Interpreting STEREO Observations of the Solar Corona and Inner Heliosphere using a Global MHD Model

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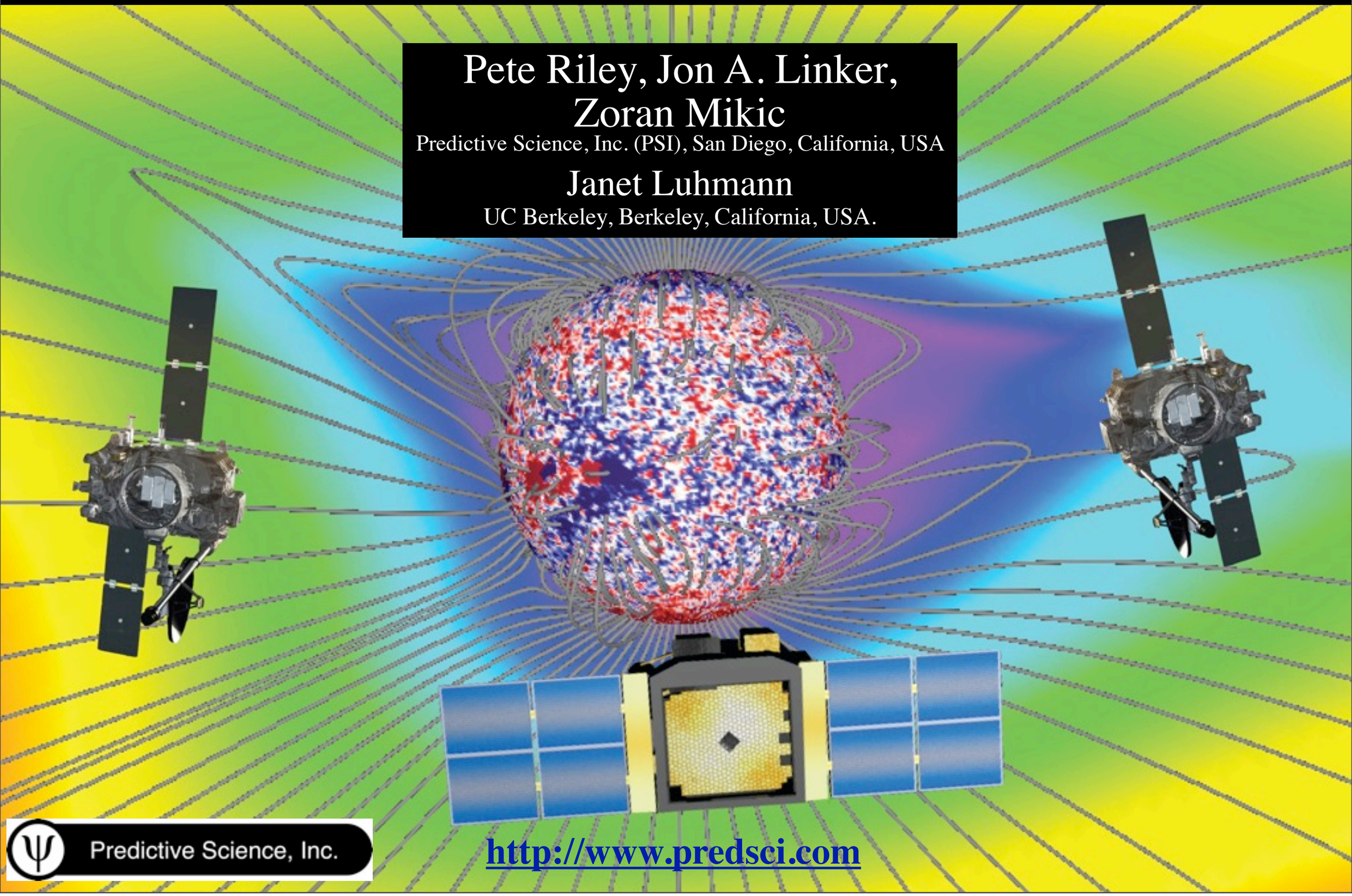

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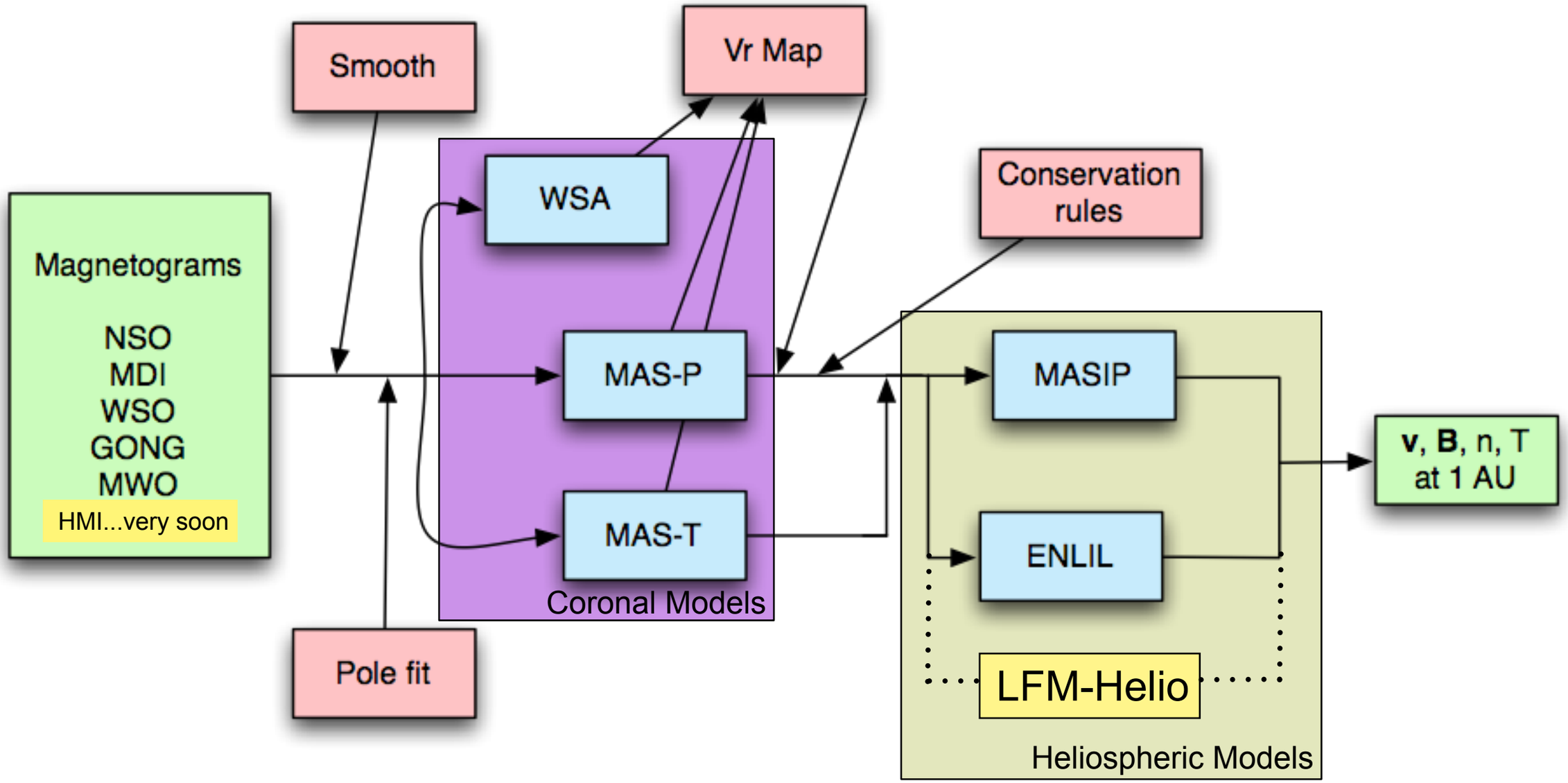
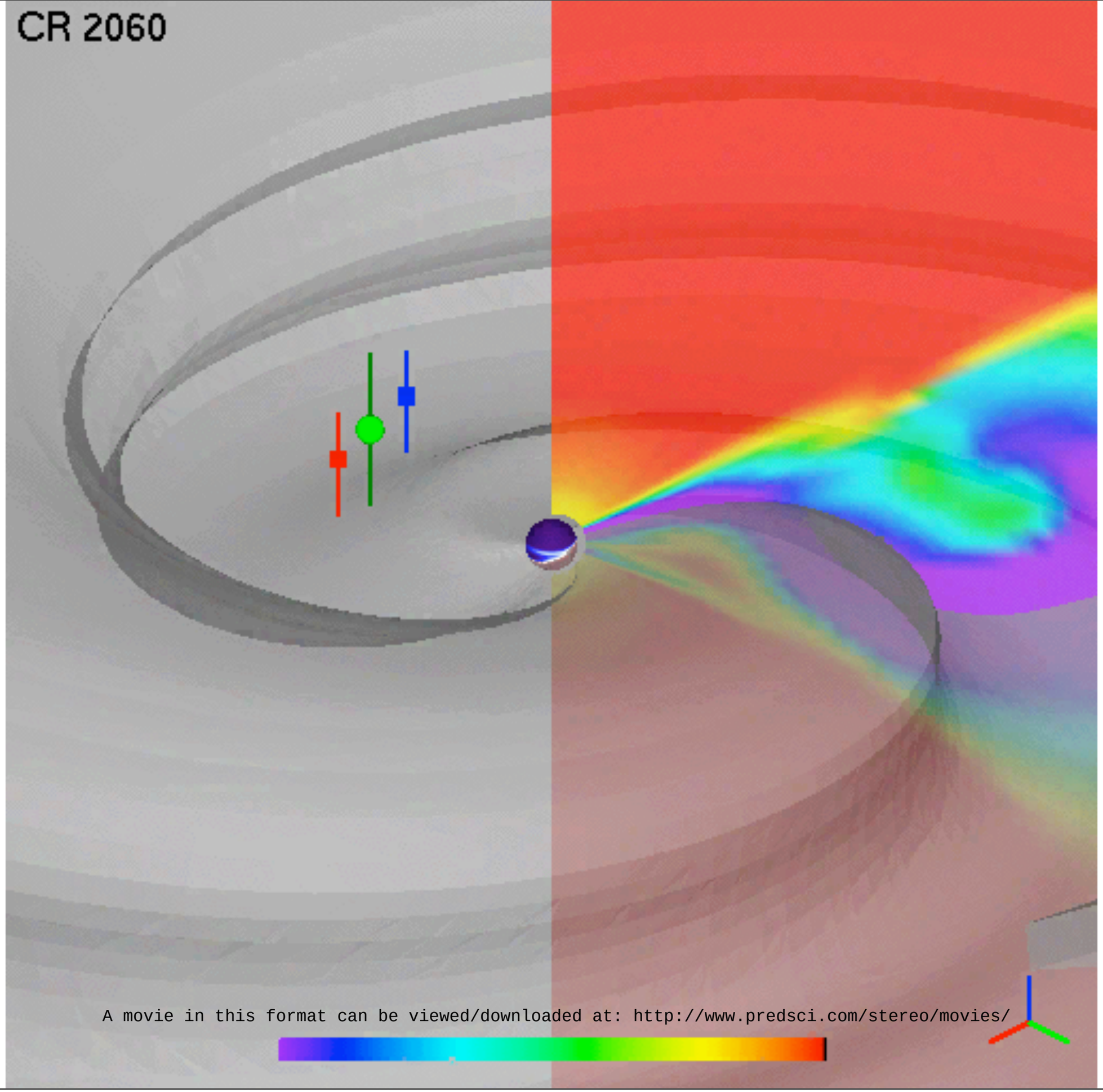
OUTLINE

