Brief Description of the Model

COMESEP

http://www.comesep.eu/
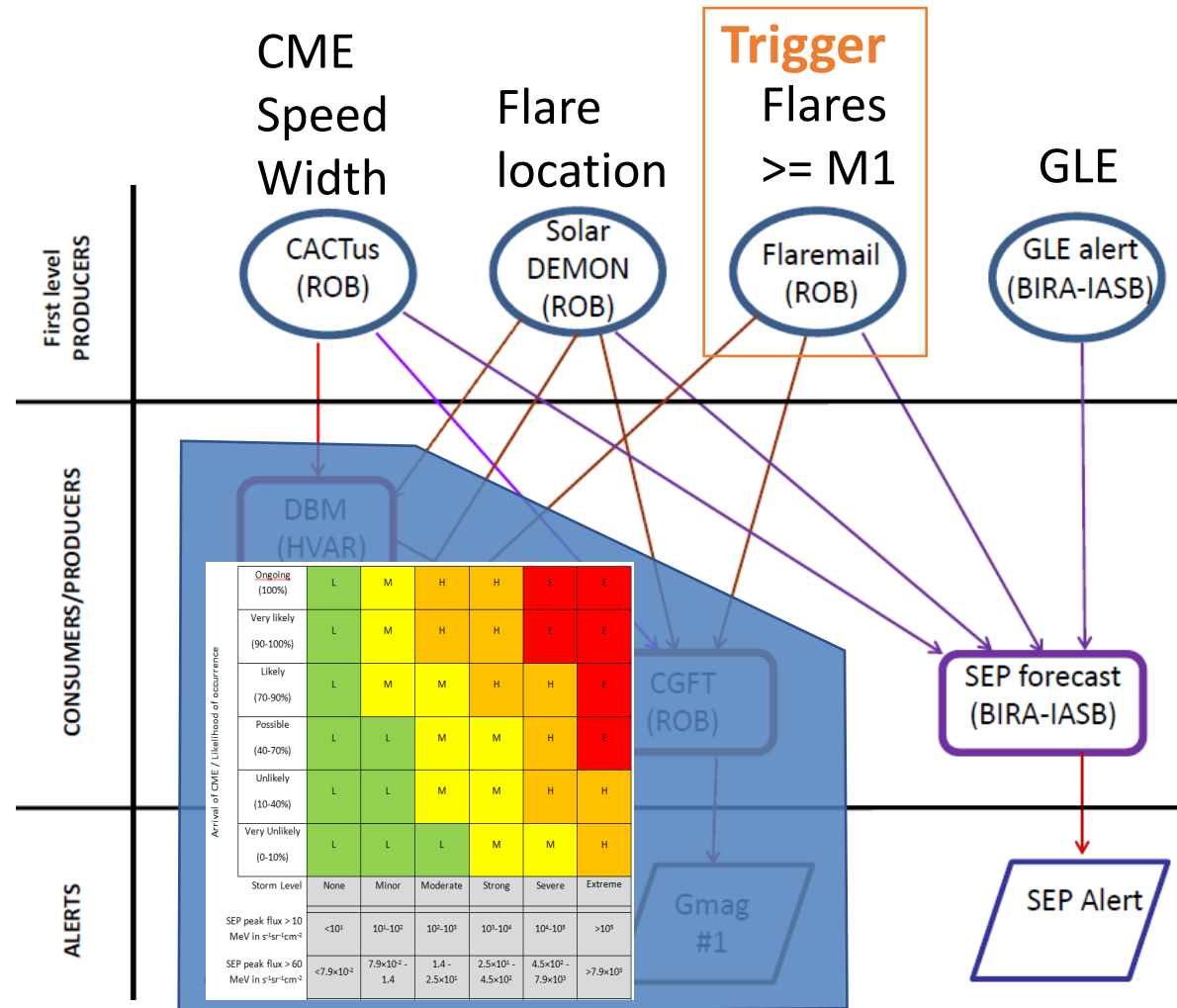
- Operational since November 2013

- Occurrence probability & storm level based on statistical analysis

- The SEP intensity time profiles based on a test particle model simulation

- SEP alerts are updated if new information becomes available

- Runs fully automatic without human intervention

Trigger

CME Speed Width

Flare location

Flares >= M1

GLE

First level PRODUCERS

CACTus (ROB)

Solar DEMON (ROB)

Flaremail (ROB)

GLE alert (BIRA-IASB)

