AOGS 2011 Taipei, ST17
Collaborative researches and operations of space weather forecasting in Asia-Oceania region

Development of WASAVIES:

Warning System of Aviation Exposure to SEP

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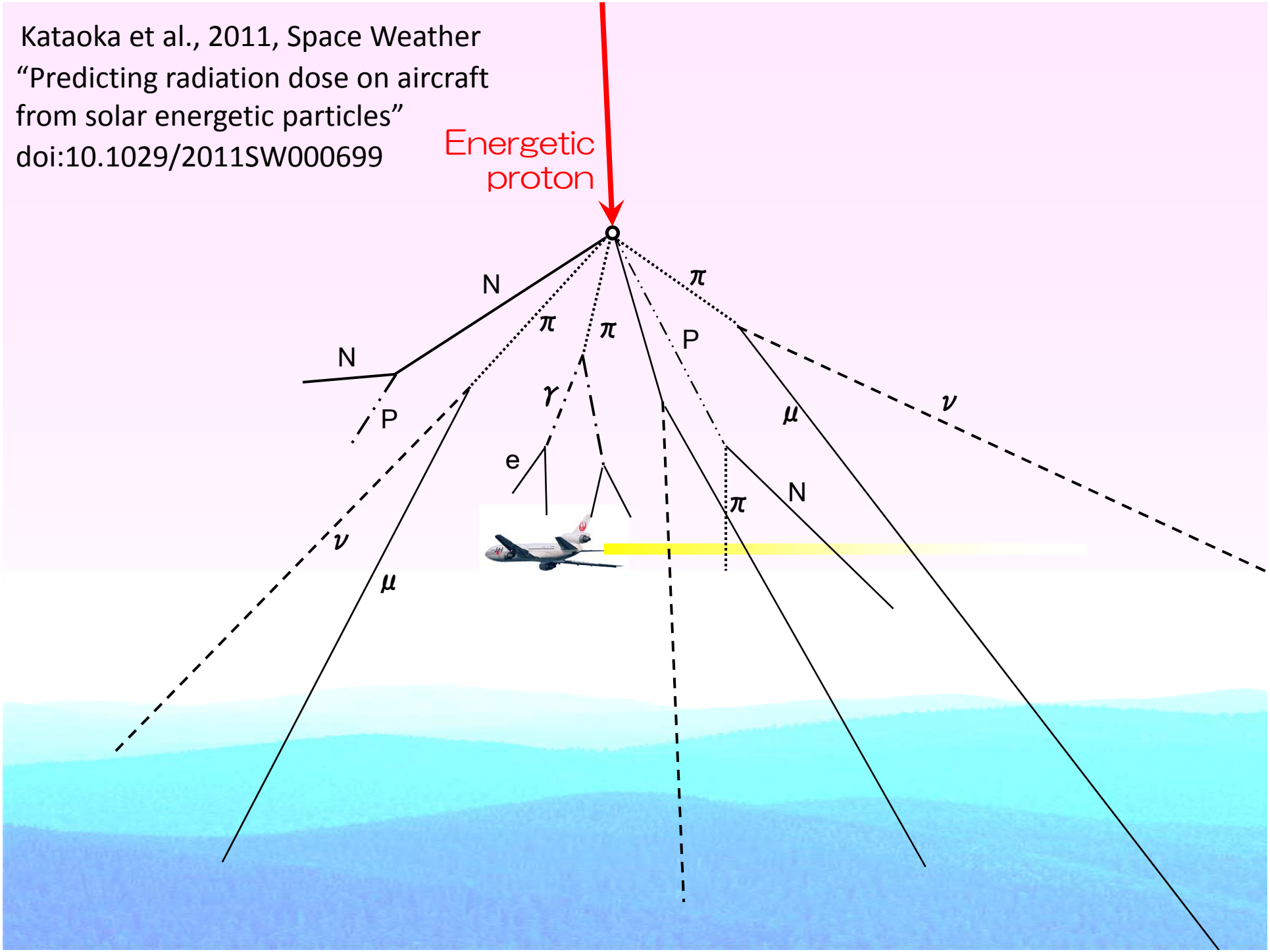
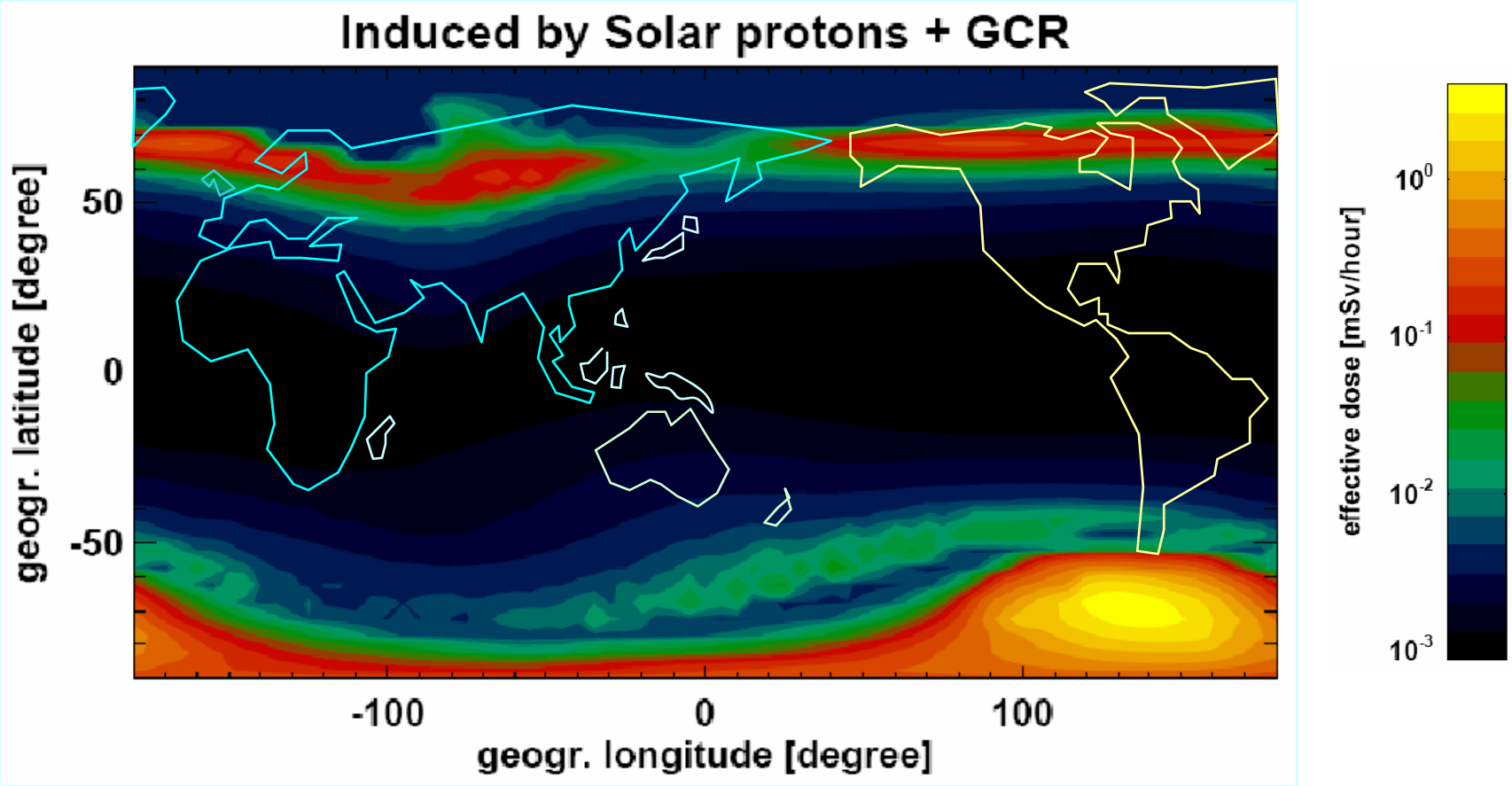
Kataoka et al., 2011, Space Weather
"Predicting radiation dose on aircraft from solar energetic particles"
doi:10.1029/2011SW000699