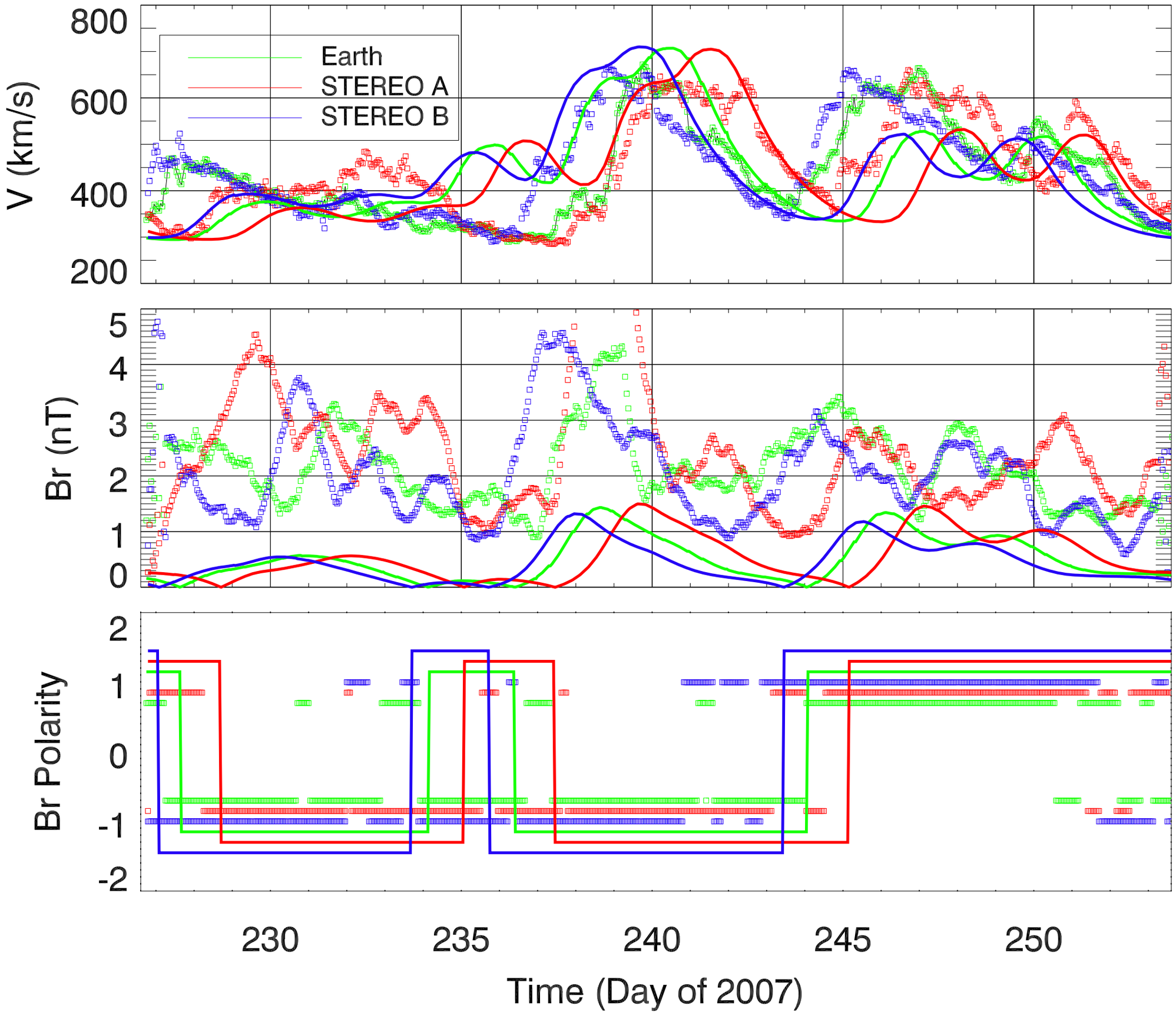
- Introduction to the global MHD model and results
- Review of STEREO *in situ* Observations (v, B) for mission to date
- A cross-correlation analysis
- Interpretation of the results using the global MHD results
- Summary

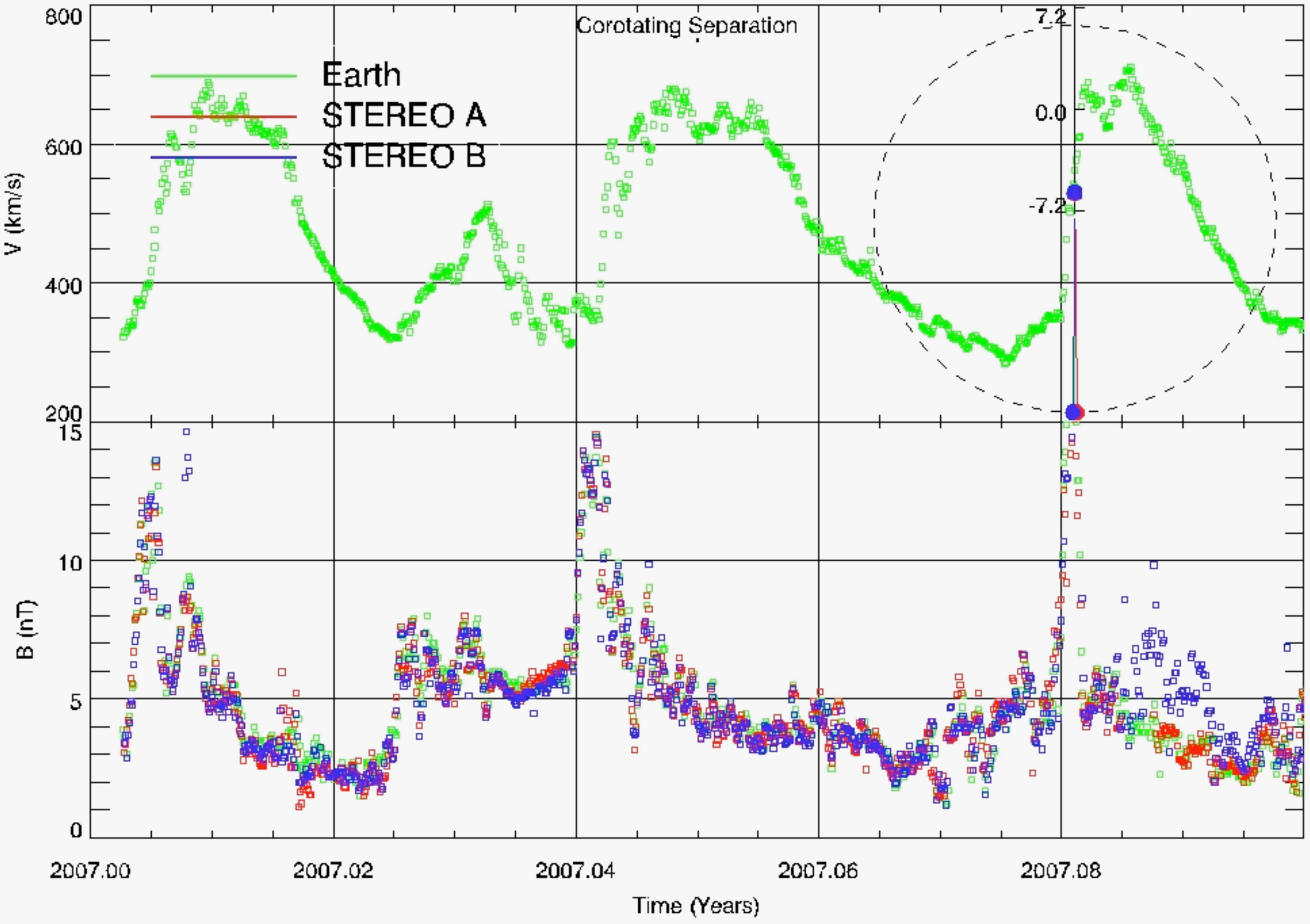
Modeling the global solar corona and inner heliosphere with CORHEL




CR 2060
A movie in this format can be viewed/downloaded at: http://www.predsci.com/stereo/movies/

