Forecasting SEP transport and acceleration

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Brief description of the model

Components of the predictive tool:

- MHD: BATS-R-US/AWSoM-R+EEGGL
- SEP: M-FLAMPA

BATS-R-US: Block Adaptive Tree Simulation Roe-type Upwind Scheme
AWSoM-R: Alfén Wave Solar atmosphere Model in Real time
EEGGL: Eruptive Event Generator with Gibson-Low flux rope
M-FLAMPA: Multi Field Line Advection Model for Particle Acceleration

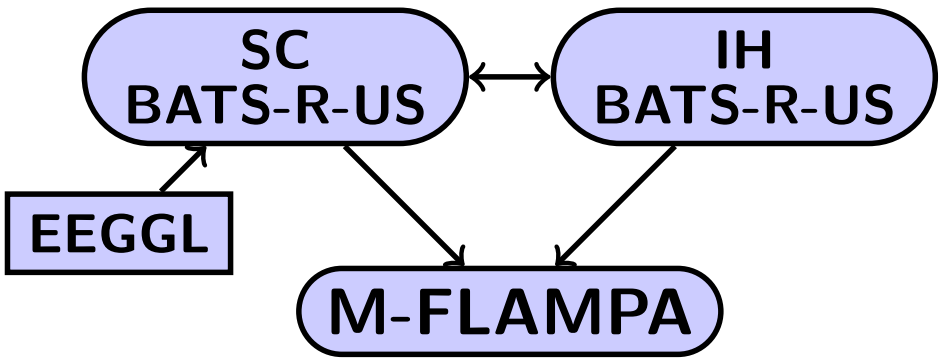

Figure 1: Data/parameter flow among models

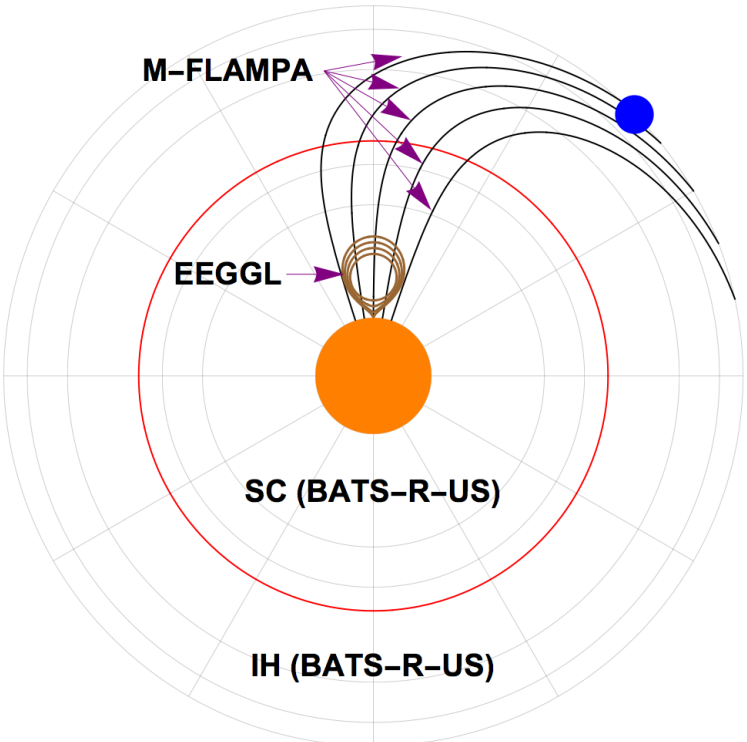

Figure 2: Domain partitioning among components

Model Results: September 2017

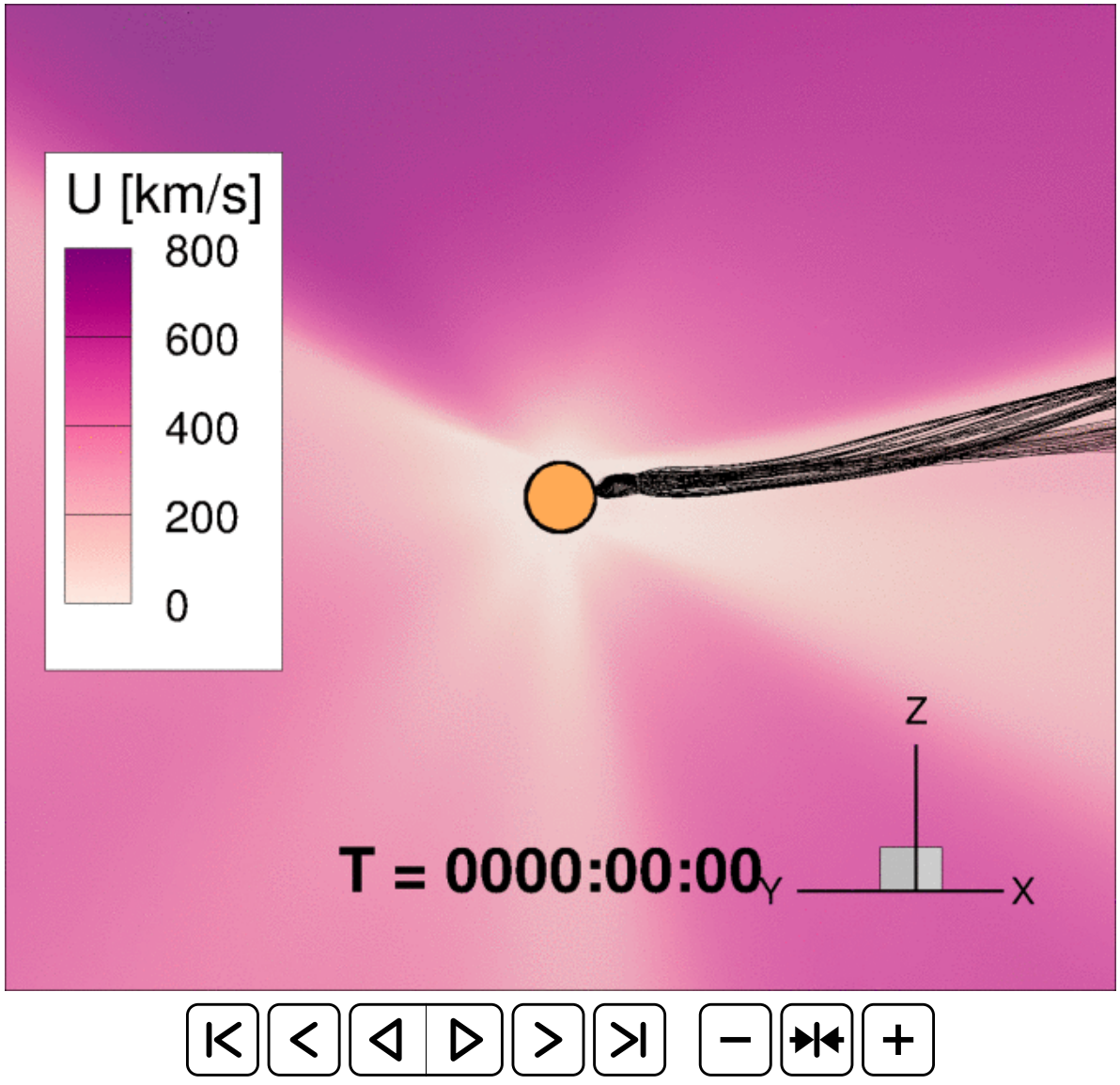

Figure 3: CME distorts the extracted field lines and drives the shock that results in SEP acceleration

