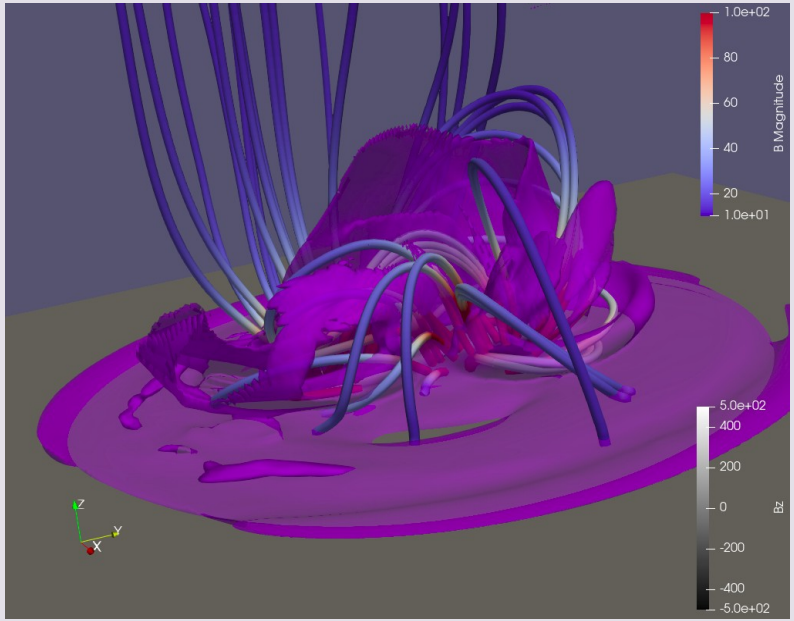
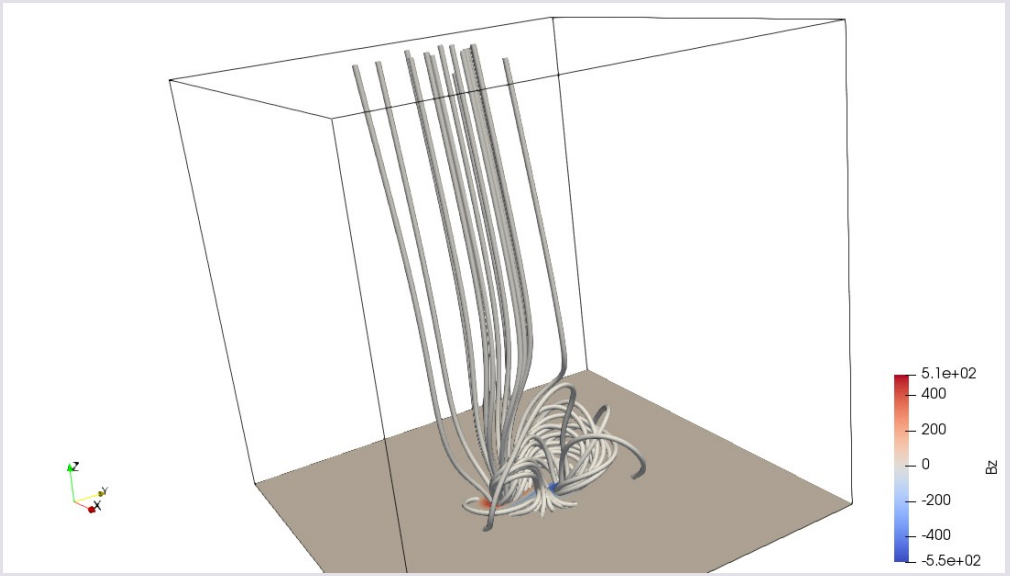
Visualization and analysis of MHD simulation output

K. Moraitis, J. Zhuleku, V. Agalianou, A. Giannis
University of Ioannina, Greece

5th Hel.A.S. Summer School
"Magnetohydrodynamics in Astrophysics"
Ioannina, 16-20 September 2024

Objective

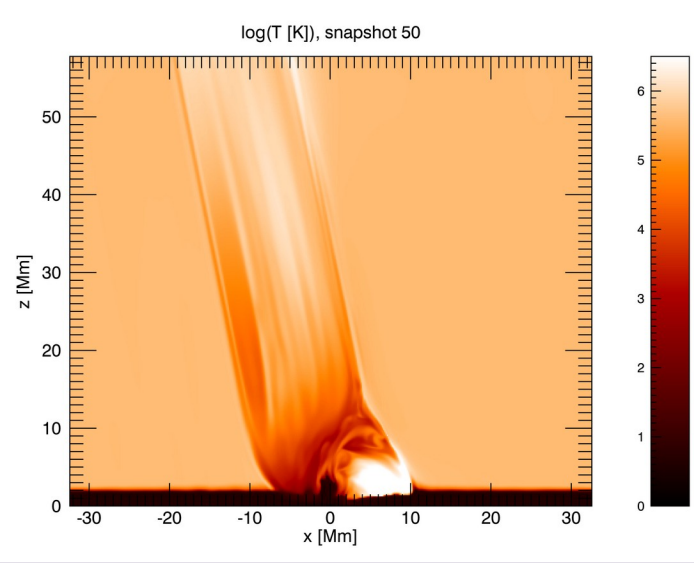

1.0e+02
80
60
40
20
1.0e+01
B Magnitude
5.0e+02
400
200
0
-200
-400
-5.0e+02
Bz
Z
Y
X

