NASA METEOROID ENVIRONMENT OFFICE

The 2026 meteor shower activity forecast for low Earth orbit

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The purpose of this document is to provide a forecast of major meteor shower activity in low Earth orbit (LEO). Typical activity levels are expected for nearly all showers in 2026. The October Draconids and Andromedids, which are expected to outburst in 2025, should return to low levels in 2026.

1 Overview

No meteor shower outbursts are predicted for 2026. The fluxes and enhancement factors in this document correspond to the "typical" level of activity of the showers in our list, with the Andromedids being the sole exception.

The Andromedids may exhibit minor activity late next year. This shower has proven particularly difficult to forecast, due in part to the break-up of its now-extinct parent comet 3D/Biela. The current best prediction by the MSFC meteoroid stream model [1, 2] indicates a zenithal hourly rate (ZHR) of 3, producing a shower flux lower than that produced by the sporadic meteoroid complex. Note that unexpected outbursts of this shower have occurred in the past.

This document is designed to supplement spacecraft risk assessments of the sporadic meteoroid complex (such as that modeled by the Meteoroid Engineering Model, MEM; [3]). Meteor shower results are presented relative to an estimate of the sporadic flux – our baseline for comparison – and are weighted to a constant kinetic energy. One shower – the Geminids – attains a flux level exceeding that of the baseline meteoroid environment for 6.7-J (0.04-cm-equivalent) meteoroids. This energy corresponds to that capable of penetrating an EVA suit. The Geminids also attain a flux level matching the baseline sporadic flux for 105-J (0.1-cm-equivalent) meteoroids, a rough threshold for structural damage. The Geminids, along with the Daytime Arietids and Quadrantids, match or exceed the baseline flux for 2.83-kJ (0.3-cm-equivalent) particles, which is near the limit for pressure vessel penetration.

Meteor shower fluxes drop dramatically with increasing particle size. Thus, a PNP (probability of no penetration) risk assessment should use the flux and flux enhancements corresponding to the smallest particle capable of penetrating a component because this size will be the dominant contributor to the risk.

2 Details

Our forecasting algorithm is presented in detail in ref. [4] and has not changed in recent years. Figure 1 gives the expected visual meteor rates (ZHR) for ground observers during calendar year 2026. The visual rate is dominated by the Quadrantids in early January, the eta Aquariids in May, the Perseids in mid-August, and the Geminids in mid-December. Although meteor astronomers record and predict showers in terms of visual rates, ZHR does not directly correspond to meteoroid flux. The conversion from ZHR to flux must take into account the biases of the typical human observer, the speeds of the shower meteors, and the mass distributions of meteoroids belonging to these showers. The result is a flux profile that looks significantly different from the ZHR profile and in which high flux does not necessarily correspond to a visually spectacular meteor shower.

Showers typically contain proportionally more large particles than the sporadic meteoroid complex does; for this reason, showers are more significant at larger particle sizes, masses, or energies. Figure 2 gives the shower flux profiles for four limiting kinetic energy values. These values are listed in Table 1 alongside their equivalent masses and diameters. Figure 2 also includes an estimate of the baseline sporadic meteoroid flux for each of these limiting kinetic energies (horizontal lines). The flux plot illustrates that for small particle sizes (low kinetic energies), shower fluxes are typically less significant when compared to the sporadic flux.

Figure 2 also indicates that, depending on the energy threshold considered, a handful of showers produce the highest fluxes. The basic characteristics of five major showers, including radiant position at the time of the shower's peak, are listed in Table 2 (the full list of forecasted showers is provided at the end of this document in Table 3). For a spacecraft, the apparent directionality of a meteor shower (i.e., the aberrated radiant) will be shifted by the spacecraft's geocentric velocity.

In order to facilitate risk assessments, including Bumper PNP calculations, we provide flux enhancement factors for all of 2026 in 1-hour intervals (Figure 3). The largest flux enhancement factors in Figure 3 correspond to a kinetic energy of 6.7 J (0.04-cm-equivalent particles), which have higher absolute fluxes than the 105-J (0.1-cm-equivalent particles) factors shown alongside them.