CR 2060/Obs: gong/<(A,B)= 27.6°





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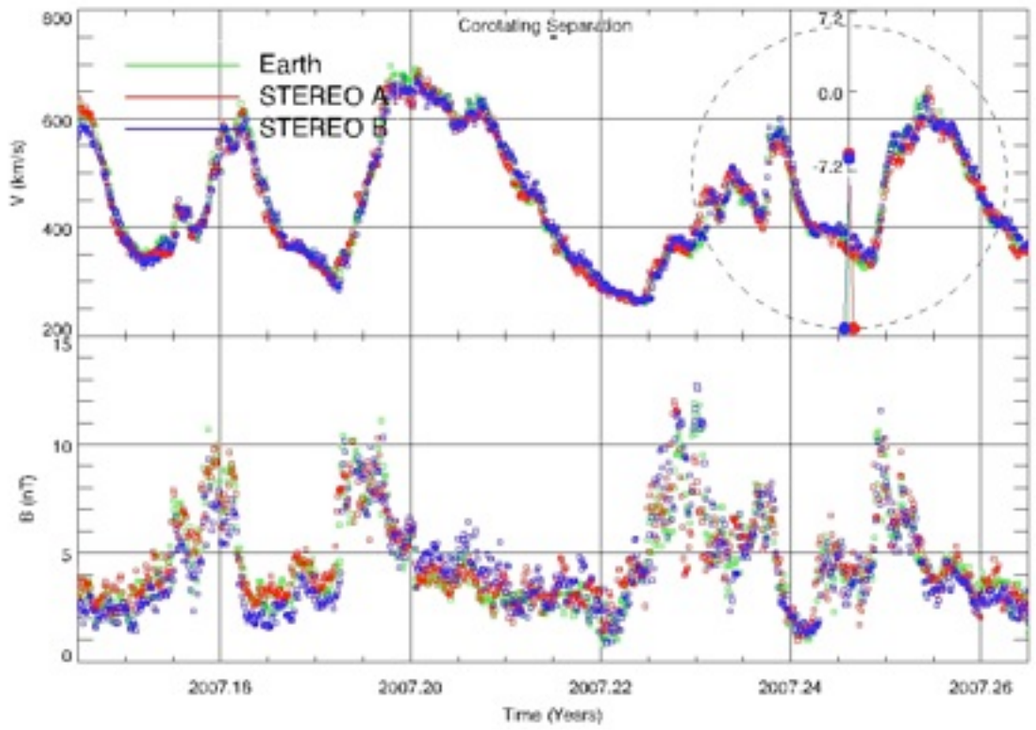
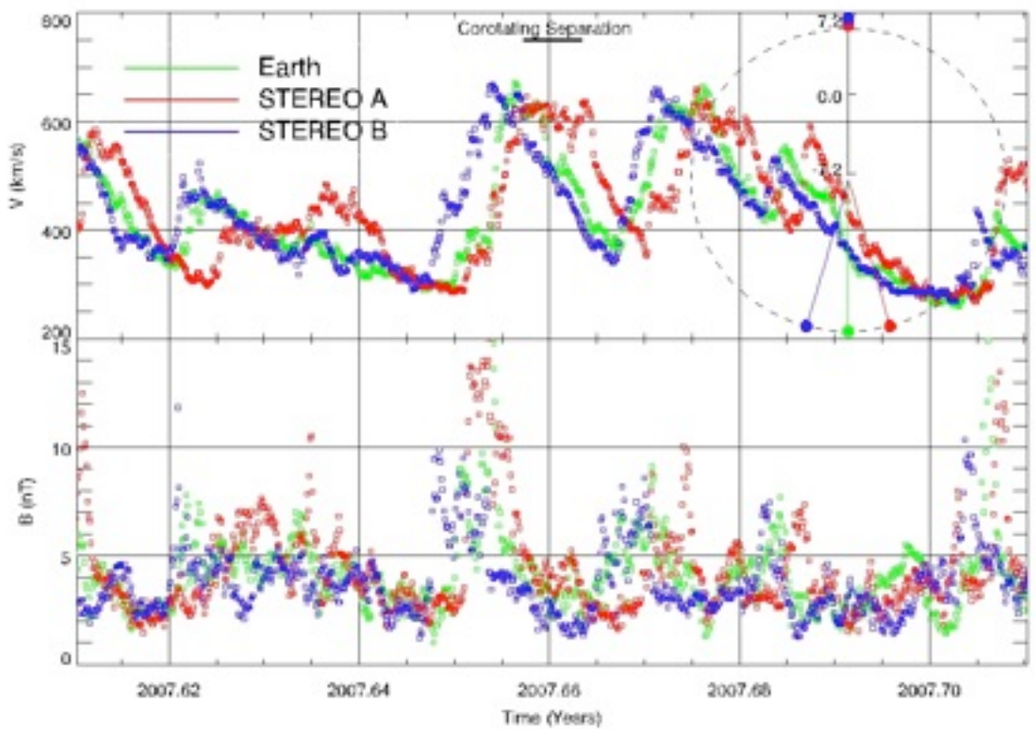
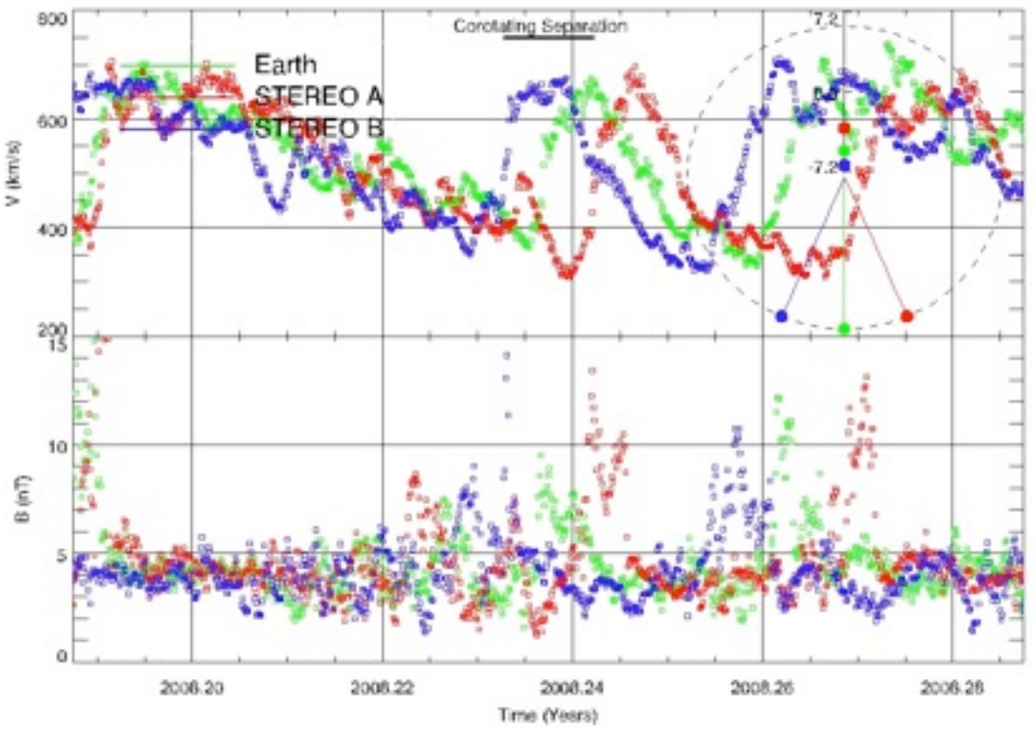
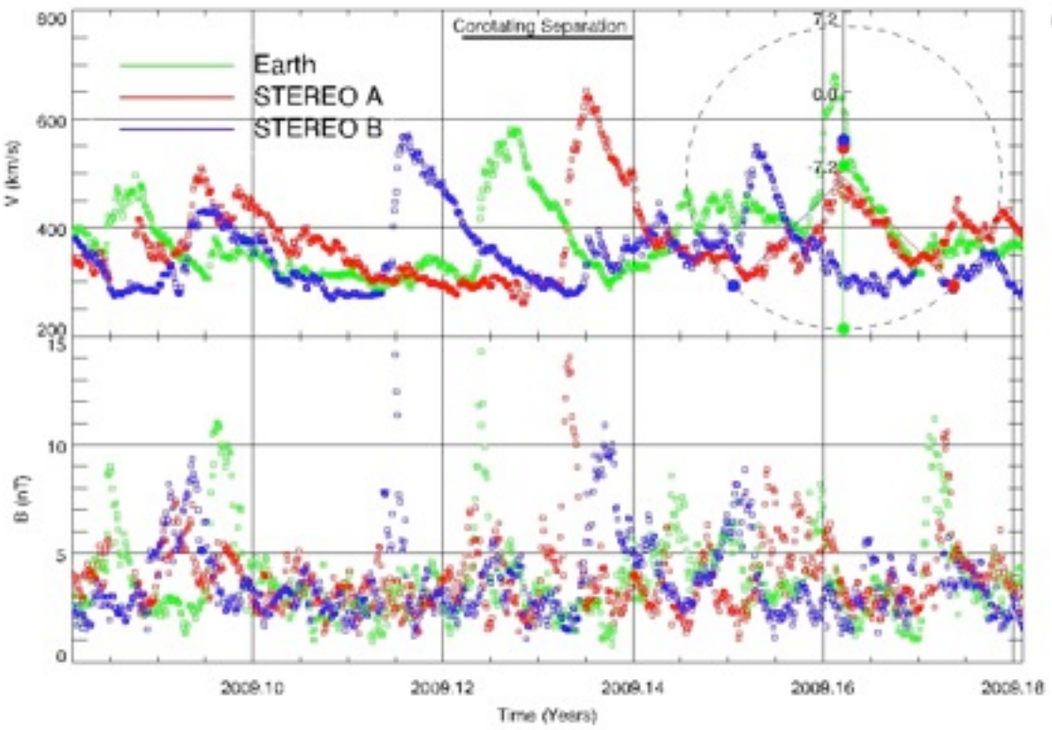
The Cross Correlation of Two Variables

$$(f \star g)(t) \stackrel{\text{def}}{=} \int_{-\infty}^{\infty} f^*(\tau)\ g(t+\tau)\, d\tau,$$