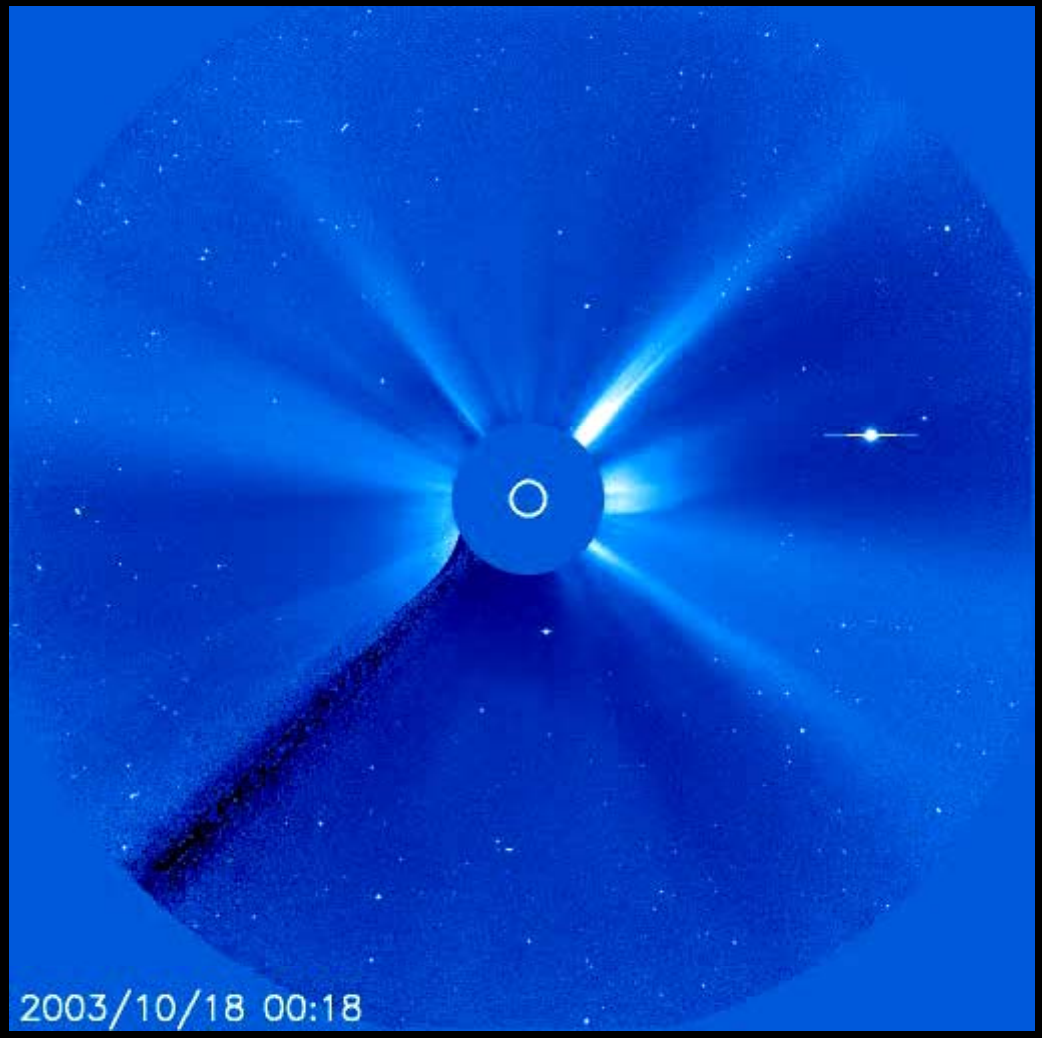
Effective dose rate at airplane altitude



Courtesy of Prof. Erwin O. Flückiger and Prof. Rolf Bütikofer

As space weather specialists, we have responsibility to clarify the situation.

Ultimate space weather forecast



1. From Sun to Earth
2. Both MHD and particles
3. Real-time observations

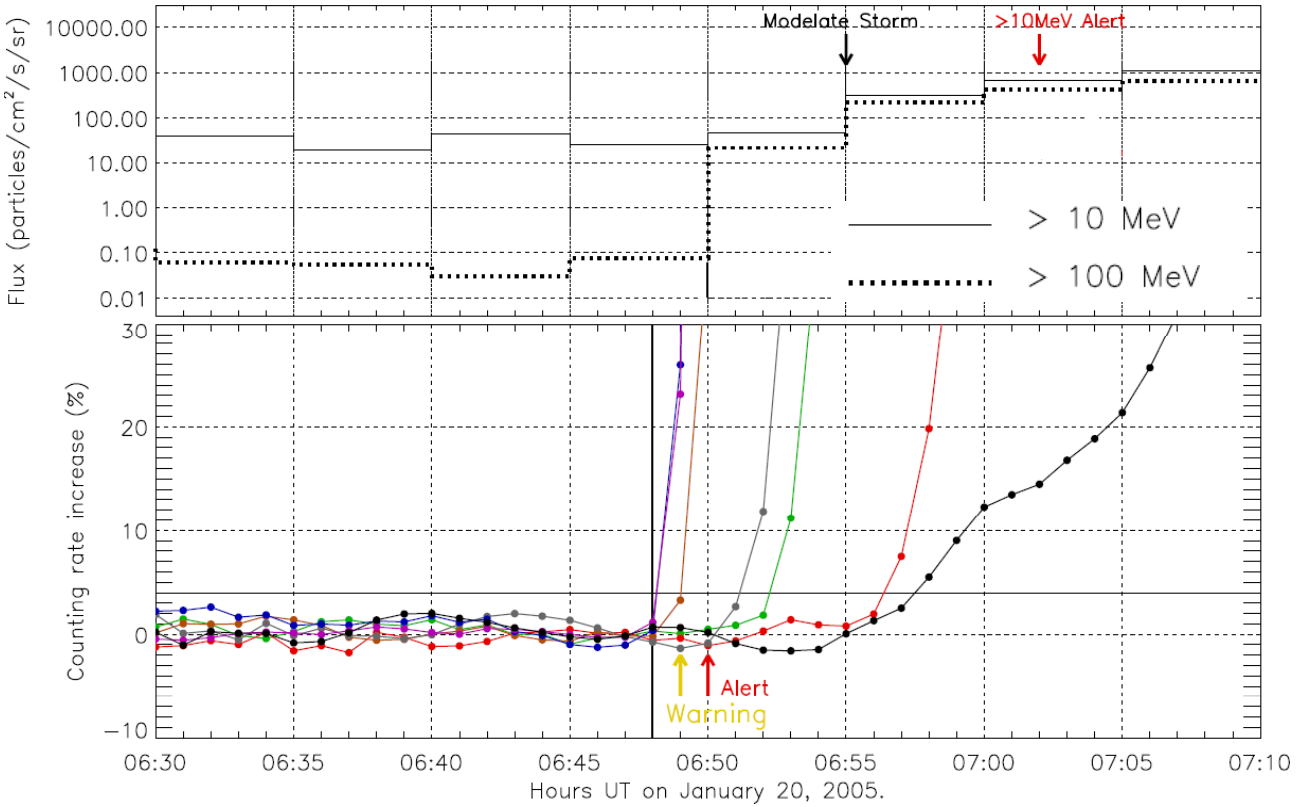
We are developing physics-based SEP forecast model. Scientific problems include both flare particle release and shock evolution in highly non-uniform medium.