The fluxes and enhancement factors presented in this memo may or may not apply to individual spacecraft. For instance, we have not presented crater-limited fluxes; meteoroids incident on a surface at right angles penetrate deeper for many ballistic limit equations, and, for a surface directly facing the shower, this can further boost the significance of a shower relative to the background by another factor of approximately two. Conversely, a surface tilted away from a shower radiant will encounter a less significant flux enhancement, and it is possible for the Earth to shield the spacecraft from all or part of a shower at a particular point in time. This forecast is designed for spacecraft in LEO; it does not, for instance, cover spacecraft orbiting the Moon or near the Sun-Earth Lagrange points.

kinetic energy	**equivalent mass** at 20 km s^{-1}	**equivalent diameter** at 1 g cm^{-3}
6.7 J	3.35×10^{-5} g	0.04 cm
105 J	5.24×10^{-4} g	0.1 cm
2.83 kJ	1.41×10^{-2} g	0.3 cm
105 kJ	5.24×10^{-1} g	1.0 cm

Table 1: The limiting kinetic energies (and their equivalent masses and diameters at 20 km s^{-1} and 1 g cm^{-3}) to which we report fluxes, fluences, and enhancement factors.

shower name	radiant		speed	date of maximum
	RA (°)	dec (°)	(km s^{-1})	(UT)
Quadrantids	230	+49	41	2026-01-03 18:38
Daytime Arietids	42	+24	39	2026-06-10 02:03
Southern delta Aquariids	342	-16	42	2026-07-30 00:39
Perseids	47	+58	61	2026-08-13 14:09
Geminids	113	+32	35	2026-12-14 13:00

Table 2: Highly active (in terms of flux) meteor showers in 2026. The radiant is the geocentric, unaberrated radiant and speed is that at an altitude of 100 km.

3 Contact information

The Meteoroid Environment Office will update this forecast as necessary. Those with questions or special needs in the near future are encouraged to contact Bill Cooke using the details listed below. This document was prepared by:

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References

[1] Moser and Cooke. MSFC Stream Model Preliminary Results: Modeling Recent Leonid and Perseid Encounters. *Earth Moon and Planets*, 95:141–153, 2004.

[2] Moser and Cooke. Updates to the MSFC Meteoroid Stream Model. *Earth Moon and Planets*, 102:285–291, 2008.

[3] Moorhead, Kingery, and Ehlert. NASA's Meteoroid Engineering Model 3 and its ability to replicate spacecraft impact rates. *Journal of Spacecraft and Rockets*, 57:160–176, 2020.

[4] Moorhead et al. Meteor shower forecasting in near-Earth space. *Journal of Spacecraft and Rockets*, 56(5):1531–1545, 2019.