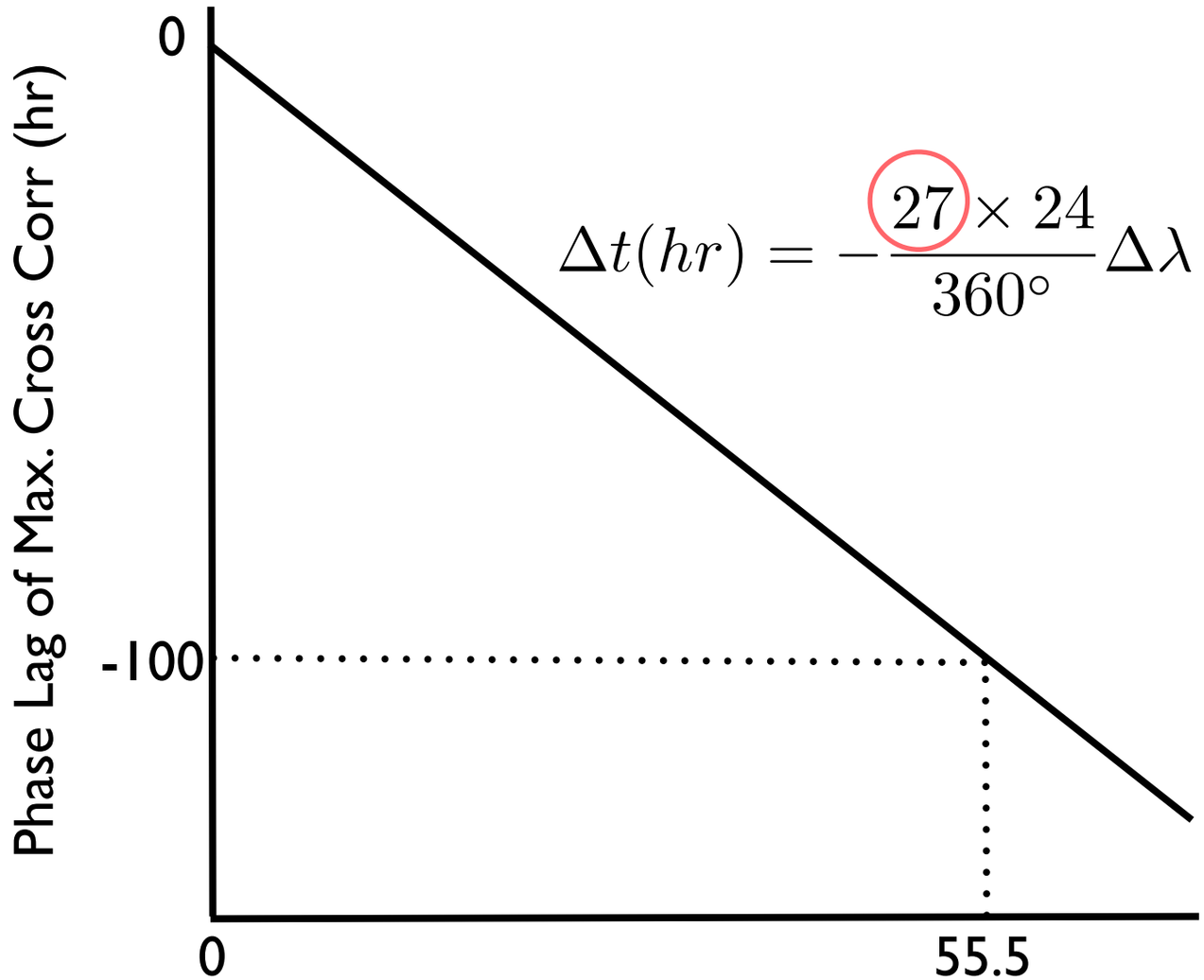


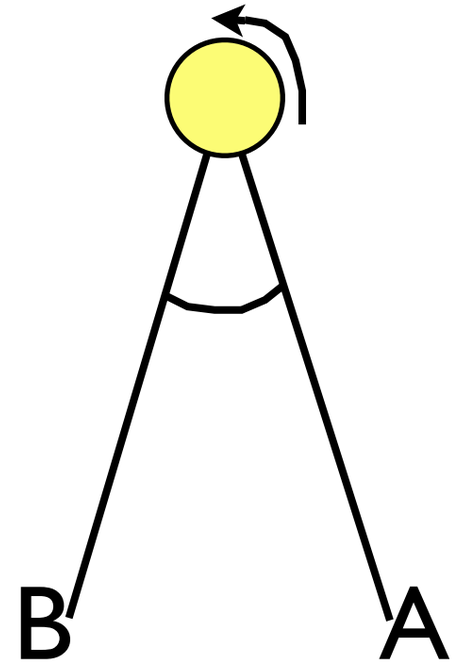


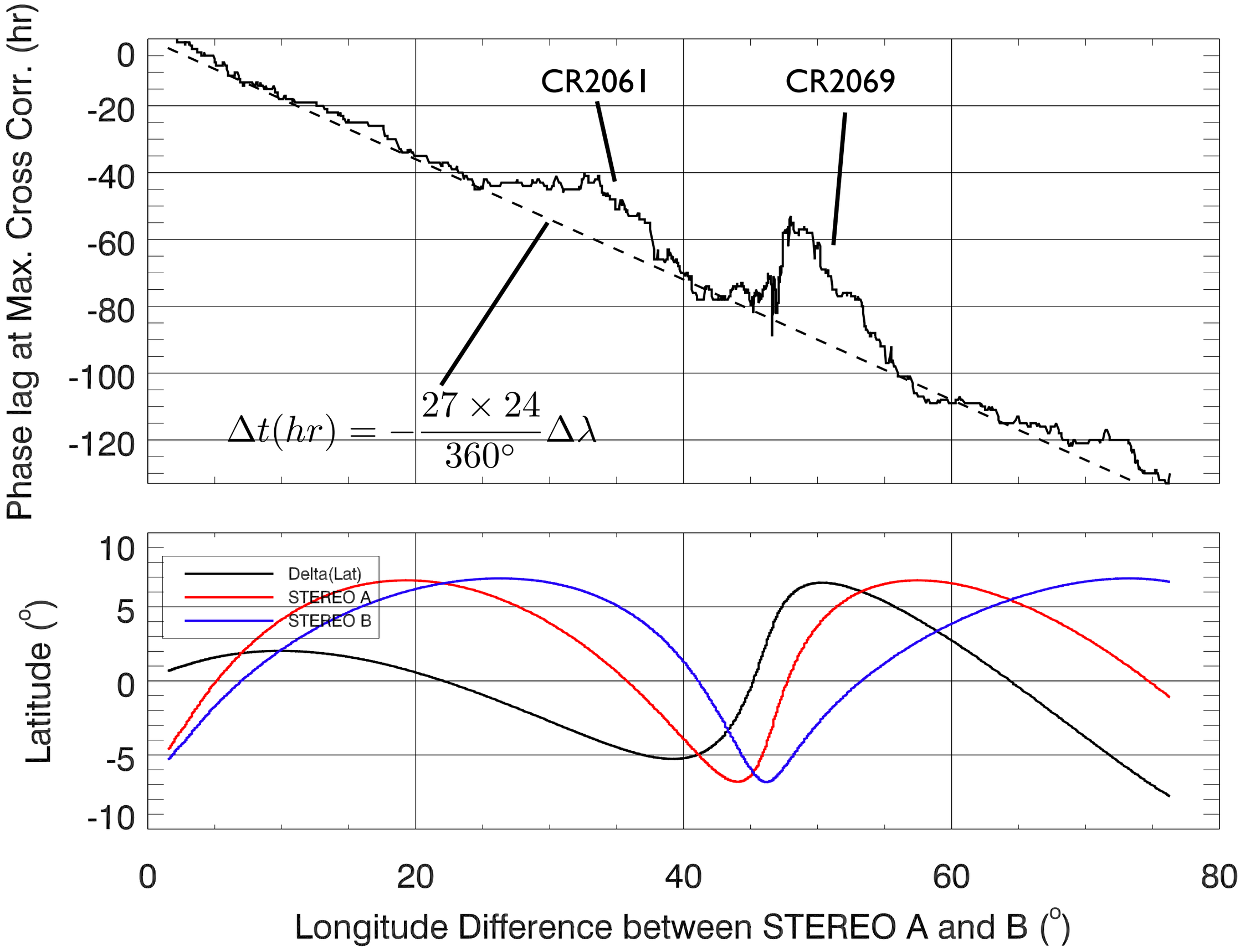
What should the cross correlation look like for STEREO A and B Bulk Solar Wind Velocity?

For corotating flow:

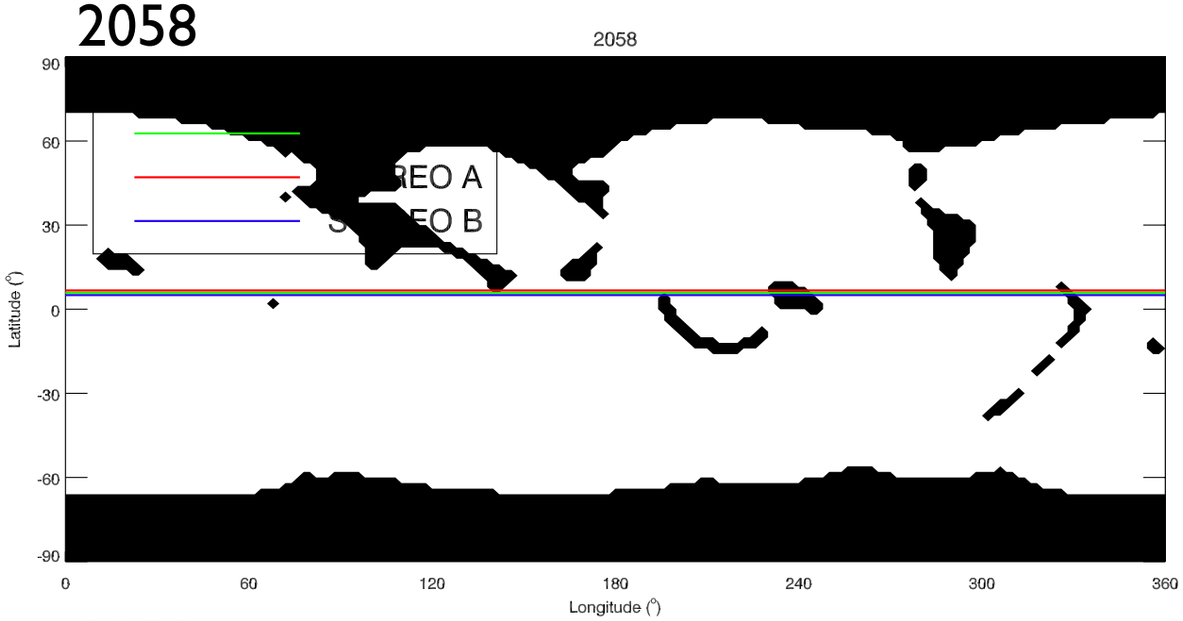
$$\Delta t(hr) = -\frac{27 \times 24}{360^\circ}\Delta\lambda$$






Phase lag at Max. Cross Corr. (hr)
0
-20
-40
-60
-80
-100
-120
CR2061
CR2069
$\Delta t(hr) = -\frac{27 \times 24}{360^\circ} \Delta\lambda$
Latitude (°)
10
5
0
-5
-10
Delta(Lat)
STEREO A
STEREO B
0
20
40
60
80
Longitude Difference between STEREO A and B (°)

2058



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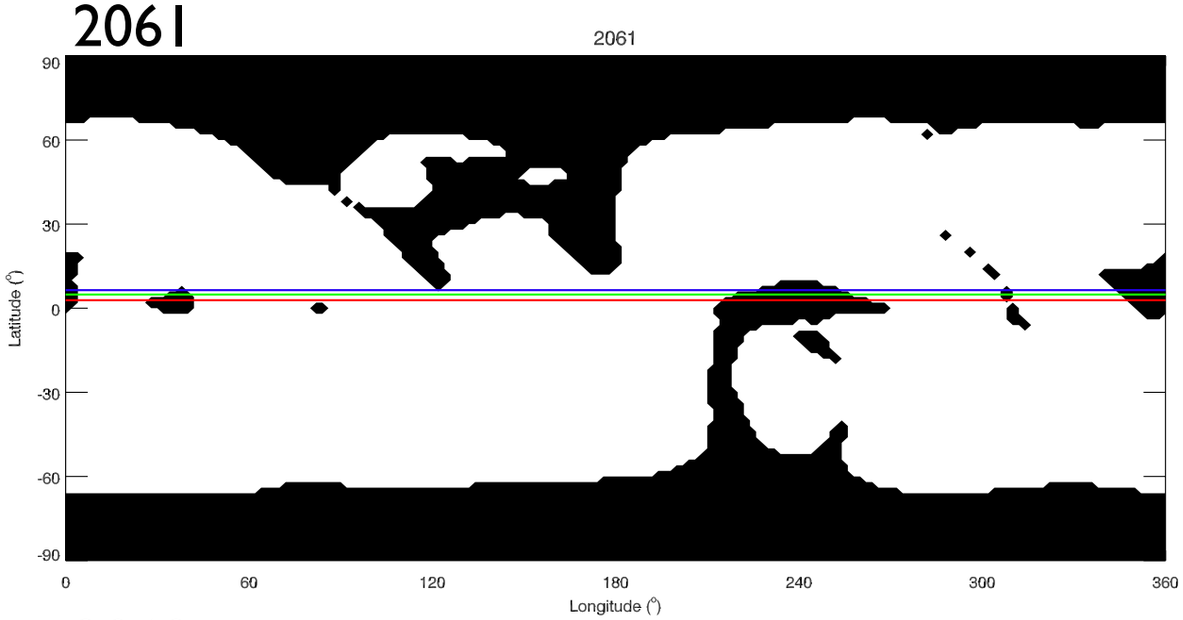

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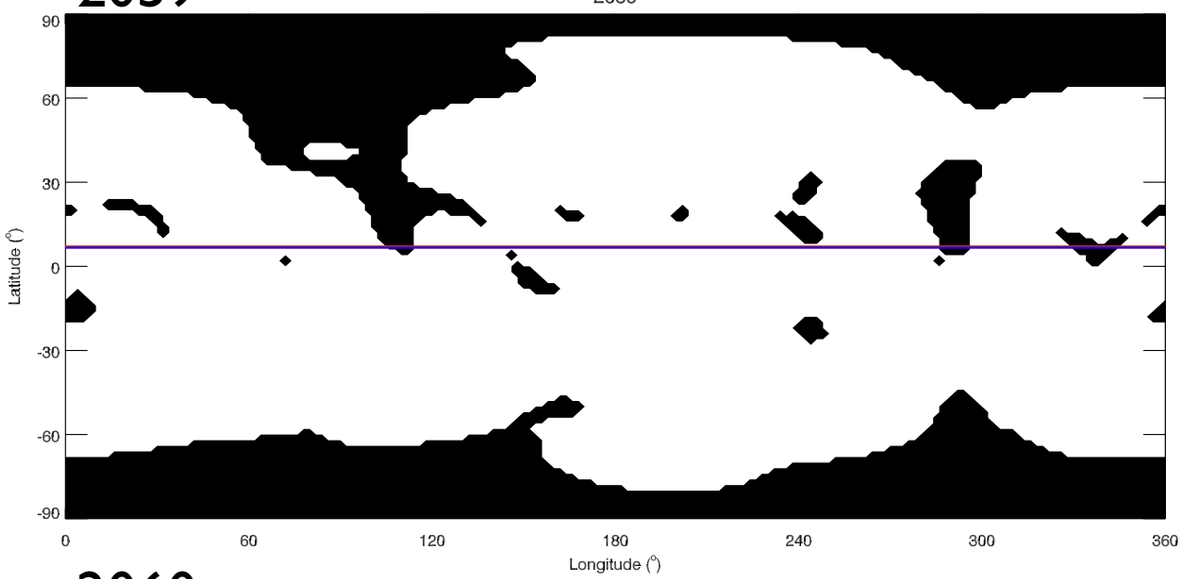

