

# Meteor Activity Outlook for December 9-15, 2023

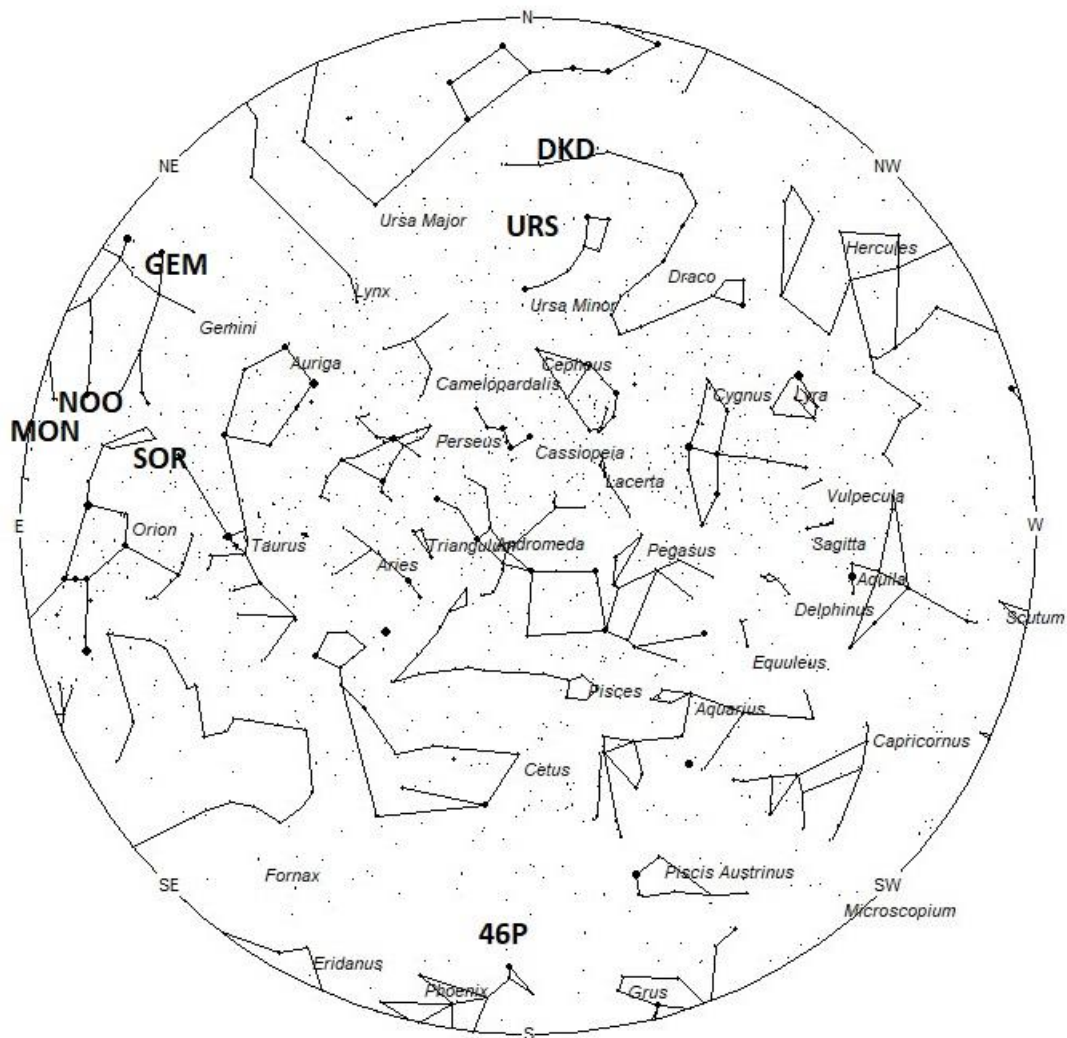


Gary Mead captured this multi-bursting fireball on July 20, 2023, at 22:37 MDT (4:37 UT on July 21) from the Tony Grove Campground, Utah, USA. ©Gary Mead

