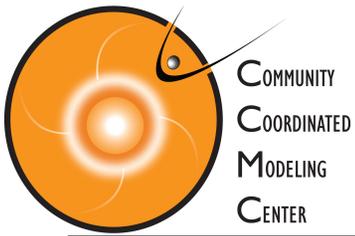


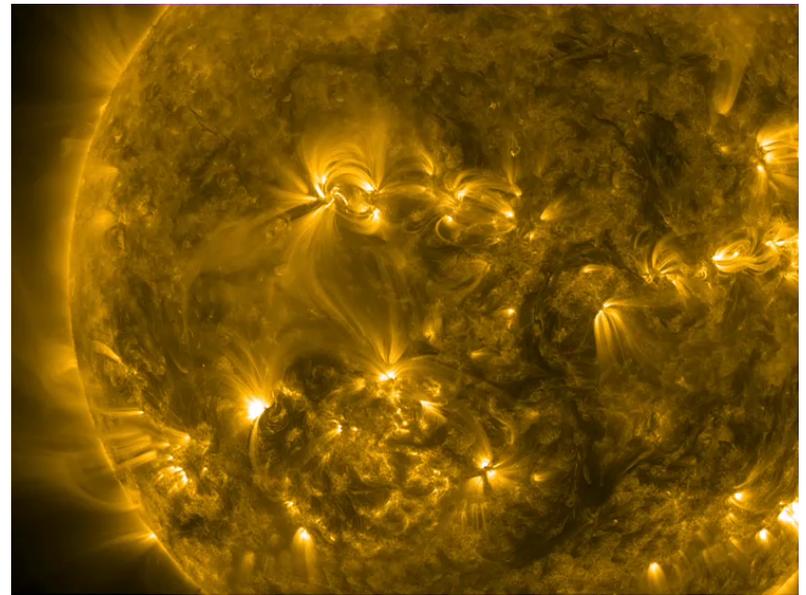
NASA LWS TR&T and AISR Programs

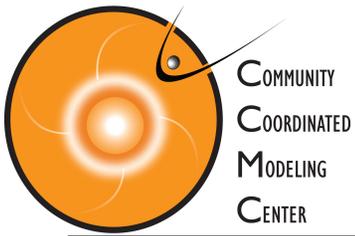


GENESIS

LWS Strategic Capability Call

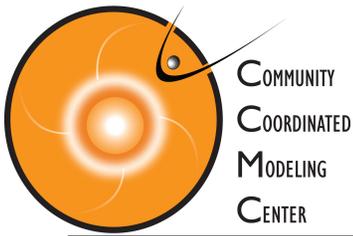
- 2006 LWS TR&T Strategic Capability solicitation
 - Need for a community model suite to study pre-flare build up of magnetic energy in coronal field of active regions
 - To be driven by a time series of vector magnetic field data
 - And their implied photospheric flows





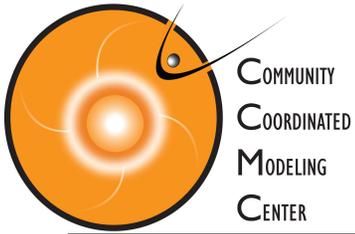
Motivation

- Models driven by time series of photospheric magnetograms need to modify the magnetograms to,
 1. Match magnetogram data to the model's spatial and temporal grid
 - resolution and field of view issues
 2. 'Propagate' magnetograms to the desired height in the atmosphere
 3. Manage the induction equation constraint
 - Determine surface flows consistent with magnetogram time series and constraint equations



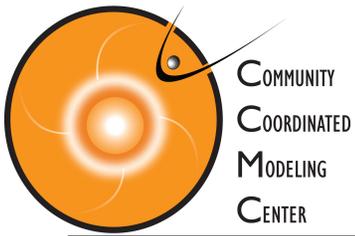
Grid Mismatch

- Model algorithms and their solutions dictate the grid resolution and timestep requirements
- In general these do not match the properties of the magnetograms
 - Best HMI vector magnetogram cadences are 12 minutes (for limited field of view – so called HMI SHARPs)
 - MHD codes may require integration timesteps of order 1 second or less for accurate time evolution
- No guarantee that a single magnetogram source will match the field of view of the model
 - Probably need to combine magnetogram sources and types

