

SPACEINN WP4 Helioseismology

Deliverable D4.8 Web site providing access to simulated data

Coordinated by the Max-Planck-Institut für Sonnensystemforschung (MPG)

Following the recommendations of the first local helioseismology working group meeting (see D4.9), the selected simulation codes are available under 'Modelling Tools' and the selected data sets are available under 'Simulated Data' in the SPACEINN local helioseismology website: <http://www.mps.mpg.de/projects/seismo/SpaceInn/index.html> .

Screen shots of the webpages are shown below (Figs. 1-4).



The screenshot shows the homepage of the SPACEINN local helioseismology website. At the top left is the SpaceInn.eu logo, a blue triangle with white text and a yellow starburst. To its right is the Max Planck Institute for Solar System Research (MPS) logo. The main heading is 'Exploitation of Space Data for Innovative Helio- and Asteroseismology', with 'Helioseismology' below it. A vertical navigation menu on the left includes: Home, Outreach, Observations, Helioseismology Tools, Modeling Tools, Simulated Data, Links, Meetings, and GDC-SDO Help Desk. A blue 'Welcome' banner is on the right. Below it, a paragraph explains the project's goals and its successor, HELAS. A 'What is local helioseismology & why is it important?' section follows, describing solar oscillations and their use in studying the Sun's interior. At the bottom left are logos for the SEVENTH FRAMEWORK PROGRAMME and HELAS. A 'webmaster' link is at the bottom right.

Figure 1. Screen shot of the top page of SPACEINN local helioseismology website



Max Planck Institute for
Solar System Research



Exploitation of Space Data for Innovative Helio- and Asteroseismology

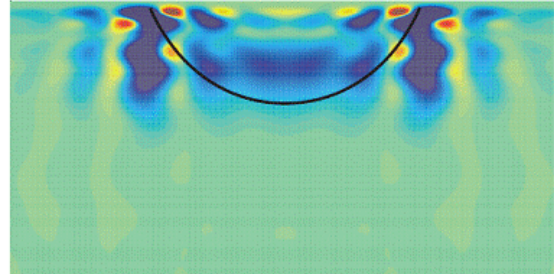
Helioseismology

- Home
- Outreach
- Observations
- Helioseismology Tools
- Modeling Tools
- Simulated Data
- Links
- Meetings
- GDC-SDO Help Desk

Modelling Tools

Tools for local helioseismology modelling.

- ▶ [SLiM](#)
- ▶ [SPARC](#)
- ▶ [CSM models](#)
- ▶ [Sunspot model](#)
- ▶ [Sunspot simulations \(Rempel\)](#)
- ▶ [Flux tube model](#)
- ▶ [Eigenvalues & Eigenfunctions](#)
- ▶ [Ray tracing](#)
- ▶ [Born Kernels](#)
- ▶ [CO5BOLD waves](#)



[webmaster](#)

Figure 2. Screen shot of the website for modeling tools

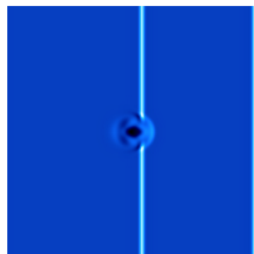


Exploitation of Space Data for Innovative Helio- and Asteroseismology

Helioseismology

- Home
- Outreach
- Observations
- Helioseismology Tools
- Modeling Tools
- Simulated Data
- Links
- Meetings
- GDC-SDO Help Desk

Semi-spectral Linear MHD (SLiM)



This version of the Semi Spectral Linear MHD code propagates a wave packet (f , p_1 , p_2 etc) through a box ($145 \text{ Mm} \times 145 \text{ Mm} \times 12 \text{ Mm}$) in the horizontal direction of near surface solar atmosphere. The atmosphere may contain anomalies such as sunspots, or flows. The code calculates the derivatives spectrally in horizontal space, finite difference method in depth and using a Lax-Wendroff scheme in time.

If you use this code and/or its results, please contact [schunker \[at\] mps.mpg.de](mailto:schunker[at]mps.mpg.de), for the appropriate acknowledgement.

Documentation:

[SLiM: a code for the simulation of wave propagation through an inhomogeneous, magnetised solar atmosphere](#), 2007, Cameron, Gizon &

Daiafallah, *Astronomische Nachrichten*, 328, 313

Downloads:

[SLiMv0.1 package](#)

[Libraries](#) you may need.