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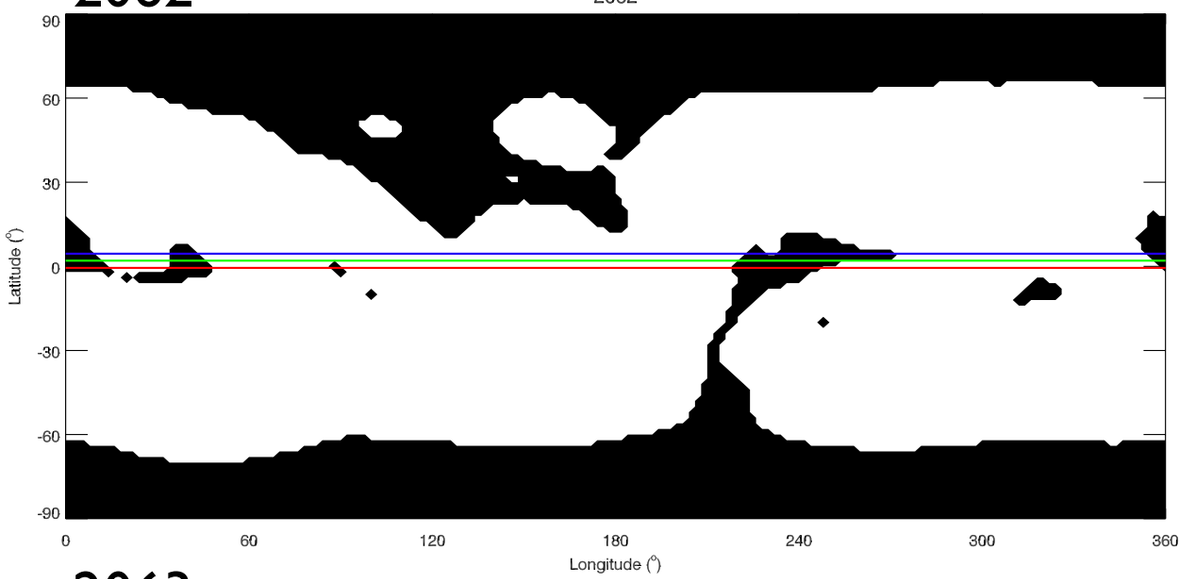

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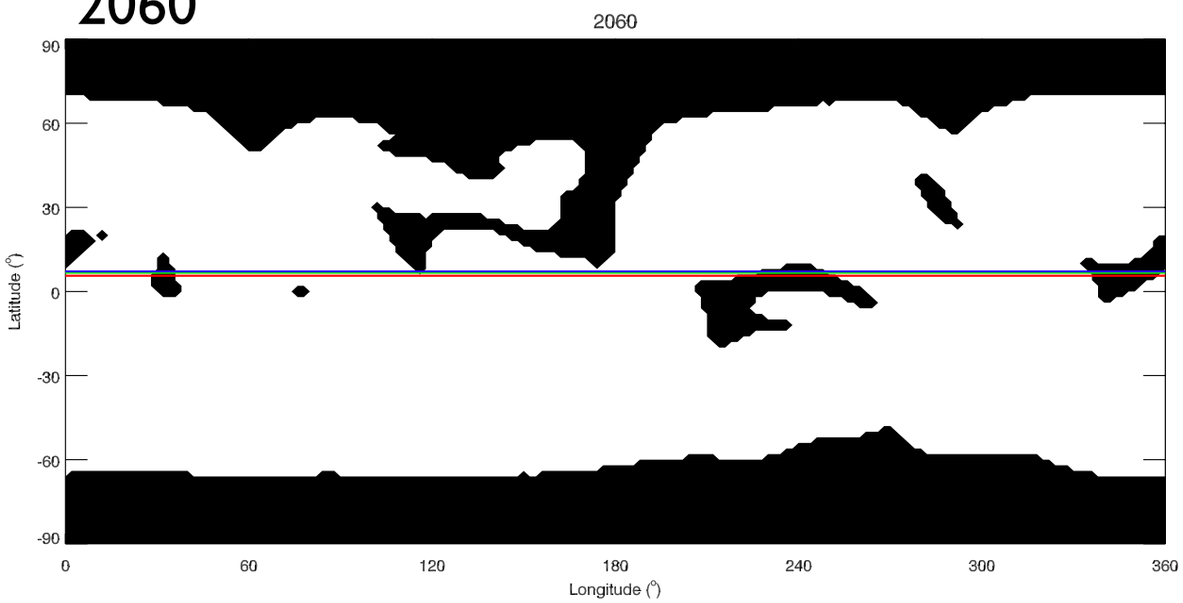

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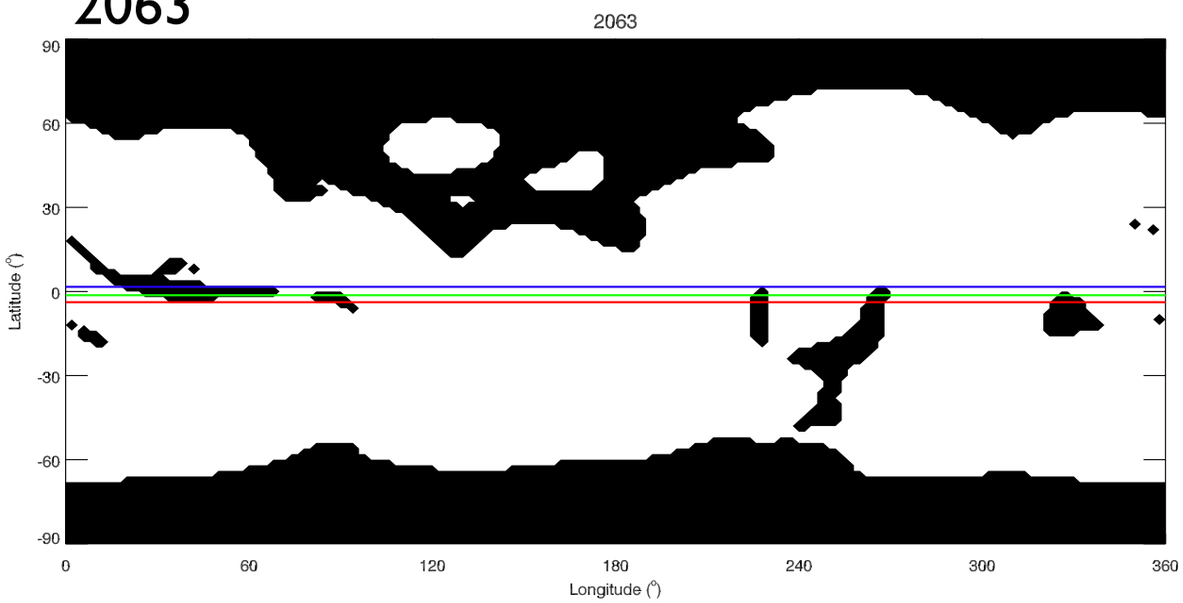

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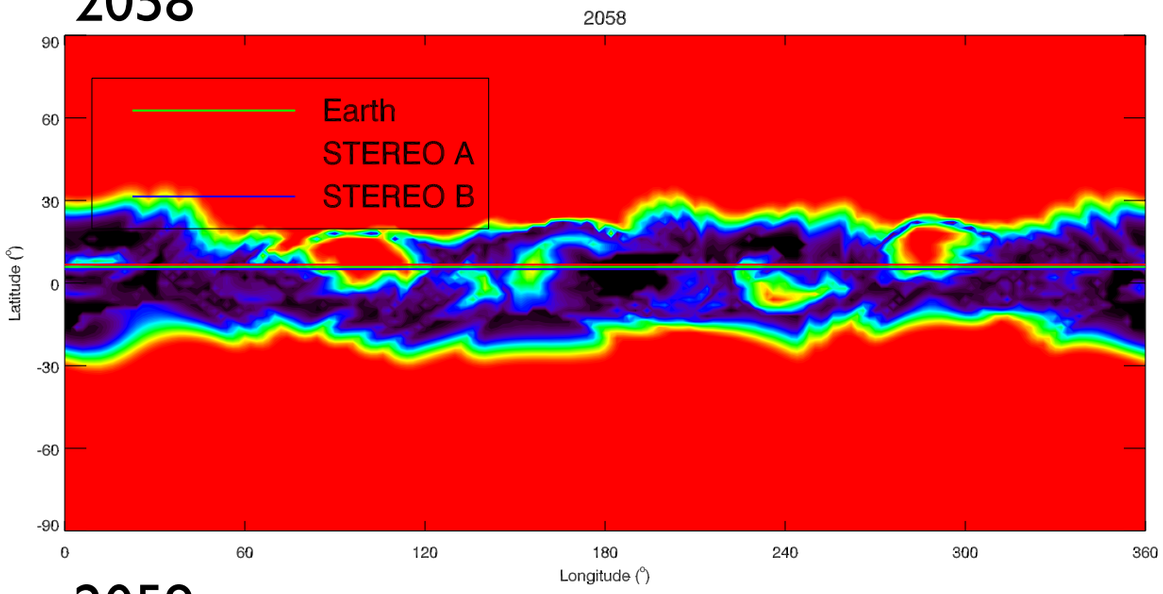

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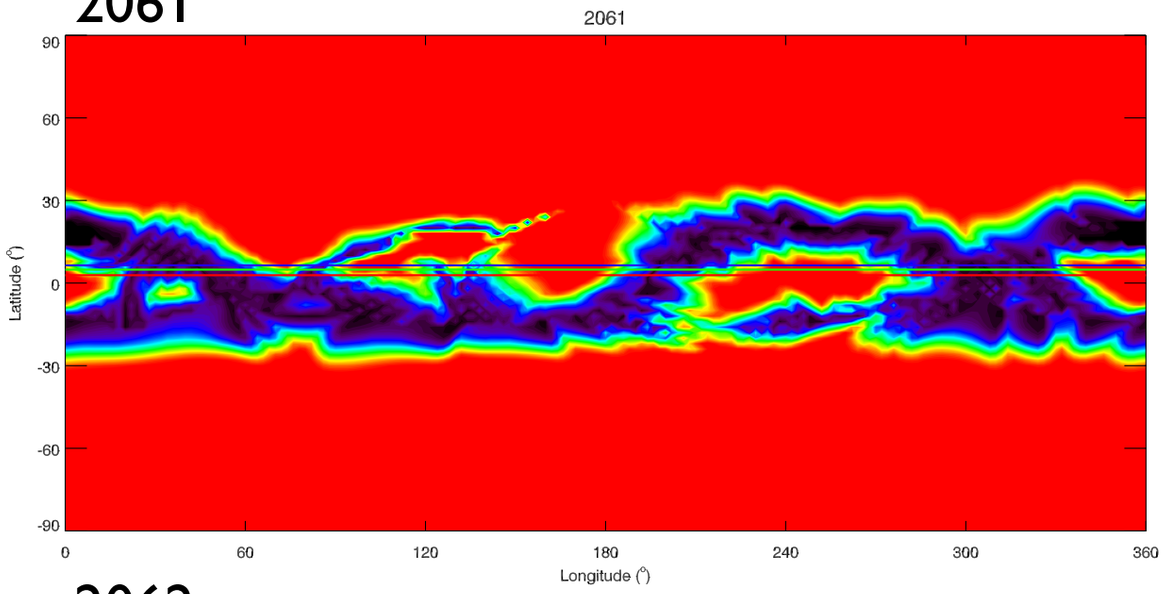

