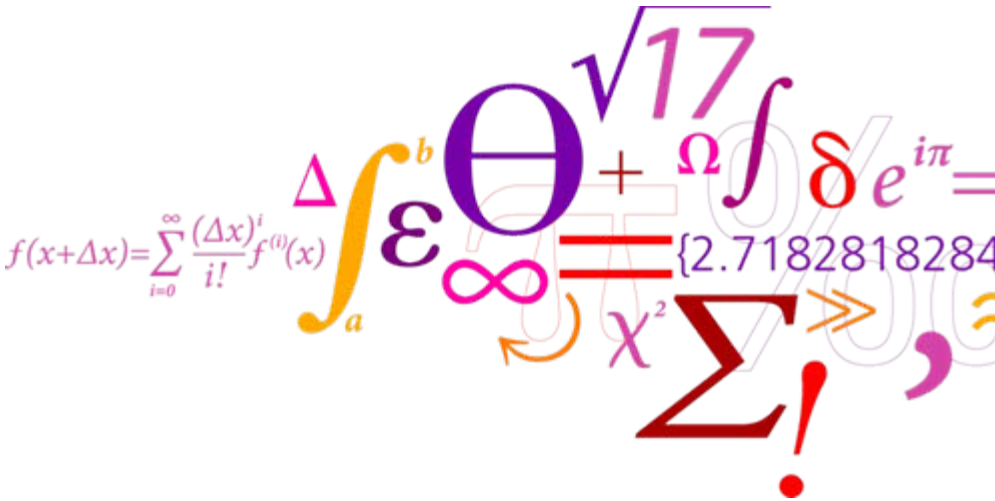
User Feedback: Heliospheric Models

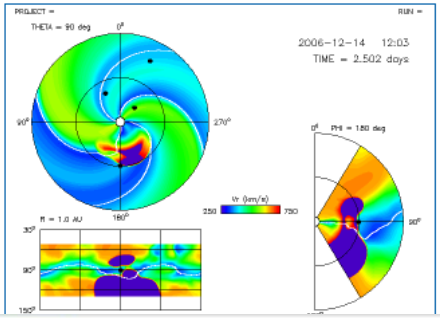
Thea Vilstrup Falkenberg, Master of Science in Engineering, Applied Physics
Ph.D. student, DTU Space

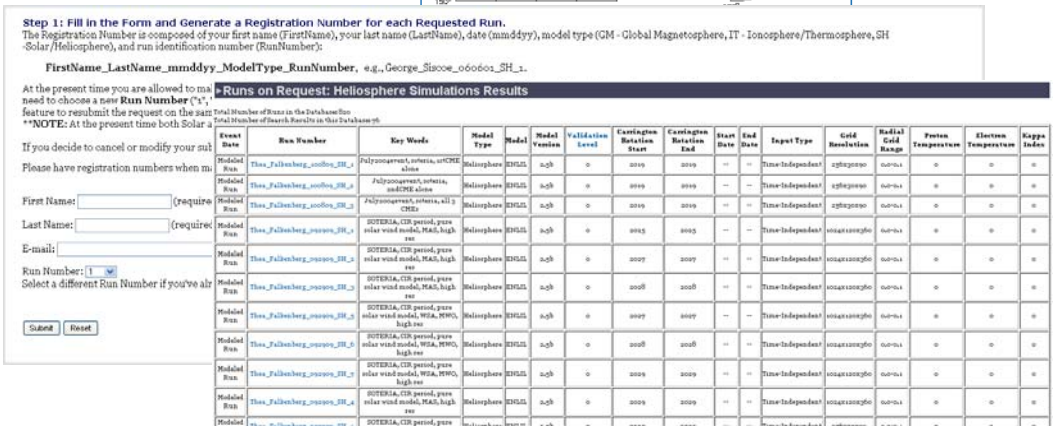


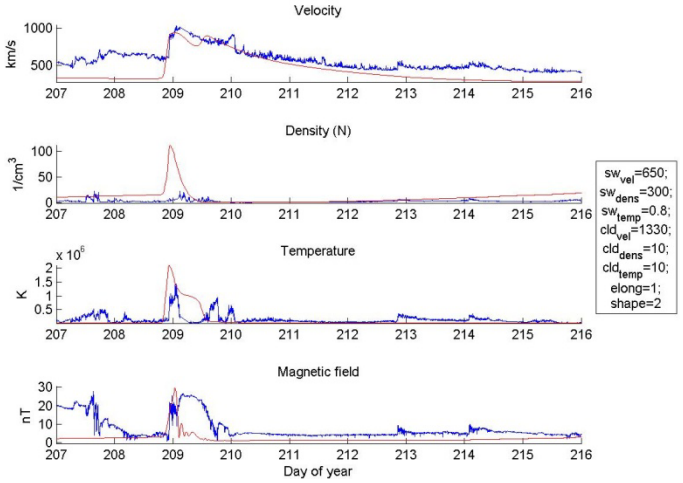
DTU Space
National Space Institute

Outline

- Model (ENLIL)
- Interface walk-through
  - How to request a run
  - How to access a run
- What I use ENLIL for
- SOTERIA
- Suggestions for improvements of the interface







ENLIL with Cone Model

CCMC Services available for ENLIL with Cone Model
Request a Run
View Request Results

Model Developer(s)
D. Odstrcil
University of Colorado at Boulder

Model Description
ENLIL is a time-dependent 3D MHD model of the heliosphere. It solves equations for plasma mass, momentum and energy density, and magnetic field, using a Flux-Corrected-Transport (FCT) algorithm. Its inner radial boundary is located beyond the sonic point, typically at 21.5 or 30 solar radii. It can accept boundary condition information from either the WSA or MAS models. The outer radial boundary can be adjusted to include planets or spacecraft of interest (eg 2 AU to include both Earth and Mars, 5 AU to include Ulysses, 10 AU to include Cassini). It covers 60 degrees north to 60 degrees south in latitude and 360 degrees in azimuth.

ENLIL + Cone Model Description:
ENLIL cone model forecasts CME propagation from the ENLIL inner boundary (which is usually at 21.5 Rs) to the point of interest. The cone model is based on the idea that close to the Sun CME propagates with constant angular and radial velocity, and so has the shape of a cone. ENLIL takes the cone model input parameters at its inner boundary. These input parameters are the following:

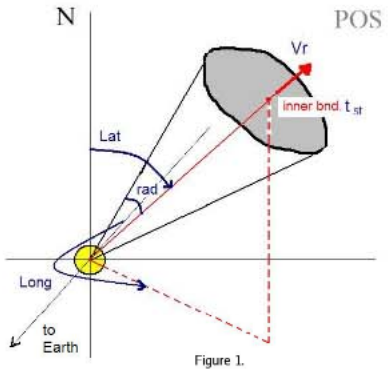


Figure 1.

1. Start date (yyyy-mm-dd).

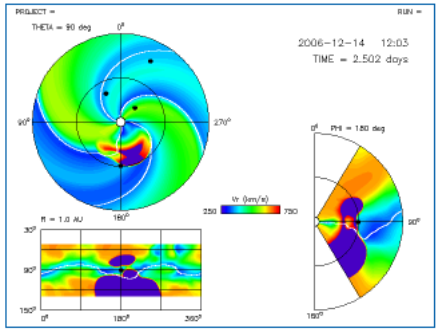
2. Start time (hh-mm)
This is the moment of time (UT) when the CME reaches ENLIL inner boundary.

3. Cone latitude (deg).
Co-latitude of the cone axis (angle **Lat** in the Figure 1)

4. Cone longitude (deg).
Longitude of the CME cone axis (angle **Long** in the Figure 1, (note Long=180 degrees is in the Earthward direction)

5. Cone radius (deg).
Angular width of the cone (angle **rad** in the Figure 1).

6. Radial velocity (km/s) at the ENLIL inner boundary.



References and relevant publications
Xie et al., JGR, vol 109, A03109; doi:10.1029/2003JA010226, 2004.

Relevant links

- General description of ENLIL model
- Description of the data structure and organization in the ENLIL
- General description of Solar wind, time description systems & coordinate systems used and more. This file also contains instructions for installation.

CCMC Contact(s)
Peter MacNeice
301-286-2061

Developer Contact(s)
D. Odstrcil

Interface: request a run

Step 1: Fill in the Form and Generate a Registration Number for each Requested Run.
The Registration Number is composed of your first name (FirstName), your last name (LastName), date (mmddyy), model type (GM - Global Magnetosphere, IT - Ionosphere/Thermosphere, SH -Solar/Heliosphere), and run identification number (RunNumber):

FirstName_LastName_mmddyy_ModelType_RunNumber, e.g., George_Siscoe_060601_SH_1.

At the present time you are allowed to make up to 4 different submissions on the the same date (mmddyy) for each model type. For each new submission made on the same date for the same model type you need to choose a new **Run Number** ("1", "2", "3", or "4"). Multiple submissions made on the same date with the same Run Number and Model Type will overwrite the previous submission. You can use this feature to resubmit the request on the same date.
NOTE: At the present time both Solar and Heliospheric models are **Model Type SH**

If you decide to cancel or modify your submission at later date, please contact the CCMC staff.

Please have registration numbers when making inquiries about your requests. You will need your registration number to view the results when the simulations have finished.

First Name: [ ] (required)

Last Name: [ ] (required)

E-mail: [ ] (required)

Run Number: [1]
Select a different Run Number if you've already requested any Solar **OR** Heliospheric run today (unless you want to overwrite the run)

[Submit] [Reset]

The Registration Number For This Run Is: Thea_Falkenberg_012110_SH_1

Please have the registration number when making inquiries about the run.

Select Model Type:

- ○ Solar
- ◉ Heliosphere

[Continue]

Interface: request a run

The Registration Number For This Run Is: Thea_Falkenberg_012110_SH_1

Please have the registration number when making inquiries about the run.

Model Type: Heliosphere
Input Type: Time-Independent

Step 2: Choose the Heliosphere Simulation Model:

Exospheric Solar Wind
ENLIL
ENLIL + Cone Model
SWMF

Step 3: Is This a Continuation of a Previous Run or a New Run?

- (•) **New run**
- ( ) **Restart an existing run** *(this option is not yet available)*

Continue

Interface: request a run

Step 4: Define the physical nature of this run

Objective:

- ○ to generate a stationary solar wind solution
- ◉ **to run ENLIL with the cone model**
- ○ to simulate influence of coronal transients on heliosphere *(option not yet available)*

Initial state:

- ◉ analytic prescription
- ○ numerical prescription *(option not yet available)*

Inner radial boundary condition:

- ◉ time-independent
  - ◉ from MAS or WSA solar model output
  - ○ analytic user-defined *(option not yet available)*
- ○ time-dependent *(option not yet available)*

Continue

Interface: request a run

Step 5: Select the model - MAS(CORHEL) or WSA - and choose the Carrington Rotation

Selected model will provide the output to be used as time-independent inner boundary condition for this ENLIL run. Check the availability of Carrington Rotation for the selected model below.

- (•) **MAS(CORHEL)**
  - ( ) Choose a Carrington Rotation from the list of magnetograms available for MAS model: [2014 NOT available - bad magnetogram]
  - ( ) Upload a user-defined magnetogram. Fortran code for generation of user-defined magnetograms can be obtained here. You will be asked to upload your magnetogram at the next step. This option is currently available for MAS model only.
- ( ) **WSA**. Choose a Carrington Rotation from ones available for WSA model:

[2014 (only MWO available)]

Choose Magnegogram Source for WSA/ENLIL runs:

- (•) Mount Wilson observatory
- ( ) Kitt Peak observatory
- ( ) Gong observatory

(If interested in several magnetogram sources, please submit separate runs, one for each magnetogram source).

NOTE: We do provide runs using Gong data. However please be aware that the Gong data is still being used in trial mode and there are some known issues with the polar fields which are currently being studied by the Gong staff.

Step 6: Specify the Number of Cone Clouds (Cone CMEs) for the Run

Number of cone clouds: [1] (up to 5)

(At the next step, you will be asked to specify the properties of all requested clouds).

Select the outer radial boundary

Select **the outer radial boundary**. This will influence the size of grid in radial dimension available to you. For near Earth conditions please select 2 AU.

[2AU]

[Continue]

Interface: request a run

Specify Properties of Fast Solar Wind for the Cone Model

Density: 300 cc
Temperature: 0.8 million K
Speed: 625 km/s

Specify Properties of Cone Cloud(s) for the Run:

Start date/time of model run: 2004-3-8 04:13
End date/time of model run: 2004-4-4 11:29
For all cone cloud(s), please select start dates and times that are within the date/time range of this run (see above)

Cloud 1:

Cloud start date: yyyy-mm-dd (date when cloud center at inner boundary)
Cloud start time: hh:mm (time when cloud center at inner boundary)
Co-latitude of cloud center: 87 (north=0, equator=90, south=180 degs)
Longitude of cloud center: 181 Range: 90 - 270 degs, where 180 deg is earthward
Radius of cloud: 25 Range: 0 - 90 deg
Cloud velocity: 650 Recommended range: 500 - 2000 km/s
Density enhancement factor: 4 (Cloud density over fast stream value). Range: 1 - 10
Temperature enhancement factor: 1 (Cloud temperature over fast stream value). Range: 0.5 - 10
Elongation factor of the trailing part of the cloud: 1 (1 for sphere, 2 for twice longer and so on up to 5)
Shape of the cloud: spherical

Set the Simulation Grid

Select **grid resolution (NRxNTxNP)** from predefined list (more options are coming soon)
256x30x90

Continue

Interface: request a run

Run objective: cone_model
Initial state: analytic_prescription
Boundary condition: time-independent
Time-independent boundary condition type: from_MAS_model
Carrington Rotation: 2014
Simulation grid: 256x30x90
Outer boundary: Mars
Observatory: MWO

The results of the run you requested will be made available to the general research community via our web-based interface.

Please provide below brief comments about the run that may be helpful to other visitors. This information will be published on the Web as a **Title and Introduction** to the results of the run you requested.

Please provide a **Key Word** that will help sort and search the results of simulations via our web-based interface, especially if you are submitting a series of runs.

Key Word: (required)

You may provide here **comments** about this Web interface and describe additional desirable options of the output data analysis (not required). This information will be reviewed by the CCMC staff and will not be published on the Web.

SUBMIT REQUEST FOR AUTOMATIC PROCESSING.
RESET

Special Request

If you are submitting a Special Request please check this box: ☐.

Special Requests are not submitted for automatic processing. Special Requests are reviewed and manually modified by the CCMC staff. Processing of Special Requests may be delayed. On Special Request some default restrictions may be removed. Special Requests are executed only if resources are available.

Describe your Special Request in the field below. Please provide a short justification.

SUBMIT SPECIAL REQUEST RESET

Interface: find a run

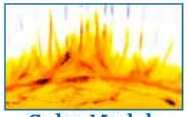
About US | Space Weather Models at CCMC | Request A Model Run | View Model Run Results | Instant Run | Experimental Real-Time Simulations

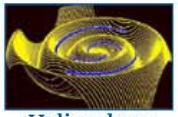
Home | STEREO support | Search run database | Publications policy | Special sun-earth connection events | 3D VRML output for selected events | Request run output

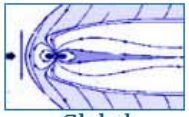
View Results of Requested Runs

View the results of your requested run as well as the results of runs submitted by other users.

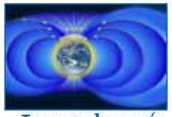
CCMC Publications Policy: If you use the results from the Runs on Request in a scientific publication or presentation, please acknowledge the originators of the computational model and the CCMC. For more details see the detailed policy description.
Note: For tracking purposes for our government sponsors, we ask that you notify the CCMC whenever you use CCMC results in scientific publications or presentations by emailing CCMC .


Solar Models Runs Results


Heliosphere Models Results


Global Magnetosphere Models

INNER Magnetosph. Models


Ionosphere / Thermosphere Models Results

Mission Support

- **STEREO**
  View output from the daily WSA, ENLIL and PFSS model runs.
- **THEMIS**
- **MMS**
- **SOTERIA**

Search the Simulation Results Database

Search and view simulation results for all model runs executed at the CCMC over the last four years. We maintain a comprehensive searchable and sortable database of all executed runs.