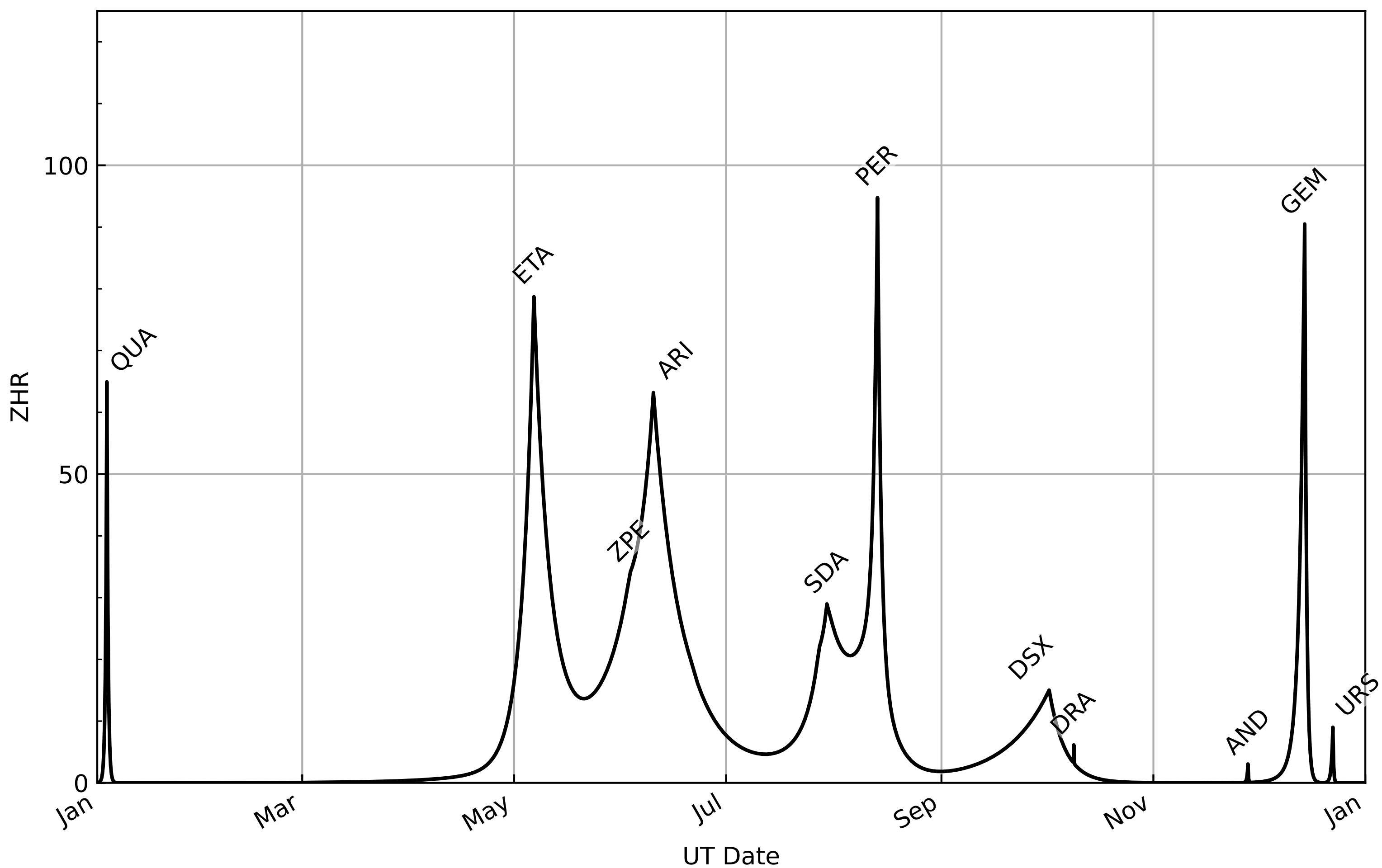

Figure 1: Meteor shower visual rates (zenithal hourly rate, or ZHR) over the course of 2026. Note how showers overlap; a large, broad shower such as the Daytime Arietids (ARI) can boost the cumulative shower ZHR and flux at the peak of an adjacent shower such as the Daytime zeta Perseids (ZPE).

