Using Solar-Helio Models at CCMC

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4th CCMC Workshop
Arecibo Observatory, Puerto Rico
November 5, 2007

“I requested the 1000th run at CCMC[!]”

Overview

- Provide personal feedback using MAS/ENLIL and WSA/ENLIL solar-helio (CISM) models

  See talks tomorrow by N. Arge, P. Riley, and D. Odstrcil regarding models…

- Present my latest CCMC results

Using CCMC Solar-Helio Models: “Pros”

Good user interface

CCMC User Interface

(top) Select preferences in the run request interface:

- desired Carrington Rotation (CR)
- input solar coronal model
- solar magnetograms (WSA)
  - maximum radial distance of run

(bottom) Various output data in different formats (color contour plots, 1D line plots, etc.,) and plotting parameters (e.g., plot variables, plot axes range, etc.)

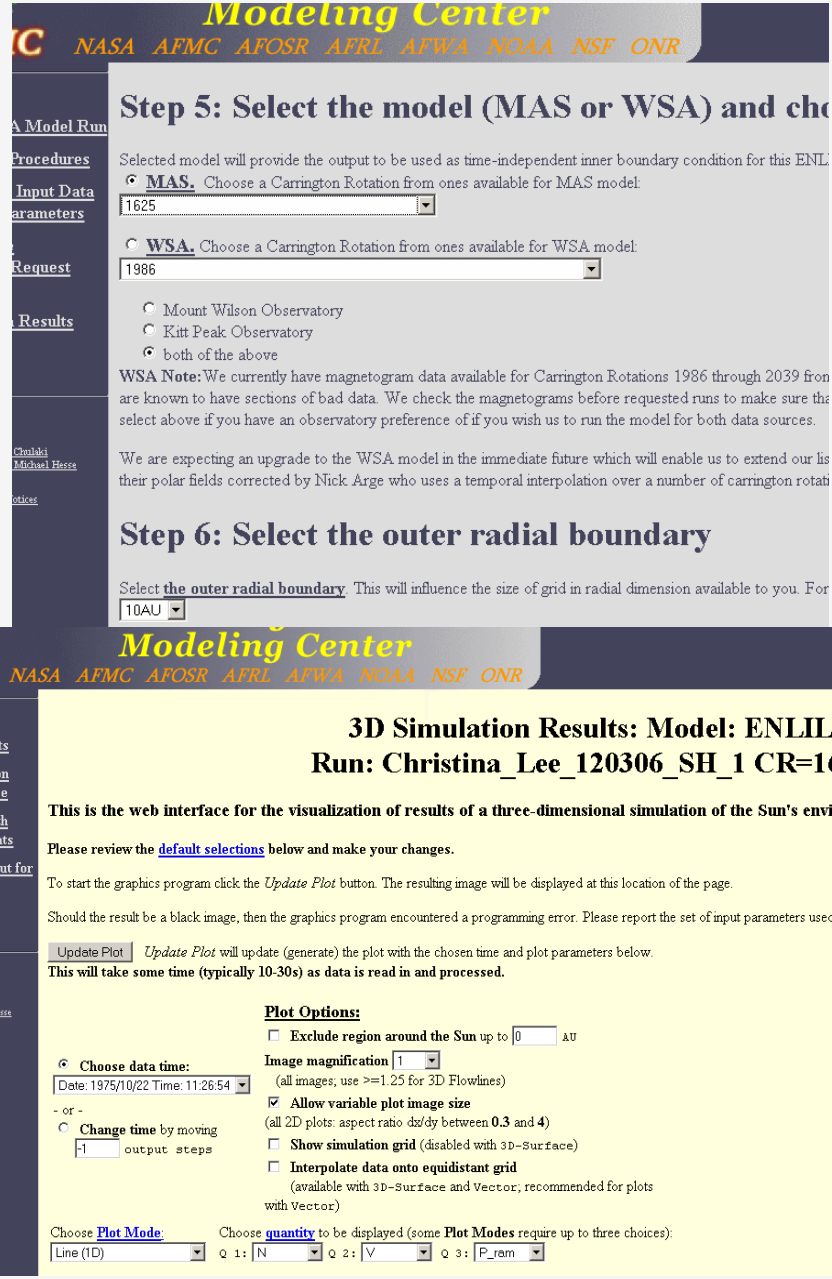
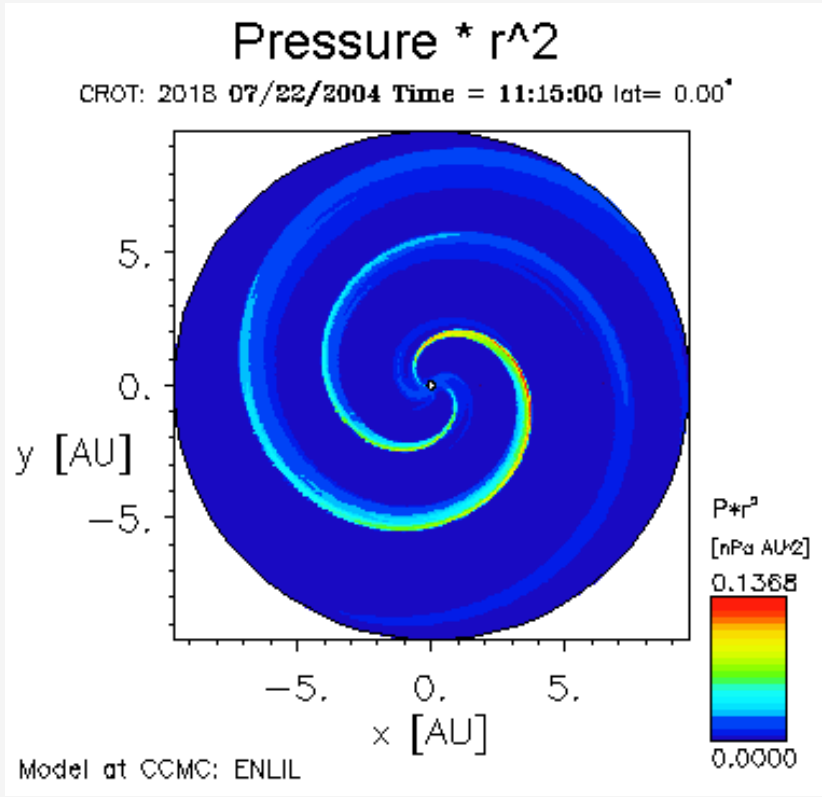
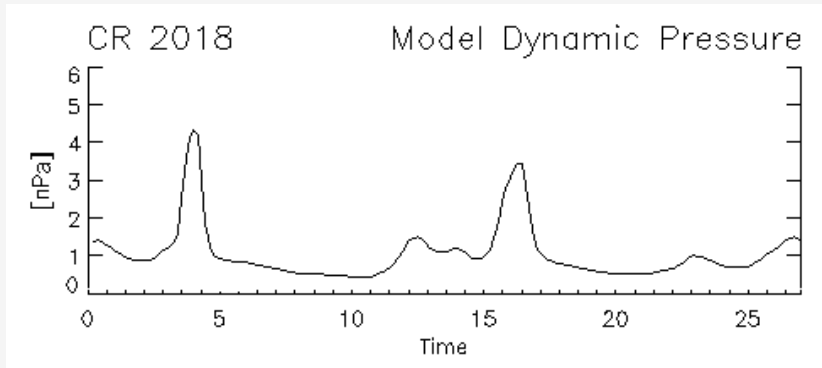


Illustration from model results of how solar wind dynamic pressure evolves for one Carrington Rotation



(top) CCMC-generated output of a 2-D color contour plot for the variation in pressure with radial distance.

(bottom) Time series for dynamic pressure generated from the CCMC-generated ASCII text data output file.