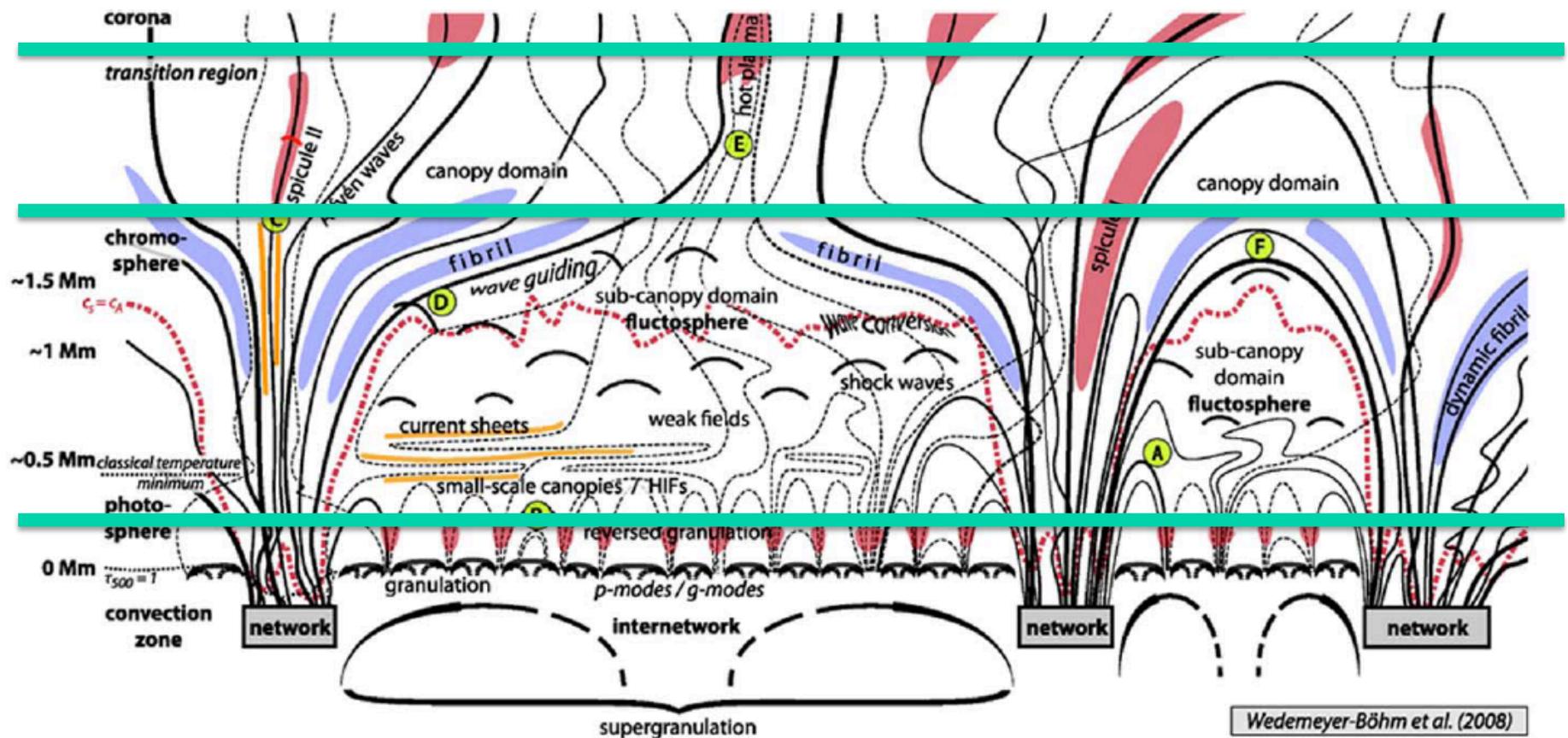


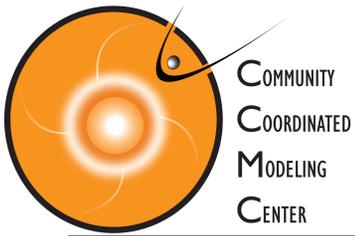
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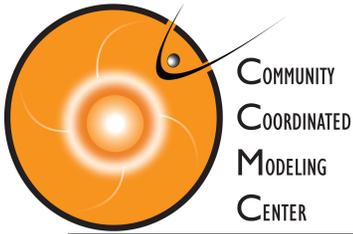
Magnetogram Height and Model Inner Boundary





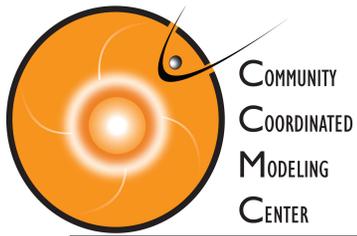
Motivation

- Models driven by time series of photospheric magnetograms need to modify the magnetograms to,
 1. Match magnetogram data to the model's spatial and temporal grid
 - resolution and field of view issues
 2. 'Propagate' magnetograms to the desired height in the atmosphere
 3. **Manage the induction equation constraint**
 - **Determine surface flows consistent with magnetogram time series and constraint equations**



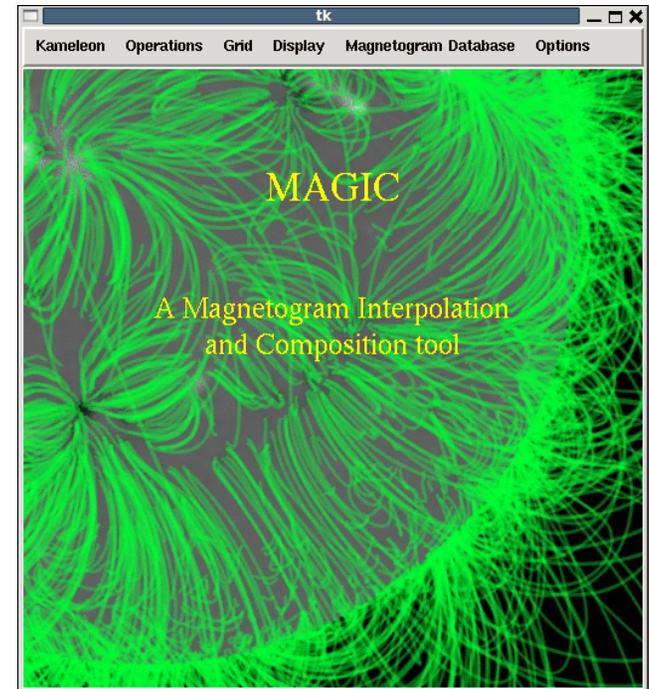
The Message

- All models consuming magnetograms need to process them.
- MHD models need to do EXTENSIVE processing
- Much of this processing has yet to be defined.
- Magnetogram processing MUST be under the control of the model user !!
- The infra-structure to do this needed its own Strategic Capability
- We have created the initial framework.

