SpaDe Definitions Catalogue Documentation

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Earthquakes

***Depth*:** *depth of the event in kilometers (depth where the earthquake begins to rupture).*

- This depth may be relative to the WGS84 geoid, mean sea-level, or the average elevation of the seismic stations which provided arrival-time data for the earthquake location.

- The choice of reference depth is dependent on the method used to locate the earthquake, which varies by seismic network. Since SpaDe includes data from many different seismic networks, the process for determining the depth is different for different events.

- The depth is the least-constrained parameter in the earthquake location, and the error bars are generally larger than the variation due to different depth determination methods.
- Sometimes when depth is poorly constrained by available seismic data, the location program will set the depth at a fixed value. For example, 33 km is

often used as a default depth for earthquakes determined to be shallow, but whose depth is not satisfactorily determined by the data, whereas default depths of 5 or 10 km are often used in mid-continental areas and on mid-ocean ridges since earthquakes in these areas are usually shallower than 33 km.

Depth_err: *Uncertainty of reported depth of the event in kilometers.*

- The depth error, in km, defined as the largest projection of the three principal errors on a vertical line.

***Dmin*:** *Horizontal distance from the epicenter to the nearest station (in degrees).*

- 1 degree is approximately 111.2 kilometers. In general, the smaller this number, the more reliable is the calculated depth of the earthquake.

***Gap*:** *The largest azimuthal gap between azimuthally adjacent stations (in degrees).*

- In general, the smaller this number, the more reliable the calculated horizontal position of the earthquake. Earthquake locations in which the azimuthal gap exceeds 180 degrees typically have large location and depth uncertainties.

Horizontal_err: *Uncertainty of reported location of the event in kilometers.*

- The horizontal location error, in km, is defined as the length of the largest projection of the three principal errors on a horizontal plane. The principal errors are the major axes of the error ellipsoid, and are mutually perpendicular.

- The horizontal and vertical uncertainties in an event's location varies from about 100 m horizontally and 300 meters vertically for the best located events, those in the middle of densely spaced seismograph networks, to 10s of kilometers for global events in many parts of the world. We report an "unknown" value if the contributing seismic network does not supply uncertainty estimates.

Identifier: *Unique identifier for a specific version of a product. The id is made of of these four attributes*:

- *source* The product contributor, usually a network code.
- *type* The type of product.
- *code* A unique identifier from the product source, for this type of product.
- *updateTime* A millisecond timestamp that indicates when this version of the product was created.

- Two products with the same source, type, and code, with different updateTimes indicate different versions of the same product. The latest updateTime for a product supersedes any earlier updateTime for the same product.

Latitude: *The angular distance of the event's place north or south of the Equator.*

- An earthquake begins to rupture at a hypocenter which is defined by a position on the surface of the earth (epicenter) and a depth below this point

(focal depth). We provide the coordinates of the epicenter in units of latitude and longitude.

- Coordinates are given in the WGS84 reference frame. The position uncertainty of the hypocenter location varies from about 100 m horizontally and 300 meters vertically for the best located events, those in the middle of densely spaced seismograph networks, to 10s of kilometers for global events in many parts of the world.

Location source: *The network that originally authored the reported location of this event.*

- *Typical values: ak, at, ci, hv, ld, mb, nc, nm, nn, pr, pt, se, us, uu, uw.*

Longitude: *The angular distance of the event's place east or west of the Greenwich Meridian.*

Mag_err: *Uncertainty of reported magnitude of the event.*

- The estimated standard error of the magnitude. The uncertainty corresponds to the specific magnitude type being reported and does not take into account magnitude variations and biases between different magnitude scales. We report an "unknown" value if the contributing seismic network does not supply uncertainty estimates.