Using CCMC Solar-Helio Models: “Pros”

Good user interface

Ability to request many runs/day

Quick turn-around time of result output

Fast response time to resolve issues regarding output results

Modelers are very accommodating to special requests (to within limits of the model capabilities)

Useful “quick view” plots are provided with each run submission result output page

Using CCMC Solar-Helio Models: “Cons”

Output figures need additional labels
(version of model, Carrington Rotation, observatory)

Limited information about models on the website
(model grid sizes, boundaries, versions being used)

References for the models not always provided

Obtaining ASCII files of run results not automatic

Slower turn-around time of result output
during “busy” season or “bug” in system

“Limitations” of Models at CCMC

MAS/ENLIL

- Currently utilizes solar magnetograms from NSO only

  Plans to use other magnetograms are underway, I think…

WSA/ENLIL

- Existing list of CRs no earlier than 1986 (Feb. 3, 2002)
  MAS/ENLIL goes back to CR 1625 (Feb. 19. 1975)

Some general questions:

- Clarification on existing models at CCMC – versions?
- Magnetograms – other sources besides NSO & MWO?
- Documentation – references? Posting of sample results?
- Carrington Rotations – plans to extend existing list?

For the novice CCMC user…

Errors can occur

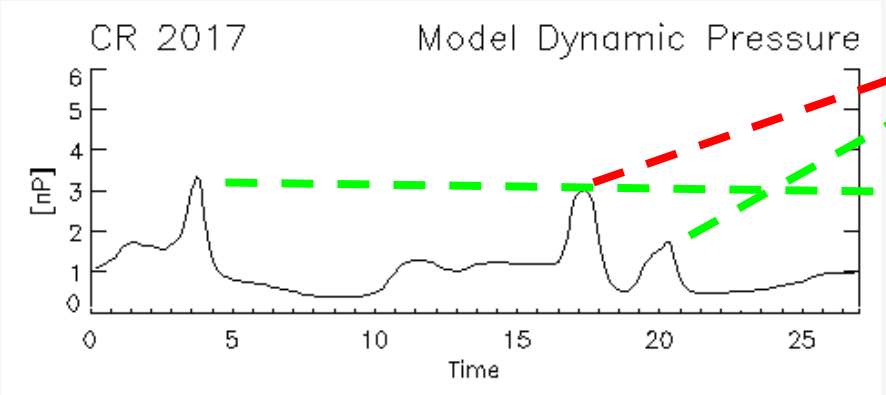
in run results

so beware!

e.g., results not for CR requested, corrupted magnetogram → weird results, etc…

My CCMC results!