[webmaster](#)

Figure 3. Screen shot of an example of some modeling tools (SLiM code example)

- Home
- Outreach
- Observations
- Helioseismology Tools
- Modeling Tools
- Simulated Data
- Links
- Meetings
- GDC-SDO Help Desk

Simulated Data

Index:

- [1. Spherical-shell simulations of magnetoconvection](#)
- [2. Numerical Simulations of linear waves/modes in complex media](#)
- [3. Box simulations of compressible magnetoconvection](#)

1. Spherical-shell simulations of magnetoconvection

Names	Link/Contact person	Comments and References
ASH (anelastic spherical harmonic) simulation	website Contact: S. Brun (CEA) sacha.brun@cea.fr	3D anelastic HD and MHD simulations, shell up to $0.98 R_{\text{sun}}$, full sphere ($r=0$) now possible. Availability: Data available on demand (Any of Sacha Brun's 2-D or 3-D data are available on demand, HD or MHD). Contact Sacha Brun. References: e.g. Brun, Miesch & Toomre 2004 ApJ more reference info
MagIC	Contact: Wicht (MPS)	Anelastic stellar simulation. Availability: To be confirmed References: Wicht 2002 Physics of the Earth and Planetary Interiors Gastine and Wicht 2012 Icarus
MHD EULAG	Contact: Charbonneau (Universite de Montreal)	Global MHD simulation of convection zone (Anelastic simulation). Availability: To be confirmed References: e.g. Cossette, Charbonneau, Smolarkiewicz 2013, ApJL
AMaTeRAS (AMR Magnetohydrodynamics code with Technique of RSS for Astro- and Solar physics)	Contacts: Hotta (Univ. Tokyo) hotta.h@eps.s.u-tokyo.ac.jp M. Rempel (HAO) rempe1@ucar.edu	Simulation with reduced sound speed. References: e.g. Hotta et al. 2012 A&A



2. Numerical Simulations of linear waves/modes in complex media

Names	Link/Contact person	Availability
SPARC and Glass	website Contact: S. Hanasoge hanasoge@mps.mpg.de E. Papini (MPS) papini@mps.mpg.de	SPARC : Linear HD, plane-parallel geometry Glass : Linear HD, 3D spherical geometry – full sphere Availability: SPARC codes can be downloaded from the website
SLiM (Semi-spectral Linear MHD) code	website Contact: R.Cameron (MPS) cameron@mps.mpg.de H. Schunker (MPS) schunker@mps.mpg.de	Simulation of wave propagation through an inhomogeneous, magnetised solar atmosphere Cameron et al. 2007 AN Availability: Older version is available on the web. For newer version contact Cameron.
IAC MHD Mancha code	website Contact: T. Felipe(NWRA) tobias@cora.nwra.com E. Khomenko(IAC) khomenko@iac.es	The current working version of the code is 2.5D/3D magnetohydrodynamical code with hyper diffusion algorithms and Cartesian grid written in Fortran 90 (2.5D means that all vector quantities are in three dimensions, while the derivatives are only done in two dimensions). Availability: Contact Felipe or Khomenko for current version data. Newer version will be available at the webpage around later 2014.
SAC code	Sheffield group	Reference: Shelyag et al. 2008 A&A , Shelyag et al. 2009 A&A
Pencil Code	website	Codes for high-order finite-difference code for compressible hydrodynamic flows with magnetic fields. Availability: open, extendable code
Artificial helioseismology data by Thomas Hartlep	website Contact: Thomas Hartlep (see website)	Numerical simulations of helioseismic oscillations in a 3D full sphere Sun. Several datasets with different setups are available. Availability: Datasets are downloadable from the website
Artificial helioseismology data by K. Parchevsky	Contact: K. Parchevsky	3D simulation of acoustic waves in the solar upper convection zone. Reference: e.g. Parchevsky & Kosovichev 2007 ApJ

3. Box simulations of compressible magnetoconvection

Names	Link/Contact person	Comments
MURaM	website Contact: M. Rempel (HAO) rempe1@ucar.edu R. Cameron (MPS) cameron@mps.mpg.de	3D MHD simulation including radiative transfer Reference: Voelger et al. 2005 A&A Availability: Will be open on their website Currently no documents for users yet. Some snapshots and shorter time series (1-2hr) are available at MPS. For this, contact R. Cameron. For sunspot data and longer (1day -) data, contact M. Rempel.
STAGGER	website Contact: Bob Stein (Michigan State Univ.) steinr@msu.edu	3D MHD convection simulation. Reference: e.g. Stein et al. 2009 AIPC , Stein et al 2009 ASPC , Stein 2012 LRSP Availability: Some datacubes are available on the website. Selected datacubes (96Mm×96Mm×20Mm, 5hr) of Quiet Sun (with weak magnetic field) are available at MPS. For this, contact: K. Nagashima (MPS) nagashima@mps.mpg.de
Bifrost	Research Group in Oslo	Stellar atmosphere simulation from the convection zone to the upper atmosphere (corona). Reference: Gudikson et al. 2011, A&A
C05BOLD	website	3D radiative hydrodynamics simulation Reference: Freytaet et al. 2012 J. Nutto, Steiner, Roth 2012 A&A
Pencil Code	website	Availability: Codes are open and extendable

[webmaster](#)

Figure 4. Screen shot of the website for simulated data