



Contribution ID: 134

Type: **Contributed Oral**

Data-driven flux emergence with Athena++: comparison of boundary driving strategies

Tuesday 2 December 2025 17:45 (15 minutes)

Despite the large quantity of observational data available, the Sun's magnetic field dynamics remain a mystery. Solar flares and eruptions, which result from the field evolution, can have significant impacts on Earth and our space environment. Data-driven modelling of the solar magnetic field uses photospheric observations as boundary conditions to drive a simulation of the field above the photosphere with the goal of recreating flux emergence and eruptive events. Different strategies for characterising the driven boundary exist in the literature, but there is no consensus on the most effective method. We restrict our focus to treatment of the boundary driving and exclude the considerations associated with augmenting the data itself (e.g. initial field inversions, postprocessing to improve consistency with Maxwell's equations etc). We consider driving using (i) the magnetic field ($\mathbf{B}$) or (ii) the electric field ($\mathbf{E}$) data. We present simulation results with different choices of data-driving method but under identical problem conditions and with the same numerical tool (Athena++). Previous comparisons in the literature have used different simulation conditions and numerical tools. We compare the results qualitatively (field structures) and quantitatively (magnetic helicity, magnetic energy injection, total energy, and magnetic flux) with results indicating that electric field driving is superior, numerically speaking.

Authors: TAPINO, Kyriakos (University of Sydney - SIFA); WHEATLAND, Michael

Presenter: TAPINO, Kyriakos (University of Sydney - SIFA)

Session Classification: Solar Terrestrial and Space Physics

Track Classification: Topical Groups: Solar Terrestrial and Space Physics