Adopted plot style for displaying solar wind parameters



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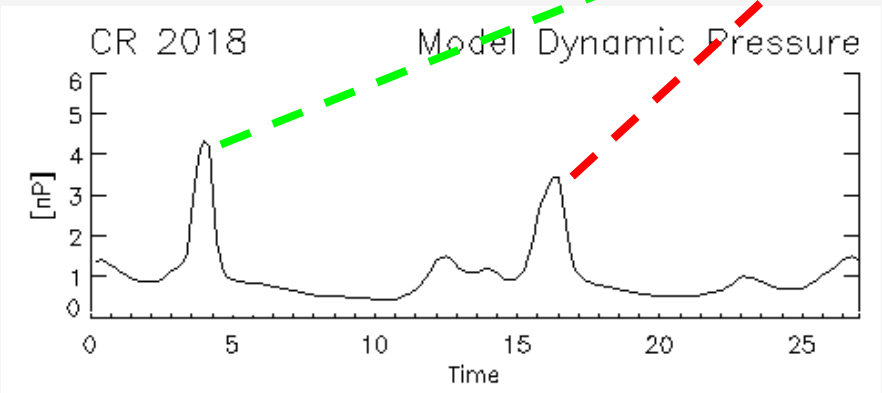
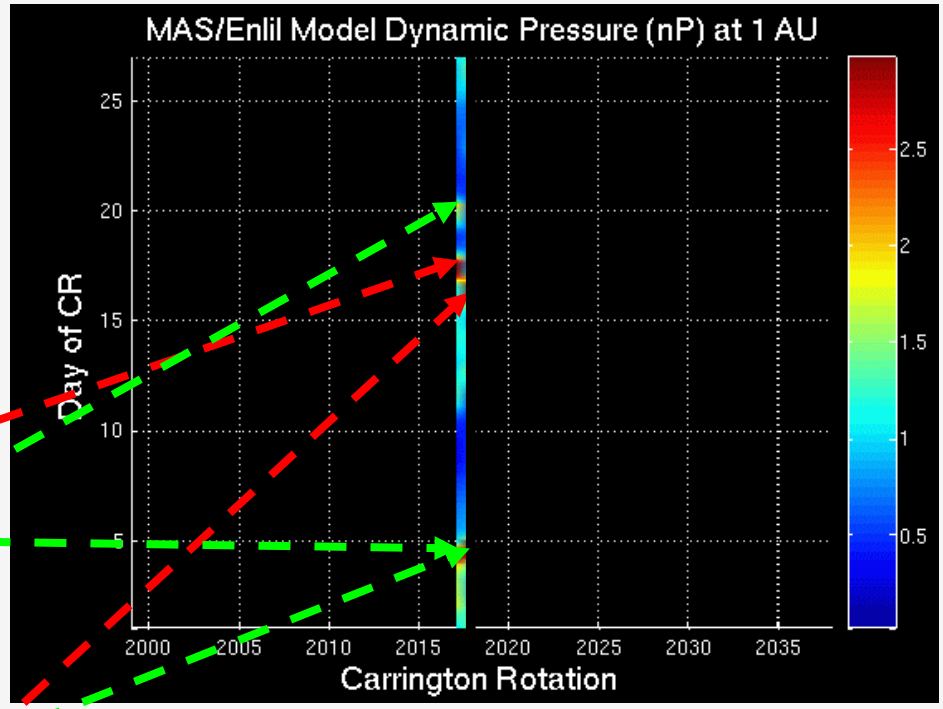
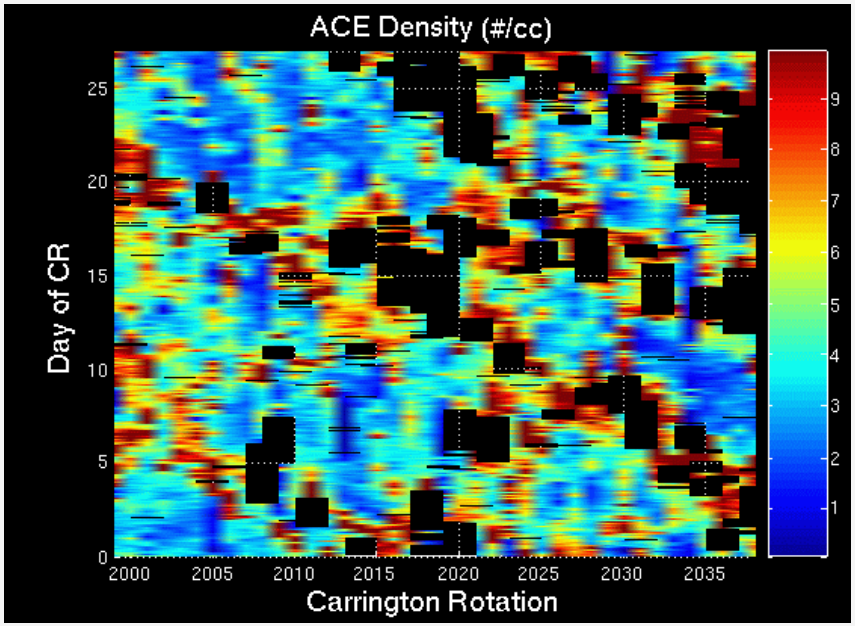
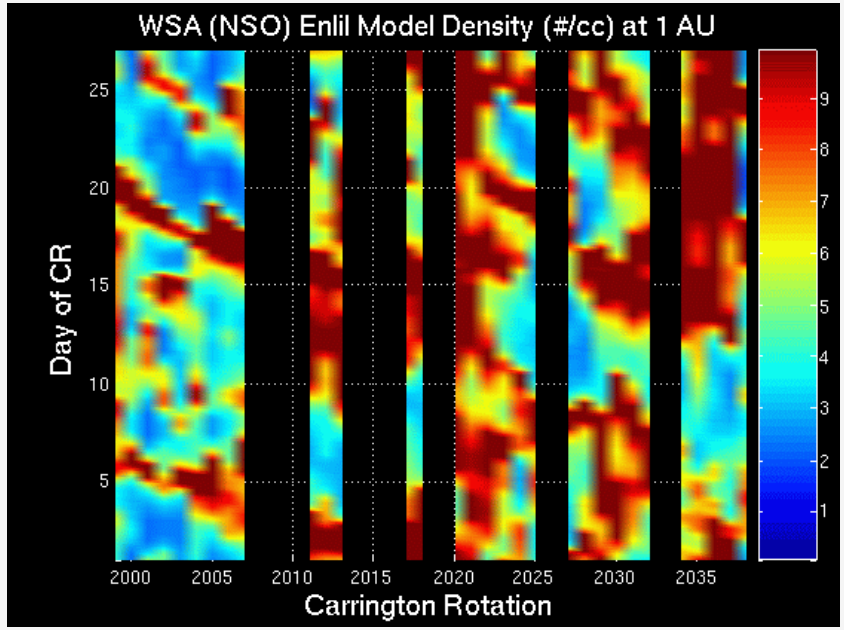


