Description

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The SEPEM Reference Event List (REL) contains a set of periods in which high flux levels of Solar Energetic Particles (SEPs) were observed. These periods are known as Solar Particle Events (SPEs). This list, based on solar proton flux measurements, is intended to focus on periods of high flux, each event (or episode) may comprise multiple enhancements due to different solar events, eruptive and acceleration processes.

Events are defined based on the following five selection criteria:

* start threshold: A flux threshold trigger that defines the start of an event. This should exceed the background flux level.
* end threshold: When the flux drops this value the event ends. This should exceed the background flux level.
* minimum peak value: A filter removing episodes which do not exceed this value. This biases the list to focus on larger events while handling any time-varying background issues.
* minimum duration: A filter removing episodes with a duration below this value. This helps to mitigate the effects of spurious data.
* dwell time: this parameter is used to merge events that follow each other very closely in time. If two consecutive events are separated by time interval below this they are joined into a single (compound) event. This parameter allows to remove unwanted effects whereby events can be split if the data series drops below the end threshold for a short period of time.

The first version of the REL contained 250 events covering the period from 1973-11-01 to 2015-05-31. It was defined on the basis of the 2nd (differential) channel of the SEPEM RDS (Reference Data Set) v1.0 which has an energy range from 7.23 – 10.45 MeV with the following criteria:

* start threshold: 0.01 cm-2 s-1 sr-1 MeV-1
* end threshold = 0.01 cm-2 s-1 sr-1 MeV-1
* minimum duration: 24 hours
* dwell time: 24 hours
* minimum peak value: 0.5 cm-2 s-1 sr-1 MeV-1

This event list suffered from missing the onset in some SPEs due to the low energy of the reference energy channel.

The present Solar Energetic Particle Environment Modelling (SEPEM) system is operated by the Royal Belgian Institute for Space Aeronomy and available for registration and use by registered users here:

<http://sepem.eu/>

Or may alternatively be accessed via the ESA Space Weather Service Network portal:

<https://swe.ssa.esa.int/>

A description of the system and its functionalities is available in a peer-reviewed journal article [Crosby, N., et al. (2015), SEPEM: A tool for statistical modeling the solar energetic particle environment, Space Weather, 13, 406–426, doi:10.1002/2013SW001008] which also describes the first version of the SEPEM REL.

Contact Point

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Reference Event List v2

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The file (RELv2) constitutes the second version of the REL and was derived from the RDSv3.2 covering the period from 1974-07-01 to 2017-12-31. To correct the onset issue the RELv2 exploits the availability of derived >5 MeV integral channel in the RDSv3.2 with the following criteria:

* start threshold: 0.05 cm-2 s-1 sr-1
* end threshold = 0.05 cm-2 s-1 sr-1
* minimum duration: 24 hours
* dwell time: 24 hours
* minimum peak value: 15 cm-2 s-1 sr-1

The algorithm for the RELv2 applied the selection criteria in the following order:

1. find episodes between the start and end thresholds;
2. reject the episodes shorter than the minimum duration;
3. merge events separated by less than the dwell time;
4. calculate the total fluence and peak value for each event;
5. reject the events for which the peak value is below the minimum value;

The resulting RELv2 contains 254 events.

The criteria were chosen to return an event list similar to the RELv1 for the purposes of consistency. The removal of 2 events before July 1974 was due to a change in the start time of the RDS to make the data processing more homogenous. 8 additional events were added due to the extension of the time period. For the overlapping time periods of the RELv1 and RELv2 there is a difference of 2 events despite the change in event definition and reference energy channel.

RELv2 Data file

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All data are comma-separated. The RELv2 set is composed of a single CSV (.csv) file. The file format is a header line followed by event records:

Column 1 contains the event number (starting with 1 and ending with 254)

Column 2 contains the event start date in yyyy-mm-dd HH:MM:SS format (always in 5-minute time resolution)

Column 3 contains the event end date in yyyy-mm-dd HH:MM:SS format (always in 5-minute time resolution)

Columns 4-6 contain the start and end indices within the RDSv3.2 of the start and end dates and the difference between the two.

Column 7 contains the duration of the event (in hours)

Column 8 contains the peak flux of the event in the >5 MeV energy channel [cm-2.s-1.sr-1]

Column 9 contains the fluence of the event in the >5 MeV energy channel [cm-2.sr-1]