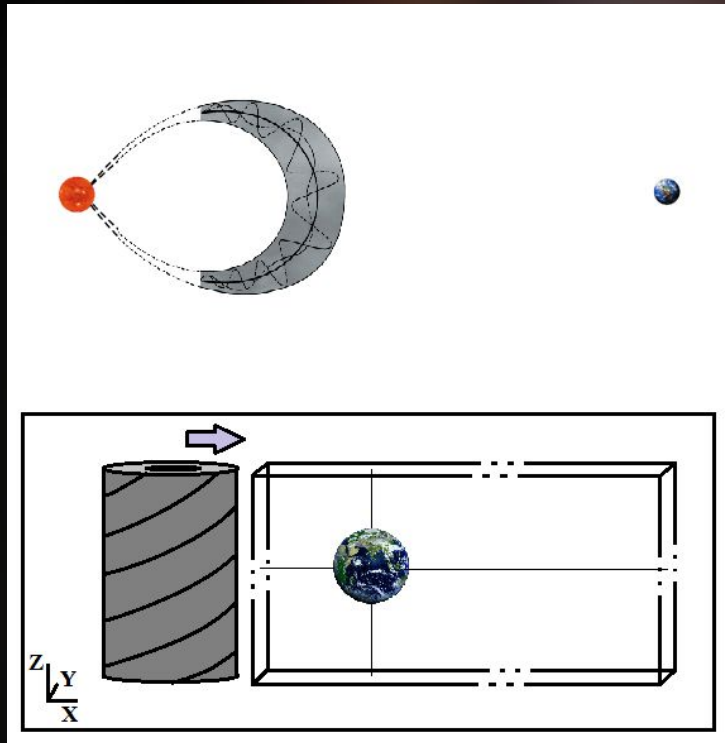
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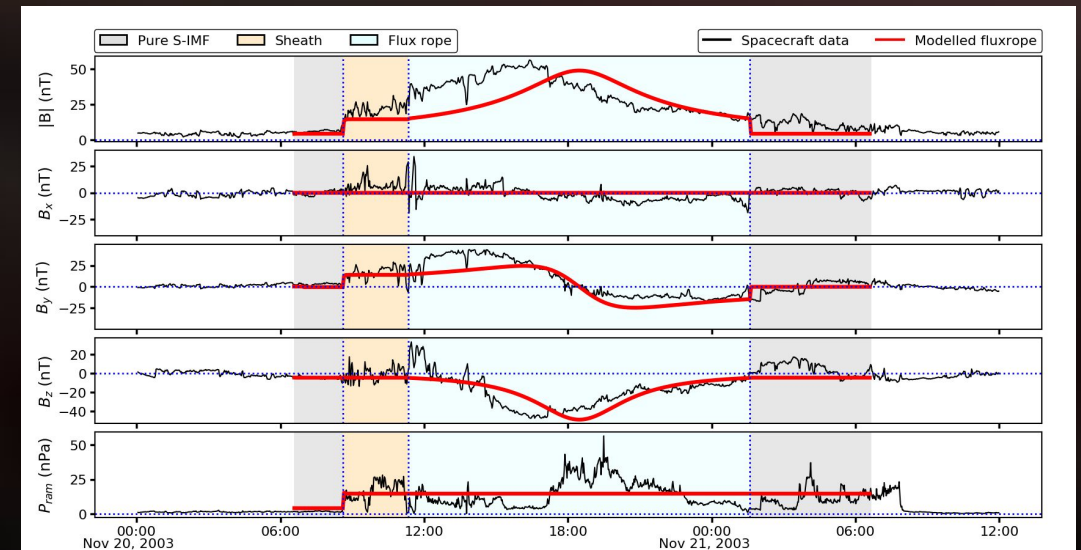
Geomagnetic Impact of Interplanetary CME using CESSI-STROMI

STROMI or the Storm interaction module:

- 3D MHD simulation of star-planet interaction using PLUTO architecture.
- Interplanetary CME with cylindrical Gold-Hoyle (GH) type magnetic flux rope.