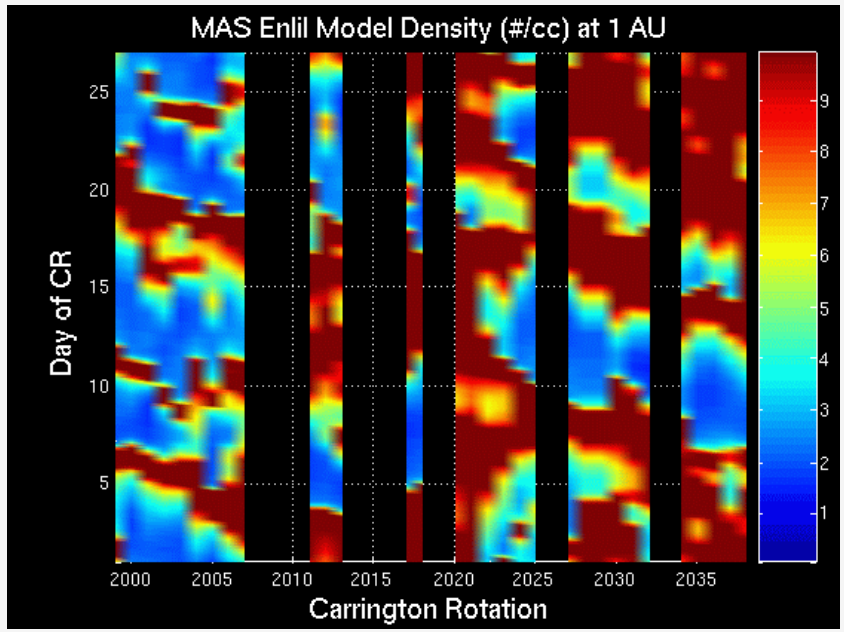


Time series of dynamic pressure (left) modeled at 1 AU for CR 2017 and 2018. The time series can be stacked against each other, where the magnitude of the dynamic pressure is now represented in color.