Magnitude: *Earthquakes magnitude according to the Richter magnitude scale.*

Magnst: *The total number of seismic stations used to calculate the magnitude for this earthquake.*

Magtype: *The method or algorithm used to calculate the preferred magnitude for the event.*

- *All Magnitude Types by the USGS (United States Geological Survey)*: https://www.usgs.gov/programs/earthquake-hazards/magnitude-type

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Net: *The ID of a data contributor. Identifies the network considered to be the preferred source of information for this event.*

AK	Alaska Earthquake Center	NM	New Madrid Seismic Network
AT	National Tsunami Warning Center	NN	Nevada Seismological Laboratory
CI	California Integrated Seismic Network: Southern California Seismic Network (Caltech/USGS Pasadena and Partners) and Southern California Earthquake Data Center)	PR	Puerto Rico Seismic Network
HV	Hawaii Volcano Observatory	PT	Pacific Tsunami WArning Center)

LD	Lamont-Doherty Cooperative Seismographic Network	SE	Center for Earthquake REsearch and Information
MB	Montana Bureau of Mines and Geology	US	USGS National Earthquake Information Center
NC	California Integrated Seismic Network: Northern California Seismic System (UC Berkeley, USGS Menlo Park, and Partners)	UU	University of Utah Seismograph Stations
UW	Pacific Northwest Seismic Network		

Nst: *The total number of seismic stations used to determine earthquake location.*

- Number of seismic stations which reported P- and S-arrival times for this earthquake. This number may be larger than the Number of Phases Used if arrival times are rejected because the distance to a seismic station exceeds the maximum allowable distance or because the arrival-time observation is inconsistent with the solution.

Place: *Textual description of named geographic region near to the event. This may be a city name, or a Flinn-Engdahl Region name.*

- *We use a GeoNames dataset to reference populated places that are in close proximity to a seismic event.*

Rms: *The root-mean-square (RMS) travel time residual, in sec, using all weights.*

- This parameter provides a measure of the fit of the observed arrival times to the predicted arrival times for this location. Smaller numbers reflect a better fit of the data.

- The value is dependent on the accuracy of the velocity model used to compute the earthquake location, the quality weights assigned to the arrival time data, and the procedure used to locate the earthquake.

Sat source: *Satellite source of information.*

Status: *Indicates whether the event has been reviewed by a human.*

- Typical values: “automatic”, “reviewed”, “deleted”.

Trigger time: *Time in which the event was first detected.*

- Times are reported in *milliseconds* since the epoch (`1970-01-01T00:00:00.000Z`), and do not include leap seconds. In certain output formats, the date is formatted for readability.

- We indicate the date and time when the earthquake initiates rupture, which is known as the "origin" time. Note that large earthquakes can continue rupturing for many 10's of seconds. We provide time in UTC (Coordinated Universal Time). Seismologists use UTC to avoid confusion caused by local time zones and daylight savings time.

Type: *Type of seismic event.*

- Typical values: “earthquake”, “quarry”.

Updated: *Time when the event was most recently updated.*

- Times are reported in milliseconds since the epoch. In certain output formats, the date is formatted for readability.

Space Weather Events (SWE)

Flux: *The energy flux rate of flow emitted by the solar flare, in* w/m^2.

Class	W/m^2 *between 1 & 8 Ångströms*
A	$<10^{-7}$
B	$\geq 10^{-7} < 10^{-6}$
C	$\geq 10^{-6} < 10^{-5}$
M	$\geq 10^{-5} < 10^{-4}$
X	$\geq 10^{-4}$

- Each X-ray class is logarithmic, with each class being 10 times stronger than the previous one, and within each category ranging from 1 to 9.

Region: *number assigned to a plage or sunspot region.*

- *Represents where the event was detected.*

Sat source: *satellite source of information.*

Time end obs: *End time of the event's observation.*

Time start obs: *Start time of the event's observation.*

Trigger time: *Time in which the event triggers its maximum peak.*

Terrestrial Gamma-Ray Flashes (TGF)

DEC: *The Declination of the trigger in the selected equinox.*

- This was given in J2000 decimal degree coordinates in the original data.