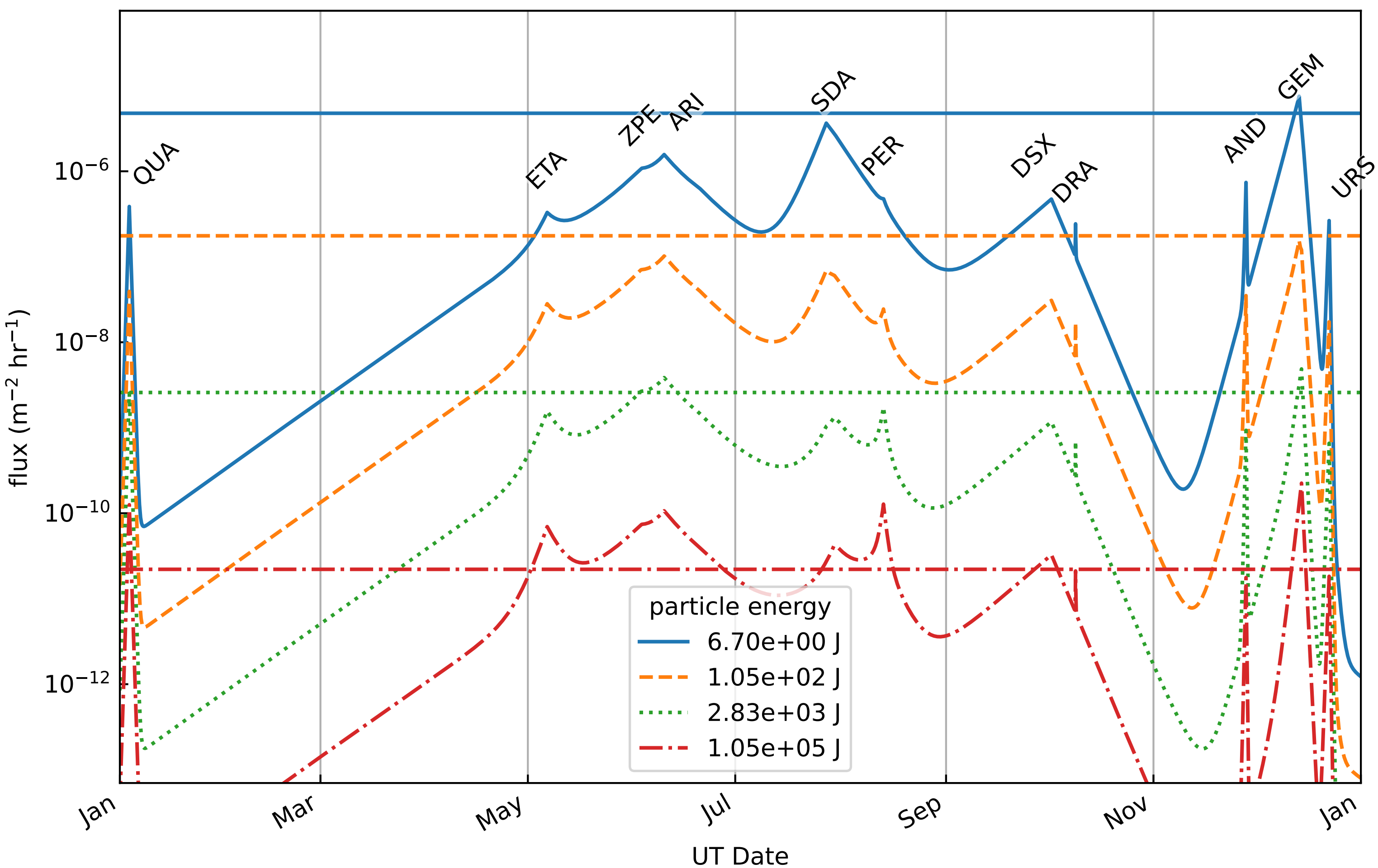

Figure 2: Meteor shower flux (variable lines) and sporadic meteoroid flux (horizontal lines) over the course of 2026. Fluxes have been weighted to a constant limiting kinetic energy. Fluxes are quoted for four particle kinetic energies; these kinetic energies correspond to particles with diameters of 0.04 cm, 0.1 cm, 0.3 cm, and 1 cm, assuming a density of 1 g cm^{-3} and a speed of 20 km s^{-1}. Some showers, such as the Perseids (PER) and Quadrantids (QUA), are more heavily weighted toward large particles and thus play a more significant role for 1-cm-equivalent particles than for 0.04-cm-equivalent particles.