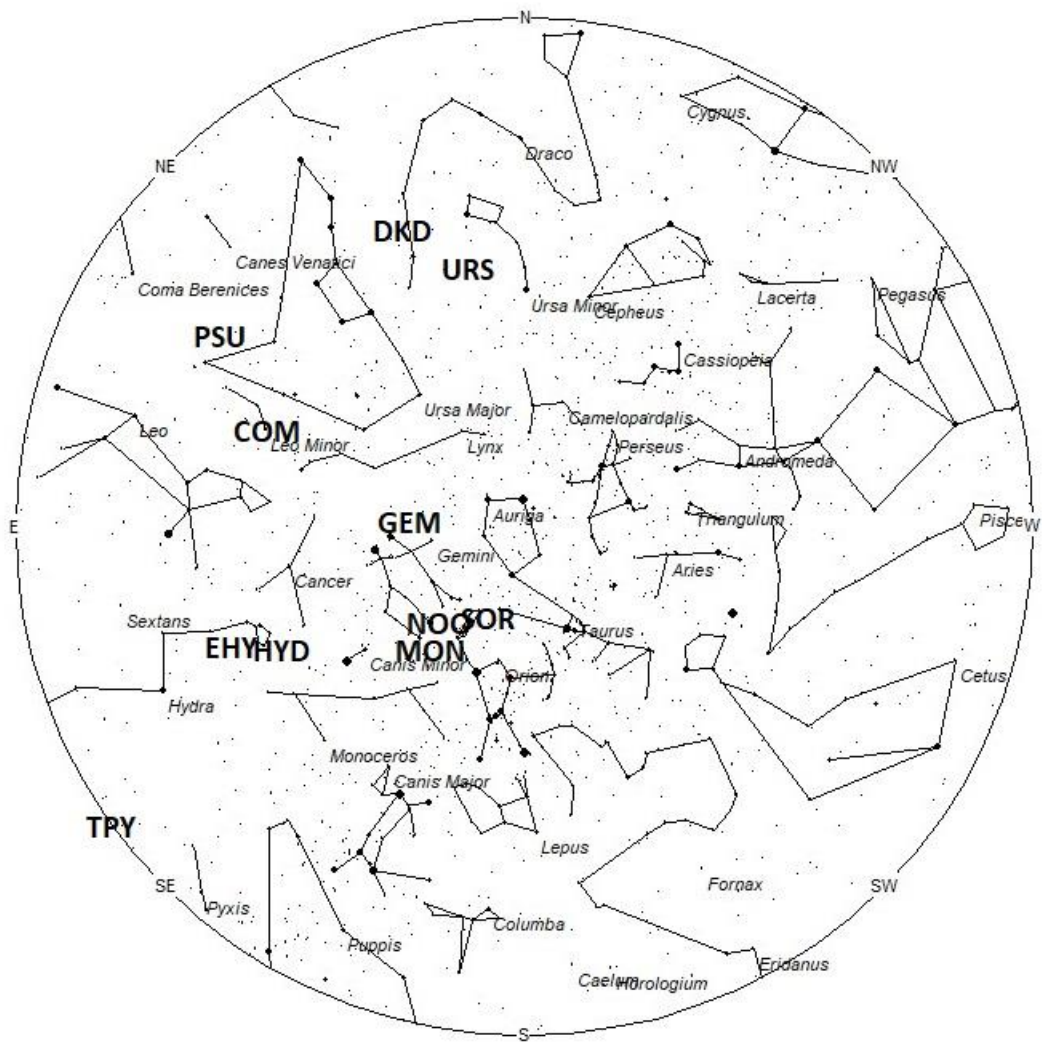
During this period, the moon reaches its new phase on Tuesday December 12th. On that night the moon will be near the sun and will be invisible at night. This weekend the waning crescent moon will rise during the early morning hours, still bright enough to be a nuisance. This can be overcome by simply keeping the moon out of your field of view. The estimated total hourly rates for evening observers this weekend should be near 4 as seen from mid-northern latitudes (45N) and 3 as seen from tropical southern locations (25S). For morning observers, the estimated total hourly rates should be near 40 as seen from mid-northern latitudes (45N) and 20 as seen from tropical southern locations (25S). The actual rates seen will also depend on factors such as personal light and motion perception, local weather conditions, alertness, and experience in watching meteor activity. Note that the hourly rates listed below are estimates as viewed from dark sky sites away from urban light sources. Observers viewing from urban areas will see less activity as only the brighter meteors will be visible from such locations.