Simulations of Special Sun-Earth Connection Events

View results of Special Sun-Earth Connection Event Simulations. Such event is usually a big storm or a series of storms that attract the attention of the space science community. Working groups such as Geospace Environment Modeling (GEM) or SHINE sometimes identify Special Sun-Earth Connection Events. The CCMC provides model run results for such events:

- SHINE Campaigns support
- CAWSES Internet Campaign support

3D VRML Output for Selected Events

View VRML Output for selected events. Virtual Reality Markup Language (VRML) files are created with the Space Weather Explorer (SWX), an OpenDX application developed at CCMC. Magnetospheric VRML files contain the plasma density in two slices and a selection of 3D magnetic field lines in the magnetosphere emanating from the Earth and field lines transported with the solar wind. Files have been created from simulations of selected space weather events.

CDF output for a run

Request **CDF-formatted output** for a CCMC request.

Interface: find a run

Heliosphere Simulation Results

- View ALL Heliosphere Runs on Request
- View Runs for the following model(s):
  - (•) ENLIL
  - ( ) Heliospheric Tomography
  - ( ) Exospheric Solar Wind Model
  - ( ) SWMF

[View Runs]

SEARCH heliosphere requests database for string(s): Falkenberg

For multiple strings, please separate them with AND or OR operators
If searching for a date, use the following format: YYYY/MM/DD.

(•) **Search In All Columns**
or
( ) **Search In Columns Below** (Key words automatically included, feel free to choose multiple columns):

- [x] Run Number
- [ ] Run Requestor's Last Name
- [ ] Date of Request
- [ ] Model
- [ ] Carrington Rotation
- [ ] Event Date
- [ ] Input Type
- [ ] Run Type

[Find it!]

Interface: find a run

▸Runs on Request: Heliosphere Simulations Results

Total Number of Runs in the Database: 820
Total Number of Search Results in this Database: 76

Event Date	Run Number	Key Words	Model Type	Model	Model Version	Validation Level	Carrington Rotation Start	Carrington Rotation End	Start Date	End Date	Input Type	Grid Resolution	Radial Grid Range	Proton Temperature	Electron Temperature	Kappa Index
Modeled Run	Thea_Falkenberg_100809_SH_1	July2004event, soteria, 1stCME alone	Heliosphere	ENLIL	2.5b	0	2019	2019	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_100809_SH_2	July2004event, soteria, 2ndCME alone	Heliosphere	ENLIL	2.5b	0	2019	2019	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_100809_SH_3	July2004event, soteria, all 3 CMEs	Heliosphere	ENLIL	2.5b	0	2019	2019	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_1	SOTERIA, CIR period, pure solar wind model, MAS, high res	Heliosphere	ENLIL	2.5b	0	2025	2025	--	--	Time-Independent	1024x120x360	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_2	SOTERIA, CIR period, pure solar wind model, MAS, high res	Heliosphere	ENLIL	2.5b	0	2027	2027	--	--	Time-Independent	1024x120x360	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_3	SOTERIA, CIR period, pure solar wind model, MAS, high res	Heliosphere	ENLIL	2.5b	0	2028	2028	--	--	Time-Independent	1024x120x360	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_5	SOTERIA, CIR period, pure solar wind model, WSA, MWO, high res	Heliosphere	ENLIL	2.5b	0	2027	2027	--	--	Time-Independent	1024x120x360	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_6	SOTERIA, CIR period, pure solar wind model, WSA, MWO, high res	Heliosphere	ENLIL	2.5b	0	2028	2028	--	--	Time-Independent	1024x120x360	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_7	SOTERIA, CIR period, pure solar wind model, WSA, MWO, high res	Heliosphere	ENLIL	2.5b	0	2029	2029	--	--	Time-Independent	1024x120x360	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_4	SOTERIA, CIR period, pure solar wind model, MAS, high res	Heliosphere	ENLIL	2.5b	0	2029	2029	--	--	Time-Independent	1024x120x360	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092009_SH_1	SOTERIA, CIR period, pure solar wind model	Heliosphere	ENLIL	2.5b	0	2025	2025	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092009_SH_2	SOTERIA, CIR period, pure solar wind model	Heliosphere	ENLIL	2.5b	0	2027	2027	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092009_SH_3	SOTERIA, CIR period, pure solar wind model	Heliosphere	ENLIL	2.5b	0	2028	2028	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled	[illegible]	SOTERIA, CIR period, pure	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Viewing the run

Thea_Falkenberg_020909_SH_29

Title/Introduction:

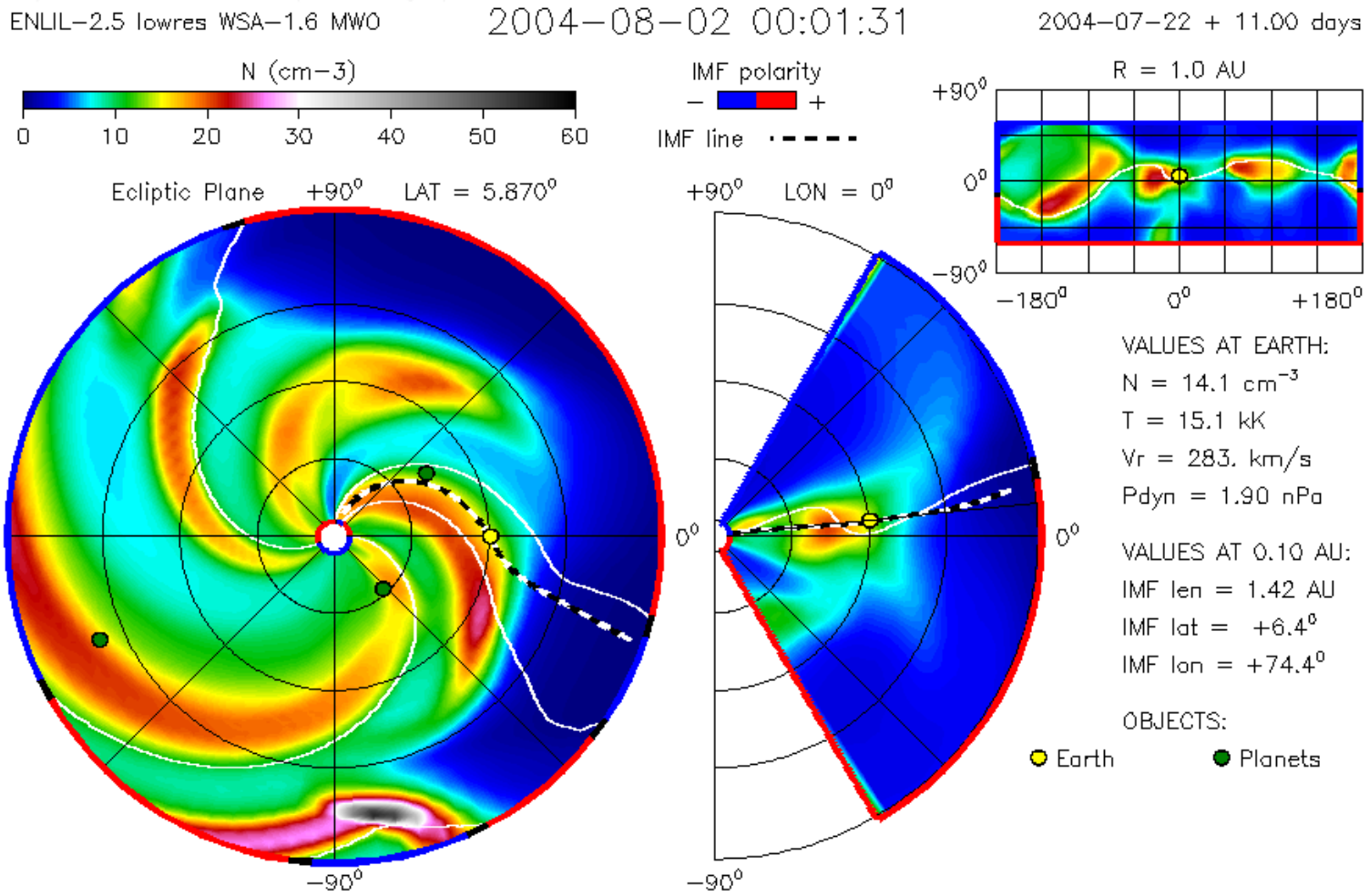
Key Word: July2004event, soteria

Model Type: Heliosphere
Model: ENLIL
Run Objective: cone_model
Initial State: analytic_prescription
Boundary Condition Type: Time-Independent
Inner Boundary Condition: from_WSA_model input
Outer Boundary: Mars
Simulation Grid: 256x30x90
Carrington Rotation: 2019

- View 3D Data
- View control file with input parameters for the run.
- View quick look graphics for the run
  Note: Quick look graphics has been designed by the model developer to enable quick evaluation of the results of the run. To find more information regarding this option please contact the CCMC staff.

ENLIL at Earth
ENLIL at Mars
ENLIL at Mercury
ENLIL at Venus

Quick look at graphics



3D Simulation Results: Model: ENLIL
Run: Thea_Falkenberg_020909_SH_29 CR=2019

This is the web interface for the visualization of results of a three-dimensional simulation of the Sun's environment.

Please review the default selections below and make your changes.

To start the graphics program click the *Update Plot* button. The resulting image will be displayed at this location of the page.

Should the result be a black image, then the graphics program encountered a programming error. Please report the set of input parameters used.

Go back to web page of run

Update Plot *Update Plot* will update (generate) the plot with the chosen time and plot parameters below.
This will take some time (typically 10-30s) as data is read in and processed.

◉ **Choose data time:**
Date: 2004/08/03 Time: 00:06:42
- or -
○ **Change time** by moving
-1 output steps
- or -
○ **Create GIF movie with current plot settings** (not for SWX plot modes)
Note: This is a queue submission system requiring the following three additional inputs:

- Start Time:
  Date: 2004/07/24 Time: 00:02:46
- End Time:
  Date: 2004/08/03 Time: 00:06:42
- **Email address** for notification (replace the example email address with yours):
  your.name@your.domain
  Note: The movie will be *requested* but **NOT be shown** in this interface. You will get an email with a download URL when the request has been completed (this will take at least a few minutes).
  Only one request can be pending at a time for each client IP or email address.

Plot Options:

☐ **Exclude region around the Sun** up to
0 AU
Image magnification 1
(all images; use >=1.25 for 3D Flowlines)
Line thickness 1 (flow lines, arrows)
Character thickness 1 (all annotations)
☐ **SWX line thickness** (Adjust the thickness of the streamlines manually) .1
☐ **SWX Streamline Type** Tubes
☑ **Allow variable plot image size**
(all 2D plots: aspect ratio dx/dy between **0.3** and **4**)
☐ **Show simulation grid** (disabled with 3D-Surface)
☐ **Interpolate data onto equidistant grid**
(available with 3D-Surface and Vector; recommended for plots with Vector)

Choose **Plot Mode:**
ColorContour (2D)

Choose **quantity** to be displayed (some **Plot Modes** require up to three choices):
Q 1: N*r^2 Q 2: N*r^2 Q 3: N*r^2
Note: divergences, gradients and curls are not yet available with SWX plot modes.

Plot Options for selected Plot Modes:

3D-Surface, 3D-Flowlines:
View angles:
AX [-90..90]: 30
AZ [-180 ... 180]: 30

Color Contour:

Planetary ascii file

1D Simulation Results
File: ENLIL_at_Earth.txt
Run: Thea_Falkenberg_020909_SH_29 Model: ENLIL

This is the web interface for the visualization of results of one-dimensional model output.

Please review the default selections below and make your changes.

To start the graphics program click the *Update Plot* button. The resulting image will be displayed at this location of the page.

Should the result be a black image, then the graphics program encountered a programming error. Please report the set of input parameters used.

Plot input parameters (only used with IDL visualization):

Time$_1$: 0.00452789 days to Time$_2$: 12.0047 days

Range: 0.00452 days (2004/07/22 00:00:00.000) to 12.00470 days (2004/08/03 00:06:46.080)

Start: Year: 2004 Month: 7 Day: 22 Hour: 0 Minute: 6 Second: 31.2096960

to End: Year: 2004 Month: 8 Day: 3 Hour: 0 Minute: 6 Second: 46.08

Choose up to three different quantities to be displayed:

Q 1: R Q 2: R Q 3: R

Log scale (apply to all quantities > 0 in plot)

Lock plot data range: Min.: 0 Max.: 1

Image magnification: 1

Line style: no line Plot symbols: diamonds Symbol size: 0.2

Reset Form — *Reset Form* will reset changes to the defaults specified by the previous run of this script.

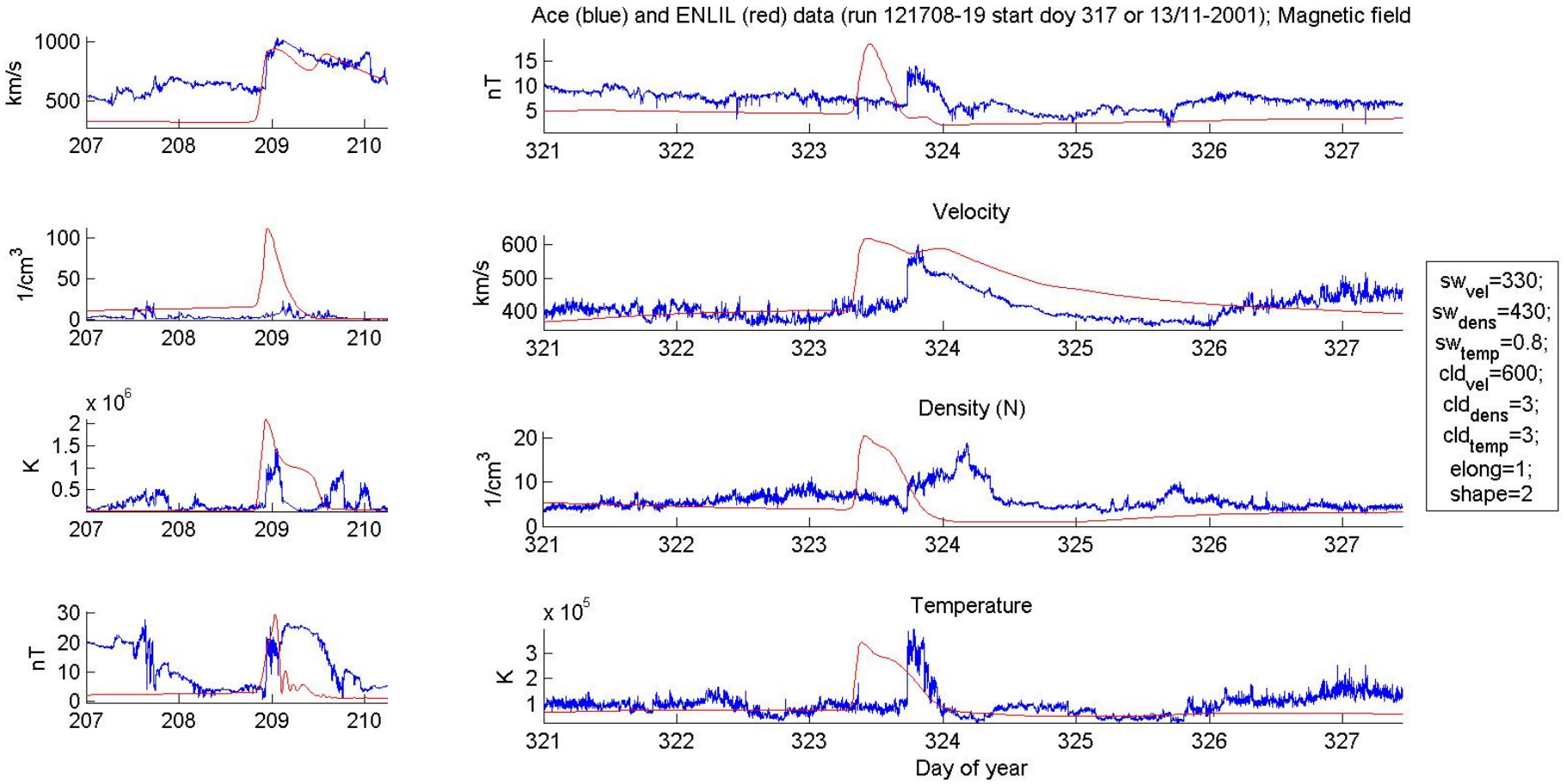
Update Plot — *Update Plot* will update (generate) the plot with the chosen time and plot parameters above or will print the entire file to screen.

Have data printed to text file.
The file format is slightly different from the original file visualized and can include computed quantities if offered and selected for plotting (i.e. quantities beyond basic MHD quantities N, P, **V**, **B**), such as B, V, J, **E**,$\mathbf{J}_{par}$.

