Project Details

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Project Title:
A Next Generation Coronal Active Region Model

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Summary:
We propose to develop a 3D model of a coronal active region's magnetic field.

The model will have five principal software components,
1. a magnetogram analysis tool
2. a component which creates surface flow fields consistent with the magnetogram data and the magnetic induction equation
3. a non-linear force-free field solver
4. a finite-element high order godonov magnetohydrodynamic code
5. an analysis toolkit for detecting key topological features in the field.

The model will construct global representations of the field, with refined grids in the vicinity of the active regions of interest. It will be capable of combining vector magnetogram data and merging it into a global field map using appropriate synoptic magnetograms. It will apply the method developed by Schuck to analyse the flow patterns which are consistent with both the observed surface magnetic fields and the induction equation. The surface fields will first be used to derive a non-linear force-free model of the global field. This solution will then be used to initialize the 3D MHD code which will compute an equilibrium field. To model quasi-steady evolution we will test two approaches. In the first we will construct a quasi-steady MHD solution by repeating these steps for a time sequence of magnetograms. In the second approach we will apply the MHD code in true time-dependent mode, by applying these same steps to the first magnetogram, but then evolving the surface boundary conditions as defined by our magnetogram time sequence to drive the MHD code in a time dependent evolution.

Our collection of tools will be accessed through a Graphical User Interface, which will give the user the ability to control most aspects of the model execution, including the degree of grid resolution to be applied in the region of active regions, and the relative weights to attach to different field observations during the construction of global magnetograms.

The GUI will also enable the user to render the final field solutions and identify null points and lines and other critical topological features.

Publication References:

no references