Model Results: September 2017

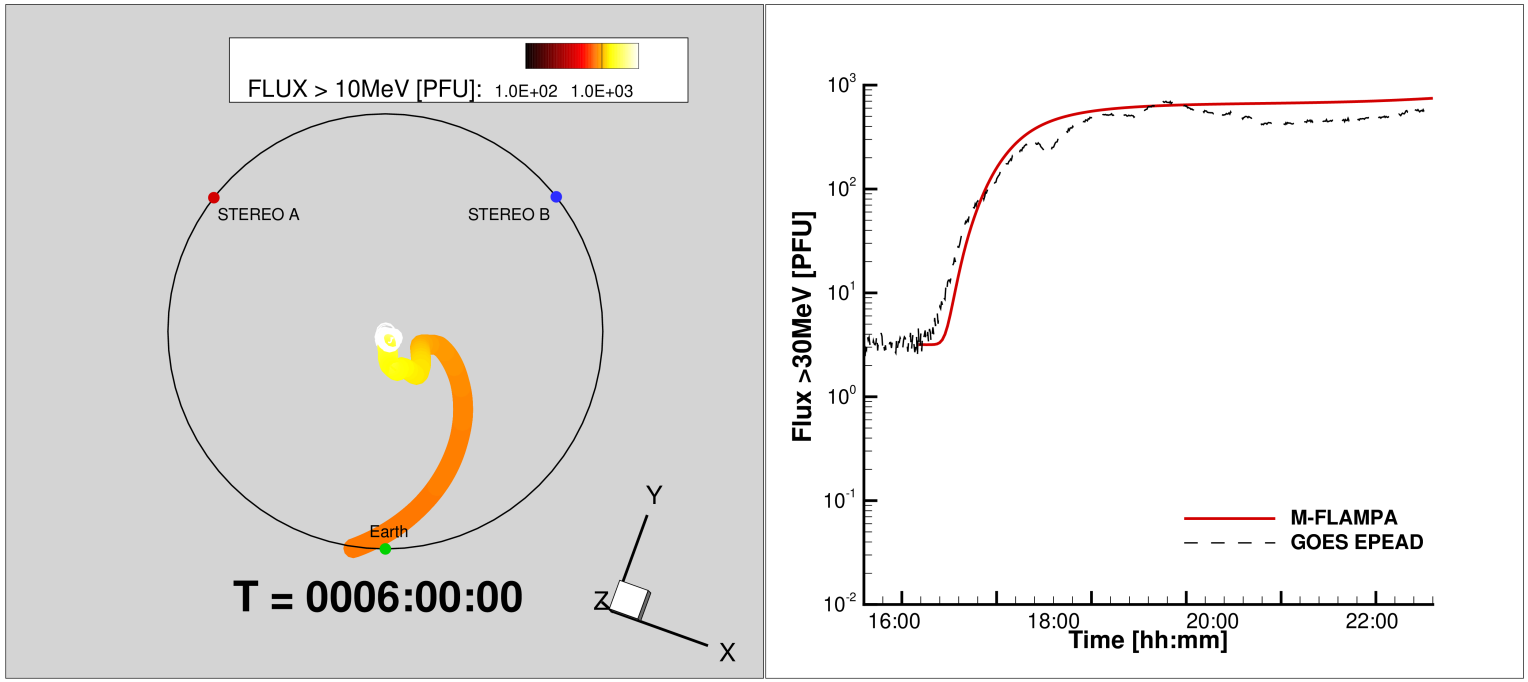

Figure 4: Integrated flux of SEPs. *Left*: top down view on a selected field line; *Right*: comparison with observed flux.