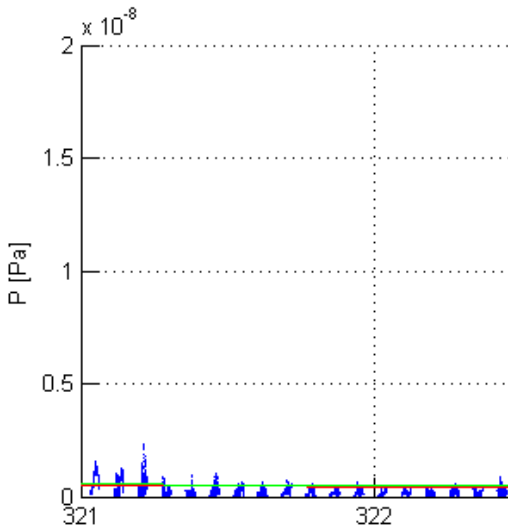
Runs-on-Request: Contact CCMC Staff
Visualization: Dr. Lutz Rastätter

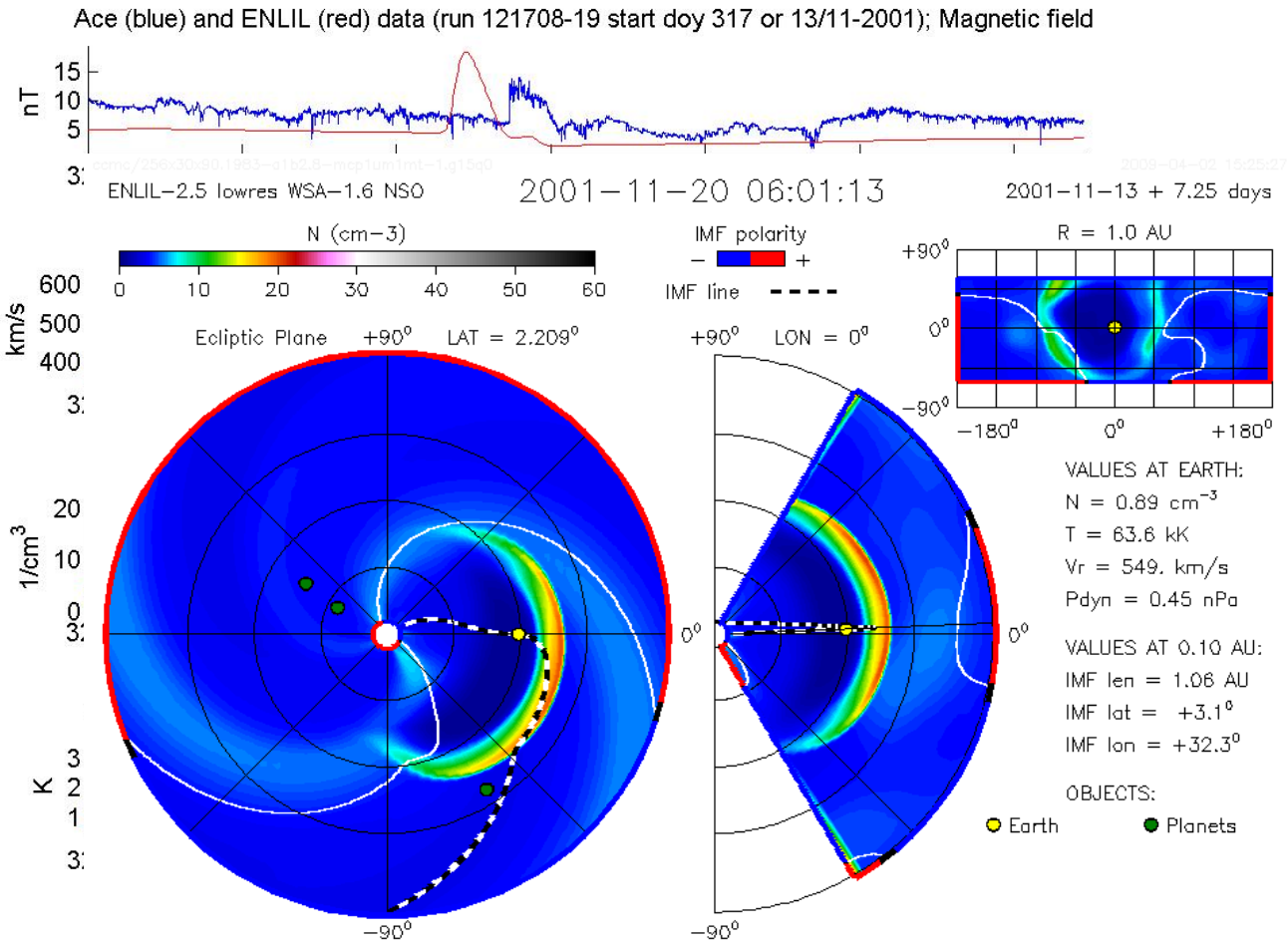
Last script update: February 2, 2009.

ENLIL at Earth

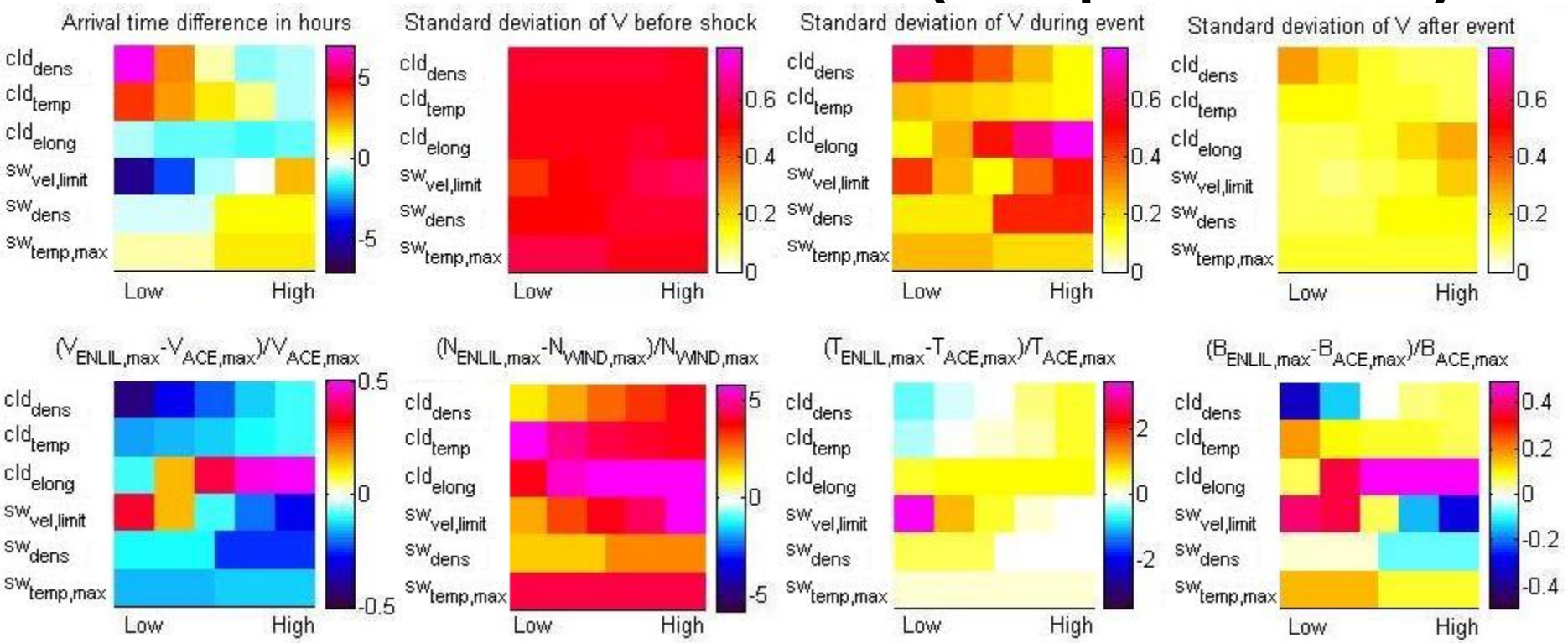


ENLIL at Mars





Parameter variation effect (comp. With ACE)



- cld_dens = 2, 4, 6, 8, 10 (x 300 cm^3)
- cld_temp =1, 3, 5, 7, 10 (x 0.8 million K)
- cld_elong = 1, 2, 3, 4, 5
- sw_vel,limit = 350, 500, 650, 800, 950 km/s
- sw_dens =150, 300 cm^3 (with cld_dens 10 and 5)
- sw_temp,max = 0.4, 0.8 million K (with cld_temp 10 and 5)

ENLIL for **SOTERIA**

- 19 research institutions from all over Europe (Denmark (DTU), Finland (Uoulu), Croatia (Observatory of Hvar), Austria (UNIGraz), Switzerland (PMOD-WRC), Poland (SRC-PAS), Russia (LPI), Germany (UGOE), Belgium (ROB, K.U.Leuven), Hungary (KO, KFKI-RMKI) and France (IEEA, Noveltis, CNRS, ObsParis))
- Expertise covers from solar surface to ionosphere
- http://soteria-space.eu/

ENLIL for SOTERIA

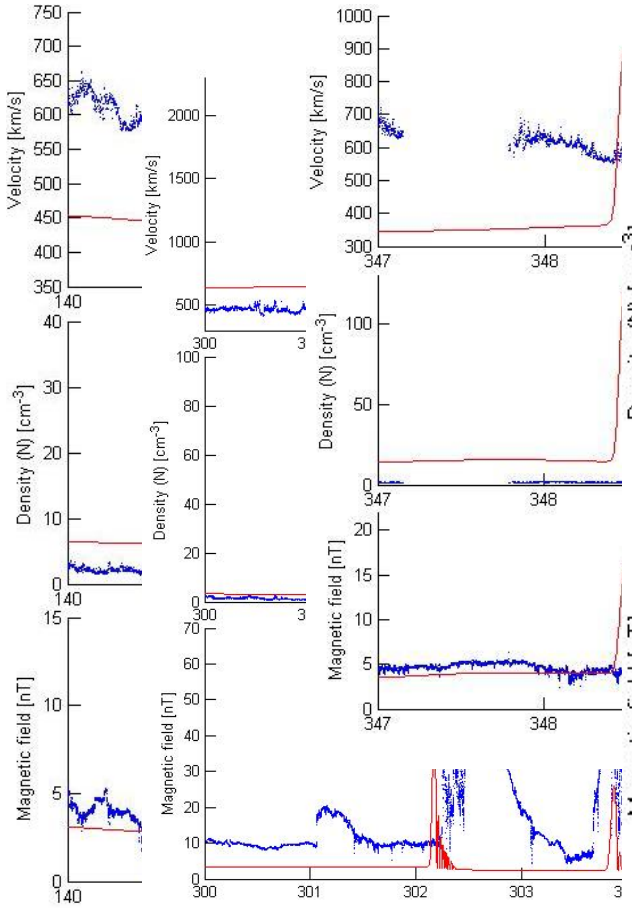
Results of simulations performed in support of SOTERIA

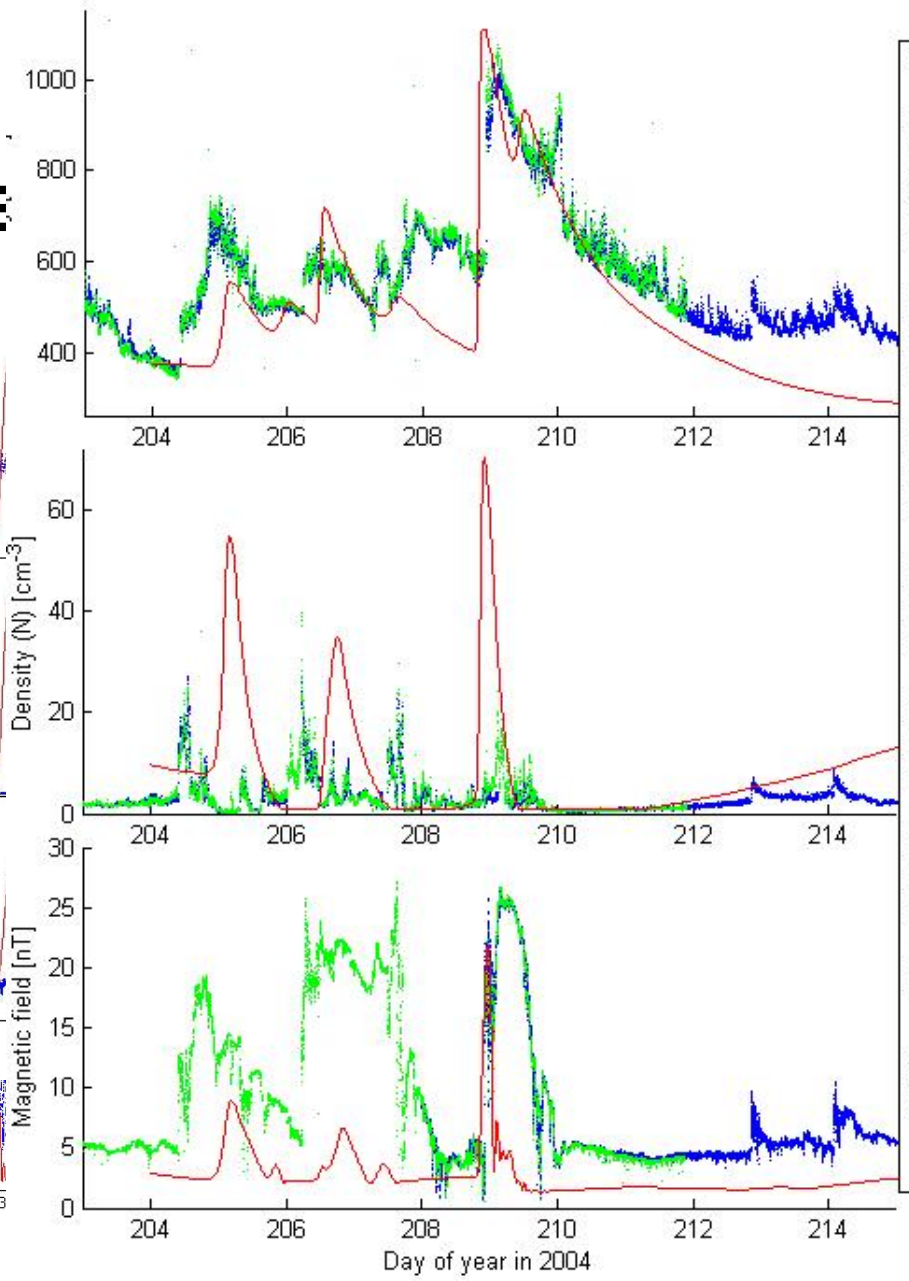
Presented below are results of simulations performed in support of SOTERIA (Solar-Terrestrial Investigation and Archives).