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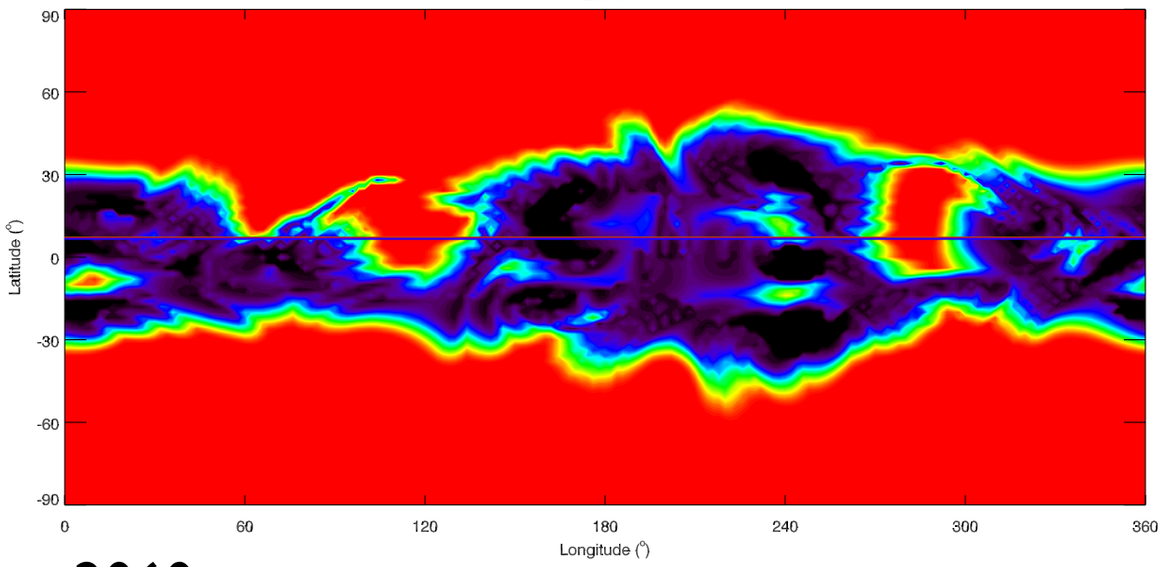

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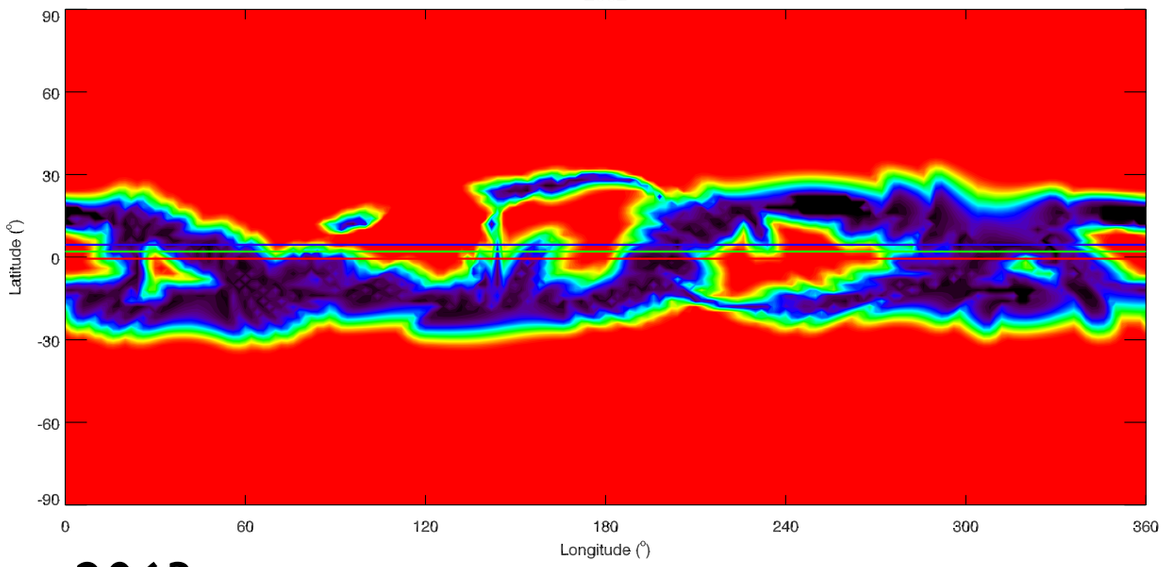

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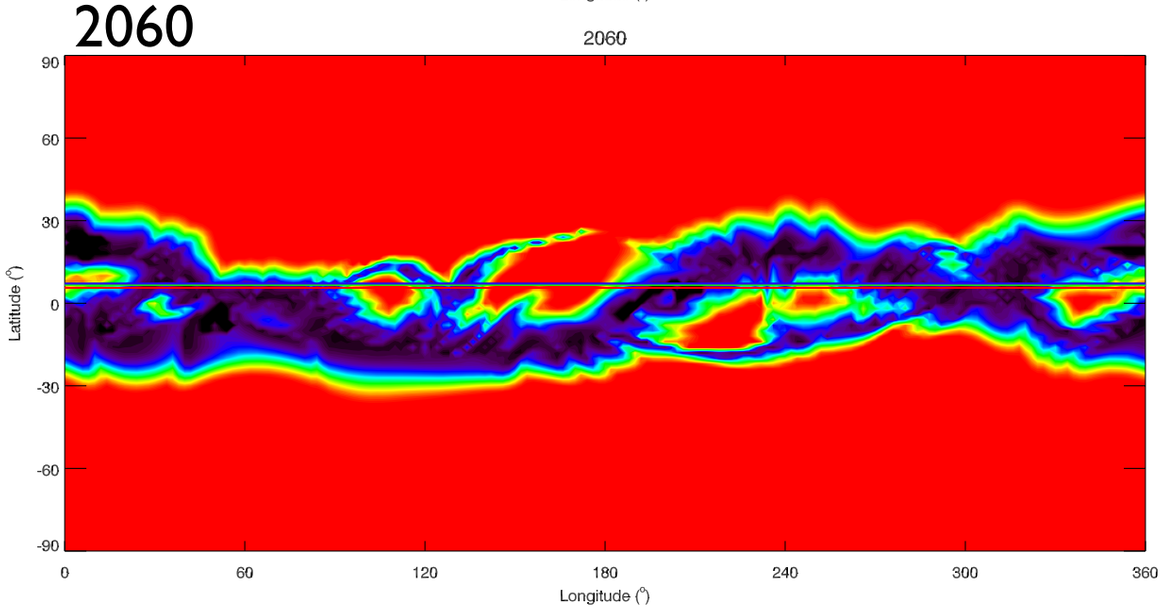

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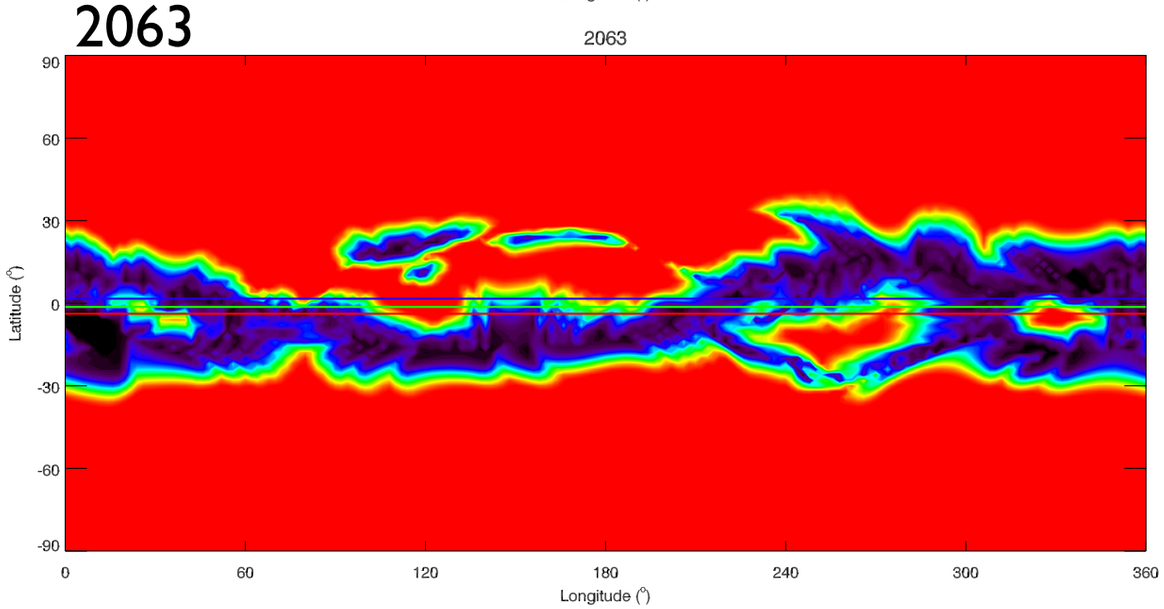

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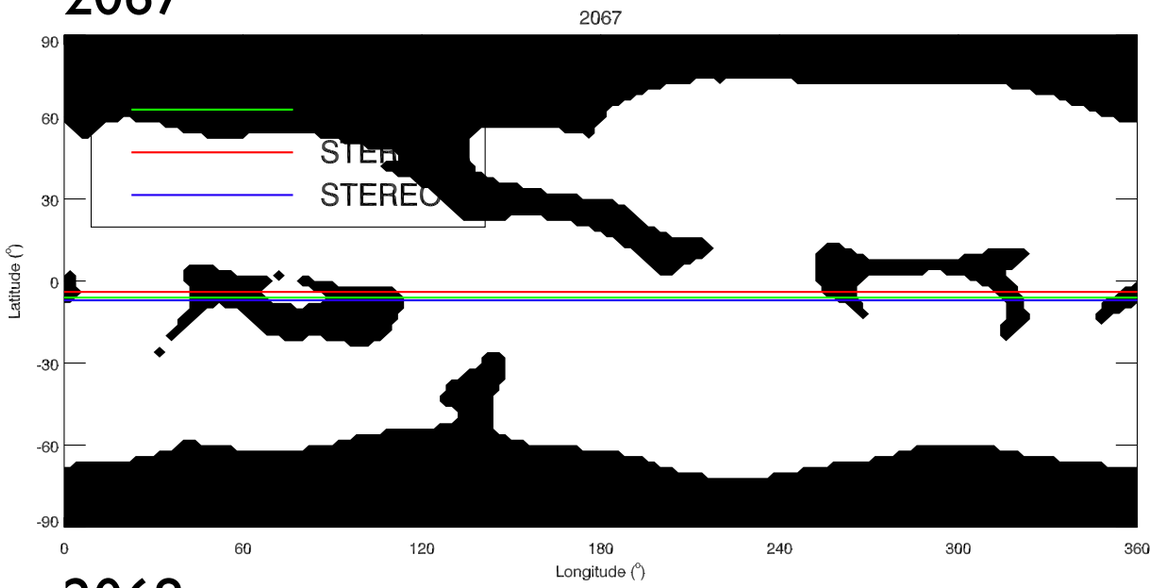

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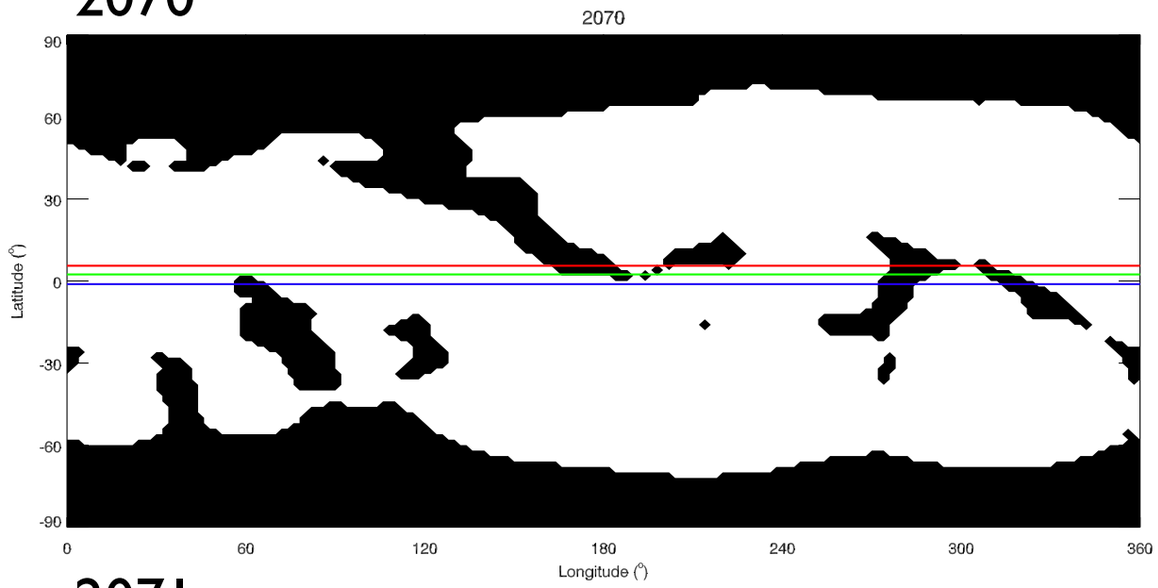