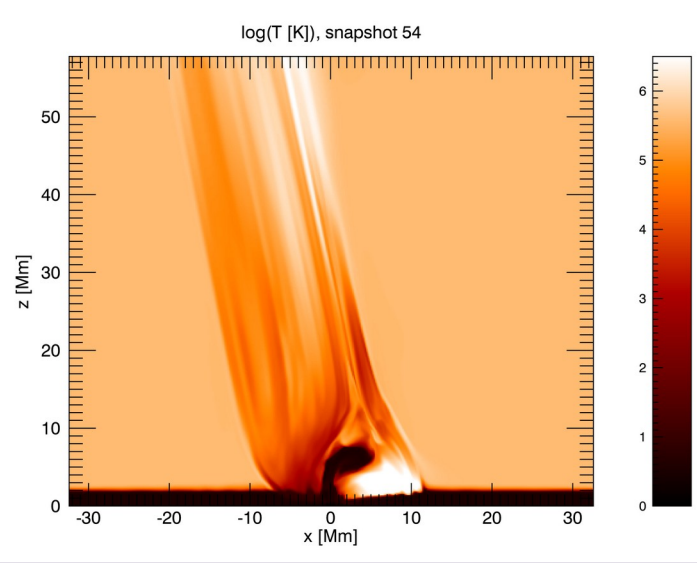

5.1e+02
400
200
0
-200
-400
-5.5e+02
Bz
Z
Y
X

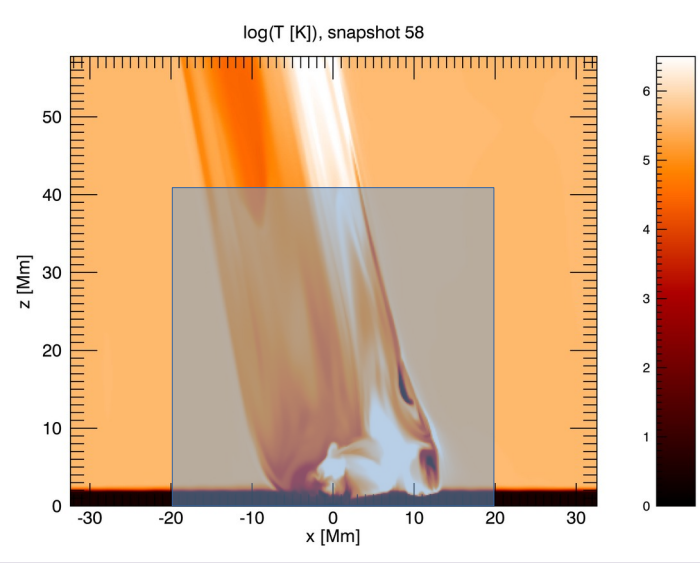
Input

- MHD flux emergence simulation (Lare3d code)
  - https://drive.google.com/drive/folders/1LJTsbibVppR8F95sxX99TRFwNjjUKhCE?usp=drive_link
- 3 snapshots (50-54-58) with cadence ~6s, naming (*_{012}.vtr), blowout jet
- Quantities: **B** in G, grid (x, y, z in Mm)
- Size 40Mm, 260^3 grid (trimmed from original 65Mm, 420^3 grid), ignore subphotospheric volume (z: -7.2Mm → 0Mm)
- 2 resolutions: high (260^3 grid, 560MB) – low (130^3 grid, 70MB)
- 1 extra file from different simulation

FE simulation







Tasks

- Install ParaView – Obtain input files
- Load/open input files – File format
- Filters
- Plot B_z on the photospheric plane – Colorbars
- Plot/overplot vertical cut and/or isosurface of electrical current/density
- Plot field lines – Color field lines
- Plot timeseries input data (*N.vtk, *_N.vtk, *.N.vtk, N*.vtk, N.*.vtk, ...)
- Save images/videos
- Automating through command line/python

References

- ParaView documentation
  - https://docs.paraview.org/en/latest/
  - User’s guide, reference manual, tutorials, ...
- The Visualization Toolkit (vtk) documentation
  - https://docs.vtk.org/en/latest/
- Lare3d code
  - https://github.com/Warwick-Plasma/Lare3d