Heliospheric runs:

Run Number	Key Word	Model	Model Version	Carrington Rotation Start	Carrington Rotation End	Input Type	Grid Resolution
Thea_Falkenberg_020909_SH_29	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_28	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_27	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_26	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_25	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_24	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_23	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_22	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_21	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_020909_SH_20	July2004event, soteria	ENLIL	2.5b	2004/07/22 08:38:58.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90

ENLIL for SOTE



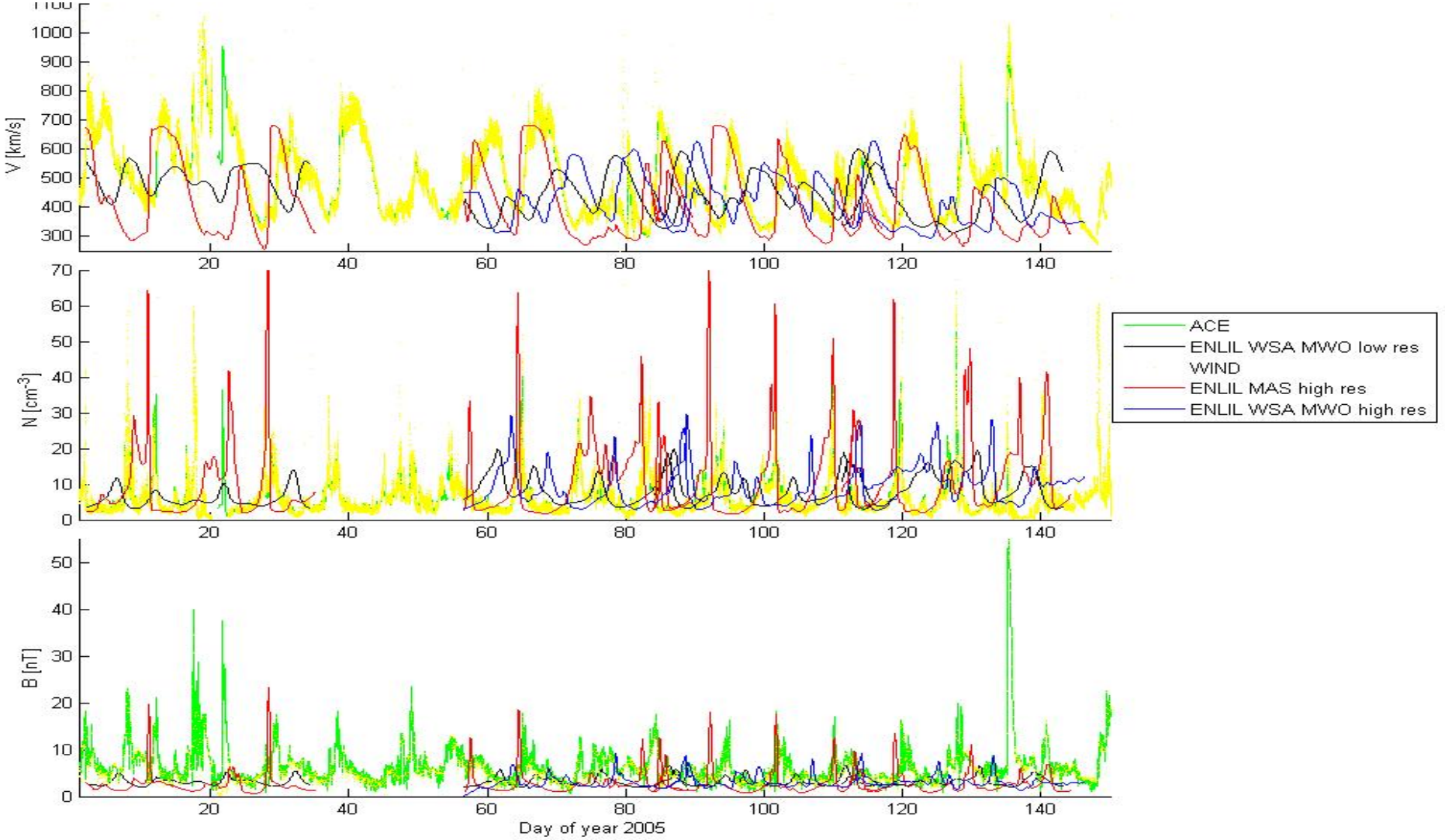


Model: ENLIL with cone, vs 2.5b

Input parameters:
$SW_{vel,limit}$=625 km/s;
SW_{dens}=300 cc;
$SW_{temp,max}$=0.8 10^6 K;
$ICME1_{start}$=20-7-2004 18:30 UT;
$ICME2_{start}$=22-7-2004 11:30 UT;
$ICME3_{start}$=25-7-2004 17:49 UT;
$ICME1_{colattitude}$=79 deg;
$ICME2_{colattitude}$=86 deg;
$ICME3_{colattitude}$=111 deg;
$ICME1_{longitude}$=146 deg;
$ICME2_{longitude}$=179 deg;
$ICME3_{longitude}$=205 deg;
$ICME1_{ang.\ radius}$=75 deg;
$ICME2_{ang.\ radius}$=60 deg;
$ICME3_{ang.\ radius}$=75 deg;
$ICME1_{vel}$=830 km/s;
$ICME2_{vel}$=850 km/s;
$ICME3_{vel}$=1330 km/s;
$ICME1_{dens}$=4*300 cc;
$ICME2_{dens}$=5*300 cc;
$ICME3_{dens}$=10*300 cc;
$ICME1_{temp}$=1*0.8 10^6 K;
$ICME2_{temp}$=1*0.8 10^6 K;
$ICME3_{temp}$=10*0.8 10^6 K;
$ICME_{elong}$=1;
$ICME_{shape}$=spherical;

WSA input
NSO magnetogram
CR:2019

ENLIL for SOTERIA, CIRs



Improvements: Timeresolution in interface

3D Simulation Results: Model: ENLIL
Run: Thea_Falkenberg_020909_SH_29 CR=2019

This is the web interface for the visualization of results of a three-dimensional simulation of the Sun's environment.

Please review the default selections below and make your changes.

To start the graphics program click the *Update Plot* button. The resulting image will be displayed at this location of the page.

Should the result be a black image, then the graphics program encountered a programming error. Please report the set of input parameters used.

Go back to web page of run

Update Plot *Update Plot* will update (generate) the plot with the chosen time and plot parameters below.
This will take some time (typically 10-30s) as data is read in and processed.

Choose data time:

Date: 2004/08/03 Time: 00:06:42
Date: 2004/07/29 Time: 06:05:49
Date: 2004/07/29 Time: 12:02:15
Date: 2004/07/29 Time: 18:00:03
Date: 2004/07/30 Time: 00:06:52
Date: 2004/07/30 Time: 06:02:53
Date: 2004/07/30 Time: 12:06:27
Date: 2004/07/30 Time: 18:02:10
Date: 2004/07/31 Time: 00:04:56
Date: 2004/07/31 Time: 06:07:32
Date: 2004/07/31 Time: 12:03:05
Date: 2004/07/31 Time: 18:06:12
Date: 2004/08/01 Time: 00:07:22
Date: 2004/08/01 Time: 06:06:21
Date: 2004/08/01 Time: 12:06:39
Date: 2004/08/01 Time: 18:05:22
Date: 2004/08/02 Time: 00:01:14
Date: 2004/08/02 Time: 06:02:37
Date: 2004/08/02 Time: 12:02:49
Date: 2004/08/02 Time: 18:01:52
Date: 2004/08/03 Time: 00:06:42

current
ot modes)
on system
dditional

46
42

ication
(replace the example email address with yours):
your.name@your.domain
Note: The movie will be *requested* but **NOT be shown** in this interface.

Plot Options:

- ☐ **Exclude region around the Sun** up to 0 AU
- **Image magnification** 1 (all images; use >=1.25 for 3D Flowlines)
- **Line thickness** 1 (flow lines, arrows)
- **Character thickness** 1 (all annotations)
- ☐ **SWX line thickness** (Adjust the thickness of the streamlines manually) .1
- ☐ **SWX Streamline Type** Tubes
- ☑ **Allow variable plot image size** (all 2D plots: aspect ratio dx/dy between 0.3 and 4)
- ☐ **Show simulation grid** (disabled with 3D-Surface)

```
# Data printout from CCMC-simulation: version 1.1
# Data type:   ENLIL  Heliosphere
# Run name:    Thea_Falkenberg_020909_SH_29 Missing data:
# Start Date, time: 2004/07/22  00:00:00
# Time      R      Lat      Lon      V_r      V_lon      V_lat
# day      AU      deg      deg     km/s      km/s      km/s      nT
0.0045278900 1.0101600 180.00000 4.9904100 359.57300 1.2043
0.0098151700 1.0101600 180.00000 4.9908900 359.56900 1.2027
0.0151018000 1.0101600 180.00000 4.9913700 359.56400 1.2006
0.0203885000 1.0101600 180.00000 4.9918400 359.55800 1.1982
0.0256745000 1.0101600 180.00000 4.9923100 359.55100 1.1953
0.0309606000 1.0101600 180.00000 4.9927900 359.54300 1.1920
0.0362460000 1.0101600 180.00000 4.9932600 359.53400 1.1883
0.0415315000 1.0101600 180.00000 4.9937400 359.52400 1.1843
0.0468163000 1.0101600 180.00000 4.9942100 359.51300 1.1798
0.0521012000 1.0101600 180.00000 4.9946900 359.50100 1.1749
0.0573855000 1.0101600 180.00000 4.9951700 359.48800 1.1697
0.0626698000 1.0101600 180.00000 4.9956400 359.47400 1.1642
0.0679535000 1.0101600 180.00000 4.9961200 359.45900 1.1583
0.0732373000 1.0101600 180.00000 4.9966000 359.44300 1.1520
```

Improvements: Longitude and factors

Specify Properties of Fast Solar Wind for the Cone Model

Density: 300 cc
Temperature: 0.8 million K
Speed: 625 km/s

Specify Properties of Cone Cloud(s) for the Run:

Start date/time of model run: 2004-3-8 04:13
End date/time of model run: 2004-4-4 11:29
For all cone cloud(s), please select start dates and times that are within the date/time range of this run (see above)

Cloud 1:

Cloud start date: yyyy-mm-dd (date when cloud center at inner boundary)
Cloud start time: hh:mm (time when cloud center at inner boundary)
Co-latitude of cloud center: 87 (north=0, equator=90, south=180 degs)
Longitude of cloud center: 181 Range: 90 - 270 degs, where 180 deg is earthward
Radius of cloud: 25 Range: 0 - 90 deg
Cloud velocity: 650 Recommended range: 500 - 2000 km/s
Density enhancement factor: 4 (Cloud density over fast stream value). Range: 1 - 10
Temperature enhancement factor: 1 (Cloud temperature over fast stream value). Range: 0.5 - 10
Elongation factor of the trailing part of the cloud: 1 (1 for sphere, 2 for twice longer and so on up to 5)
Shape of the cloud: spherical

East/West?

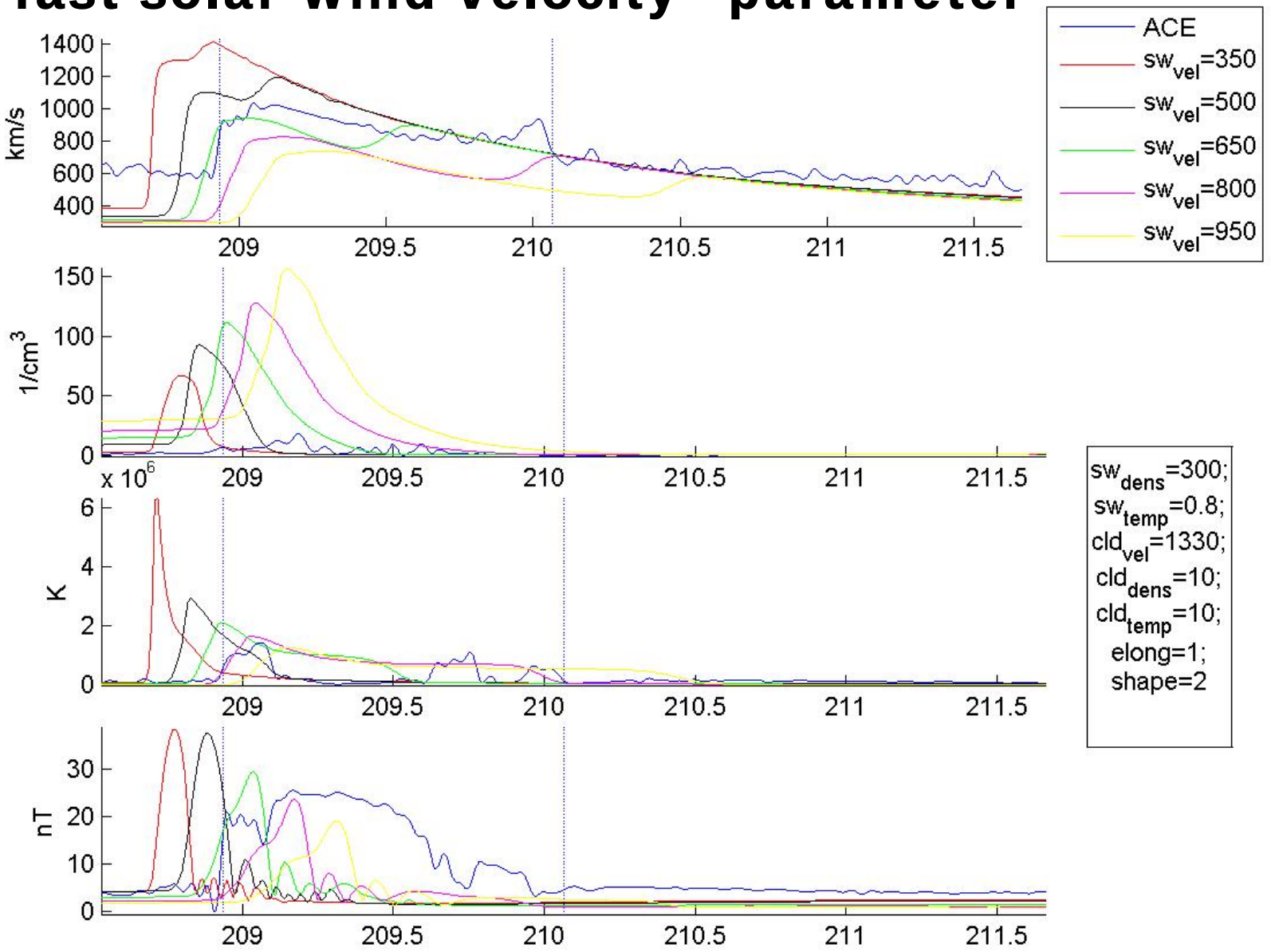
Value or both value and factor, does not have to be integer

Set the Simulation Grid

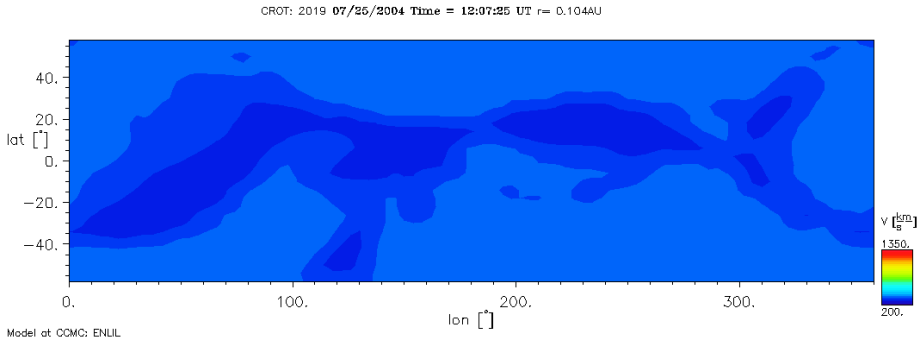
Select **grid resolution (NRxNTxNP)** from predefined list (more options are coming soon)
256x30x90