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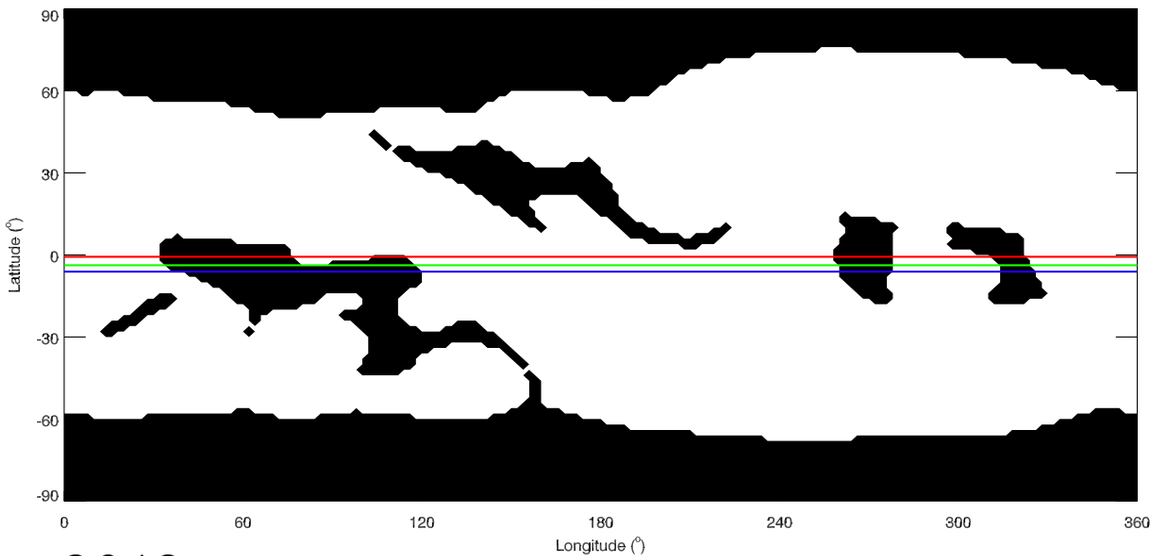

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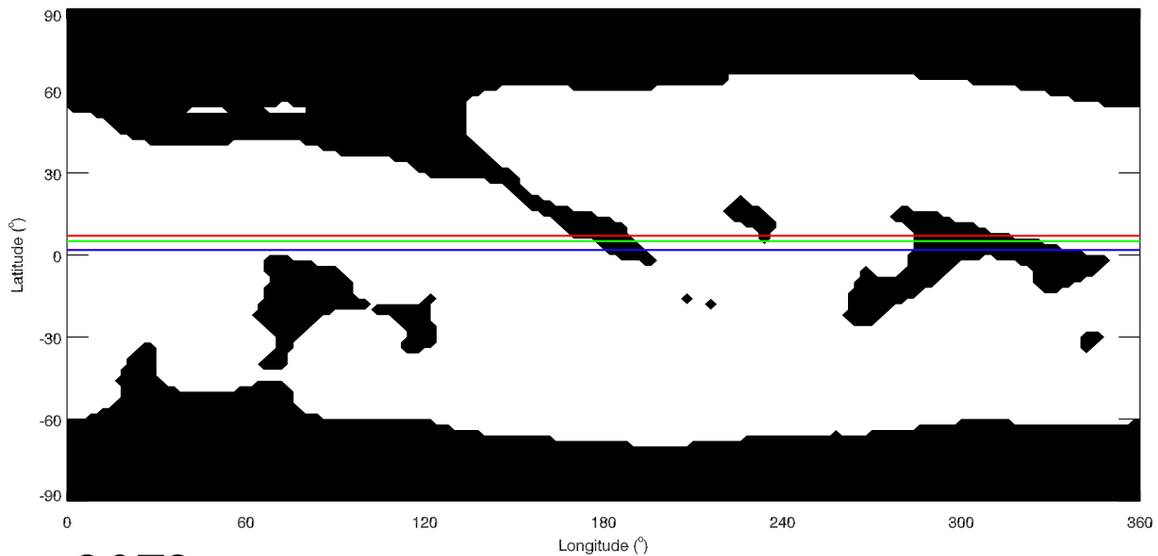

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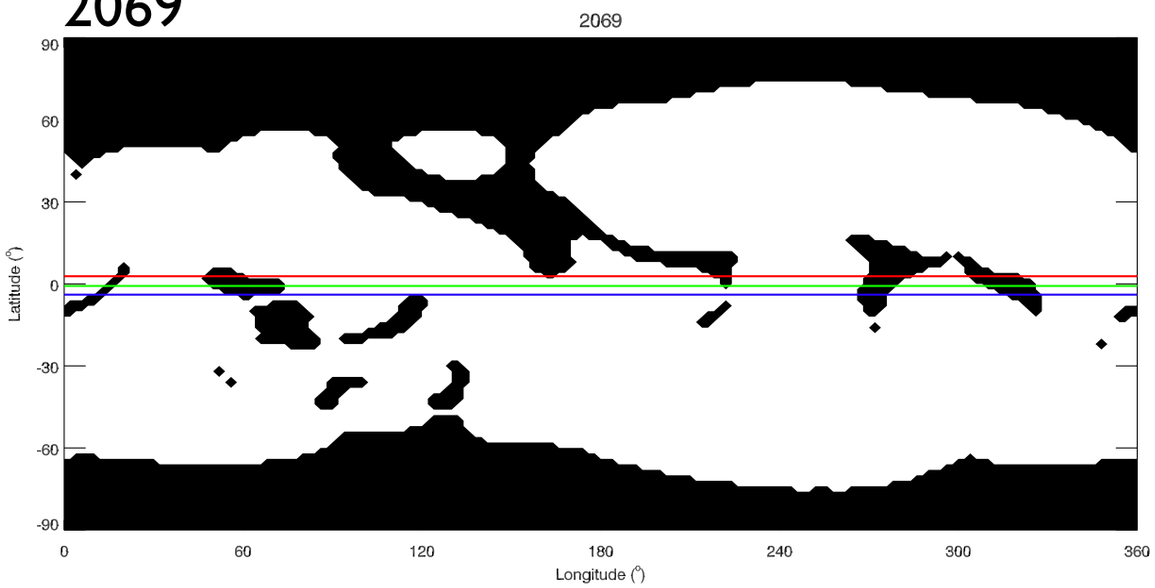

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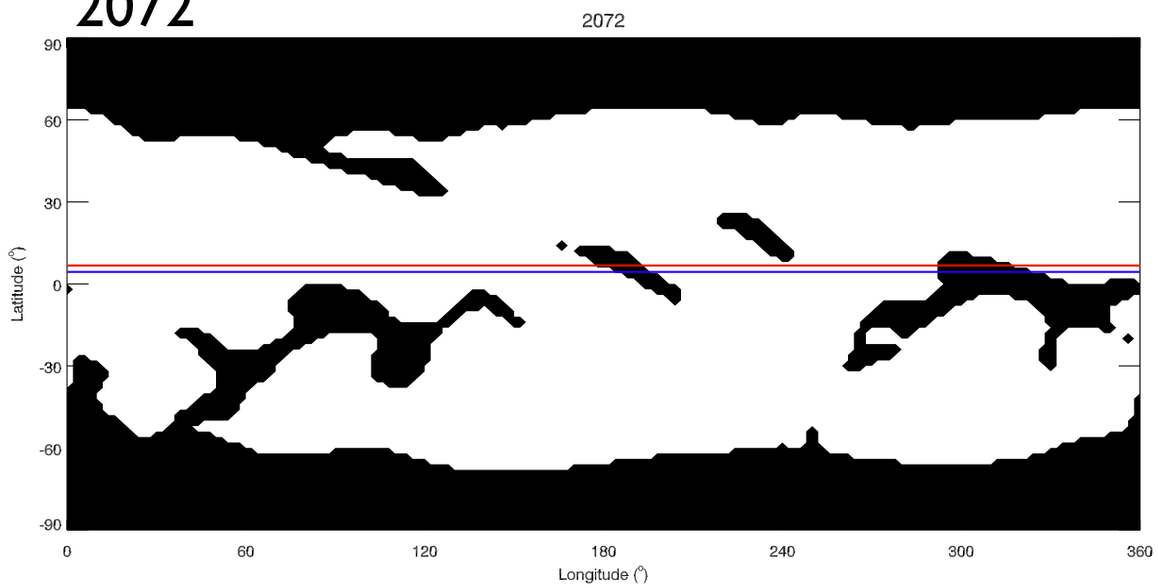

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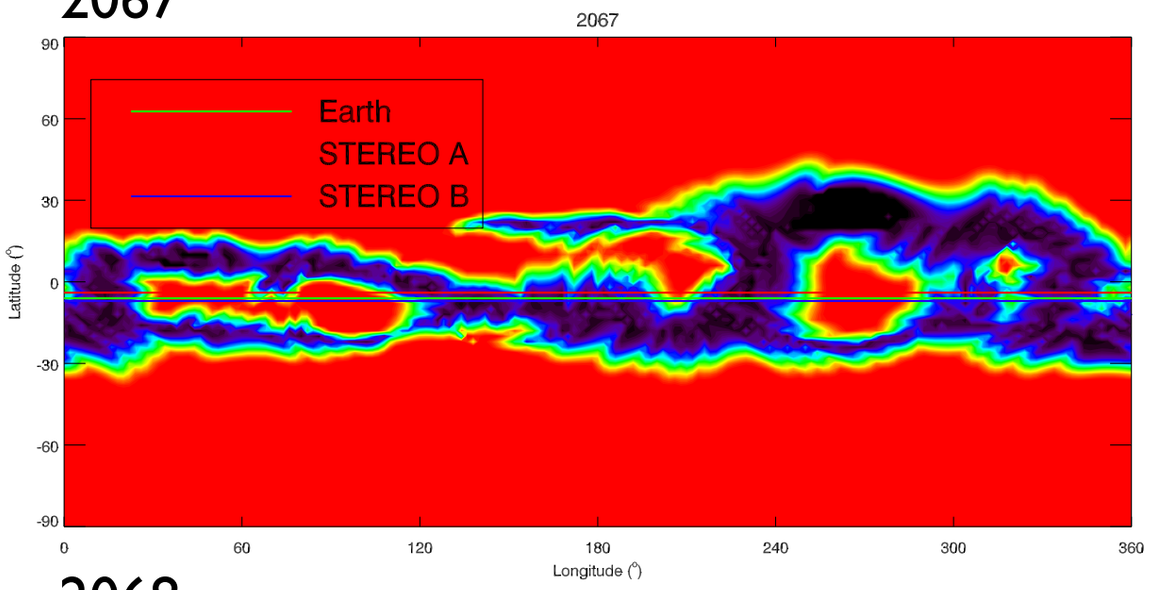