The radiant (the area of the sky where meteors appear to shoot from) positions and rates listed below are exact for Saturday night/Sunday morning December 9/10. These positions do not change greatly day to day so the listed coordinates may be used during this entire period. Most star atlases (available at science stores and planetariums) will provide maps with grid lines of the celestial coordinates so that you may find out exactly where these positions are located in the sky. I have also included charts of the sky that display the radiant positions for evening, midnight, and morning. The center of each chart is the sky directly overhead at the appropriate hour. These charts are oriented for facing south but can be used for any direction by rotating the charts to the desired direction. A planisphere or computer planetarium program is also useful in showing the sky at any time of night on any date of the year. Activity from each radiant is best seen when it is positioned highest

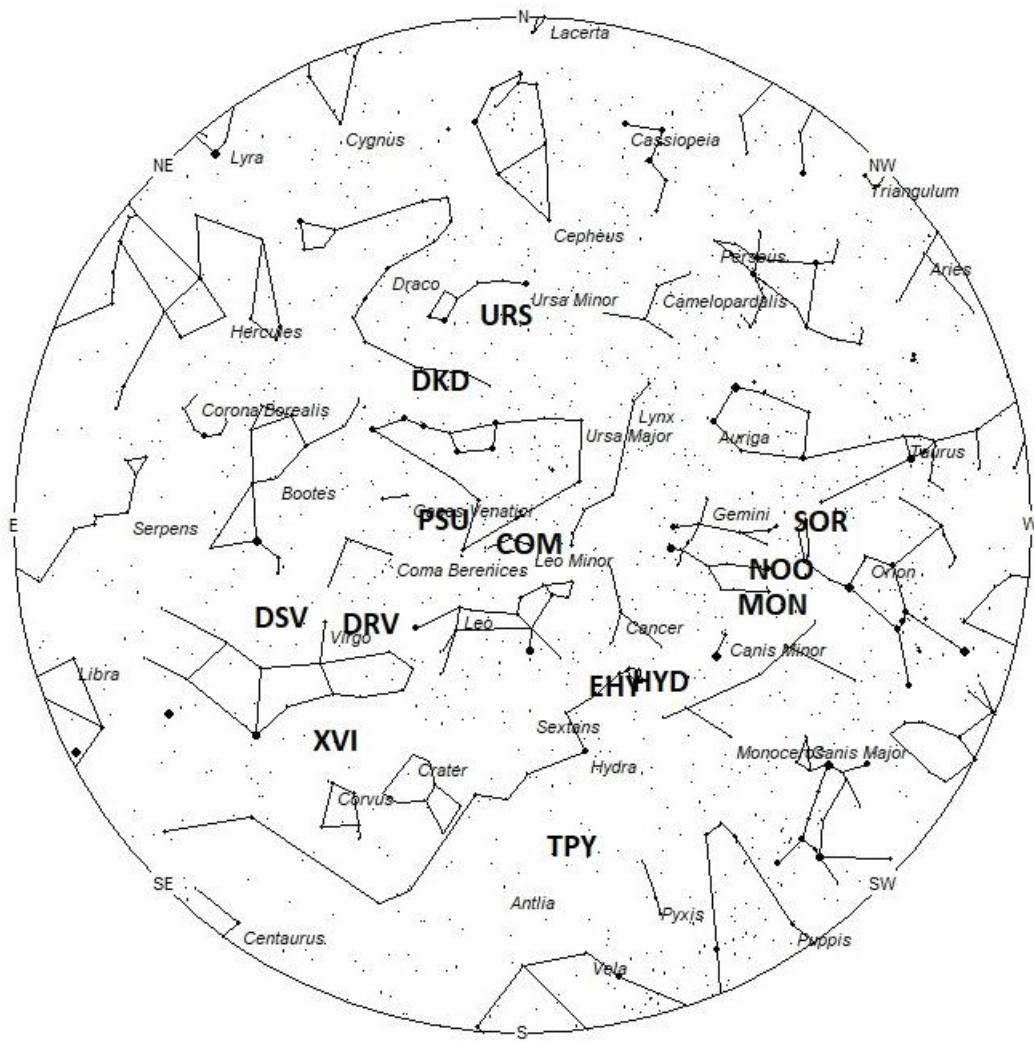
in the sky, either due north or south along the meridian, depending on your latitude. Radiants that rise after midnight will not reach their highest point in the sky until daylight. For these radiants, it is best to view them during the last few hours before dawn. It must be remembered that meteor activity is rarely seen at its radiant position. Rather they shoot outwards from the radiant, so it is best to center your field of view so that the radiant lies toward the edge and not the center. Viewing there will allow you to easily trace the path of each meteor back to the radiant (if it is a shower member) or in another direction if it is sporadic. Meteor activity is not seen from radiants that are located far below the horizon. The positions below are listed in a west to east manner in order of right ascension (celestial longitude). The positions listed first are located further west therefore are accessible earlier in the night while those listed further down the list rise later in the night.