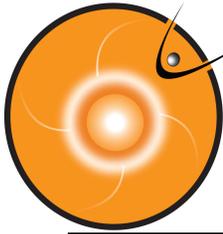


MAGIC – A Tool Suite for Preparing Magnetograms for Model Use

- GUI Driven
- Incorporates
 - Magnetogram Database
 - Extensive List of the more obvious tools
 - Simple interface to 3rd party programs to support yet-to-be-defined heavy duty processing needs
 - DAVE4VM surface flow analysis tool
 - Non-Linear Force Free Model
- Uses CCMC's KAMELEON libraries for internal file formatting and interpolation
- Visualization Tool
- Beta Version delivered Jan 2013.



CCMC
Products



COMMUNITY
COORDINATED
MODELING
CENTER

MAGIC

The screenshot displays the MAGIC software interface. The main window has a menu bar with 'Kameleon', 'Operations', 'Grid', 'Display', 'Magnetogram Database', and 'Options'. A dialog box titled 'Select Magnetograms to Download' is open, showing a list of magnetogram entries with checkboxes for selection. The list includes entries for 'GONG Big bear', 'GONG Cerro tololo', 'GONG El teide', 'GONG Learmonth', and 'GONG Mauna loa' for both 2012-05-05 and 2012-05-06. The dialog also has 'Select All' and 'Deselect All' buttons, a 'Convert to MAGIC format' checkbox, and 'OK' and 'Cancel' buttons at the bottom. To the right, a 'Magnetogram Database' panel is visible, showing search criteria for 'M SS)' and 'SS)', with values '2012 05 05 00 00 00' and '2012 05 06 00 00 00' respectively. It also has checkboxes for 'Line of Sight', 'Vector', 'Full Disk', 'Active Region', 'GONG', 'MDI', 'HMI', and 'SOLIS', along with a 'Cancel' button.

tk

Kameleon Operations Grid Display Magnetogram Database Options

Select Magnetograms to Download

Select All Deselect All

Convert to MAGIC format

- GONG Big bear 2012-05-05 00:00:00
- GONG Big bear 2012-05-06 00:00:00
- GONG Cerro tololo 2012-05-05 00:00:00
- GONG Cerro tololo 2012-05-06 00:00:00
- GONG El teide 2012-05-05 00:00:00
- GONG El teide 2012-05-06 00:00:00
- GONG Learmonth 2012-05-05 00:00:00
- GONG Learmonth 2012-05-06 00:00:00
- GONG Mauna loa 2012-05-05 00:00:00
- GONG Mauna loa 2012-05-06 00:00:00

OK Cancel

Magnetogram Database

M SS): 2012 05 05 00 00 00

SS): 2012 05 06 00 00 00

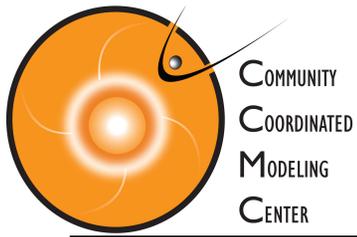
Line of Sight Vector

Full Disk Active Region

GONG MDI HMI

SOLIS

Cancel



tk

Kameleon Operations Grid Display Magnetogram Database Options

- Interpolate...
- Time Interpolation...
- Monopole subtraction...
- Combine...
- Combine using minimization...
- Combine into synoptic map...
- Project vectors...
- Map Projection...
- Differential Rotation...
- DAVE4VM...
- Potential Field Source Surface...**
- Prepare for ADAPT3D...
- ADAPT3D...
- Prepare for NLFFF...
- NLFFF...