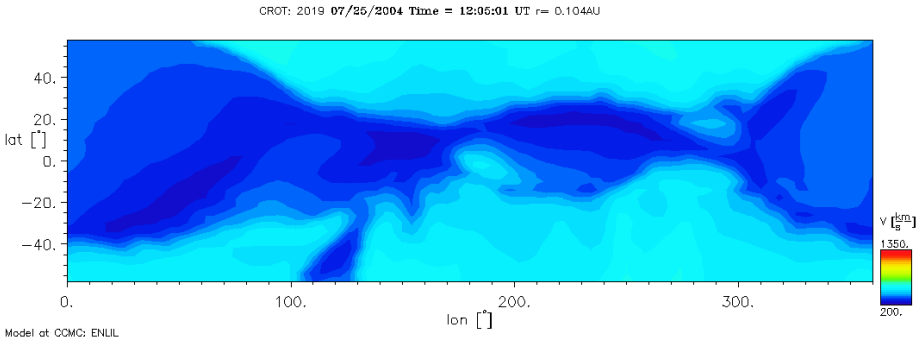
Continue

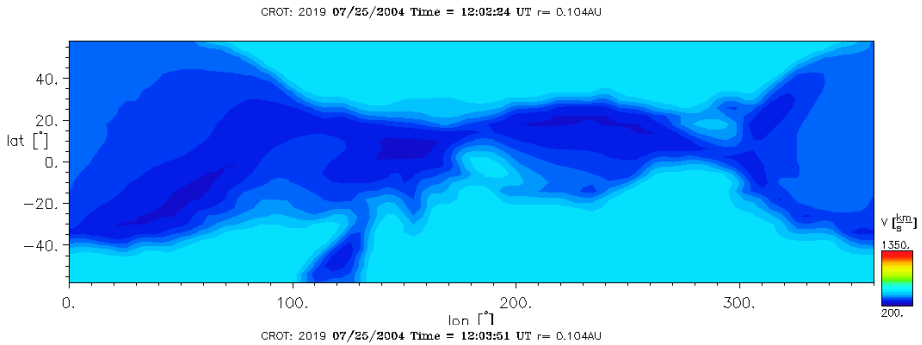
”fast solar wind velocity” parameter

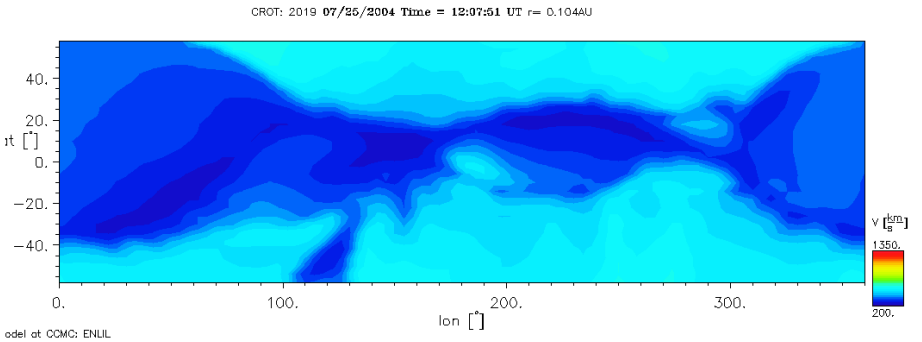


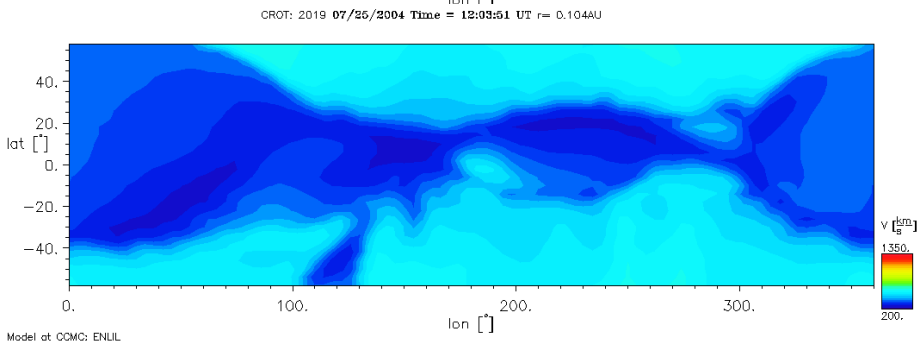
Solar wind velocity, inner boundary









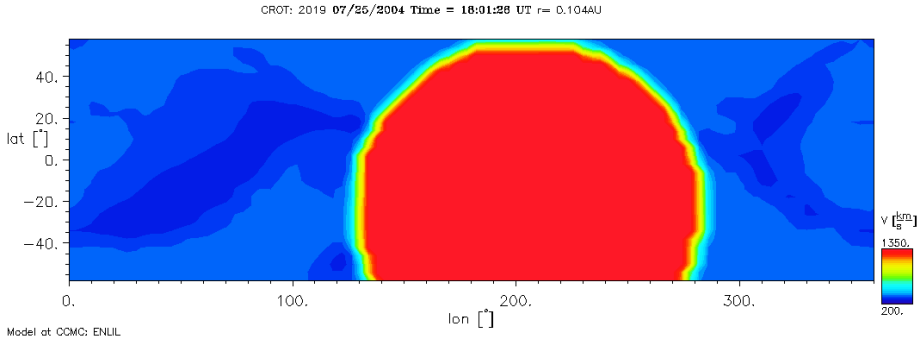


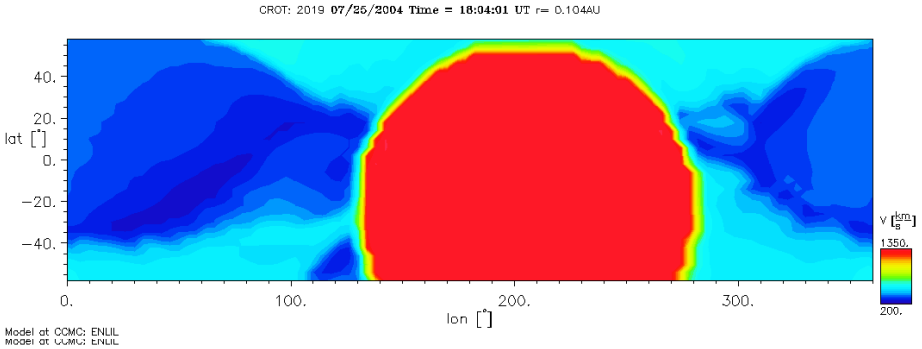
SW_Velocity= 350 Km/s SW_Velocity= 850 Km/s

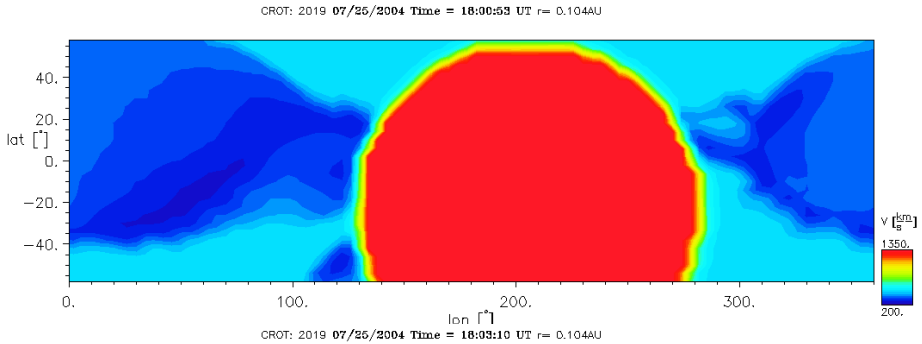
SW_Velocity= 500 Km/s SW_Velocity= 900 Km/s

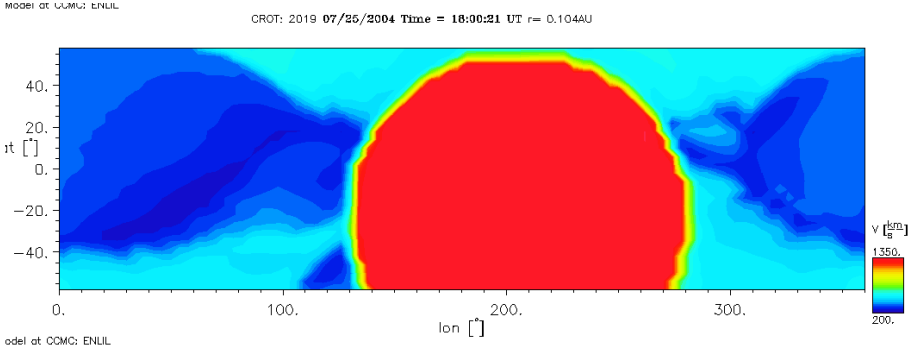
SW_Velocity= 650 Km/s

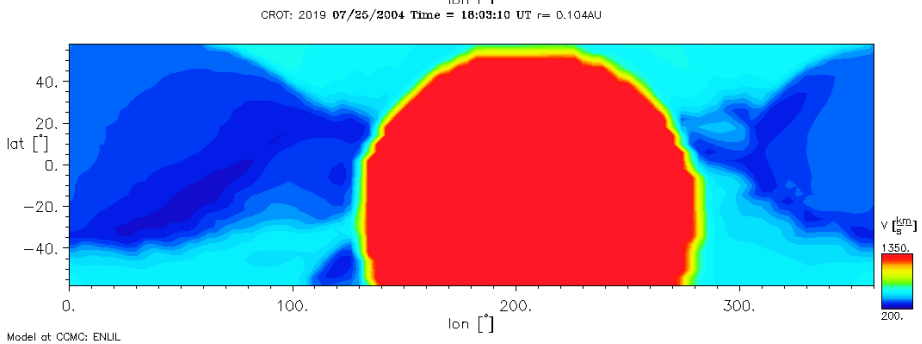
Solar wind velocity, inner boundary









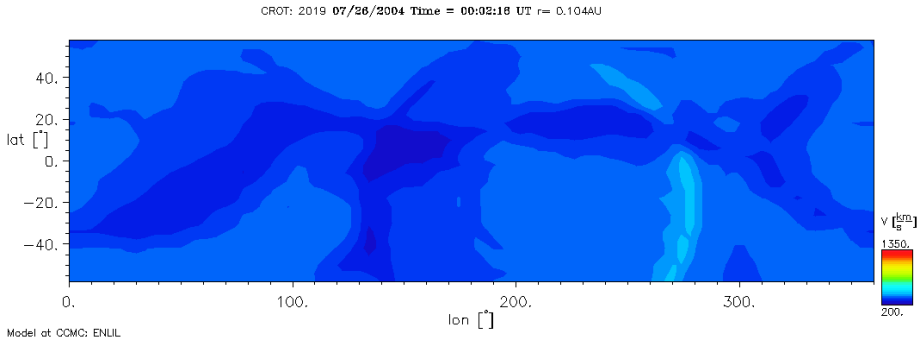


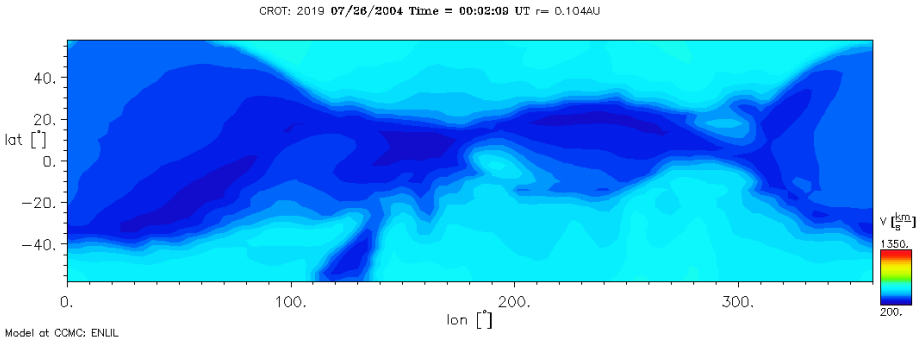
SW_Velocity= 350 Km/s SW_Velocity= 850 Km/s

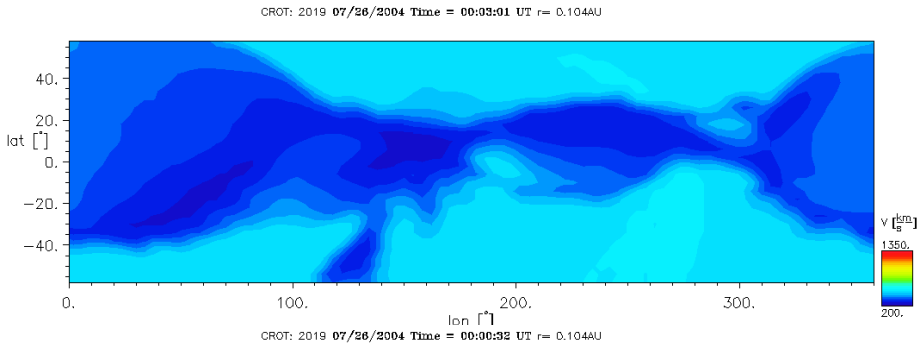
SW_Velocity= 500 Km/s SW_Velocity= 900 Km/s

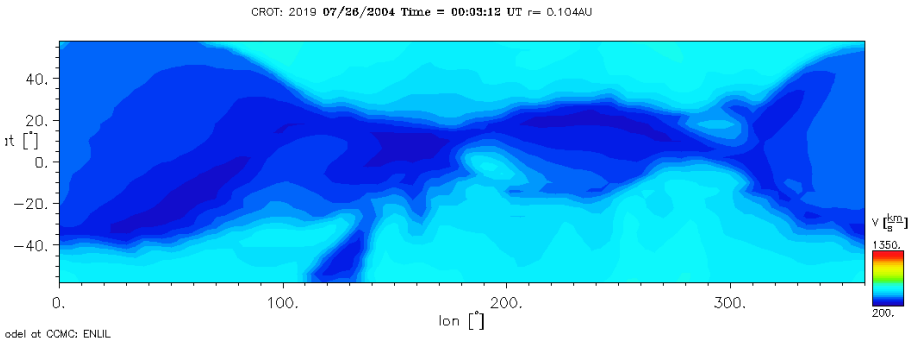
SW_Velocity= 650 Km/s

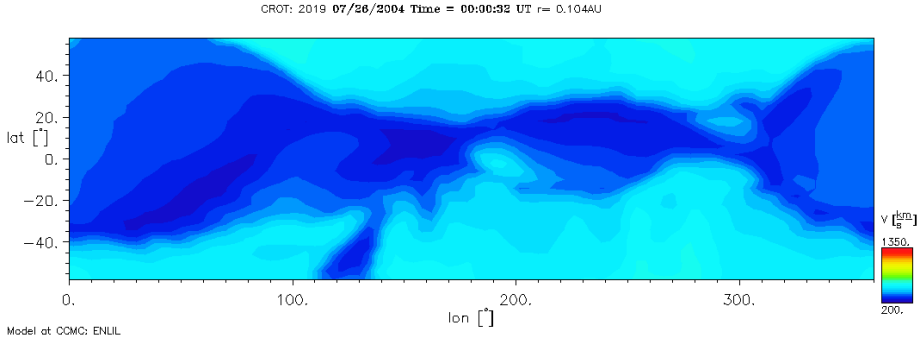
Solar wind velocity, inner boundary









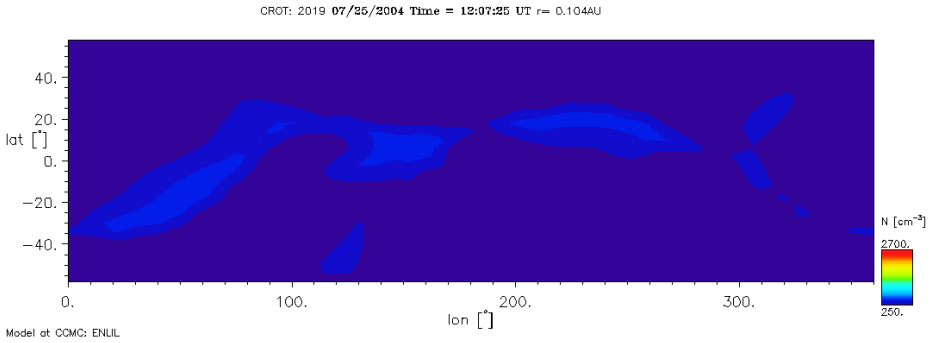


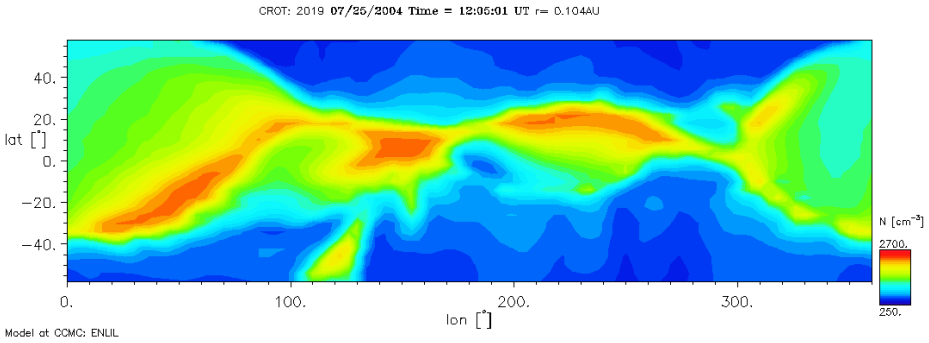
SW_Velocity= 350 Km/s SW_Velocity= 850 Km/s

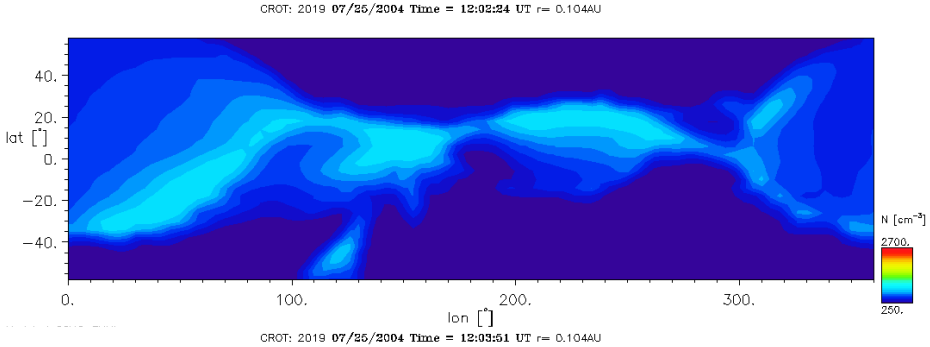
SW_Velocity= 500 Km/s SW_Velocity= 900 Km/s