Maximum energy of DSA

- Emax = 3/20 * V * Z * e * B * R / ξ
  - ξ: Bohm factor, typically ξ~10
  - R ~ V*t
- Shock parameters in corona
  - V = 2000 [km/s]
  - B = 0.1 [G] = 10^{-5} [T]
  - t = 600 [s]
- Emax = 3.6/ξ [GeV]
  - GeV protons are about the limit of DSA.

Kuwabara et al., 2006, Space Weather

1. GLE Alarm = Onset of WASAVIES



Solar proton event starts at 6:55

Alert time from Neutron Monitor at 6:50

Space Weather Message Code: ALTPX2
Serial Number: 27
Issue Time: 2005 Jan 20 0702 UTC

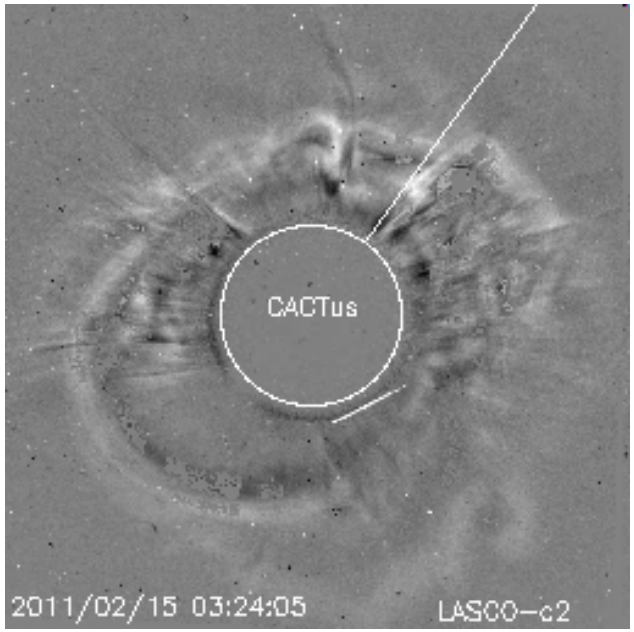
ALERT: Proton Event 10MeV Integral Flux exceeded 100pfu
Begin Time: 2005 Jan 20 0701 UTC
NOAA Scale: S2 - Moderate

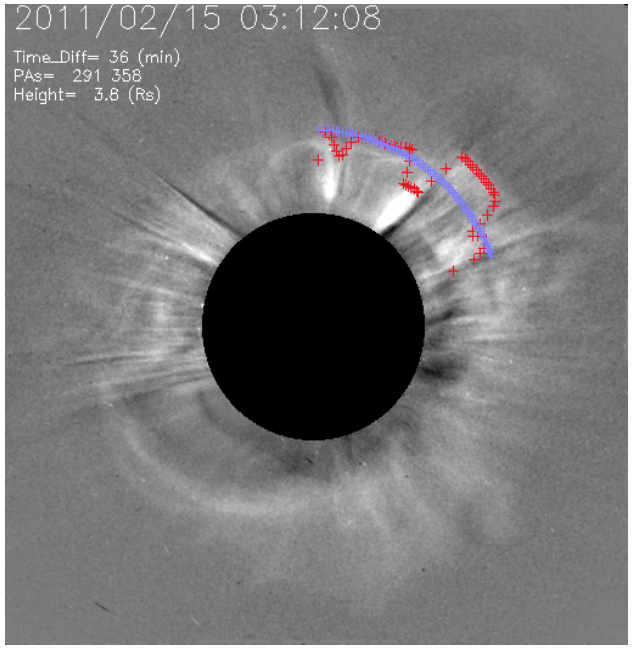
Alert time from SEC/NOAA at 7:02

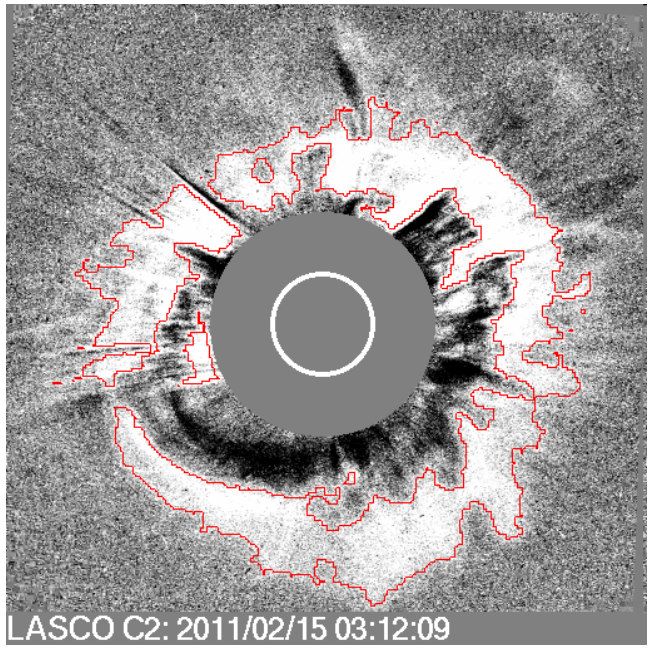
http://www.sec.noaa.gov/alerts/archive.html