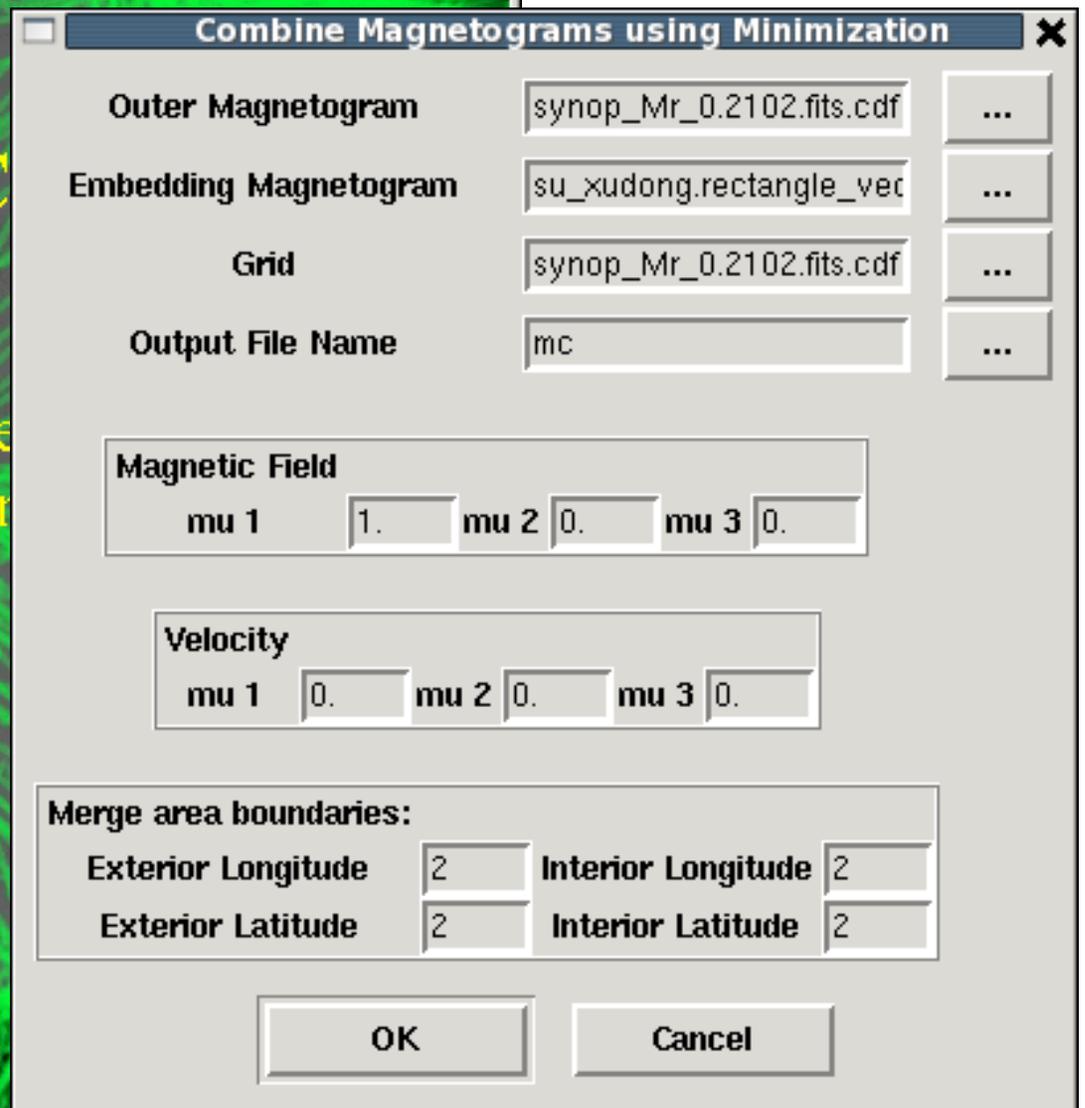
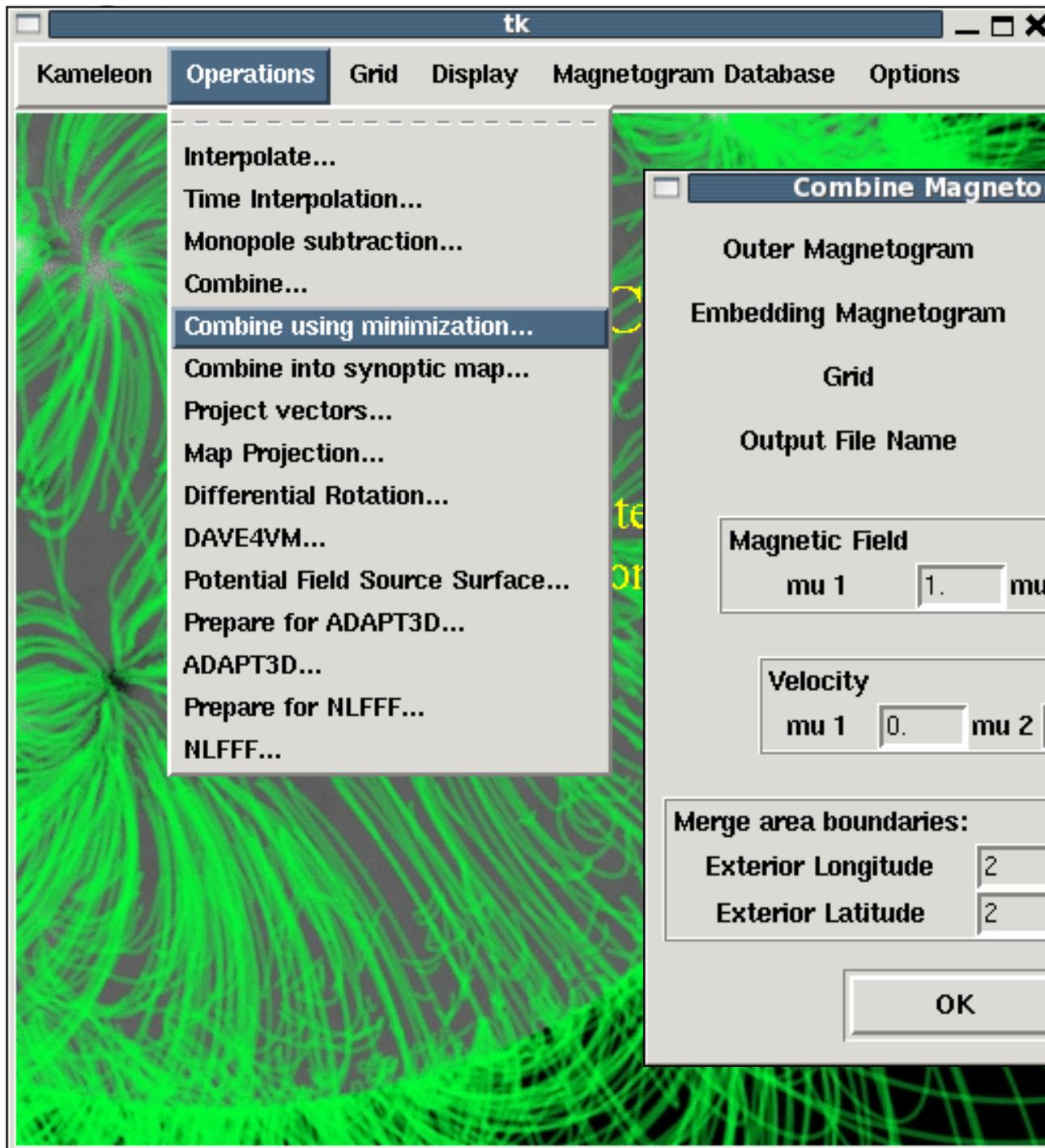
terpolation
on tool