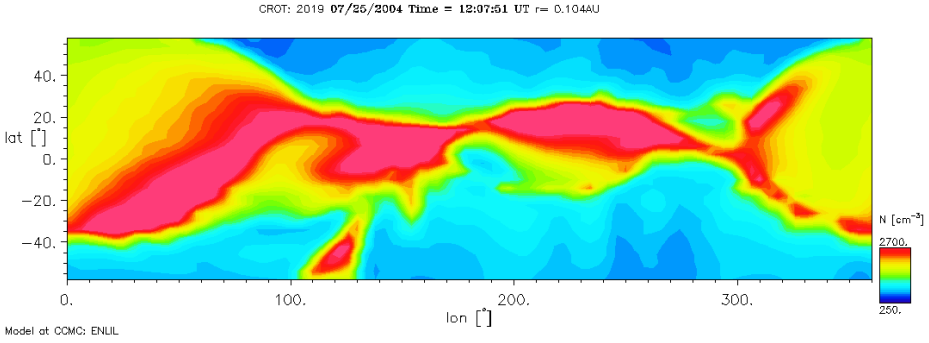
SW_Velocity= 650 Km/s

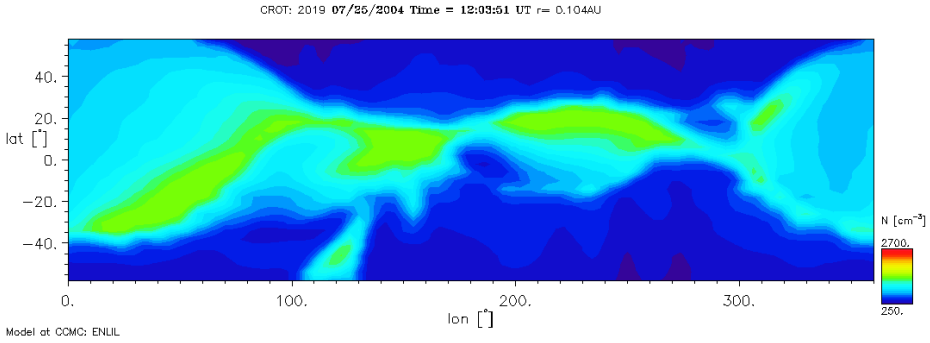
Solar wind density, inner boundary









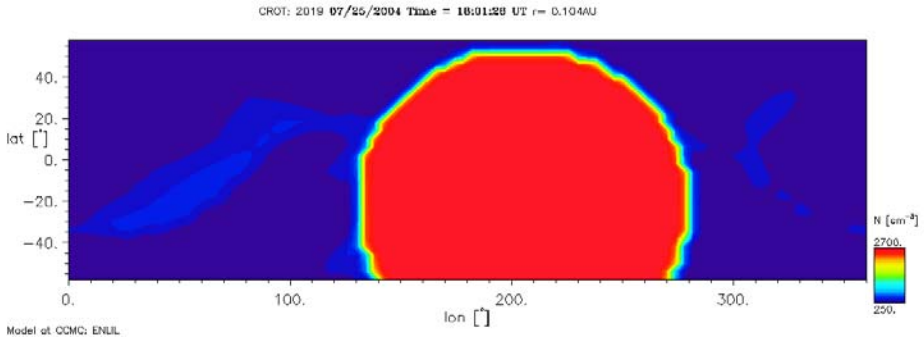


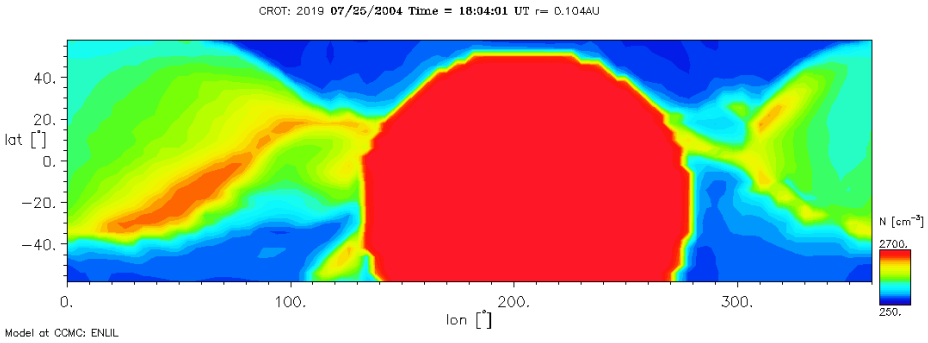
SW_Velocity= 350 Km/s SW_Velocity= 850 Km/s

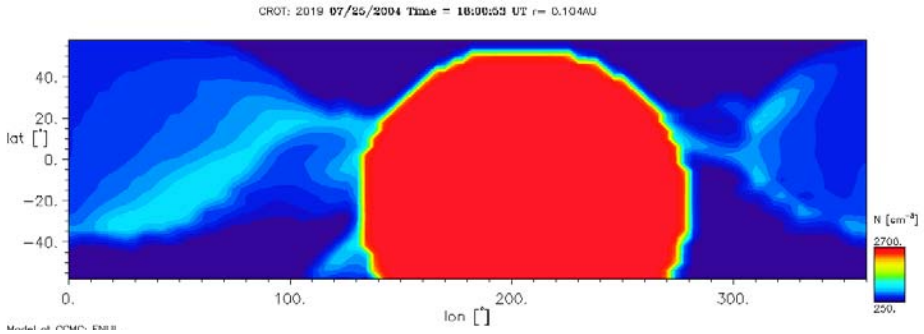
SW_Velocity= 500 Km/s SW_Velocity= 900 Km/s

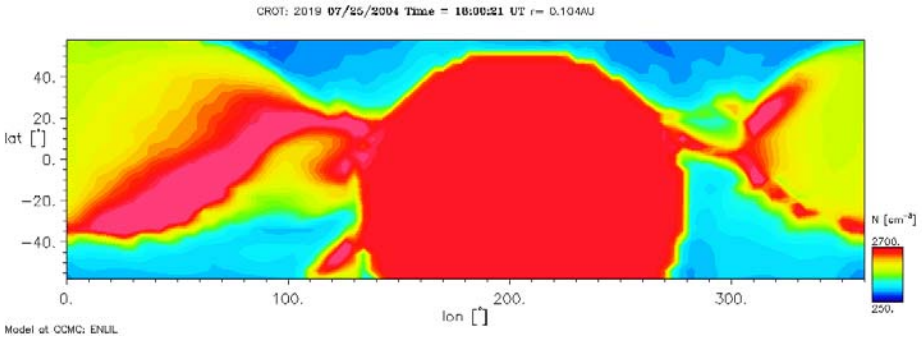
SW_Velocity= 650 Km/s

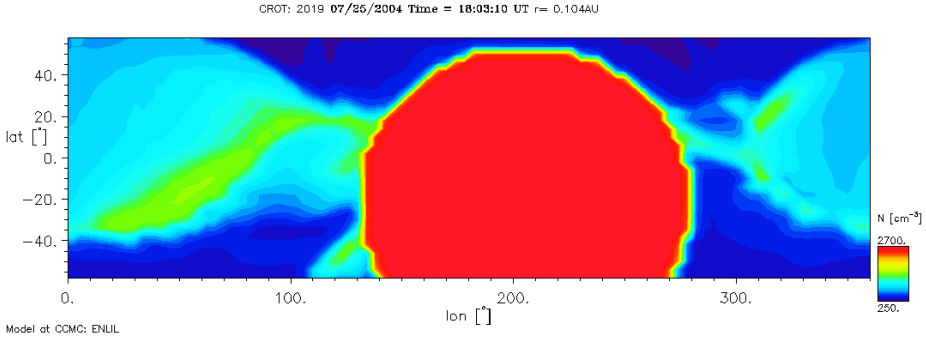
Solar wind density, inner boundary









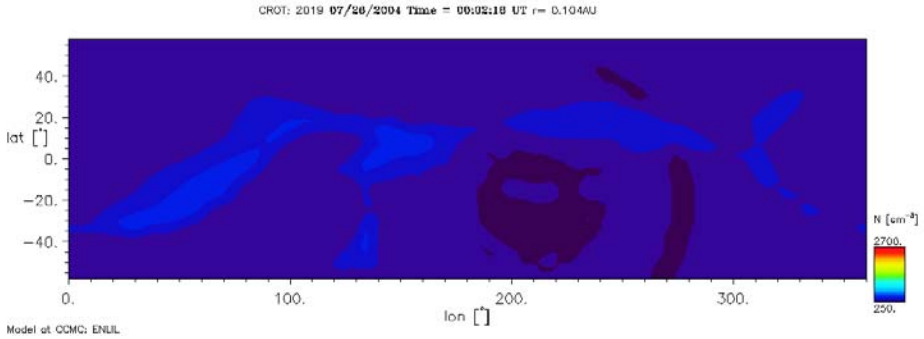


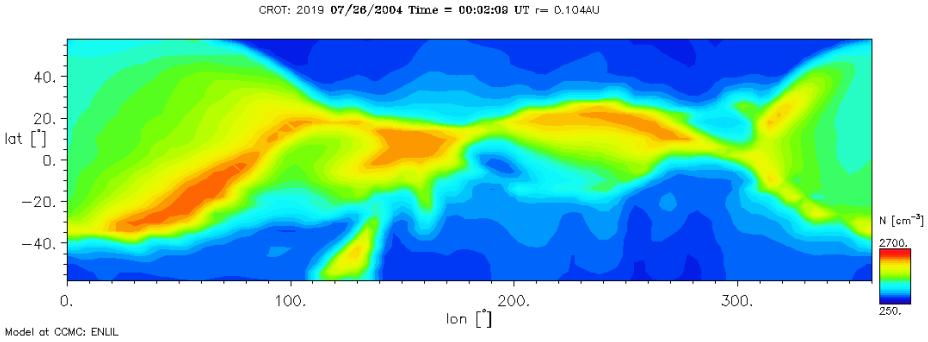
SW_Velocity= 350 Km/s SW_Velocity= 850 Km/s

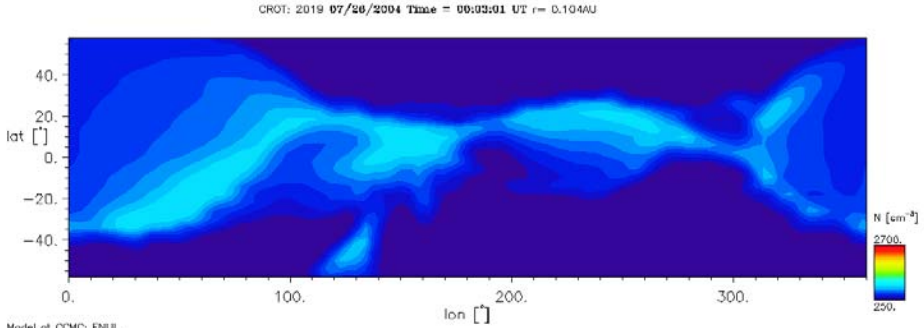
SW_Velocity= 500 Km/s SW_Velocity= 900 Km/s