CONSUMERS/PRODUCERS

DBM (HVAR)

CGFT (ROB)

SEP forecast (BIRA-IASB)

ALERTS

Gmag #1

SEP Alert

Arrival of CME / Likelihood of occurrence	None	Minor	Moderate	Strong	Severe	Extreme
Ongoing (100%)	L	M	H	H	E	E
Very likely (90-100%)	L	M	H	H	E	E
Likely (70-90%)	L	M	M	H	H	E
Possible (40-70%)	L	L	M	M	H	E
Unlikely (10-40%)	L	L	M	M	H	H
Very Unlikely (0-10%)	L	L	L	M	M	H
Storm Level	None	Minor	Moderate	Strong	Severe	Extreme
SEP peak flux > 10 MeV in $s^{-1}sr^{-1}cm^{-2}$	$<10^1$	10^1-10^2	10^2-10^3	10^3-10^4	10^4-10^5	$>10^5$
SEP peak flux > 60 MeV in $s^{-1}sr^{-1}cm^{-2}$	$<7.9\times10^{-2}$	7.9×10^{-2} - 1.4	1.4 - 2.5×10^1	2.5×10^1 - 4.5×10^2	4.5×10^2 - 7.9×10^3	$>7.9\times10^3$

Model results: September 2017

Date	Input source	Flare strength	Flare loc.	CME speed (km/s)	CME width (deg)	Probability	>10 MeV peak flux	Observed flux
2017/09/04	alert	M1.5	S09W10	-	-	Very Unlikely (6%)	Minor (17 pfu)	--
	SHINE	M1.5	S10W08	-	-	Very Unlikely (6%)	Minor (17 pfu)	
2017/09/04	alert	M1.0	S08W11	477	176 (full)	Very Unlikely (5%)	None (9 pfu)	--
	SHINE	M1.0	S07W11	-	-	Very Unlikely (6%)	Minor (17 pfu)	
2017/09/04	alert	M1.5	-	-	-	Very Unlikely (6%)	Minor (17 pfu)	--
	SHINE	M1.5	S10W11	830	28	Unlikely (20%)	None (9 pfu)	
2017/09/04	alert	M5.5	-	-	-	Unlikely (20%)	Minor (30 pfu)	210 pfu
	SHINE	M5.5	S10W11	1325	52	Unlikely (20%)	Minor (74 pfu)	

Two COMESEP predictions using the same underlying model are provided but with different input parameter sources:

- 'alert': predictions issued by the operational system in real-time based on the information available at that time.
- 'SHINE': input parameters provided for this exercise

Model results: September 2017

Date	Input source	Flare strength	Flare loc.	CME speed (km/s)	CME width (deg)	Probability	>10 MeV peak flux	Observed flux
2017/09/06	alert	X9.3	S09W35	801	342 (full)	Unlikely (33%)	Minor (65 pfu)	35 pfu (initial) 844 pfu (shock)
	SHINE	X9.3	S09W34	1850	50	Likely (83%)	Moderate (219 pfu)	
2017/09/09	alert	-	-	-	-	-	-	--
	SHINE	M1.2	S09W88	700	41	Unlikely (20%)	None (9 pfu)	
2017/09/10	alert	X8.9	S10W90	839	360 (full)	Likely (79%)	Minor (65 pfu)	1490 pfu
	SHINE	X8.2	S08W88	2500	90	Likely (63%)	Minor (933 pfu)	

Model results: July 2017

Date	Input source	Flare strength	Flare loc.	CME speed (km/s)	CME width (deg)	Probability	>10 MeV peak flux	Observed flux
2017/07/14	alert	M2.4	S09W33	-	-	Unlikely (10%)	Minor (17 pfu)	22 pfu
	SHINE	M2.4	S09W33	1300	54	Possible (57%)	Minor (47 pfu)	
2017/07/23	alert	-	-	-	-	-	-	2 pfu
	SHINE	-	-	-	-	-	-	

Discussion questions

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

The only difference are the inputs, and predominantly the CME parameters which are not always available to make realtime predictions. Including these improve the predictions.

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

COMESEP predicts the flux of the first peak (i.e. not the one related to the shock passage). When the CME information is include, the peak flux is generally better predicted for these selected events.

- ## What are the next steps for your modeling technique?

No development activities are currently foreseen. Improving the underlying statistical model (statistics, parameters, technique) would be useful to improve the predictions.