Comparison of MAS/Enlil and WSA/Enlil w/ ACE Density at 1 AU

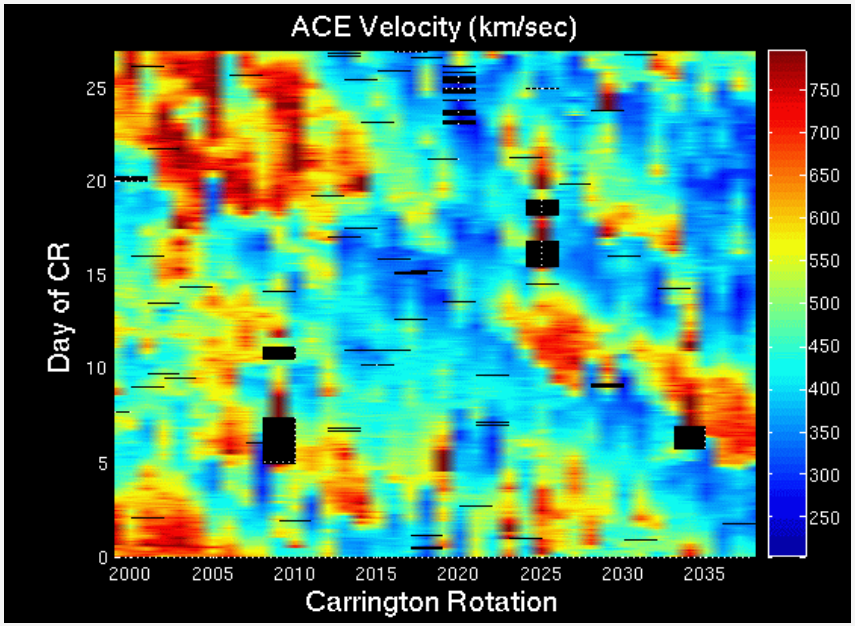




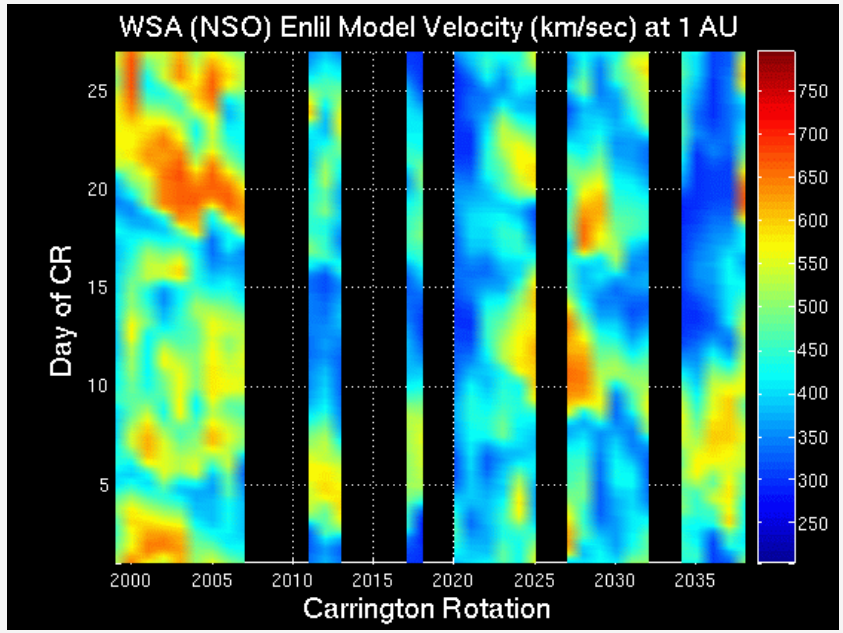


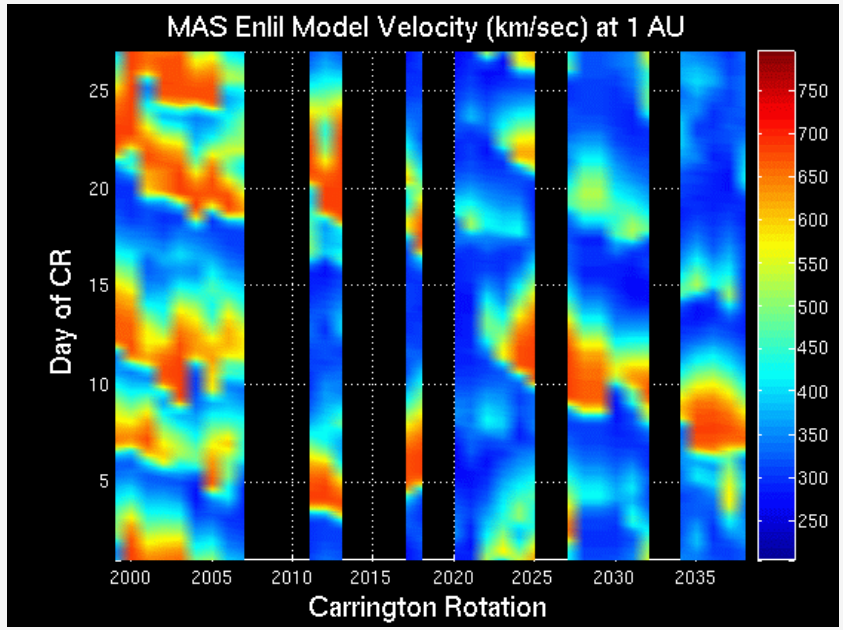
For CRs 1999-2020 where the stream interaction regions are a 2-sector structure, there are 2 corresponding high-density ridges (reds). For CRs 2020 to 2038, there are 4 high-density ridges corresponding with a 4-sector structure.