Yashiro, 2011, JpGU meeting

2. Automated CME detection = Input of WASAVIES







CACTus
Speed: 469 km/s
Width: 360 deg

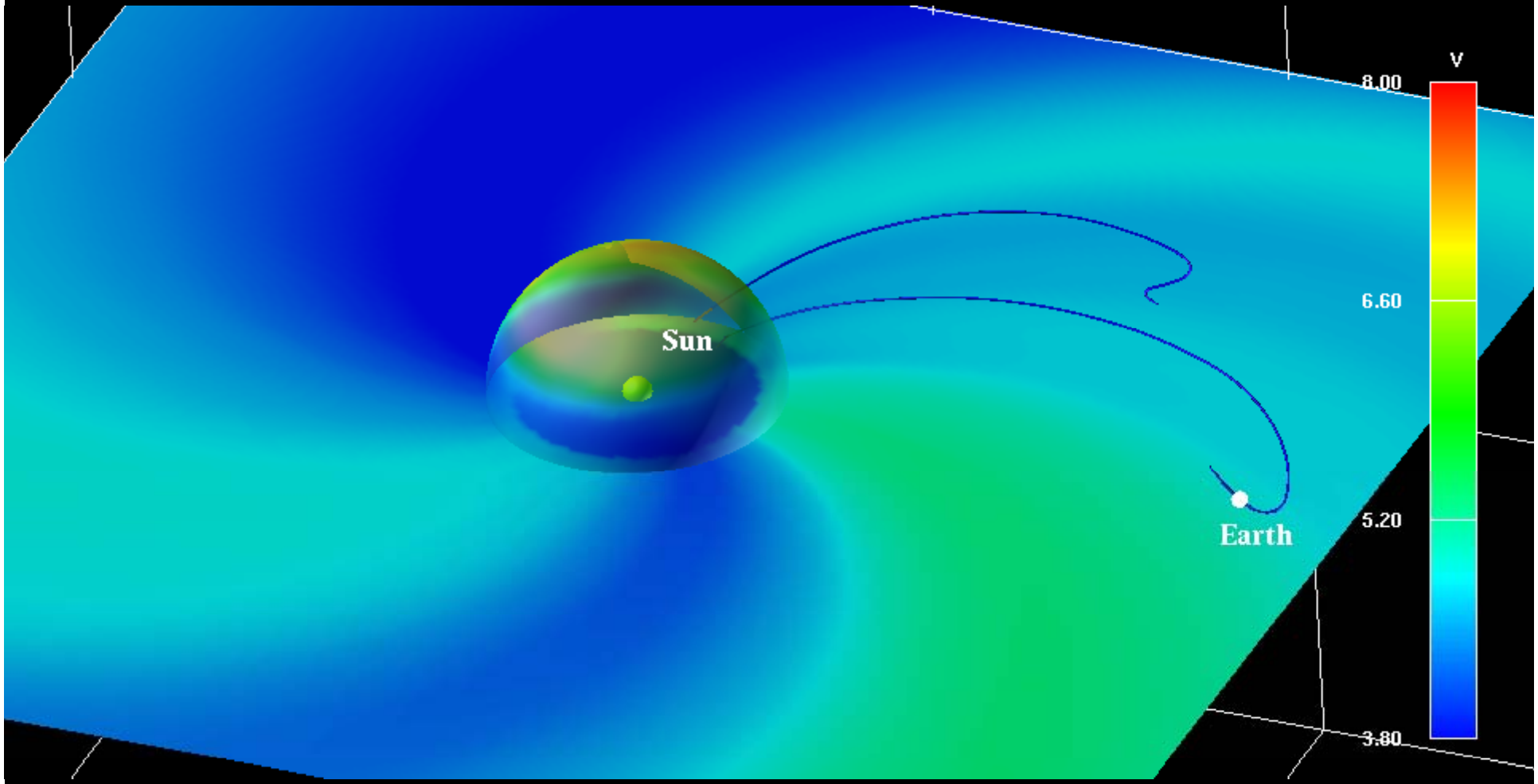
SEEDS
Speed: 507 km/s
Width: 68 deg

WASAVIES CME Module
Speed: 663 km/s
Width: 290 deg

There is one-to-one correspondence between EUV waves and CMEs (Yashiro, this meeting):
The input parameters may be obtained within 30 min or less by utilizing EUV waves .