Model Results: July 2017

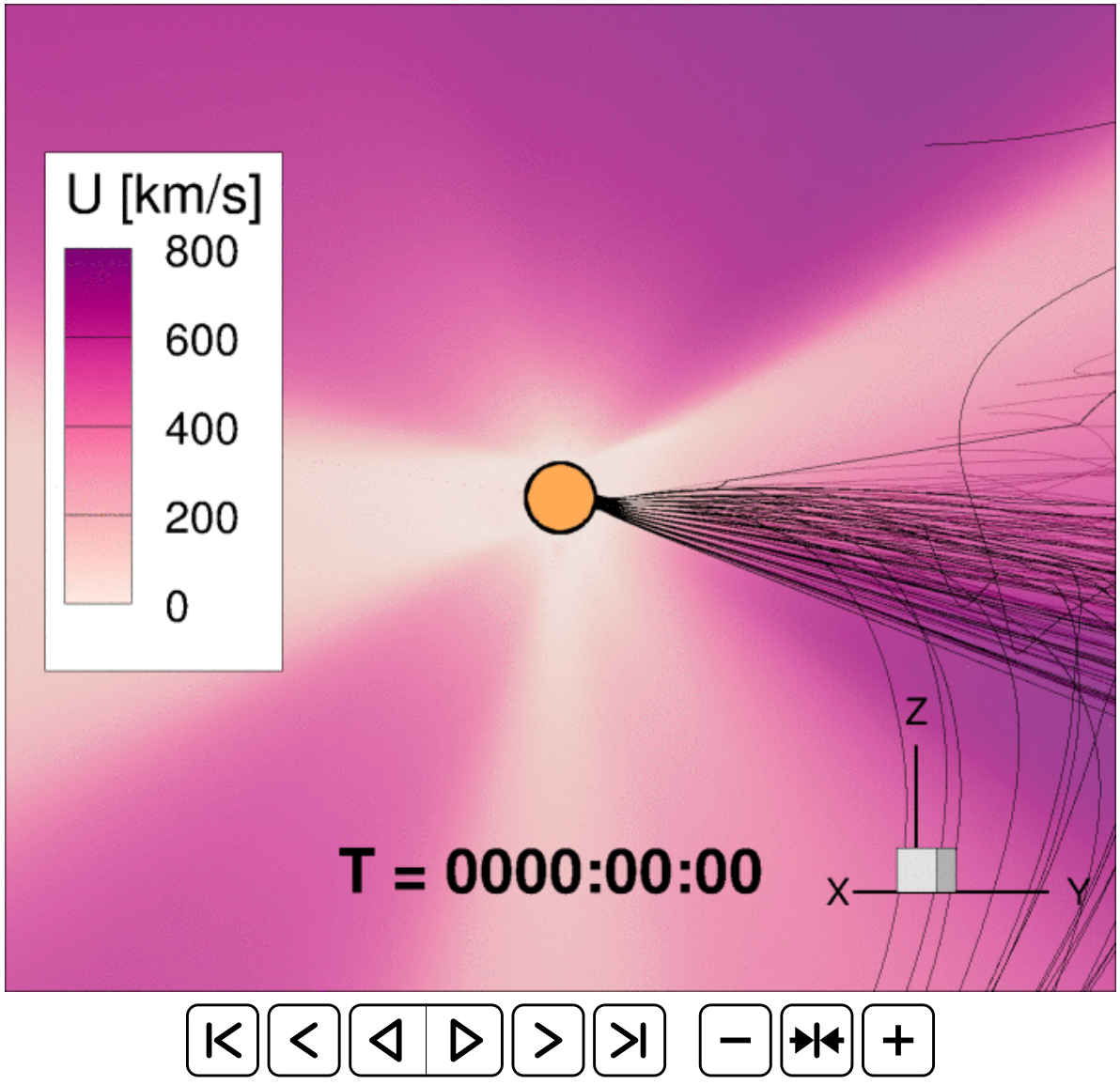

Figure 5: CME distorts the extracted field lines and drives the shock that results in SEP acceleration

