ASPECS

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Description

ASPECS uses empirical relations and Bayesian statistics to relate flare magnitude and longitude with the probability of an SPE, peak intensity, and time profile. Predictions are made prior to a flare in addition to after a flare as new data comes in, such as the measured flare magnitude and longitude, CME speed and width, and real-time proton flux

Inputs

Forecasting Module

Magnetogram: SDO/HMI SHARPs at a 12 minute cadence

Nowcasting Module

Flare Magnitude and Longitude: From SWPC Latest Flares using GOES/EXIS and SWPC SRS

CME Speed and Width: From CACTus using SOHO/LASCO

Proton Flux: From GOES/EPEAD at a 5 minute cadence

Outputs

Forecasting Module

Probability of Occurrence: For SEPs

Peak Flux: Of >10, >30, >100, and >300 MeV protons at 50% and 90% CLs

Time Profile: Of >10, >30, >100, and >300 MeV protons at 50% and 90% CLs

Nowcasting Module

Probability of Occurrence: For SEPs

Peak Flux: Of >10, >30, >100, and >300 MeV protons at 50% and 90% CLs

Time Profile: Of >10, >30, >100, and >300 MeV protons at 50% and 90% CLs

Forecast Lag Time

Inputs: 12 minutes for SHARPs

Run Time: About 45 minutes for calculating B_{eff}

Interpretation and Caveats

Nowcasting Modes: <u>Flare</u>: uses flare magnitude and location to calculate P(SEP), peak flux, and the time profile. <u>Flare+CME</u>: same as Flare, but includes CME speed and width for a better prediction. <u>In-Progress</u>: uses real-time GOES proton measurements and performs a Modified Weibull fit to get the time profile

SOLPENCO2 Time Profile: Used in the Flare and Flare+CME nowcasting modes. Uses previously ran results from SOLPENCO2 based on the flare magnitude and location. The time profile ends when the shock reaches Earth, then ASPECS adds an exponential decay for the remainder of the time profile

Modified Weibull Time Profile: Uses flare magnitude and location in the Flare and Flare+CME nowcasting modes. Uses GOES proton measurements in the In-Progress nowcasting mode

Time Profile Choice: Predictions in the Flare and Flare+CME nowcasting modes are an interplay between using SOLPENCO2 and a Modified Weibull function. Each is compared to observations if available, and the one with the lowest χ^2 is chosen

No Flare: If there is no flare info, a persistent time profile is predicted

Electron Filtering: Electron flux measurements from ACE/EPAM are used as a filter. ASPECS calculates the moving average, and if a 2-3 sigma increase above background is not observed, it sets P(SEP) to zero

Energy Expectations: ASPECS expects $E \geq 10, 30, 100, 300$ MeV if $P(SEP) \geq 0.26, 0.20, 0.15, 0.12$, respectively. These expectations help choose the pre-caluclated prediction

Flare Location: Flare longitudes may be wrong due to its internal algorithm and may affect predictions. Soon to be replaced by SolarSoft

Additional Links

iSWA Data Tree   SOLPENCO2 Description   ASPECS Web Tool

CCMC ASPECS Description SHARPs Description

Validation

		Categorical			Start Time	Onset Peak Time	Duration	Onset Peak Intensity			Intensity Time Profile		
	H	FAR	TSS	HSS	ME	ME	ME	MLE	MALE	R	MLE	MALE	R
>10 (50%)													
>10 (90%)													
>100 (50%)													
>100 (90%)													