Kataoka et al., 2009, JGR

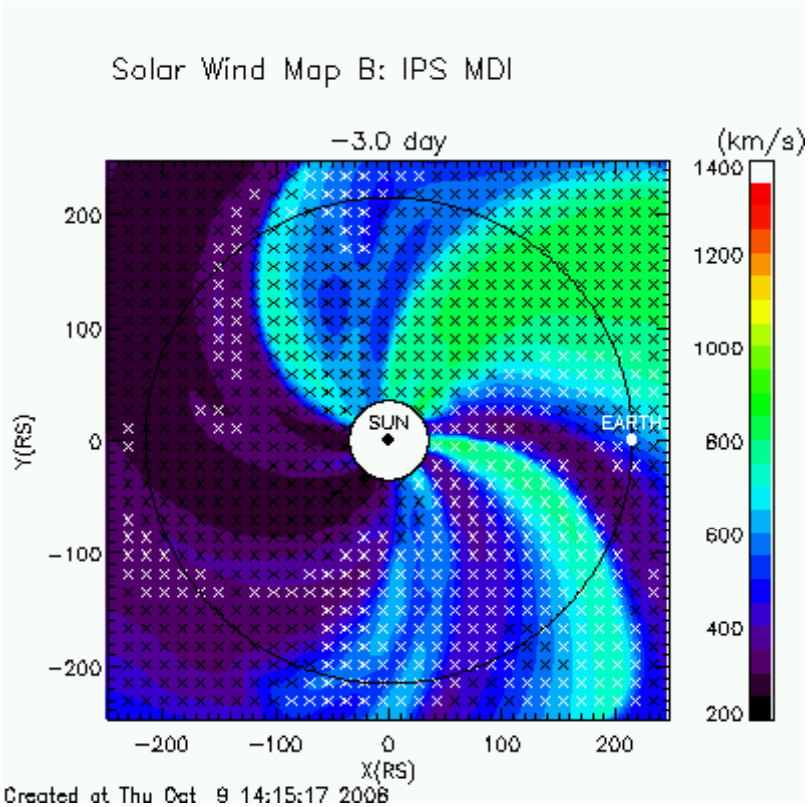
CME propagation model



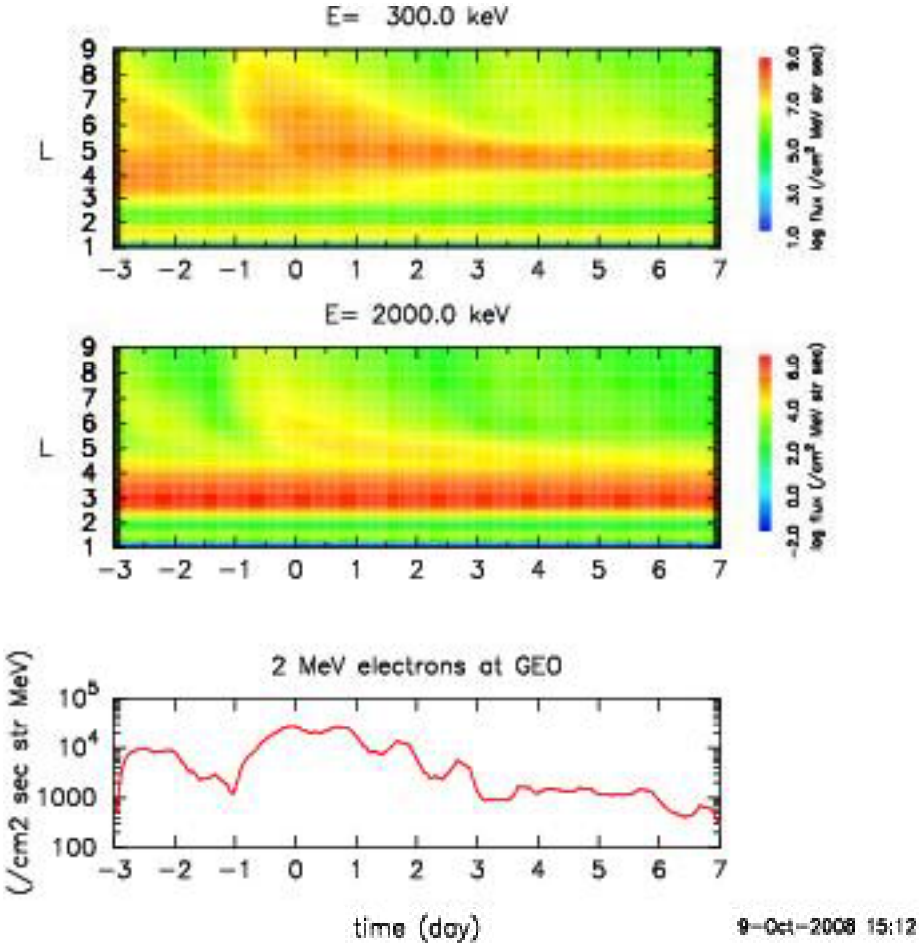
CME/flare parameters drive the CME simulation for time-varying magnetic field tracing.

Kataoka and Miyoshi, 2008, JpGU (http://hbksw1.stelab.nagoya-u.ac.jp)