PFSS

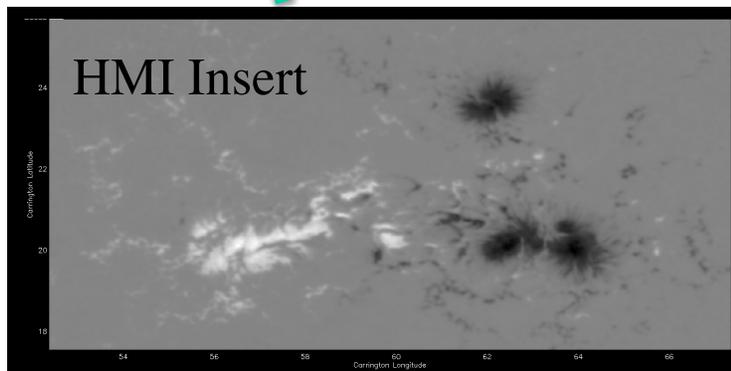
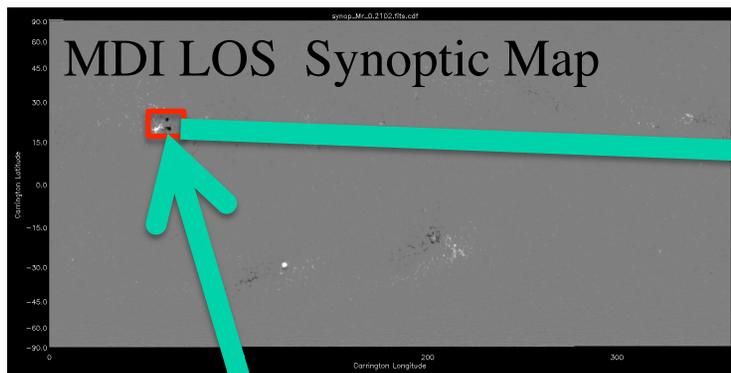
Input file ...

Number of harmonics

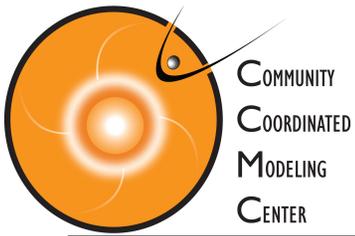
OK Cancel



Embed SDO/HMI vector magnetogram in MDI synoptic map



- Inserts limited FOV magnetograms into global magnetograms
- Adjusts field in border region using minimization of user defined integrals that balance
 - smoothness
 - agreement with original field
 - user defined integrals of current density or helicity



tk

Kameleon Operations Grid Display Magnetogram Database Options

Interpolate...
Time Interpolation...
Monopole subtraction...
Combine...
Combine using minimization...
Combine into synoptic map...
Project vectors...
Map Projection...
Differential Rotation...
DAVE4VM...
Potential Field Source Surface...
Display for ADAPT3D

Interpolation on tool

Make Synoptic Map

List File ...