Model Results: July 2017

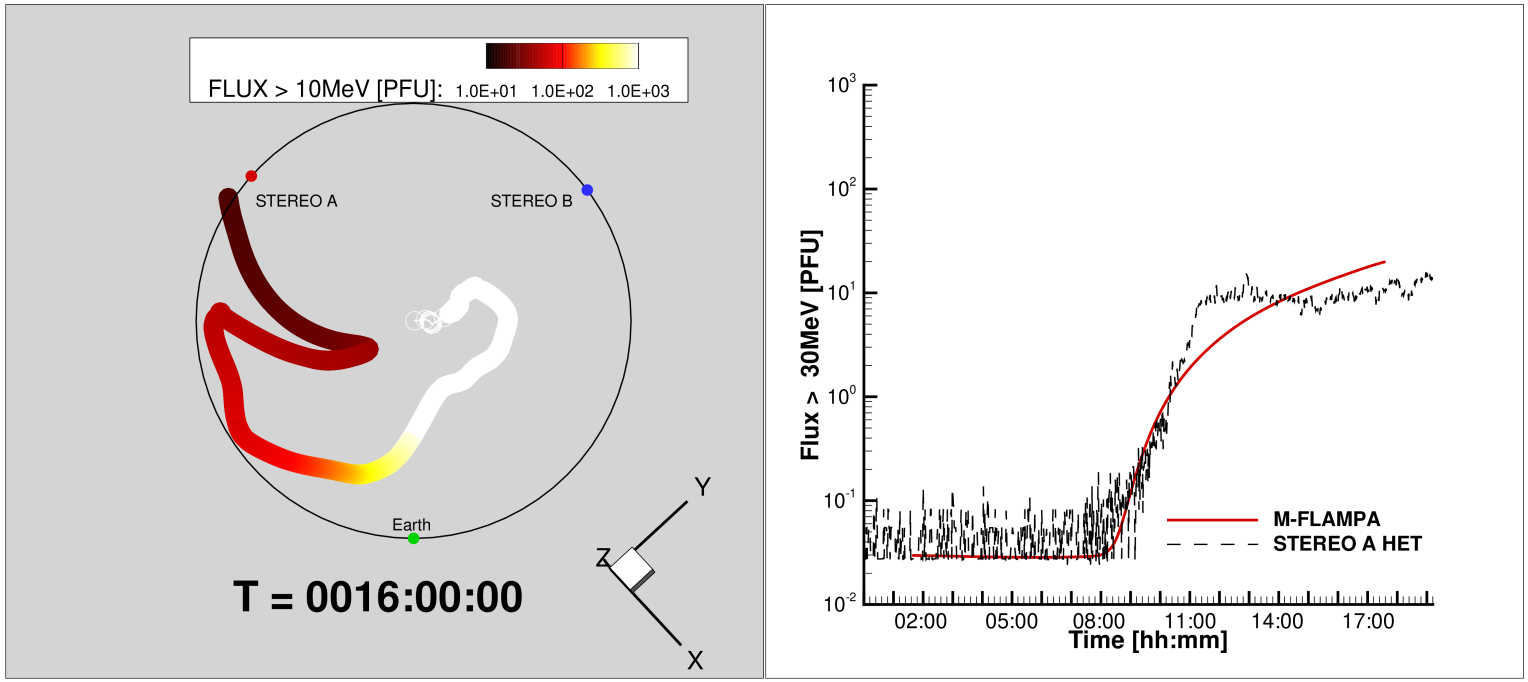

Figure 6: Integrated flux of SEPs. *Left*: top down view on a selected field line; *Right*: comparison with observed flux.

Discussion questions

- **Optimization?** N/A:
  Most "expensive" part is AWSoM-R, well established and optimized model.
- **What aspects of the event does your model capture well, and what aspects were more difficult to capture?**
  - *shock*: MHD smooths out the shock, which decreases acceleration efficiency; remedy: we trace the shock and artificially sharpen it.
  - *diffusion*: free streaming upstream has a free parameter $D = \frac{1}{3}\lambda_0 v \left(\frac{pc}{1\ \mathrm{GeV}}\right)^{1/3} \left(\frac{R}{1\ \mathrm{AU}}\right)$
  - *injection*: distribution function value at injection energy defines the modeled flux value
- **What are the next steps for your modeling technique?**

- *more streamlined operation*: eliminate the guessing game for diffusion and injection
- *focused transport equation*