Real-time radiation belt forecast since 2008

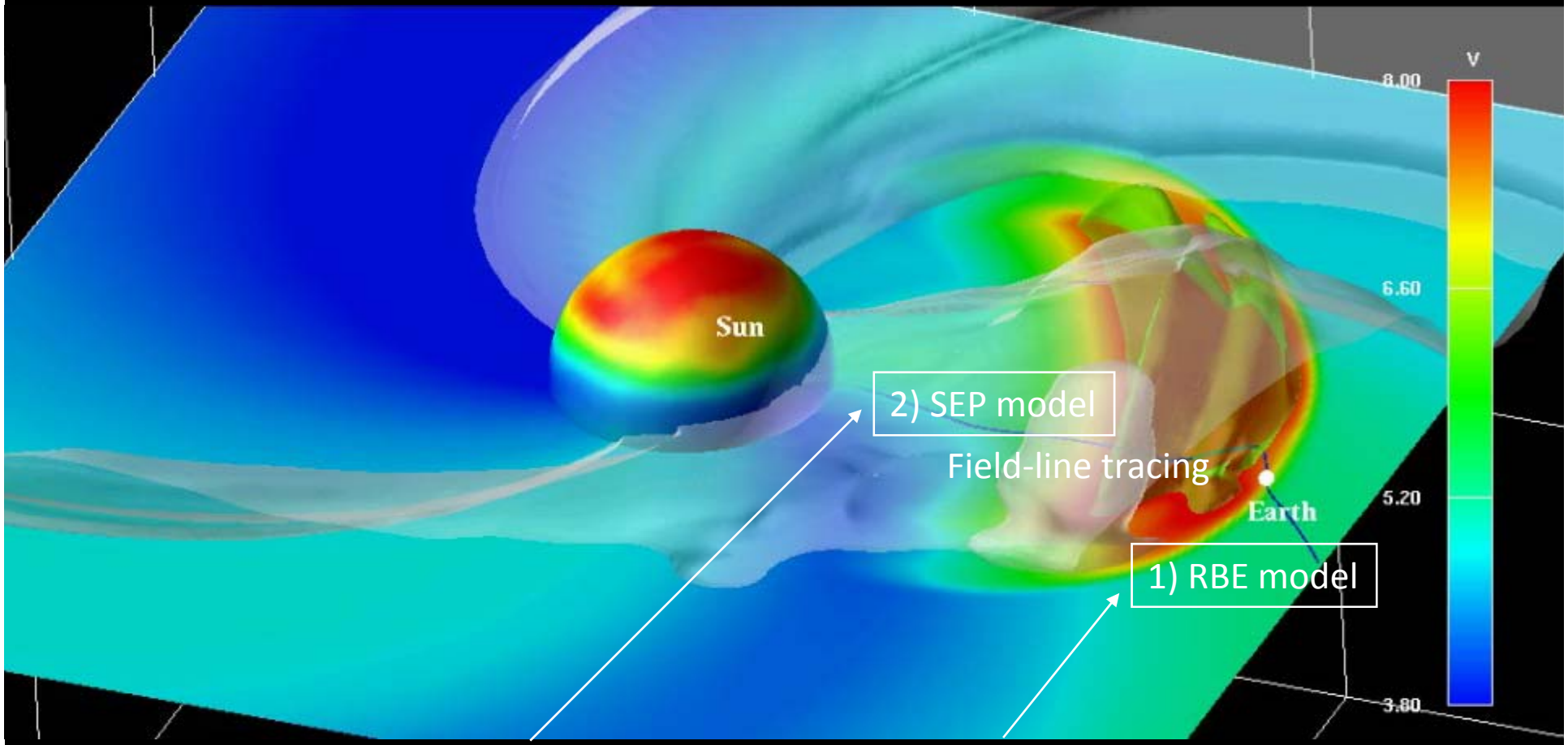


Kataoka et al. 2009 BGSW model



Miyoshi et al. 2004 RBE model

Toward real-time SEP forecast

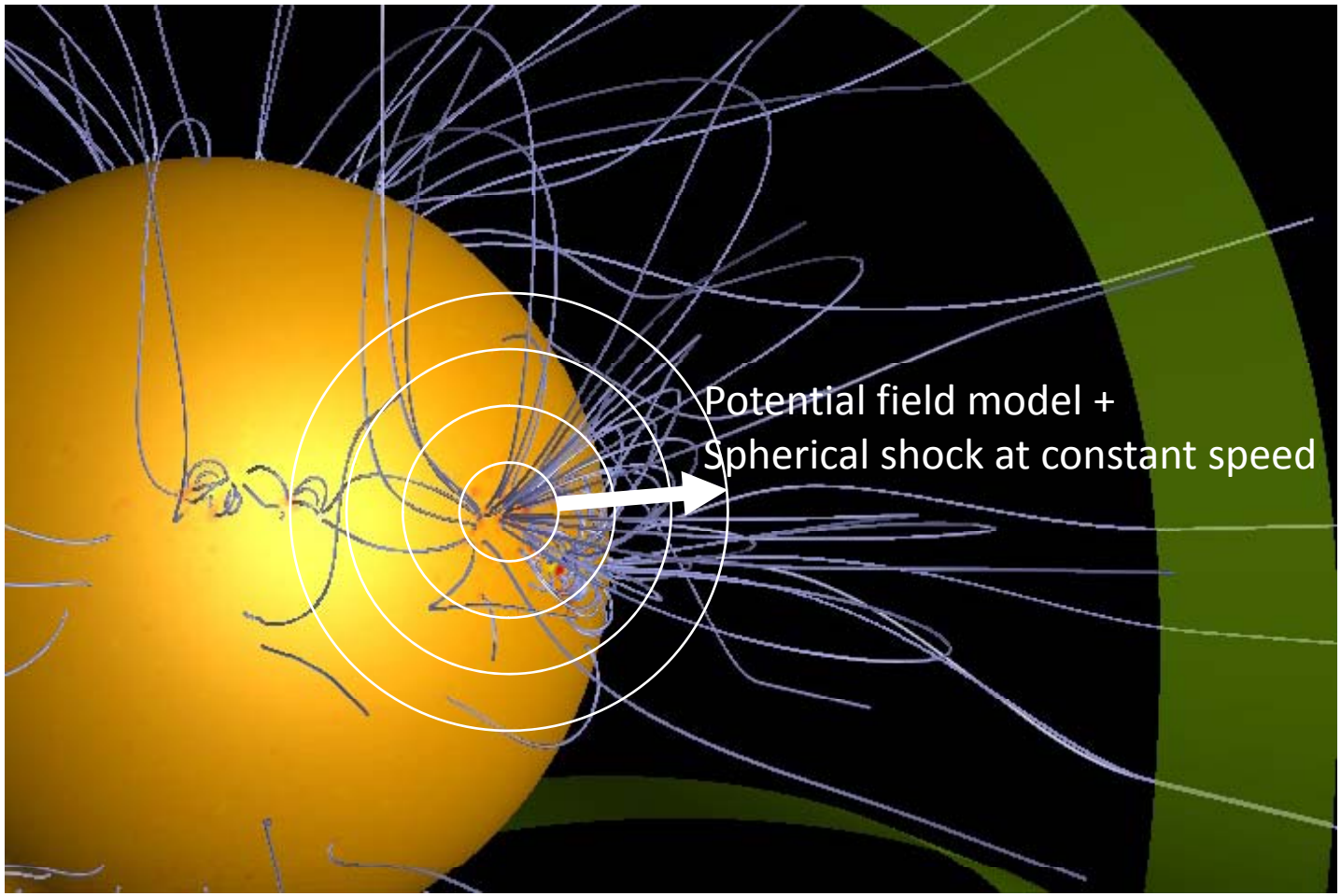


Shock parameters : Ma, β, θbn

MHD parameters: V, N, B time series

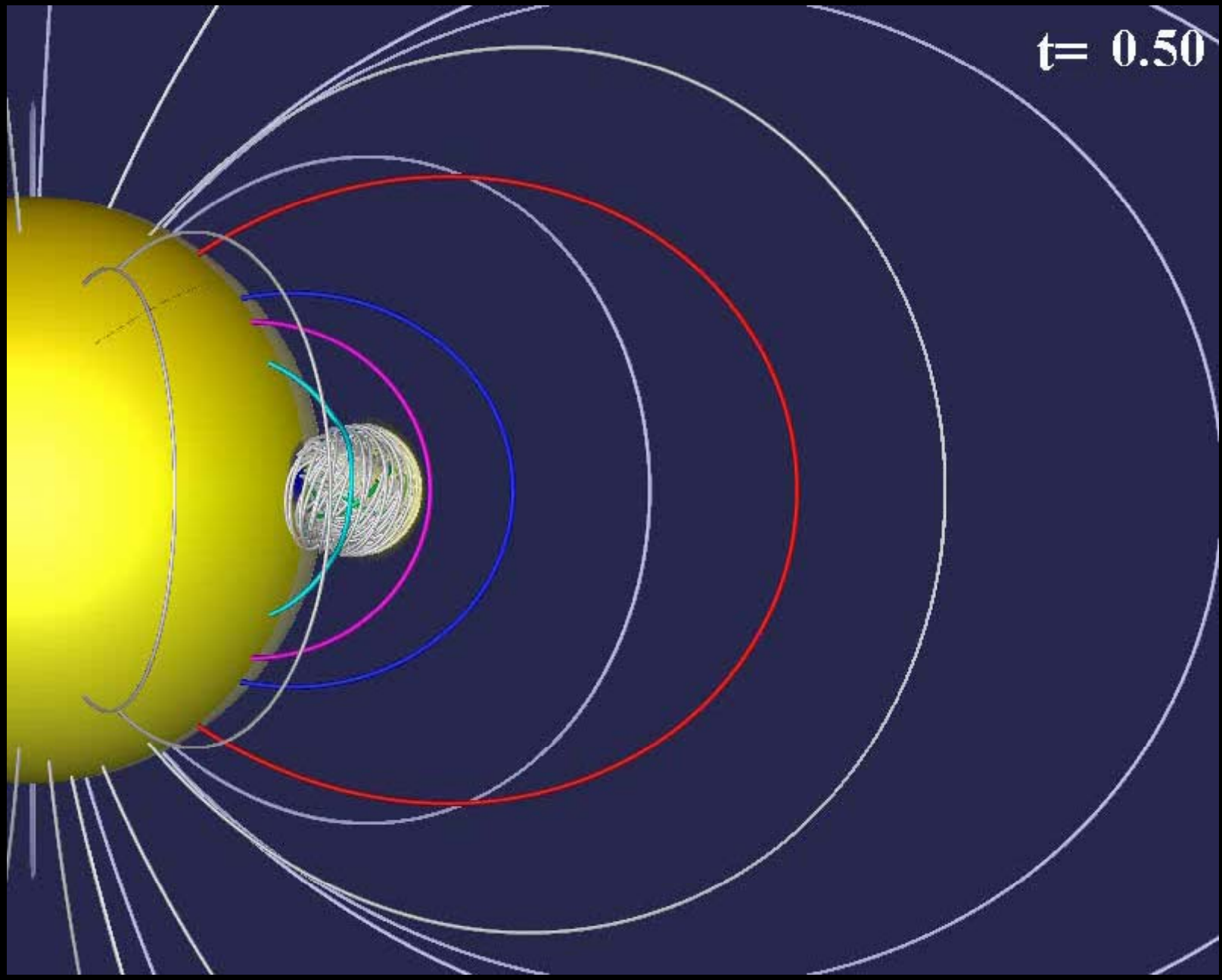
Now implementing time-dependent DSA at shocks. (Underdevelopment #1)