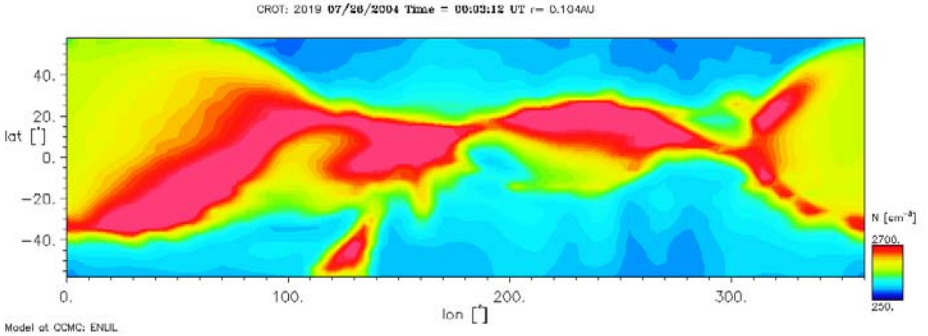
SW_Velocity= 650 Km/s

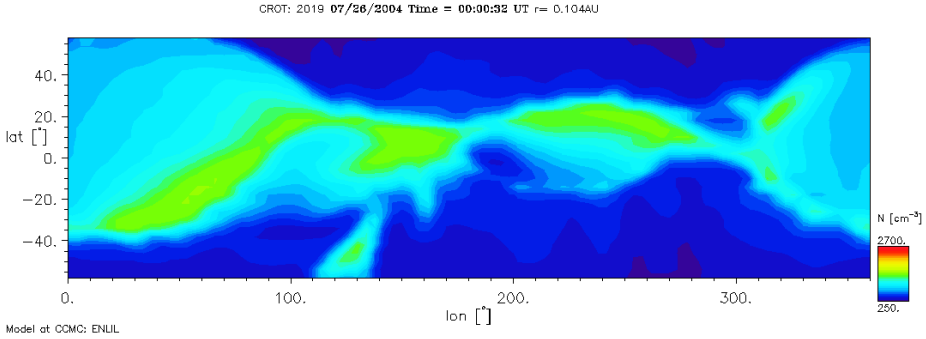
Solar wind density, inner boundary









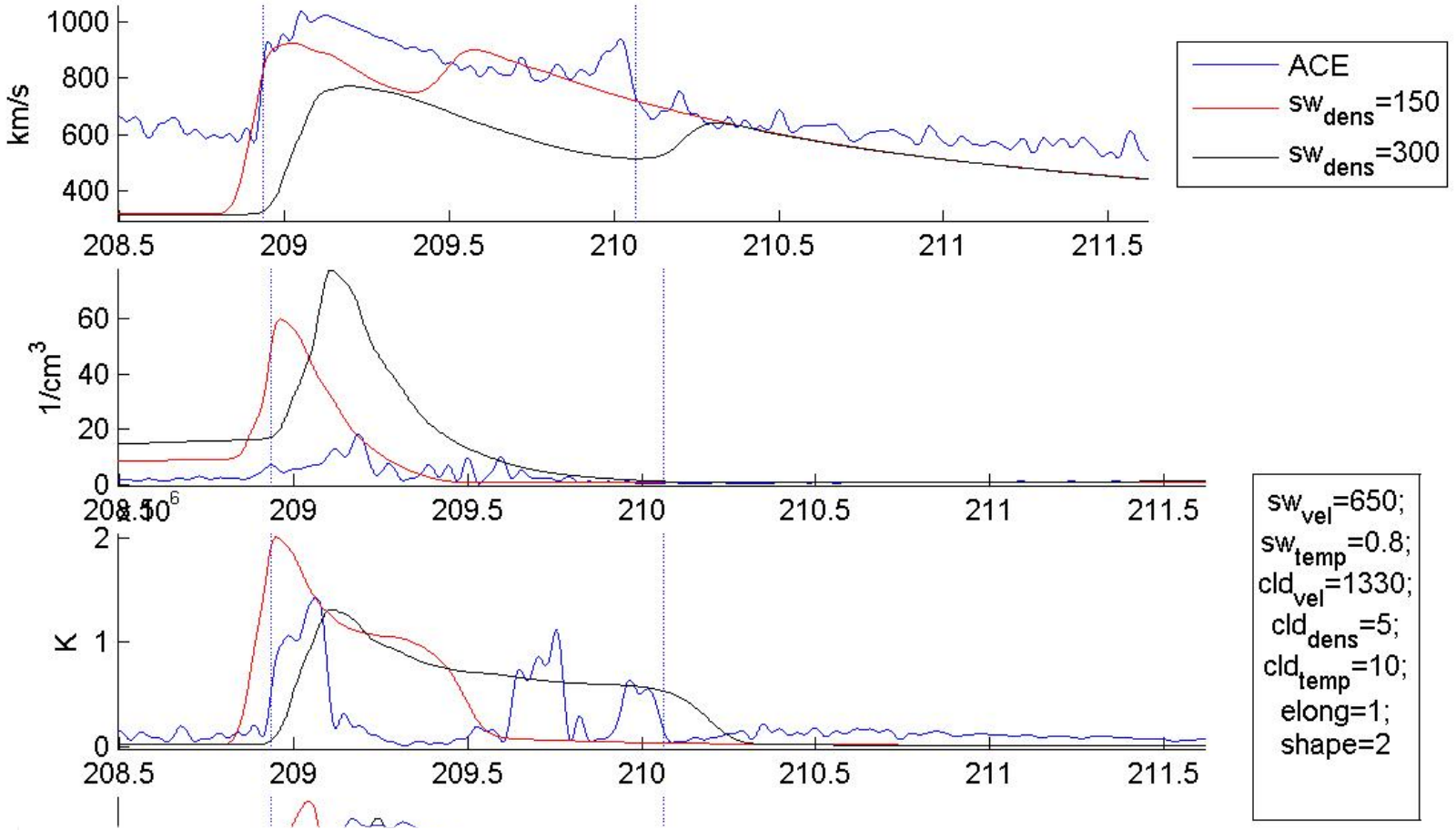


SW_Velocity= 350 Km/s SW_Velocity= 850 Km/s

SW_Velocity= 500 Km/s SW_Velocity= 900 Km/s

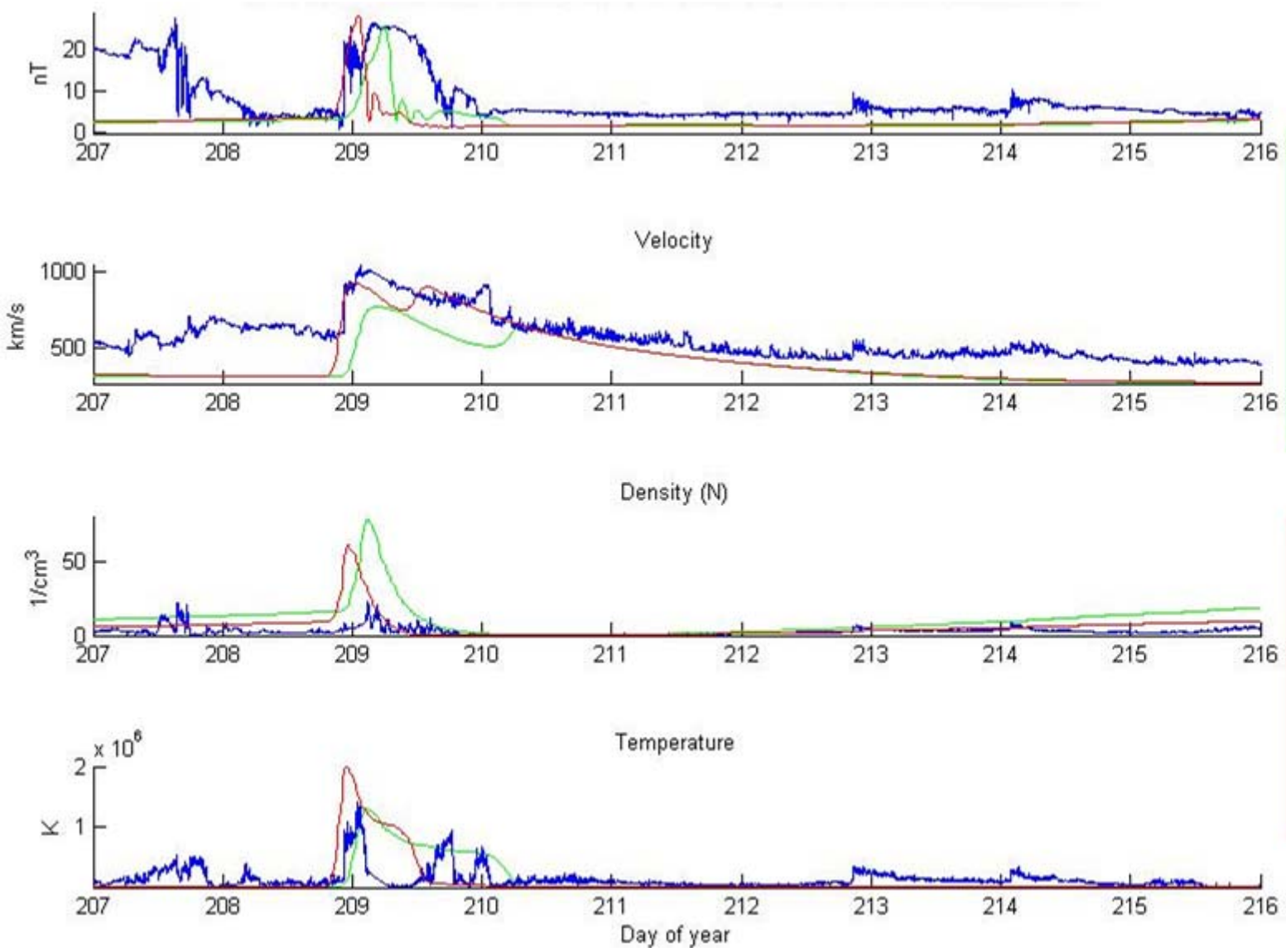
SW_Velocity= 650 Km/s

”fast solar wind density” parameter

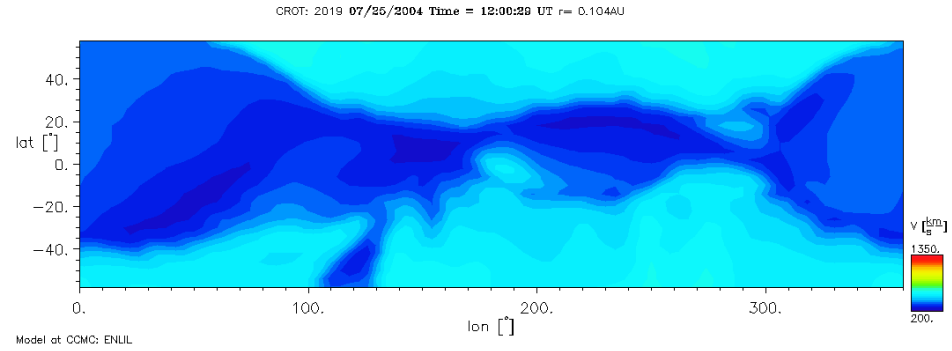


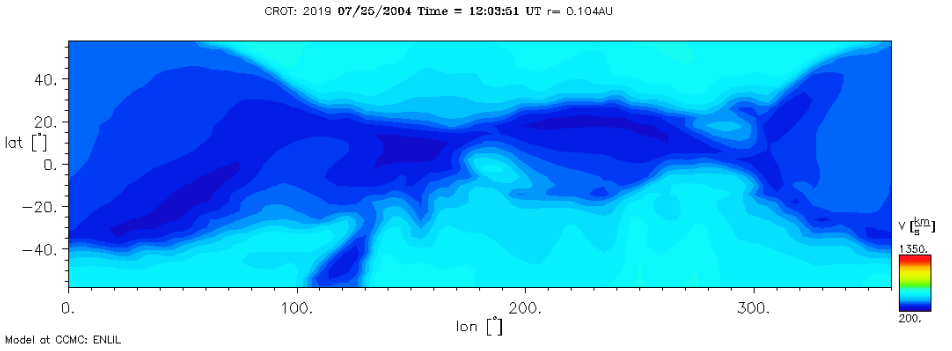
But… Cloud density =1500 cc and 3000 cc…