Output

Project LOS to R

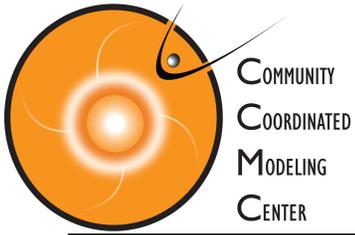
Weights

Longitude resolution

Latitude resolution

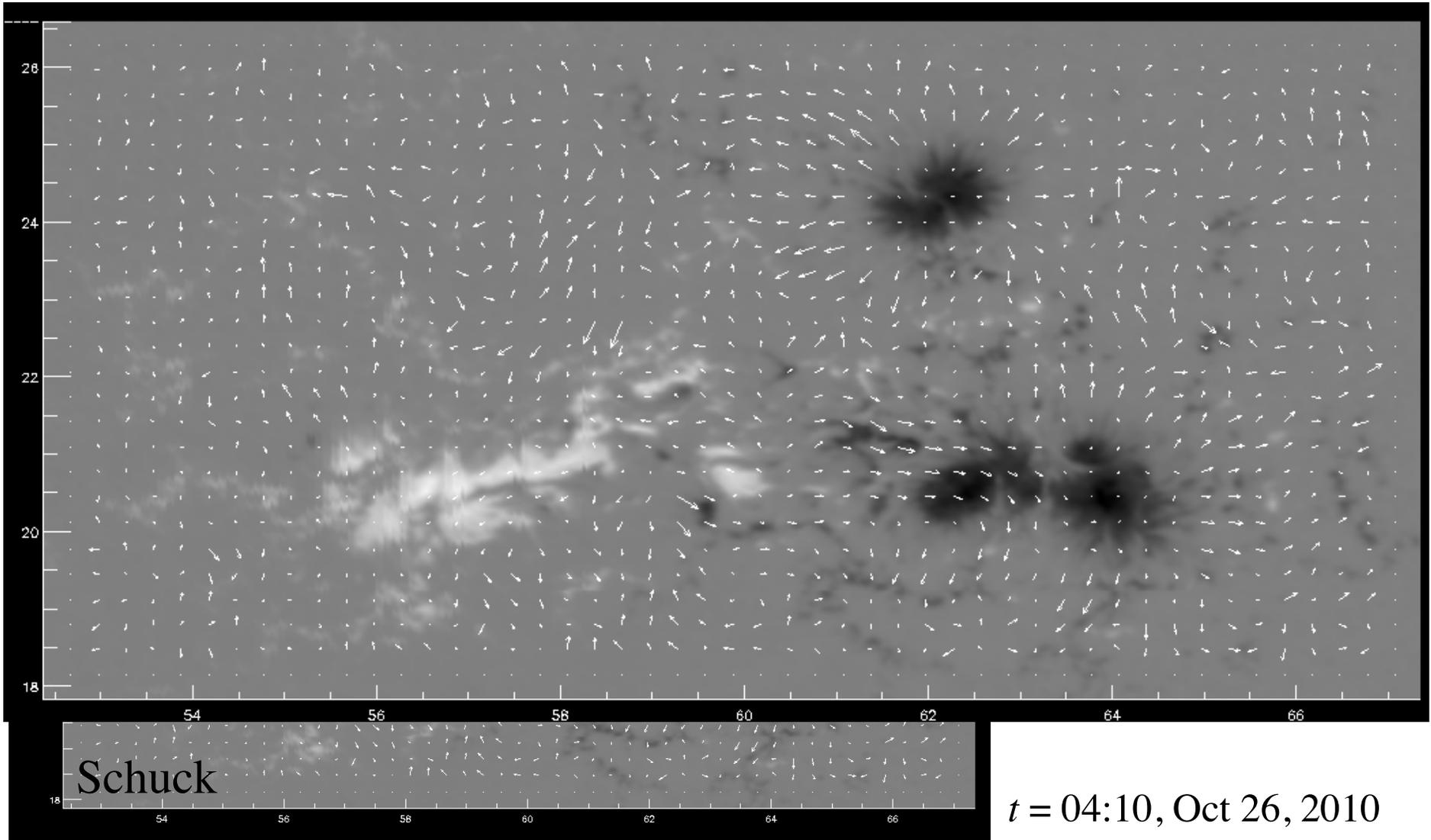
Longitude range

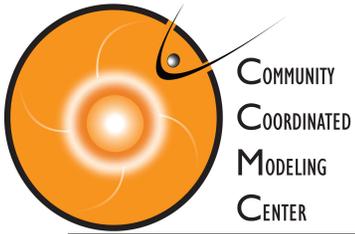
OK Cancel



MAGIC

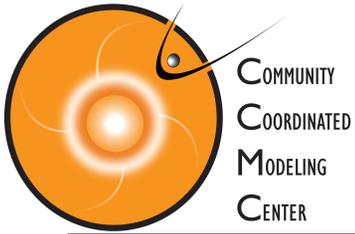
Surface flow analysis





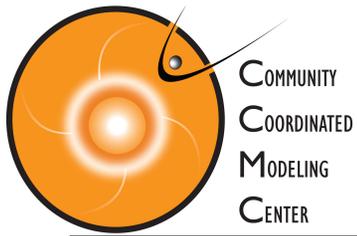
Supporting Efficient Model Execution

- MAGIC is a GUI driven application.
- You cannot stop a large parallel MHD code every timestep to get a new boundary state.
- Solution – process entire magnetogram time series in advance.
 - Return B-spline coefficients of a temporal fit to B and v at each node of the model's surface grid
- Only need to pause and rerun MAGIC if surface grid changes