Corona shock parameters at connecting with the observer point



Simplification needed for speed up

Shiota et al., 2010, ApJ

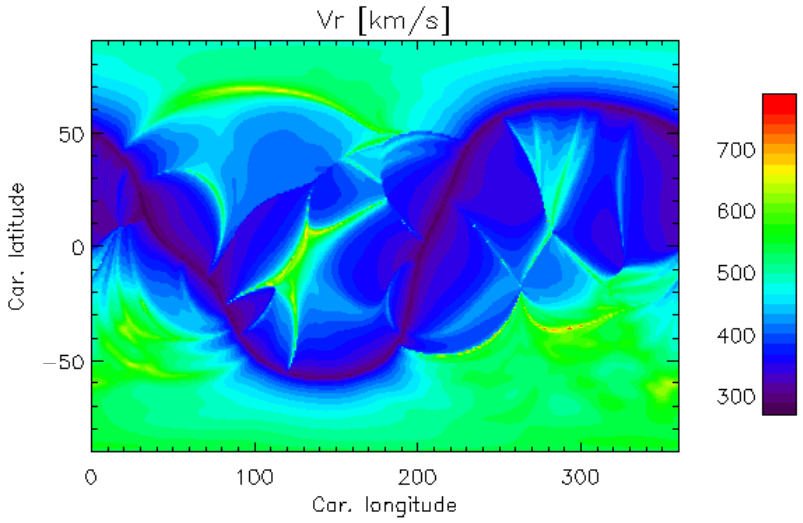


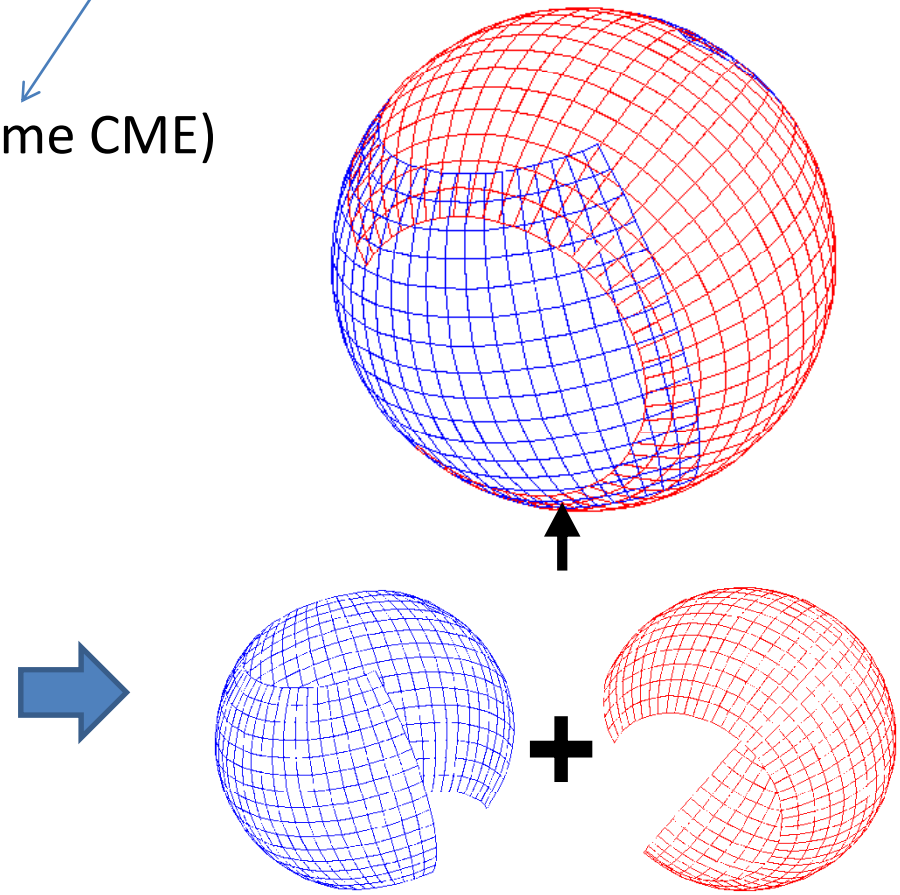
Shiota, 2011, JpGU

Global MHD solar wind simulation

- HLLD Riemann solver
  - Miyoshi & Kusano (2005)
- Yin-Yang grid
  - Kageyama & Sato (2004)
- Rotating inner boundary (+real-time CME)
  - Kataoka et al. (2009)
- Wang-Sheeley-Arge model
  - Arge & Pizzo (2000)

Underdevelopment #2





http://aurora3d.jp/

Aurora 3D
全天周立体オーロラ

南極昭和基地の空(国立極地研究所提供)