Comparison of MAS/Enlil and WSA/Enlil w/ ACE Velocity at 1 AU

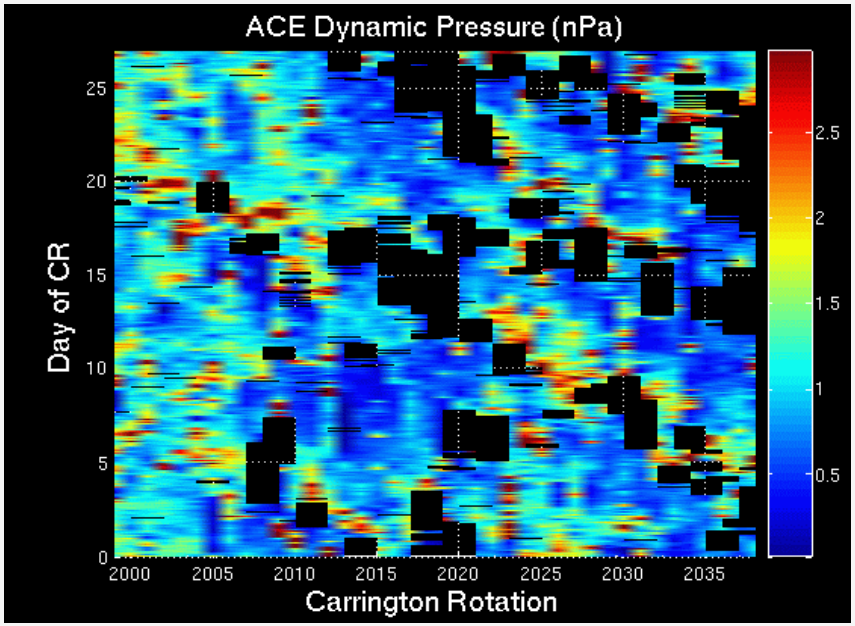


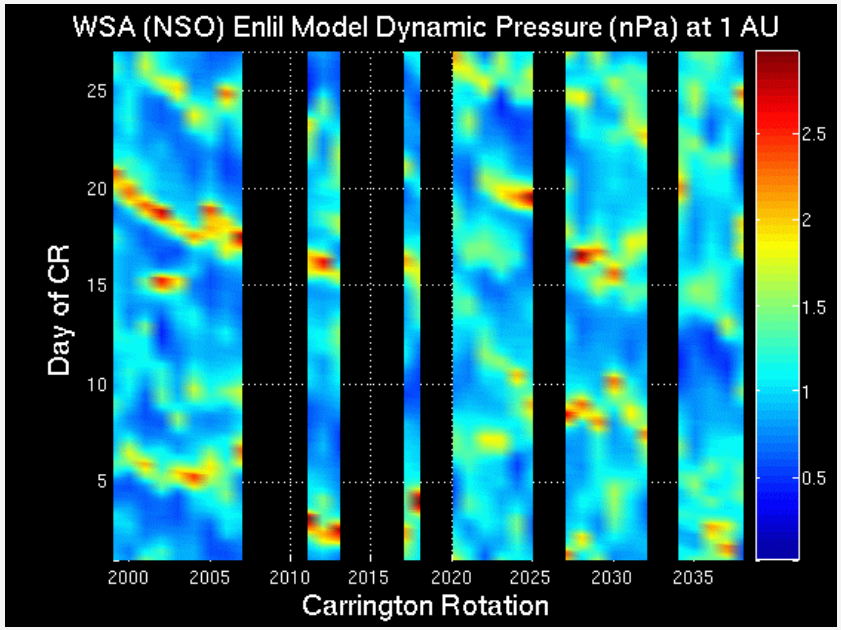
In the modeled velocity (right), it can be seen that the pattern of high velocity values (orange-red) match fairly well with those from the ACE observations (above).