- *The angular distance of an astronomical body north (+) or south (-) of the celestial equator. In geomagnetic applications, the angle between true north and the horizontal component of the local geomagnetic field.*

End time obs: *End time of the event's observation.*

Event type: *Classification of the event's type.*

0	*Single pulse*
1	*Candidate multipulse (MP) event*
2	*First pulse of MP event*
3	*Following pulse(s) of MP event*
4	*Terrestrial Electron Beam (TEB)*

Geo lat: *The spacecraft's geographical north latitude at trigger time, in degrees.*

Geo long: *The spacecraft's geographical east longitude at trigger time, in degrees.*

Ml counts: *TGF number of counts by maximum likelihood analysis.*

Ml counts err: *Error on TGF number of counts by maximum likelihood analysis.*

***Ml counts err applied*:** *ML counts value with its error applied.*

***Normalised duration*:** *Approximate duration of the event's occurrence.*

***Orbit*:** *Satellite Orbit number.*

***RA*:** *The Right Ascension of the trigger in the selected equinox.*

- *This was given in J2000 decimal degree coordinates in the original data.*

***Reliability*:** *Probability assigned to the classification of the trigger by the GBM flight software, expressed as a percentage (with 100% being most probable).*

***Sat altitude*:** *Satellite altitude at trigger time.*

***Sat source*:** *Satellite source of information.*

***Start time obs*:** *Start time of the event's observation.*

T50: *TGF duration T50 (ms).*

T50err: *Error on TGF duration T50 (ms).*

T50err applied: *T50 value with its error applied.*

TGF name: *The designation of the source of the trigger.*

Trigger time: *The time at which the trigger occurred.*

Gamma-Ray Bursts (GRB)

BAT DEC: *The Declination of the Swift Burst Alert Telescope (BAT) detection (J2000).*

- Because of the BAT's large field of view, this position may be different from other determinations. Also, for bursts that have Swift observations, but were not triggered by Swift BAT, this will be the RA determined by the detecting mission.

BAT fluence: *The fluence (10^{-7}erg/cm^2) measured by Swift Burst Alert Telescope (BAT) from the Burst in the energy range 15-150 keV.*

BAT RA: *The Right Ascension of the Swift Burst Alert Telescope (BAT) detection (J2000).*

BAT T90: *The time interval (seconds) in which 90% of the Fluence was detected by Swift Burst Alert Telescope (BAT).*

DEC: *The Declination of the trigger in the selected equinox.*

End time obs: *End time of the event's observation.*

Geo lat: *The spacecraft's geographical east longitude, in degrees.*

Geo long: *The spacecraft's geographical north latitude, in degrees.*

Max count: *The maximum count rate of the burst.*

Name: *Name of the event with date and time of occurrence.*

***Normalised duration*:** *Approximate duration of the event's occurrence.*

***RA*:** *The Right Ascension of the trigger in the selected equinox.*

***Reliability*:** *Probability assigned to the classification of the trigger (with 100% being most probable).*

***Sat source*:** *Satellite source of information.*

***Sigma*:** *The significance of the burst.*

***Start time obs*:** *Start time of the event's observation.*

***T90*:** *the time taken to accumulate 90% of the burst fluence starting at the 5% fluence level.*

***Trigger time*:** *Time in which the event triggers its maximum peak.*

***Type*:** *Type of the burst*:

- Typical values: “Confirmed GRB”, “Possible GRB”, “Short Spike”, “Undefined”, “Solar Activity”, “Soft Gamma-Ray Repeater”, “Radiation Belt”,

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XRT spectral index: *The spectral index (gamma) for the Swift X-Ray Telescope (XRT) detection of the burst source obtained from an automated time-averaged spectral fit of the Photon Counting (PC) mode data. If the PC-mode data is not available then the Window Timing mode data is used.*

Magnetic Disturbances

Field Magnitude Average: *Average magnitude of the magnetic field in nanotesla (nT) during the detected magnetic disturbance.*

Speed: *Velocity of the moving electric charges in kilometers per second (Km/s) during the detected magnetic disturbance.*

Trigger Time: *Date and time in which the event occurred.*

References

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