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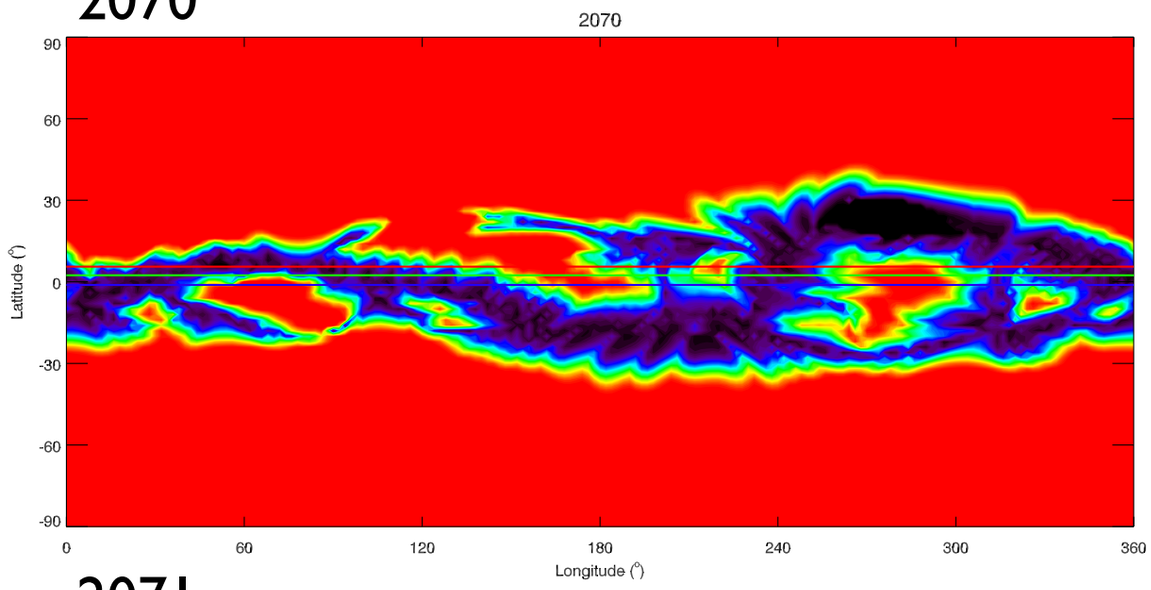

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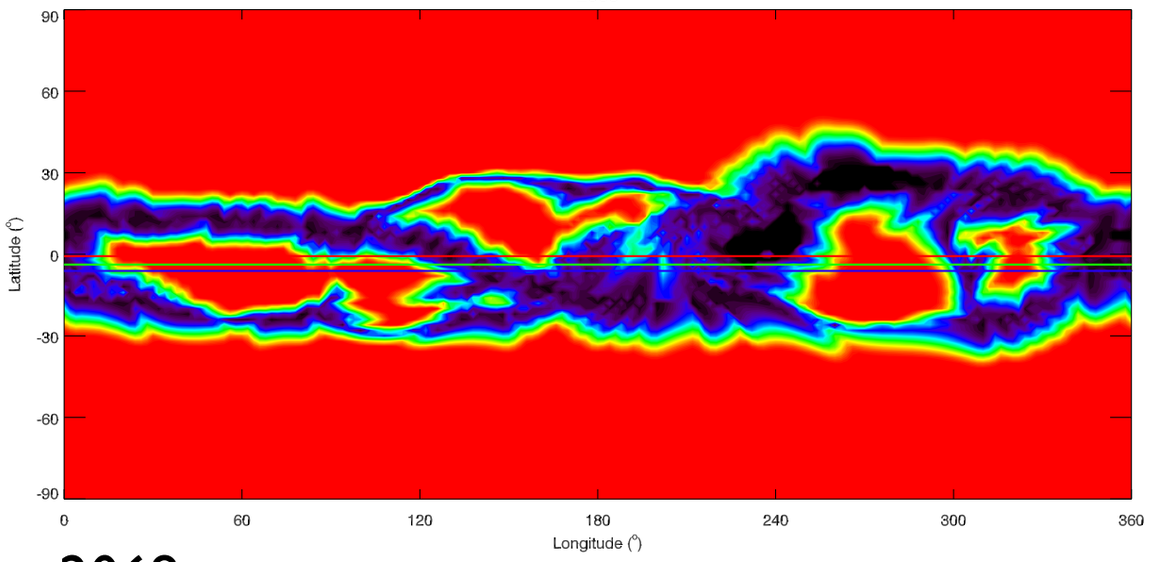

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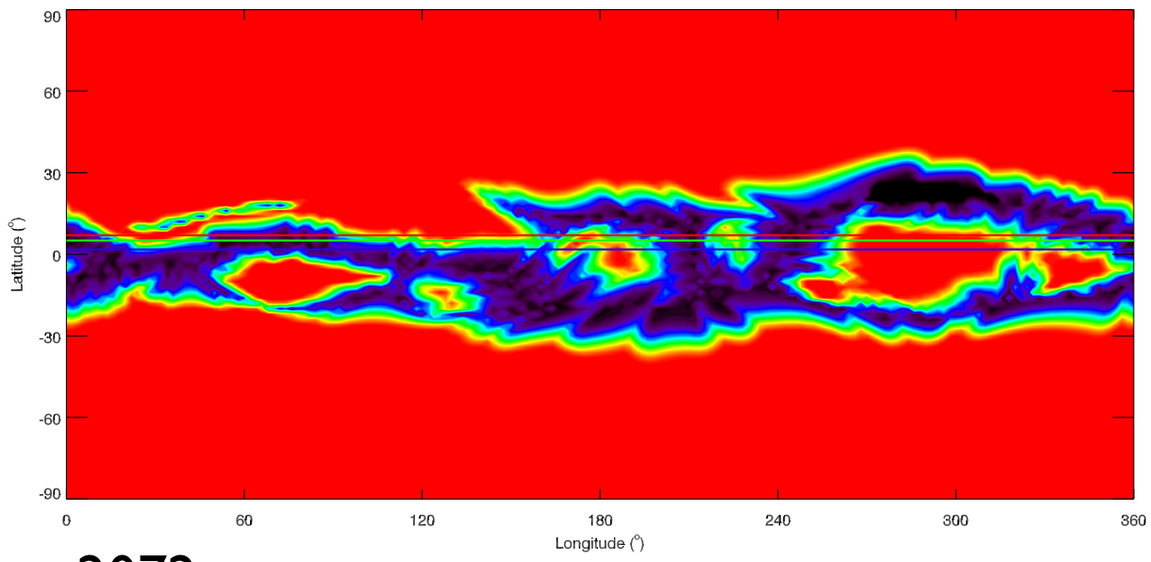

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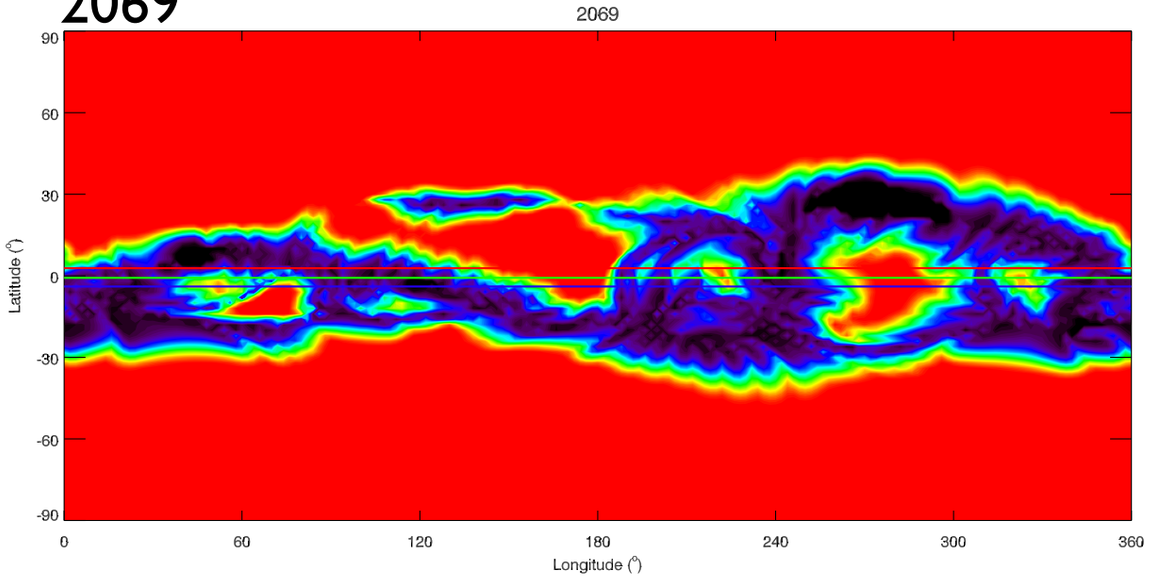

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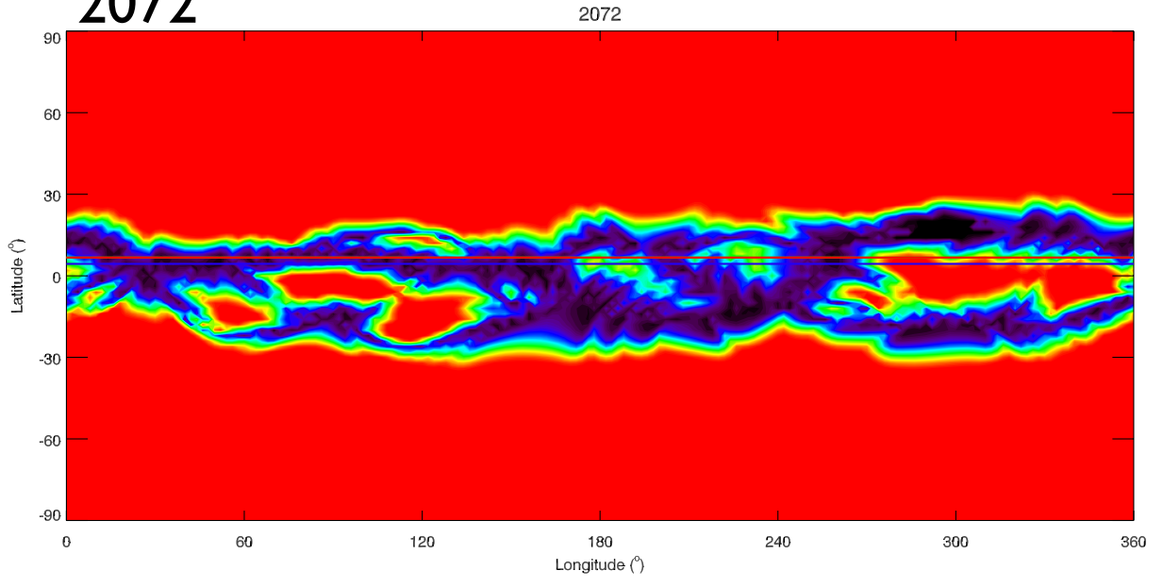

Summary

- We have performed simple *ad hoc* calculations for the entire duration of the STEREO mission (available at www.predsci.com/stereo/).
- These low-resolution CORHEL solutions show reasonable agreement with 1 A.U. data
  - Solar wind speed and IMF polarity
  - Coronal hole boundaries
  - But:
    - Solutions from different observatories disagree
    - Time-series in the ecliptic are sensitive to solution details
    - There is an important discrepancy for |B|
- Features in cross-correlation analysis of STEREO A and B interpreted using global MHD model results
  - The “lulls” in the phase lag between the SC are likely caused by temporal evolution of the equatorial/mid-latitude coronal holes.