今日の宇宙天気予報
詳しくはこちら

今日のオーロラ予報
詳しくはこちら

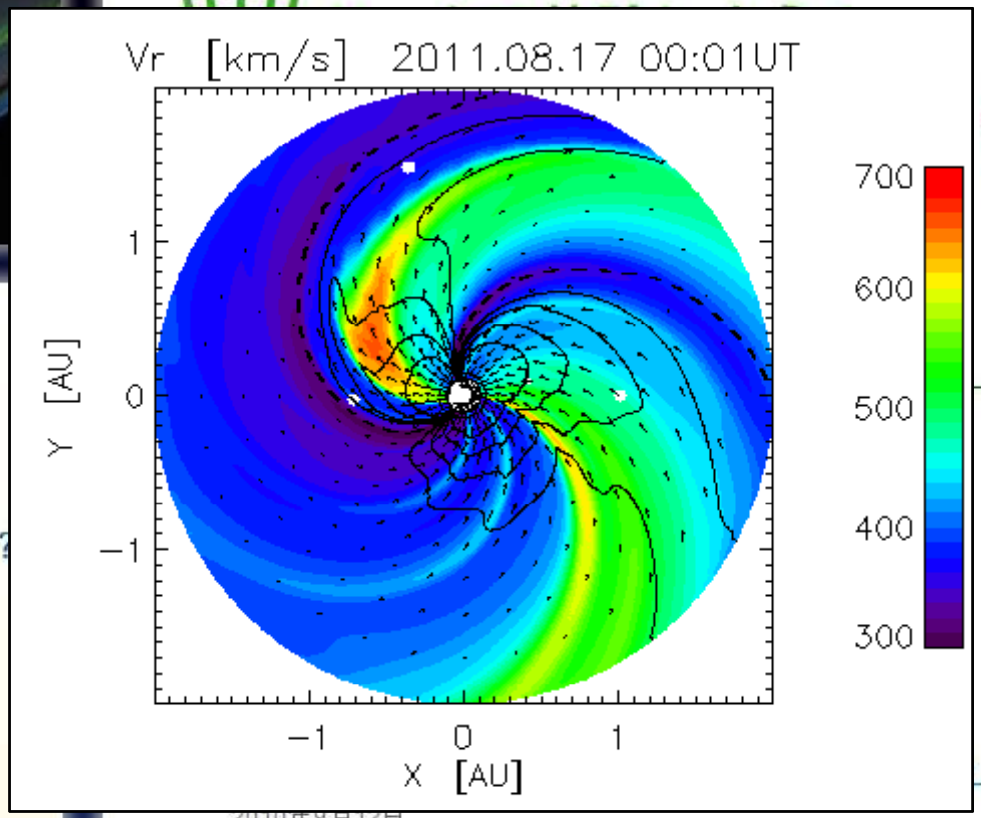
LIVE

明日はシンラドームにて3Dオーロラ上映です！オーロラ撮像ロボット、ピーアイ2によるライブ映像にて、リアルタイムのオーロラが見られるかも！？みんな遊びに来てね！ http://aurora3d.jp/

全国オーロラ講演会 2010

- オーロラ講演会について
- 全国の講演会会場はこちら
- 講演会開催者の方へ

全天周立体オーロラ映像を

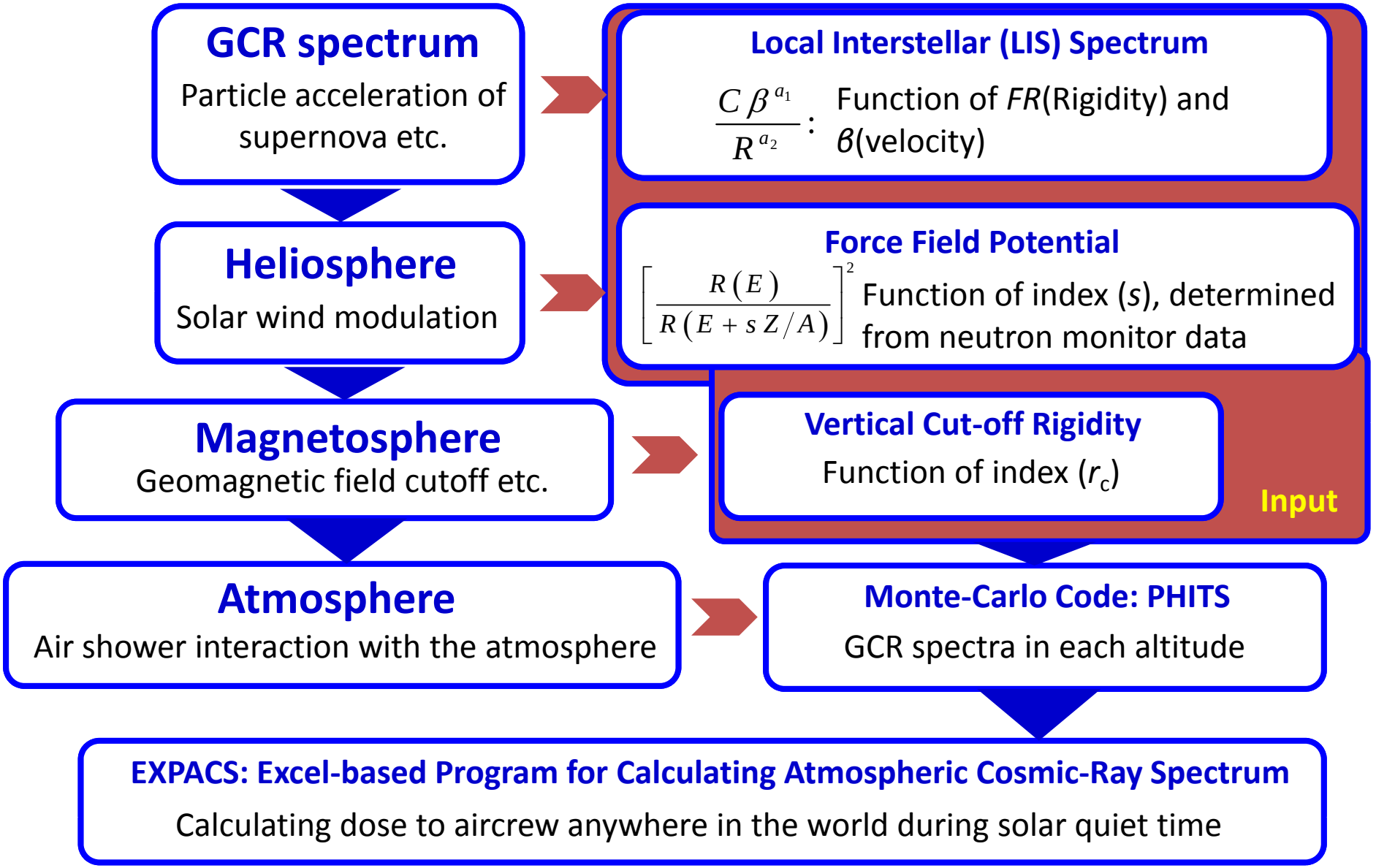


ナビゲーター
ローラちゃん

- お知らせ・イベント情報 Information / Event
- オーロラの不思議 Wonder of Aurora
- オーロラ3Dで何がわかるの？ What can we see through Aurora 3D?
- 宇宙天気予報について About Space Weather Forecast
- オーロラ関連リンク集 Links to Relevant Sites
- オーロラ研究ブログ

2010年9月12日

Sato et al., 2006 & 2008, Radiat. Res. (http://phits.jaea.go.jp/expacs/)



Yasuda et al., 2011, Radiat. Prot. Dosim. (http://www.nirs.go.jp/research/jiscard/)

EXPACS is implemented and operated as the JISCARD for the management of cosmic radiation exposure for aircraft crew in Japan.

Total Dose in 2007	Average (mSv)	Maximum (mSv)
Pilot	1.68	3.79
CA	2.15	4.24

Summary

We are developing physics-based SEP forecast model.

- Development of WASAVIES
  - Onset: GLE Alarm
    - Kuwabara et al. (2006)
  - Inputs: CME/flare parameters
    - Yashiro's new technique
  - Outputs: EXPACS/JISCARD +
    - Sato et al. (2006; 2008); Yasuda et al. (2011); http://phits.jaea.go.jp/expacs/
  - Models: CME evolution +
    - Kataoka et al. (2009); Shiota et al. (2010); http://aurora3d.jp

- Underdevelopment/Important research topics
  - Time-dependent DSA
  - Real-time CME launch
  - Flare particle release
    - Kataoka et al. (2011, Space Weather)

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