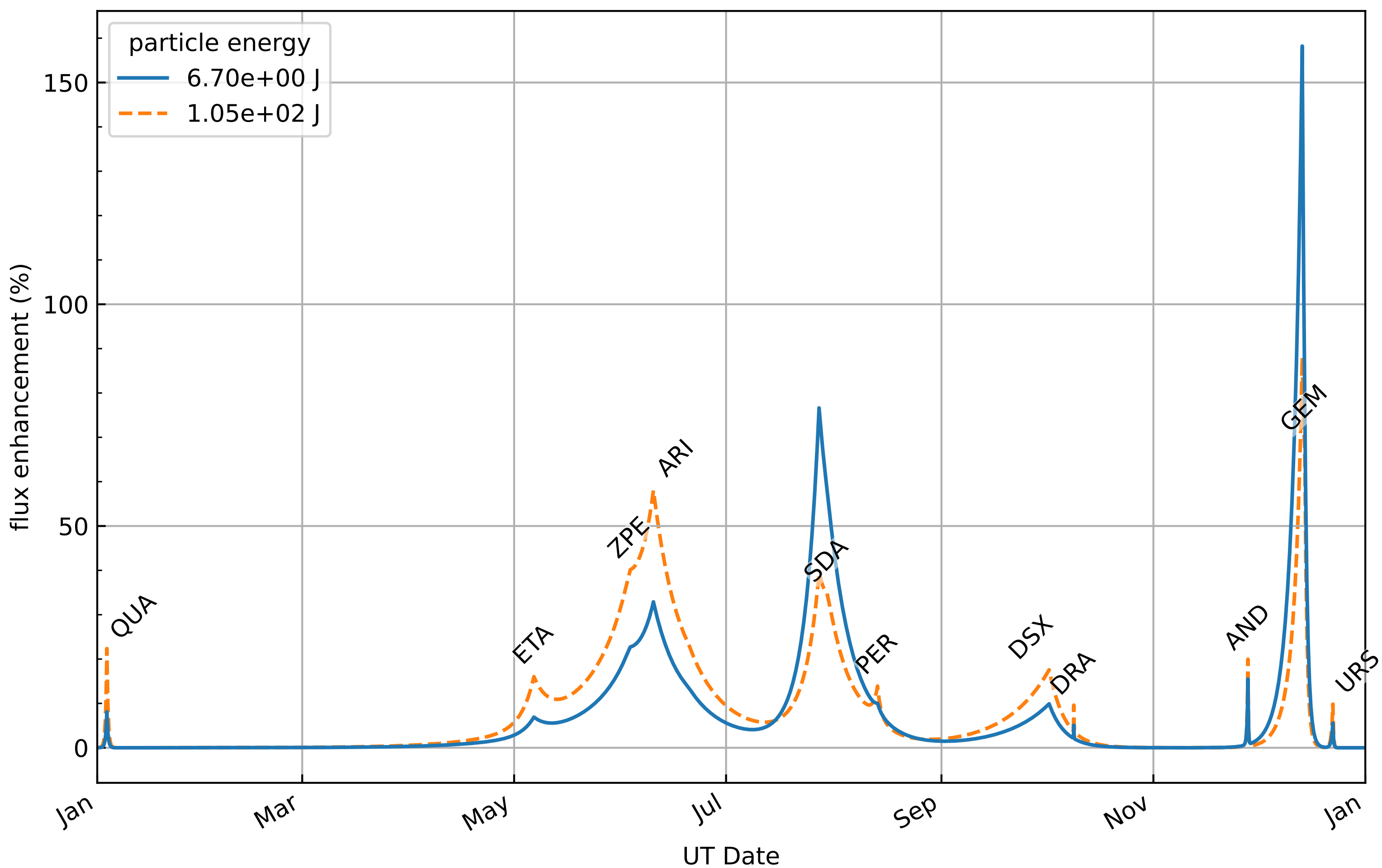

Figure 3: Meteor shower flux enhancement relative to the sporadic meteoroid flux over the course of 2026. These factors can be used in conjunction with a meteoroid model such as the Meteoroid Engineering Model (MEM) [3], to compute the flux at a particular time of year on a plate facing the unobscured shower radiant.

shower name	**ID**	**date of maximum** (UT)	**max ZHR**
Quadrantids	QUA	2026-01-03 18:38	65
eta Aquariids	ETA	2026-05-06 16:30	75
Daytime zeta Perseids	ZPE	2026-06-03 06:48	20
Daytime Arietids	ARI	2026-06-10 02:03	49
Southern mu Sagittariids	SSG	2026-06-20 03:55	2
Southern delta Aquariids	SDA	2026-07-30 00:39	20
alpha Capricornids	CAP	2026-07-31 04:30	3
Perseids	PER	2026-08-13 14:09	92
Daytime Sextantids	DSX	2026-10-01 23:40	15
October Draconids	DRA	2026-10-09 02:10	3
Andromedids	AND	2026-11-28 05:12	3
Geminids	GEM	2026-12-14 13:00	90
Ursids	URS	2026-12-22 15:54	9

Table 3: Forecasted meteor showers in 2026. Column 2 provides the 3-letter code for each shower, column 3 lists the date and time of maximum activity, and column 4 provides the shower's ZHR at the time of maximum activity.