Brief Description of the Model

Use formula based on STEREO+Earth "three spacecraft" events relating SEP peak proton intensity at 14-24 MeV, the speed of the related CME, and magnetic connection angle of the observer relative to the solar event (Richardson et al., 2014):

$I(\phi)\ (\text{MeV s cm}^2\ \text{sr})^{-1} \approx 0.013 \exp(0.0036V - \phi^2/2\sigma^2)),\ \sigma = 43°,$

where:

ϕ is the connection angle (longitude) between the solar event and the solar footpoint of the spiral magnetic field line passing the observing spacecraft;

σ is the Gaussian width; 43° is the average value.

Use CME speed and connection angle (from flare longitude wrt observer) to estimate I

Model results: September 2017

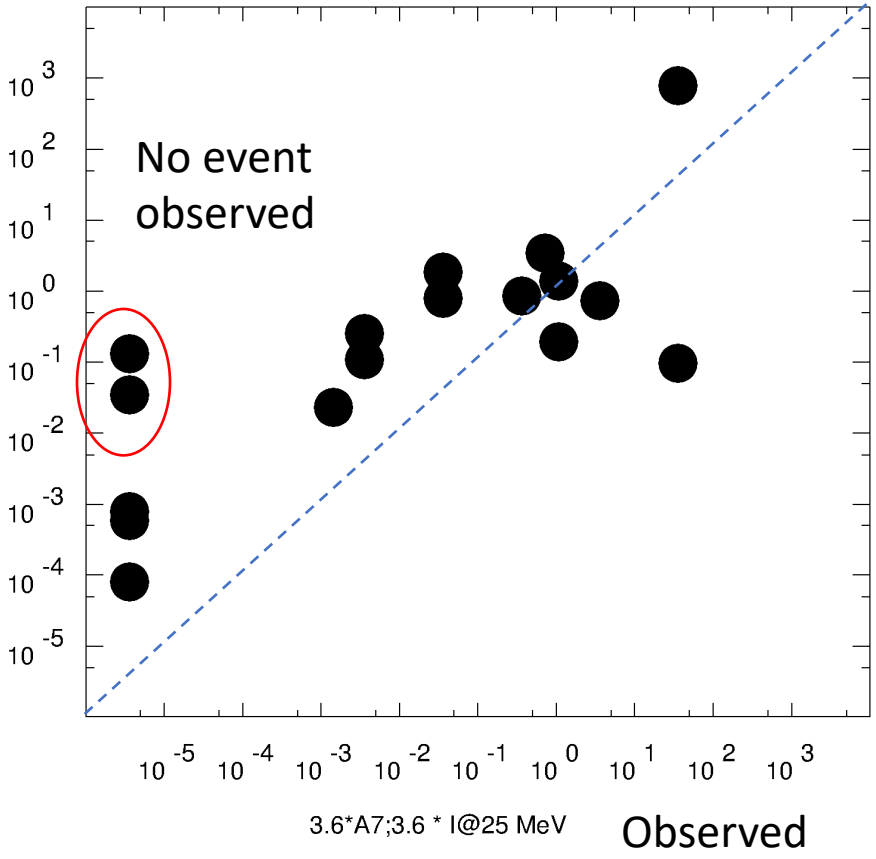
Time, location	Long	CME width	speed	Obs. I*	Pred. I
17/09/02 1500 Earth	90	94	705	0.0036	0.109
17/09/02 1500 STA	-141	94	705	…	0.00007
17/09/04 2000 Earth	11	360	1418	1.1	1.39
17/09/04 2000 STA	140	360	1418	0.0036	0.25
17/09/06 1200 Earth	34	360	1571	0.72	3.4
17/09/06 1200 STA	162	360	1571	…	0.13
17/09/10 1500 Earth	88	360	3163	36	790
17/09/10 1500 STA	-144	360	3163	3.6	0.72
17/09/17 1100 STA	-41	360	1385	1.1	0.19
17/10/11 1400 Earth	139	109	741	0.0014	0.023
17/10/11 1400 STA	-95	109	741	…	0.0006
17/10/18 0500 Earth	-126	360	1576	…	0.0008
17/10/18 0500 STA	0	360	1576	0.036	1.9

*3.6 x intensity at 25 MeV

Model results: July 2017

Time, location	Long	CME width	speed	Obs.	Pred.
17/07/14 0100 Earth	29	360	1200	0.36	0.86
17/07/14 0100 STA	162	360	1200	…	0.035
17/07/23 0400 Earth	148	360	1848	0.036	0.79
17/07/23 0400 STA	-80	360	1848	36	0.09

Predicted intensity at 14-24 MeV



General correlation, but tendency to overpredict

Couple of events significantly underpredicted.

Discussion questions

- How did your optimized run results differ from the initial run?

N/A

- What aspects of the event does your model capture well, and what aspects were more difficult to capture?

Only captures peak intensity at one energy. Does not provide intensity-time profile, ESP peak if present, advance warning of eruption., etc.

- What are the next steps for your modeling technique?

Apply to other energies, e.g., use typical spectrum, 3 S/C fitting at different energies.