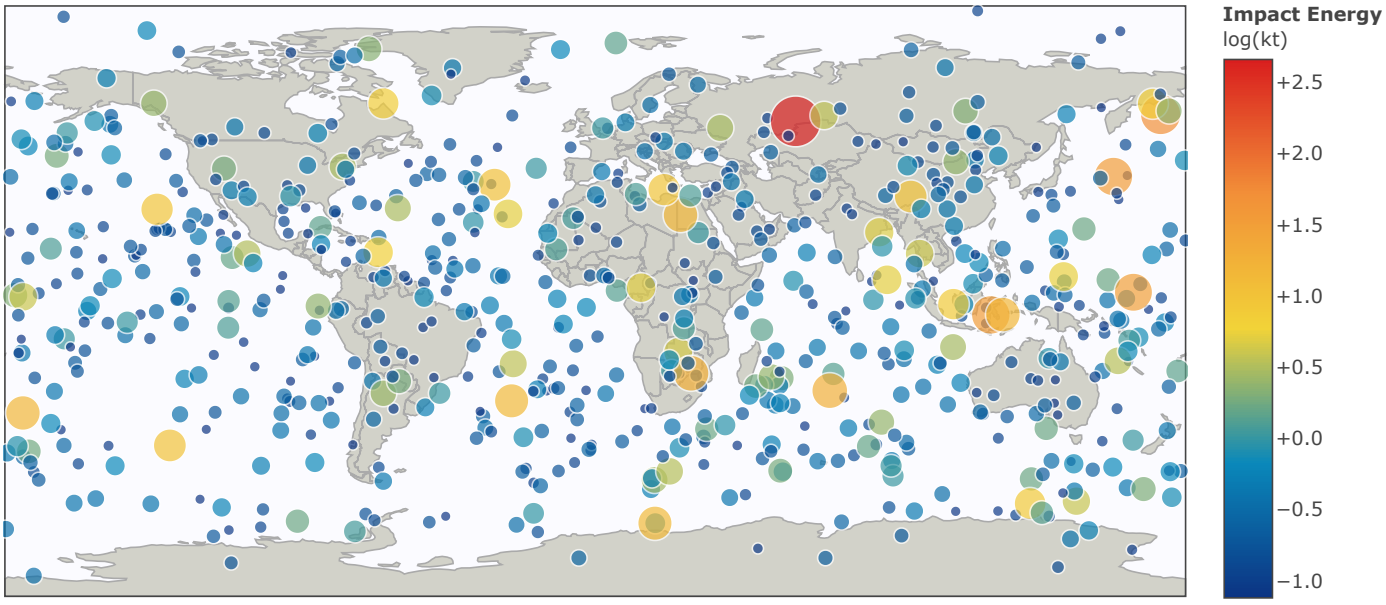
Fireballs

Fireball and Bolide Data

The following chart shows reported fireball events (intro.html) for which geographic location data are provided. Each event's calculated total impact energy is indicated by its relative size and by a color. Hover over an event to see its details. In 2019 it was determined that the Geostationary Lightning Mapper (GLM) instruments on GOES weather satellites can detect fireballs and bolides. The GLM Bolides website provides the data for those detections.

Fireballs Reported by US Government Sensors

(1988-Apr-15 to 2021-Nov-17)



https://cneos.jpl.nasa.gov/fireballs/ Alan B. Chamberlin (JPL/Caltech)

Limit data to events with an impact energy not less than the following:

unlimited

The map above can be downloaded as an image in either PNG or SVG format. SVG format can be scaled to arbitrary resolution.

The accompanying table provides information on the date and time of each reported fireball event with its approximate total optical radiated energy and its calculated total impact energy. When reported, the event's geographic location, altitude and velocity at peak brightness are also provided. Note that data are not provided in real-time and not all fireballs are reported. A blank (empty) field in the table indicates the associated value was not reported.

Peak Brightness Date/Time (UT)	Latitude (deg.)	Longitude (deg.)	Altitude (km)	Velocity (km/s)	Velocity Components (km/s)			Total Radiated Energy (J)	Calculated Total Impact Energy (kt)
					vx	vy	vz		
2021-11-17 15:53:21	6.8S	119.1E	35.0	23.0	7.0	-18.3	-12.0	2.4e10	0.086
2021-11-08 05:28:28	33.8S	7.7W	36					3.3e10	0.11
2021-10-28 09:10:30	4.1S	138.7W	35.2					3.0e10	0.1
2021-10-21 10:32:02	51.5N	51.4E	30	15.9	-14.1	-7.0	-1.9	3.7e10	0.13
2021-10-20 08:41:50	13.8N	140.4W	28					6.0e10	0.19
2021-10-20 00:43:57	59.0N	154.3E	31.4	27.5	12.9	4.2	-23.9	2.0e10	0.073
2021-09-29 10:50:59	53.9N	148.0W	28.0	21.2	-3.5	-9.0	-18.9	13.7e10	0.4
2021-09-06 17:55:42	2.1S	111.8W	26.0	13.6	-4.4	6.9	10.9	3.1e10	0.11
2021-07-30 08:06:34	7.8S	90.1E	63.0					14.6e10	0.42
2021-07-29 13:19:57	42.4N	98.4E	26.4	14.7	-1.6	-11.9	-8.4	3.7e10	0.13

Print CSV Excel

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Use the "Print" button above to print data *contained in this table*. Use the "CSV" or "Excel" buttons to download the data for use in your spreadsheet program. Allow a few seconds for downloads of large datasets.

Machine-readable data are available. See the API document for details.

Table Column Descriptions | HIDE LEGEND ()

Peak Brightness Date/Time (UT)

The date and time in UT (Universal Time) of this event's peak brightness.

Latitude (deg.)

Geodetic latitude in degrees north (N) or south (S) of the equator for this event.

Longitude (deg.)

Geodetic longitude in degrees east (E) or west (W) of the prime meridian for this event.

Altitude (km)

Altitude in kilometers (km) above the reference geoid for this event.

Velocity (km/s)

The magnitude of the meteor's pre-impact velocity in kilometers per second (km/s).

Velocity Components (km/s)

The magnitude of the meteor's pre-impact velocity in a geocentric Earth-fixed reference frame defined as follows: the z-axis is directed along the Earth's rotation axis towards the celestial north pole, the x-axis lies in the Earth's equatorial plane, directed towards the prime meridian, and the y-axis completes the right-handed coordinate system.

Total Radiated Energy (J)

The approximate total radiated energy in the atmosphere in Joules [a unit of energy given in kilograms times velocity squared, or kg × $(m/s)^2$]

Calculated Total Impact Energy (kt)

The impact energy of the event in kilotons of TNT (kt) computed from an empirical expression relating radiated and impact energy (see the Introduction (intro.html) for more details).