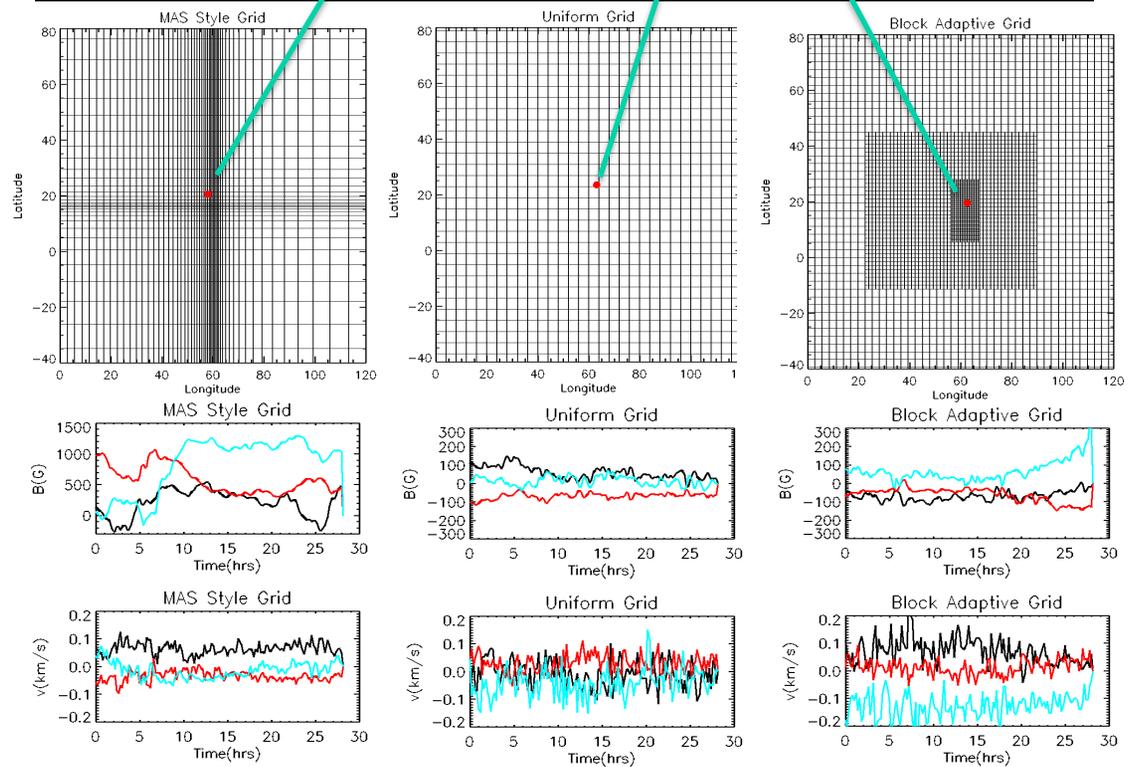
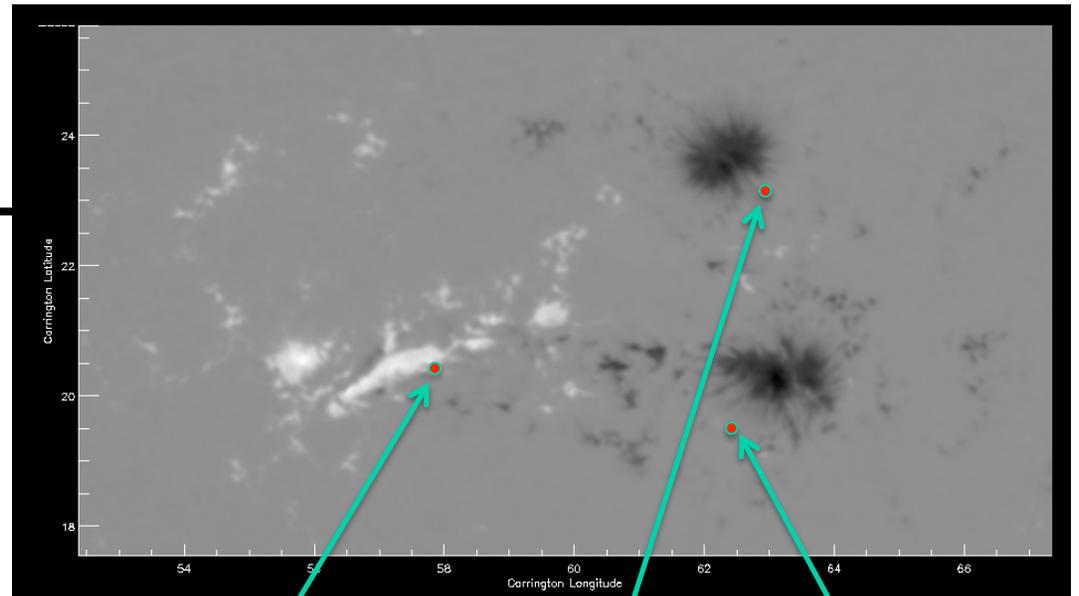


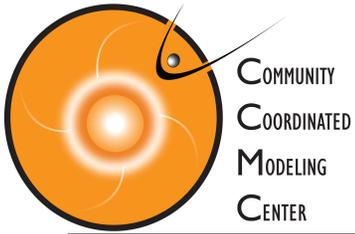
Supporting all Models

- MAGIC supports all grid types in use in current coronal models!
 - ADAPT3D – unstructured tetrahedral
 - NLFFF – evenly spaced
 - MAS – lat/lon with uneven spacing
 - SWMF – block adaptive
 - ARMS – block adaptive
 - WSA - evenly spaced



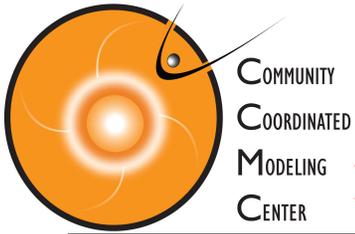
- AR11117
- HMI Vector magnetogram time series
- Grids
 1. MAS
 2. Uniform spacing
 3. SWMF, ARMS
- B-spline timeline reconstruction at grid nodes for B, v





MAGIC

- Interface supporting third party applications
 - Any third party program, provided it can read from, and write to, our Kameleon file format.
 - We provide sample read and write routines in both C and Fortran.



Web Page

http://einstein.physics.drexel.edu/~solarweather/m_installation.html

MAGIC

einstein.physics.drexel.edu/~solarweather/m_index.html

Welcome to ...on Webmail Matrix - Search AT&T Univer...Card: Home FAQs - Nintendo

MAGIC

Site Under Construction

MAGnetogram Interpolation and Composition (MAGIC)

Home Project Overview Documentation Downloads About Us

Contact

Description

Models of the Solar Corona and Inner Heliosphere use measurements of the magnetic field at or near the solar surface. MAGIC is a powerful tool developed to enable the synthesis of solar magnetic field data for use in models of the Solar Corona.