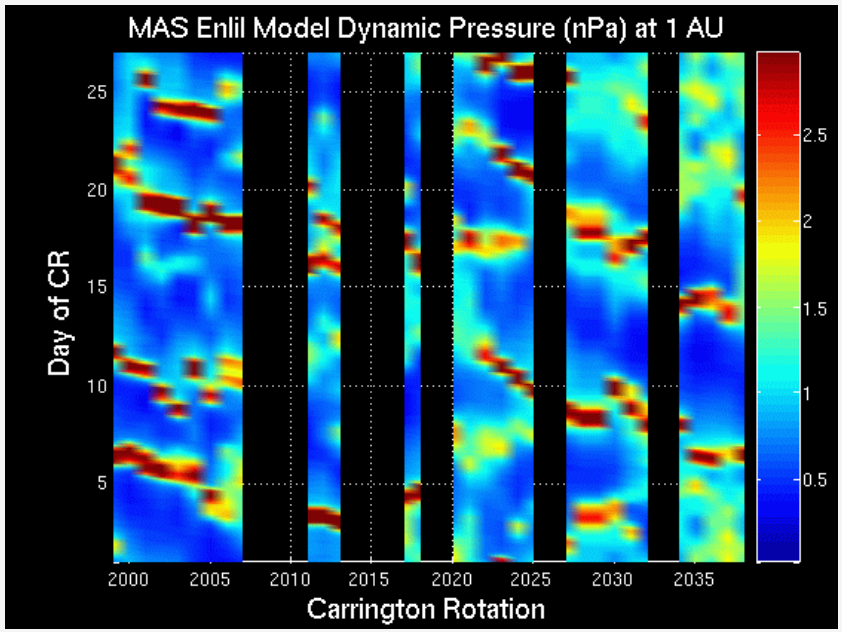




Comparison of MAS/Enlil and WSA/Enlil with ACE Dynamic Pressure at 1 AU







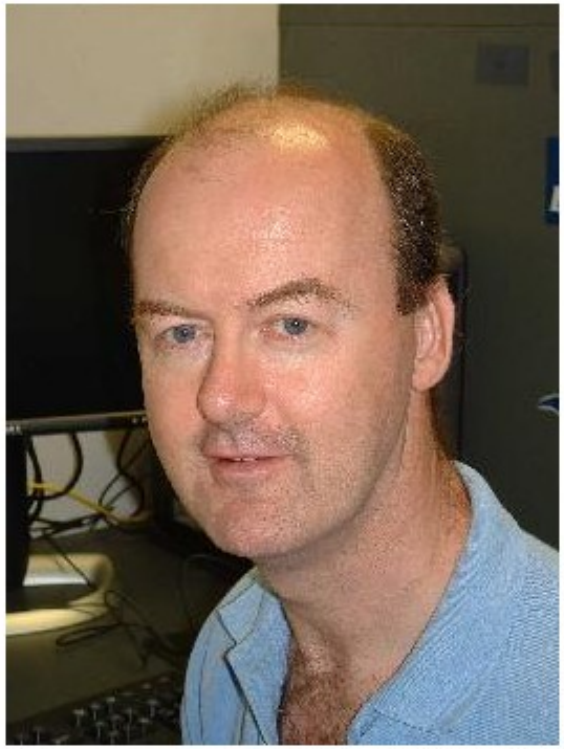
Compared to ACE observations (above), the models do a good job of replicating the high dynamic pressure ridges. It is noticeable that the MAS/ENLIL results have less mid-range values (aqua) compared to the WSA/ENLIL results.

CCMC results will be presented in a paper for publication!

The Solar Wind At 1 AU During Solar Minimum: Comparison Of 3D Numerical Model Results With Observations

C. Lee, J. G. Luhmann, D. Odstrcil, P. MacNeice, I. de Pater, P. Riley, and C. N. Arge

Special thanks to…



Anna Chulaki and Peter MacNeice