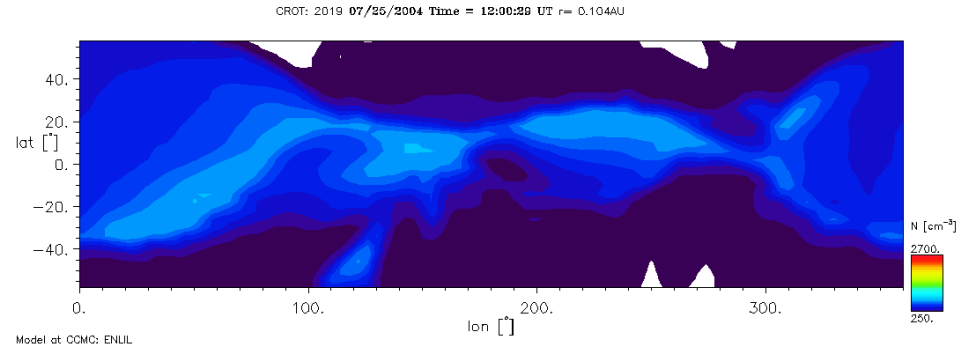
”fast solar wind density” parameter

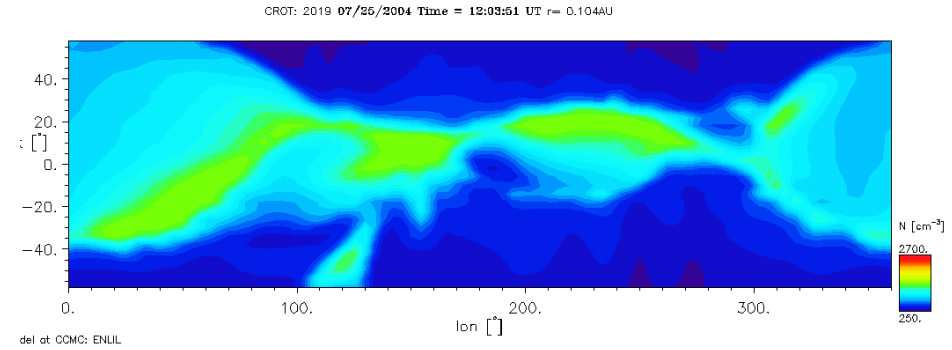


Solar wind density and velocity, inner boundary





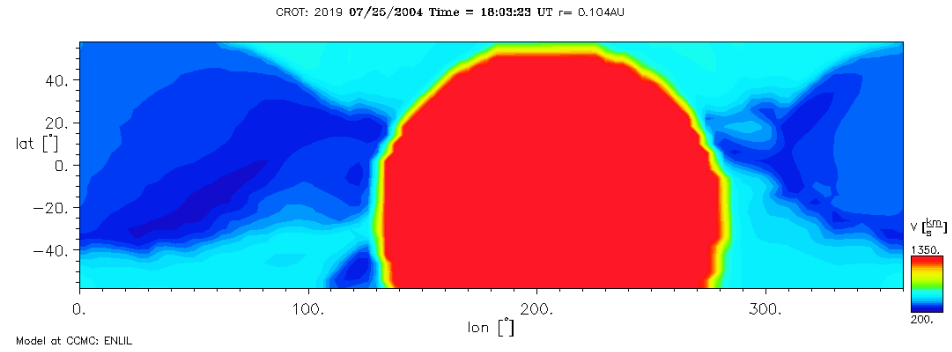


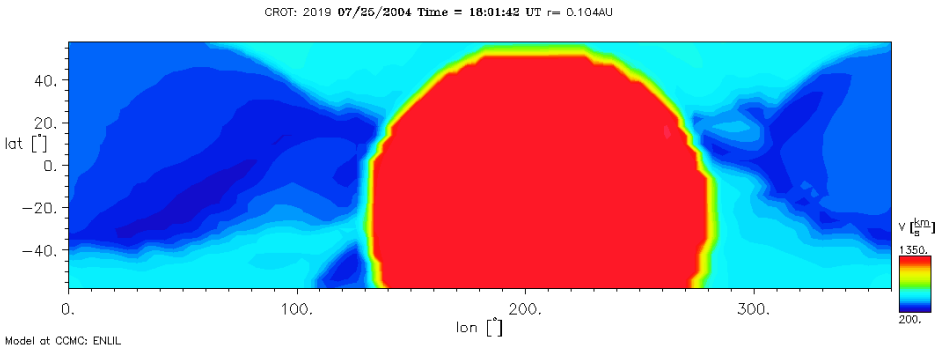


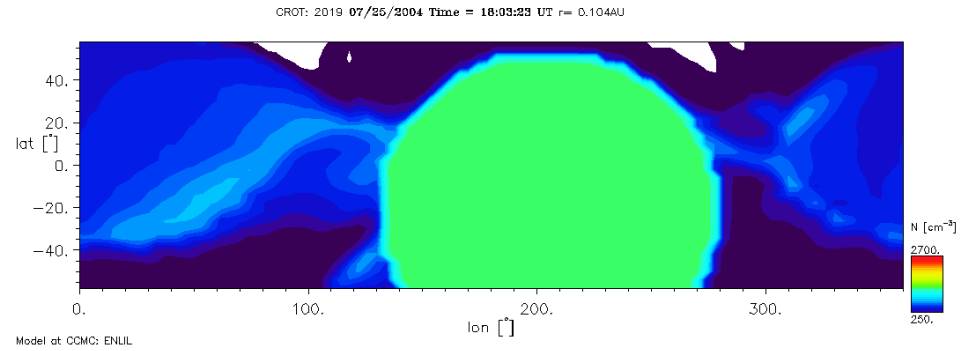
SW_dens=150 cc; cloud_dens=1500 cc

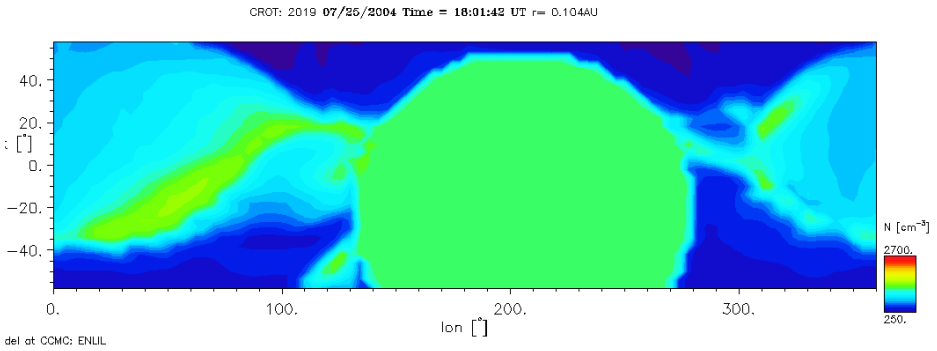
SW_dens = 300 cc; cloud_dens=1500 cc

Solar wind density and velocity, inner boundary





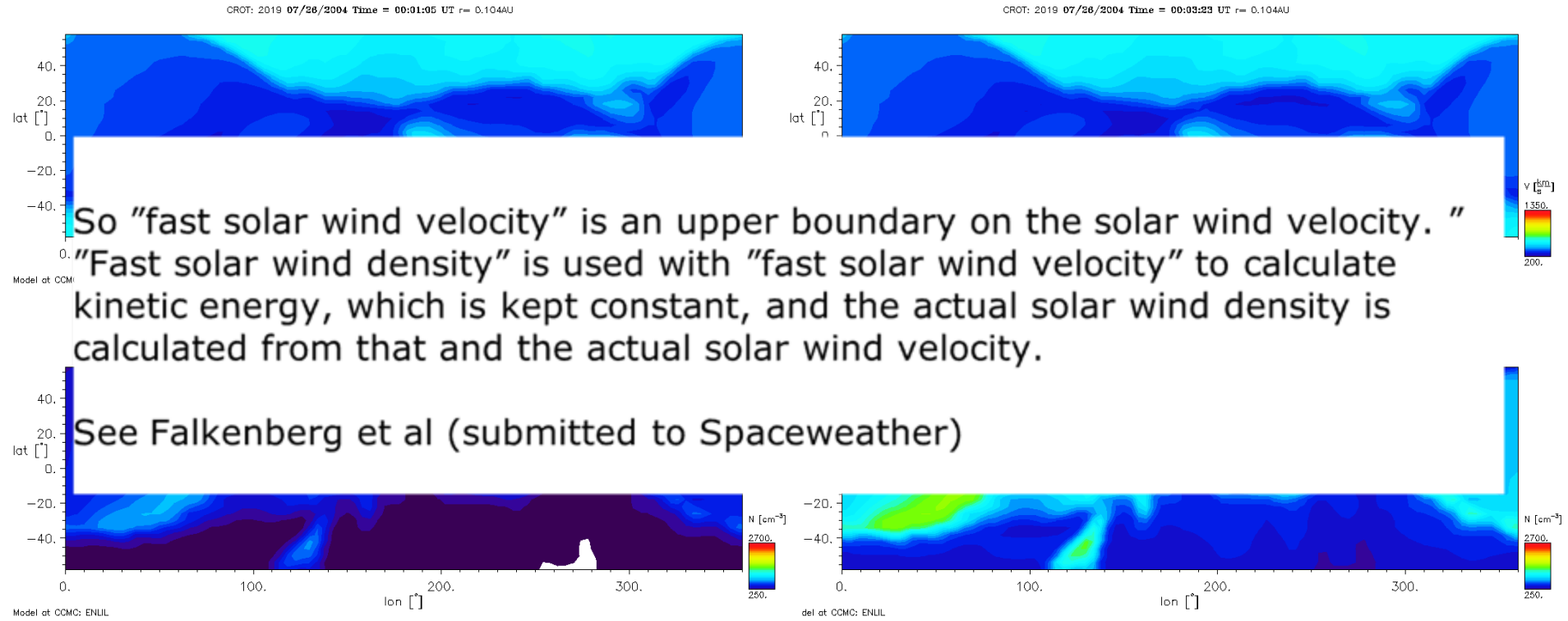




SW_dens=150 cc; cloud_dens=1500 cc

SW_dens = 300 cc; cloud_dens=1500 cc

Solar wind density and velocity, inner boundary



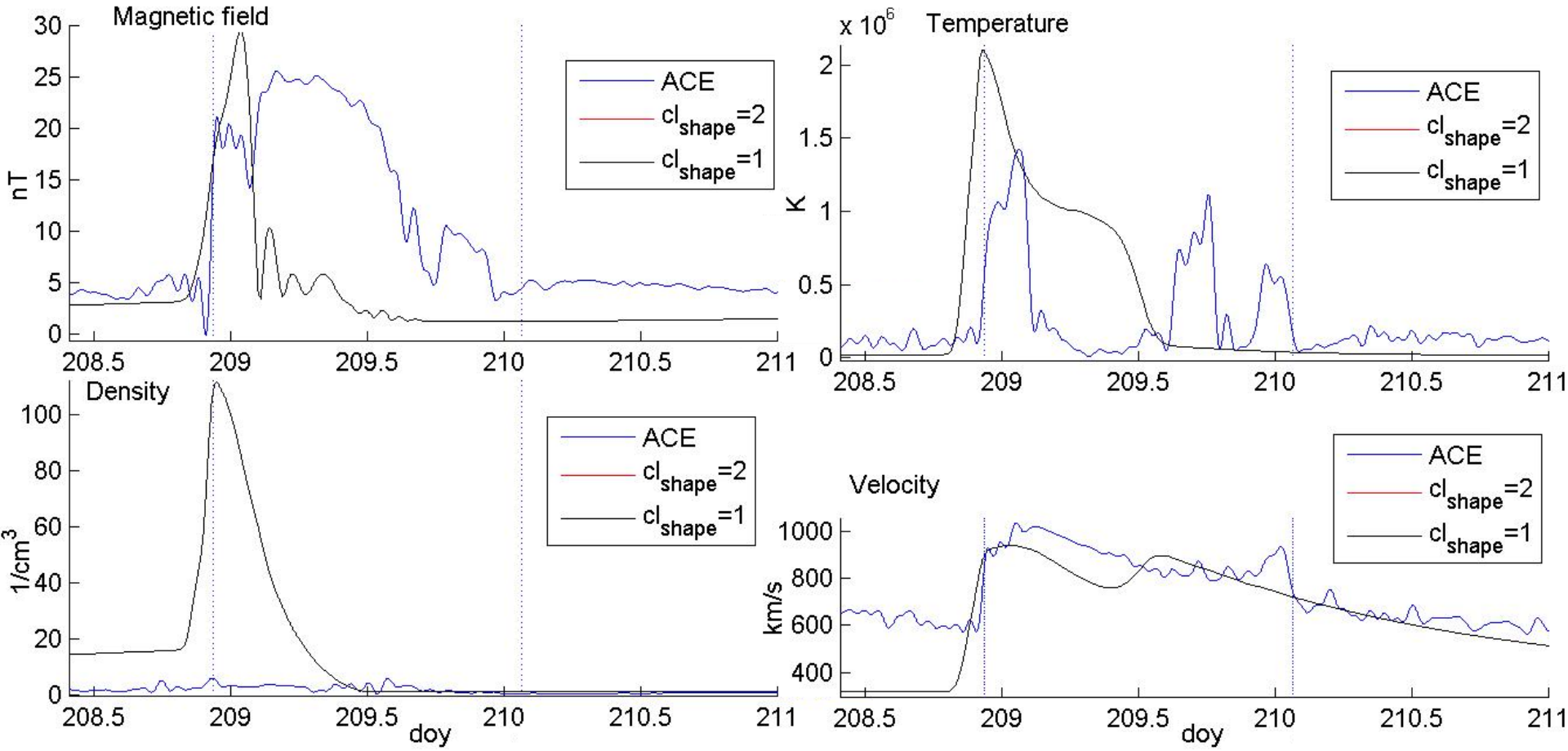
So "fast solar wind velocity" is an upper boundary on the solar wind velocity. "Fast solar wind density" is used with "fast solar wind velocity" to calculate kinetic energy, which is kept constant, and the actual solar wind density is calculated from that and the actual solar wind velocity.

See Falkenberg et al (submitted to Spaceweather)

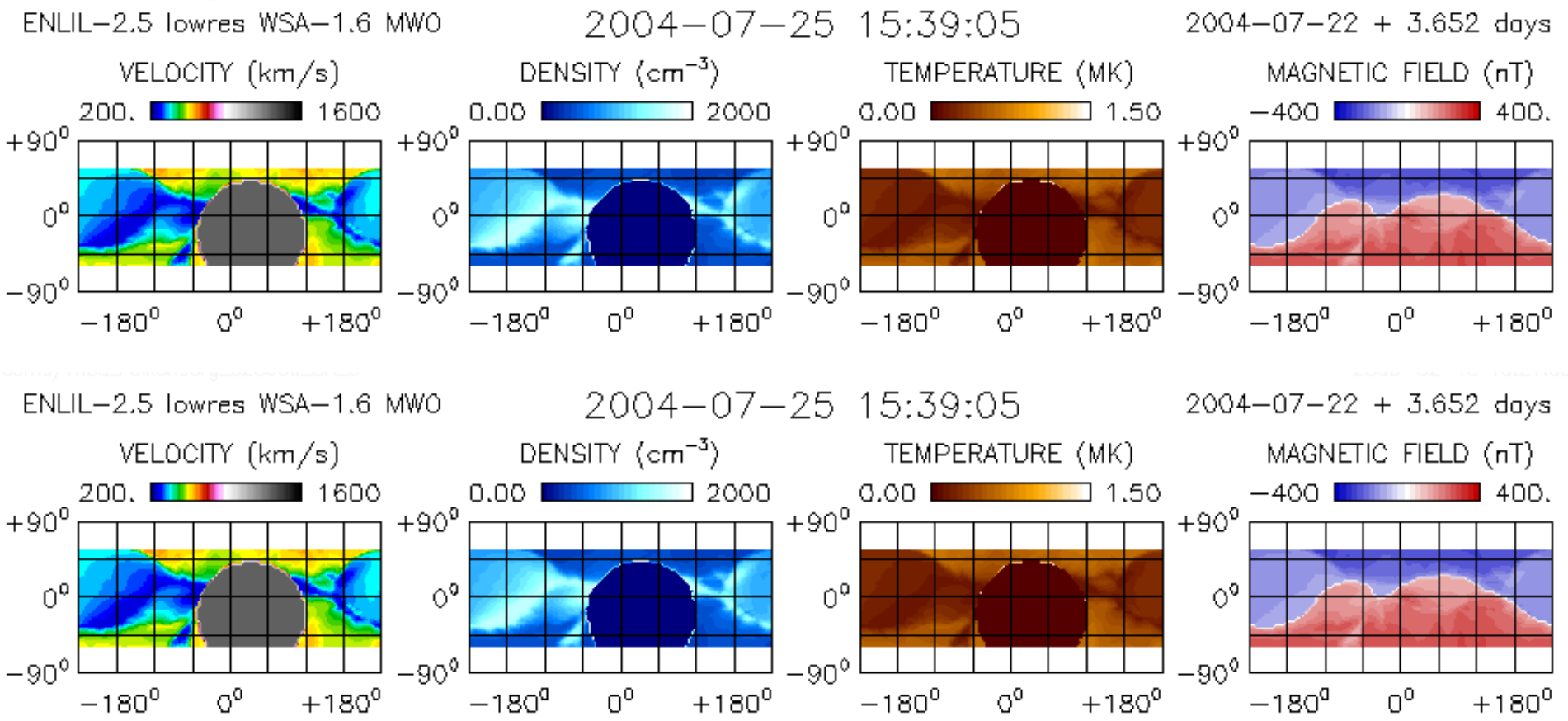
SW_dens=150 cc; cloud_dens=1500 cc

SW_dens = 300 cc; cloud_dens=1500 cc

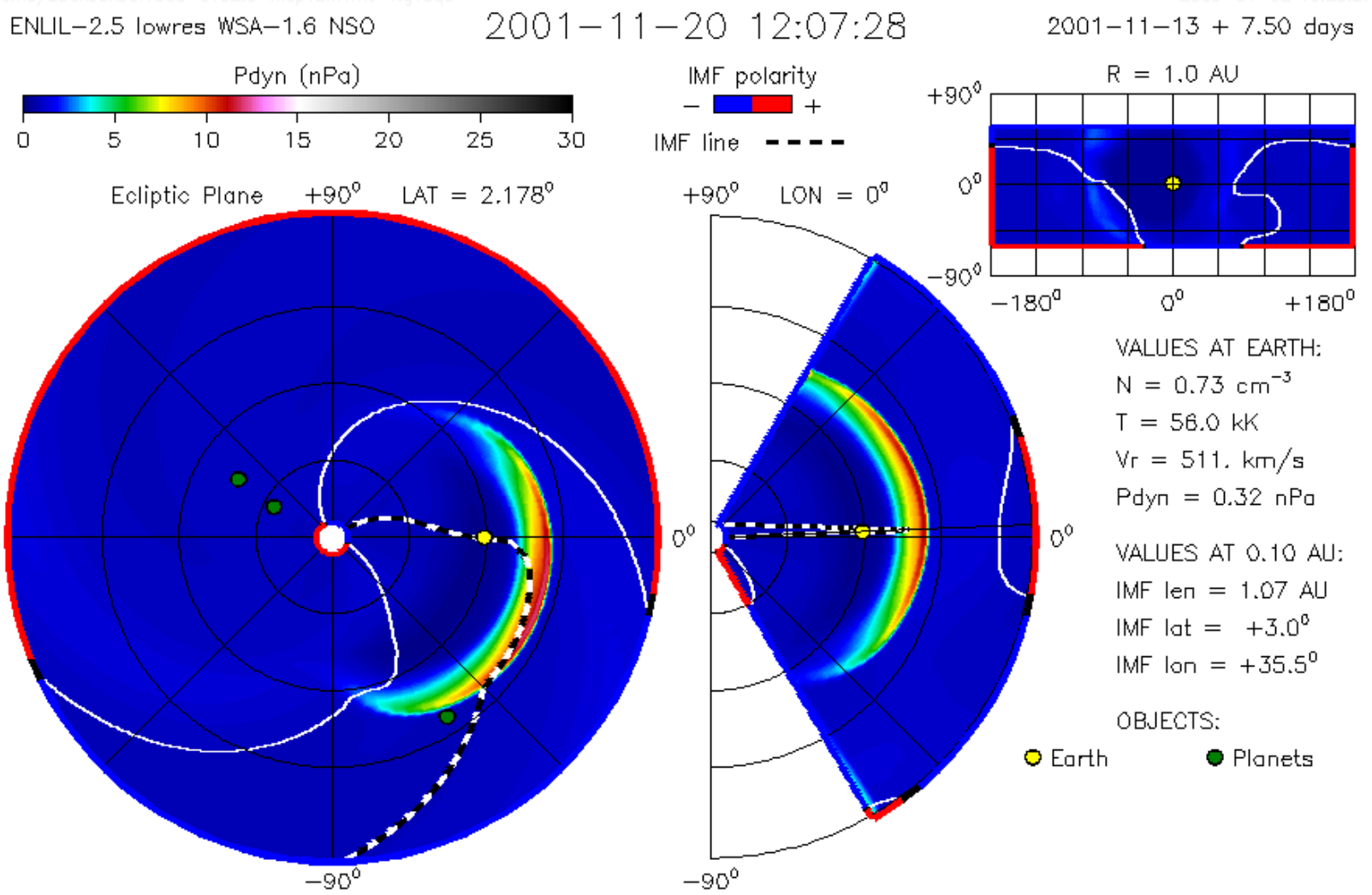
Improvements: Remove/implement shape factor



Improvements: Remove/implement shape factor



Improvements: Field-line data



Improvements: Remove irrelevant columns

▸Runs on Request: Heliosphere Simulations Results

Total Number of Runs in the Database: 820
Total Number of Search Results in this Database: 76

Event Date	Run Number	Key Words	Model Type	Model	Model Version	Validation Level	Carrington Rotation Start	Carrington Rotation End	Start Date	End Date	Input Type	Grid Resolution	Radial Grid Range	Proton Temperature	Electron Temperature	Kappa Index
Modeled Run	Thea_Falkenberg_100809_SH_1	July2004event, soteria, 1stCME alone	Heliosphere	ENLIL	2.5b	0	2019	2019	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_100809_SH_2	July2004event, soteria, 2ndCME alone	Heliosphere	ENLIL	2.5b	0	2019	2019	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_100809_SH_3	July2004event, soteria, all 3 CMEs	Heliosphere	ENLIL	2.5b	0	2019	2019	--	--	Time-Independent	256x30x90	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_1	SOTERIA, CIR period, pure solar wind model, MAS, high res	Heliosphere	ENLIL	2.5b	0	2025	2025	--	--	Time-Independent	1024x120x360	0.0-0.1	0	0	0
Modeled Run	Thea_Falkenberg_092909_SH_2	SOTERIA, CIR period, pure solar wind model, MAS, high res														
Modeled Run	Thea_Falkenberg_092909_SH_3	SOTERIA, CIR period, pure solar wind model, MAS, high res														
Modeled Run	Thea_Falkenberg_092909_SH_5	SOTERIA, CIR period, pure solar wind model, WSA, MWO, high res														
Modeled Run	Thea_Falkenberg_092909_SH_6	SOTERIA, CIR period, pure solar wind model, WSA, MWO, high res														
Modeled Run	Thea_Falkenberg_092909_SH_7	SOTERIA, CIR period, pure solar wind model, WSA, MWO, high res														
Modeled Run	Thea_Falkenberg_092909_SH_4	SOTERIA, CIR period, pure solar wind model, MAS, high res														
Modeled Run	Thea_Falkenberg_092009_SH_1	SOTERIA, CIR period, pure solar wind model														
Modeled Run	Thea_Falkenberg_092009_SH_2	SOTERIA, CIR period, pure solar wind model														
Modeled Run	Thea_Falkenberg_092009_SH_3	SOTERIA, CIR period, pure solar wind model														
Modeled		SOTERIA, CIR period, pure														

Heliosphere Simulation Results

- View ALL Heliosphere Runs on Request
- View Runs for the following model(s):
  - (•) ENLIL
  - ( ) Heliospheric Tomography
  - ( ) Exospheric Solar Wind Model
  - ( ) SWMF

View Runs

SEARCH heliosphere requests database for string(s): Falkenberg

For multiple strings, please separate them with AND or OR operators
If searching for a date, use the following format: YYYY/MM/DD.

(•) **Search In All Columns**

or

Suggestions for improvements

- Time resolution in plotting interface
  - Increase or make an option to ir
- Longitude input parameter
  - Which is East/West
- Cloud density and temperature
  - Value or both factor and value
  - Factor does not have to be integ
- Remove ”fast solar wind” values or
- Remove ”shape” option (as long as i
- Add option to upload orbit of i.e., Sp location (like the planetary ascii files
  - Maybe automatic (or tick box) o
- Field line tracing, field line data avai
- Remove irrelevant ’description colun
- WSA version number in control file
- Make clear what parameters are ope (i.e., gamma...)

```
project=examples/wsafr-2.5b
cr=2019
grd=256x30x90
x1l=0.1
x1r=2.1
x2l=30
x2r=150
datadir=$ENLIL_DATA_DIR
data=WSA_VEL/MW0/CARR/2.5deg/L72R21.5
tstop=288
ttfrom=48
ttto=288
ttstep=6

#------------------------------
# properties of fast solar wind
#------------------------------
#
# density (default 300 /cc)
  dfast=300
# temperature (default 0.8 million K)
  tfast=0.8
# speed (default 625 km/s)
  vfast=650

#----------------------------------
# properties of cone clouds for run
#----------------------------------
#
# number of clouds (default 1)
  ncloud=1
# start date time of model run (example '1997-05-12')
  start=2004-07-22
# start dates for each cone cme (example '1997-05-12','1997-05-18')
  dates='2004-07-25'
# start time of day for each cone cme (example '14:00')
  times='17:49'
# co-latitude of cloud (north=0, equator=90, south=180 degs)
  x2cld=111
# longitude of cloud
  x3cld=205
# cloud radius (default=25)
  radcld=75
# cloud velocity (default=650)
  vcld=1330
# density enhancement factor of cloud compared to fast solar wind (default=4)
  dcld=10
# temperature enhancement factor of cloud compared to fast solar wind (default=1
```

Questions