Quick Links

- [MAGIC: Project Overview](#)
- [Active Region Evolution Model Suite](#)
- [Determining Surface Flow Magnetogram Database](#)
- [Living With A Star AISRP](#)

Acknowledgments

This project has been funded by NASA's Living With a Star and Applied Information Science Research Programs.

Bringing Solar Magnetic Fields into Coronal Models

A GUI DRIVEN SUITE OF TOOLS ESIS

Currently working to update content!

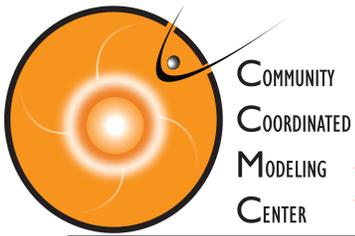
Posted by Peter MacNeice on April 18, 2013 • No associated article

We are currently updating the material on this website in preparation for posting the beta release version. This update should be complete by May 1, 2013.

Content in a preliminary state and subject to regular revision!

Posted by Peter MacNeice on May 14, 2012 • Comments (64) • No associated article

This is the initial skeleton of the web page. Expect revisions on an ongoing basis.



Web Page

http://einstein.physics.drexel.edu/~solarweather/m_installation.html

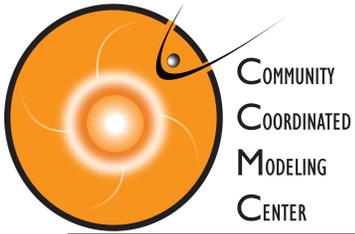
The image displays two overlapping browser windows showing the MAGIC website. The left window is titled 'Tutorial' and shows the 'Tutorial' page. The right window is titled 'Project Details: Surface Flow' and shows the 'Project Details: Surface Flow' page. Both pages feature a navigation menu, a sidebar with 'Contact', 'Description', 'Quick Links', and 'Acknowledgments', and a main content area with text and a screenshot of the MAGIC software interface.

Left Window (Tutorial):

- URL: einstein.physics.drexel.edu/~solarweather/m_tutorial.html
- Page Title: Tutorial
- Header: Site Under Construction
- Section: **MAGnetogram Interpolation and Composition (MAGIC)**
- Navigation: Home, Project Overview, Documentation, Downloads, About Us
- Sidebar: Contact, Description, Quick Links, Acknowledgments
- Main Content: Welcome to the Tutorial page! Tutorial in preparation - Stay Tuned - April 18, 2013! MAGIC is a very 'feature rich' tool suite for general processing of magnetograms. On this page you will find a number of tutorials on how to perform some of these tasks. By reviewing some of these tutorials it should quickly become apparent to a user how they can apply other tools available in the suite. Before studying these tutorials, it is important to have a clear idea of MAGIC's basic design. MAGIC is accessed through its GUI. The GUI presents a toolbar whose entries present a set of drop down menus from which a user can execute different processing tasks. MAGIC uses the KAMELEON libraries, developed by the CCMC, to convert input files into a standard format (in this case the NASA CDF format). Once in this format, all the MAGIC tools can read these files and will return processed output in the same format. Therefore, most applications can be described as a series of basic steps:
 - Search the web for appropriate magnetograms
 - Select the magnetograms to be used and download them
 - Convert the downloaded files into CDF format
 - Find the desired operation in the toolbars drop down menus and launch it.

Right Window (Project Details: Surface Flow):

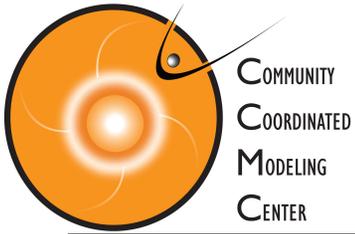
- URL: einstein.physics.drexel.edu/~solarweather/m_tutorial_42.html
- Page Title: Project Details: Surface Flow
- Header: Site Under Construction
- Section: **MAGnetogram Interpolation and Composition (MAGIC)**
- Navigation: Home, Project Overview, Documentation, Downloads, About Us
- Sidebar: Contact, Description, Quick Links, Acknowledgments
- Main Content: Tutorial - Execute Magnetogram Database Query. Click 'Magnetogram Database' on the toolbar and then select 'Query' from the drop down menu. Includes a screenshot of the MAGIC software interface showing a toolbar with 'Update' and 'Query' buttons, and a plot of magnetic field lines with the text 'MAGIC: A Magnetogram Interpolation and Composition tool'.



Status

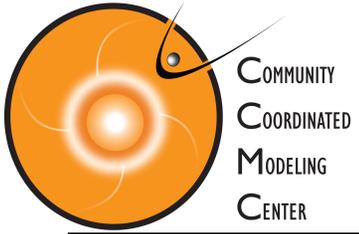
- Beta version delivered Jan 2013
- Latest version downloadable from web site
 - Tested on both Linux and OS X
- Building extensive set of tutorials
- Collaborating with NSO
- Collaborating with U.Michigan Strategic Capability

http://einstein.physics.drexel.edu/~solarweather/m_index.html



CCMC Specific Applications

- Customized synoptic map creation
- NLFFF Code will feed ISWA estimates of free-energy build up in active regions



The End