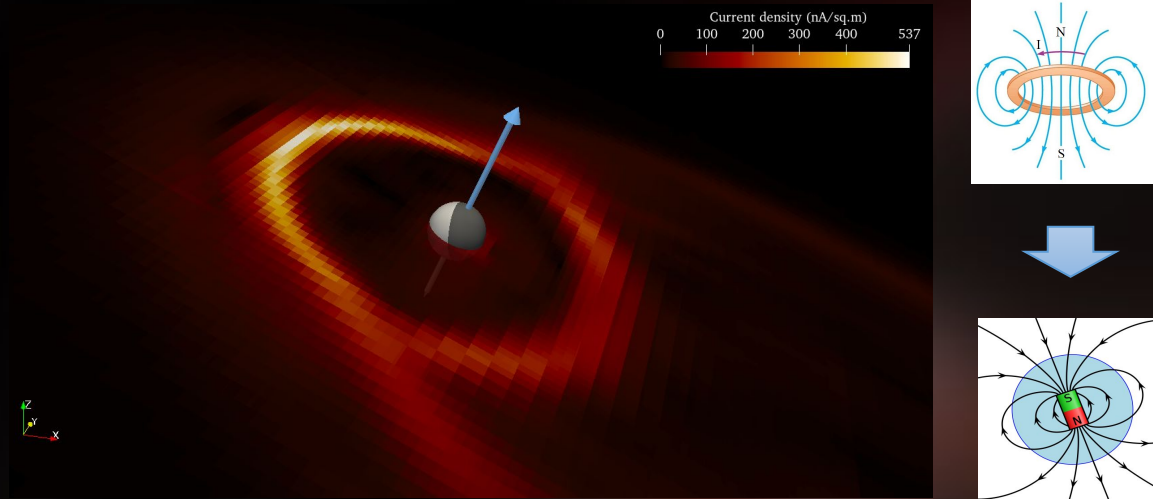
Modelling the 20-Nov-2003 storm event:



Data source: <https://spdf.gsfc.nasa.gov/index.html>

Induced Currents and Prediction of Geoeffectiveness

Current ring around Earth:



Geo-magnetic Indices:

- Information about the strength of the ring current around Earth
- Measure disturbance in terms of horizontal magnetic field H
- Disturbance Storm Time or DST Index (4 Observatories) and SYM-H Index (11 observatories)

Higher Ring
Current

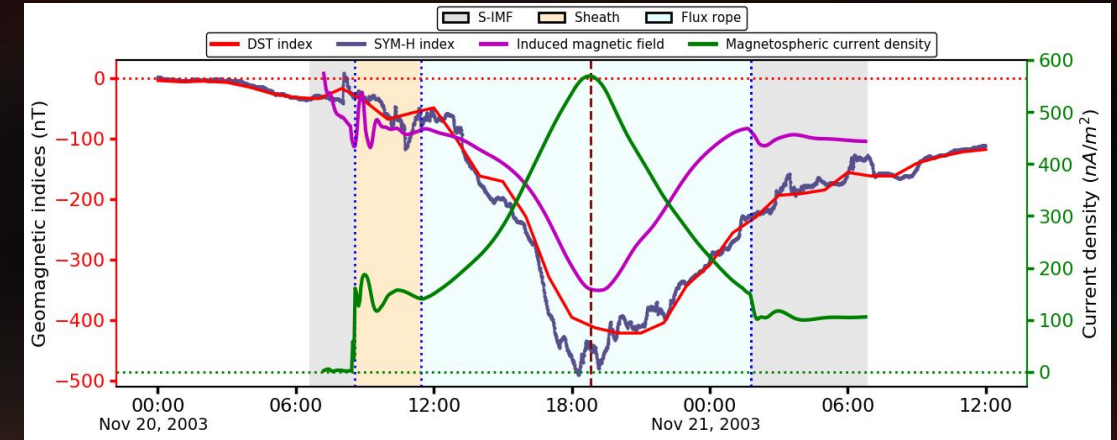


Weaker
Geo-magnetic
Field



Negative
Indices

Prediction Result:



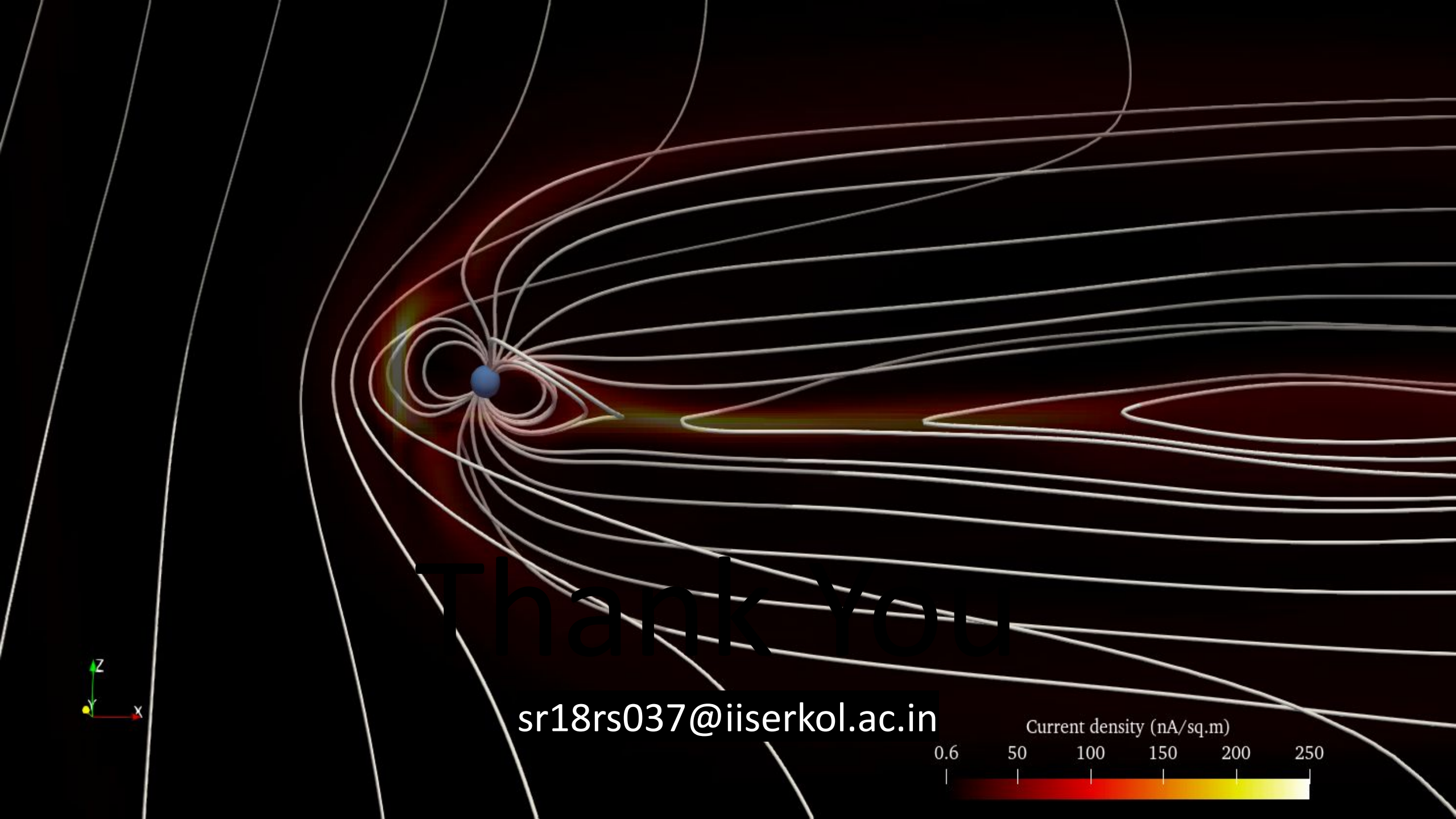
Data source: <https://spdf.gsfc.nasa.gov/index.html>

Statistical analysis:

Parameters	DST Index	SYM-H Index
1. Linearity Modelled = Slope x Observed + Intercept	Slope = 0.56 ($\sigma = 0.02$) Intercept = -25.99 nT ($\sigma = 4.12$)	Slope = 0.55 ($\sigma = 0.01$) Intercept = -24.06 nT ($\sigma = 3.61$)
2. Pearson coefficient (R)	0.85 (99.99%)	0.88 (99.99%)

Conclusion:

- Understanding and predicting the geomagnetic impact of solar storms with 60% overall accuracy for both DST and SYM-H.
- Room for improvisation as a potential prediction module.



Thank you

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