Radiant Positions at 7pm Local Standard Time



Radiant Positions at Midnight Local Standard Time



Radiant Positions at 5am Local Standard Time

## **These sources of meteoric activity are expected to be active this week.**

On the evening of December 12<sup>th</sup>, the Earth is predicted to encounter debris from **comet 46P/Wirtanen**. The timing of this encounter is at 10:14 universal time which favors New Zealand, Australia, and southeast Asia including the Philippines and the many island nations north of Australia. These meteors will have a predicted radiant of 00:29 (007) -39, which places it in southern Sculptor some 4 degrees north of the 2<sup>nd</sup> magnitude star known as Ankaa (alpha Phoenicis). This area of the sky lies low in the south at dusk for observers in the northern hemisphere but lies much higher in the sky as seen from the southern hemisphere. These meteors could be faint and difficult to observe. The velocity of these meteors would be very slow at only 10km/sec so they should be easily noticed should activity occur. Should your skies be clear near this date and time everyone is encouraged to check for any activity from this source.

The **Southern chi Orionids (ORS)** are usually included in the totals of the Southern Taurids, as the two radiants are separated by only 5 degrees. With the STA's ending, activity from this region of the sky is a combination of ORS and anthelion activity. The ORS are active from November 14 through December 16, with maximum activity occurring on December 2<sup>nd</sup>. The radiant is currently located at 05:42 (85) +18, which lies in eastern Taurus, 3 degrees southwest of the 3<sup>rd</sup> magnitude star known as chi<sup>1</sup> Orionis. This radiant is best placed in the southern sky near midnight LST, when it lies on the meridian and is located highest in the sky. Rates at this time should be near 3 per hour no matter your location. With an entry velocity of 26 km/sec., the average ORS meteor would be of medium-slow velocity.

The **November Orionids (NOO)** are active from November 13 through December 12, with maximum activity occurring on November 30<sup>th</sup>. The radiant is currently located at 06:34 (099) +15. This area of the sky lies in southwestern Gemini, 1 degree southwest of the 2<sup>nd</sup> magnitude star known as Alhena (gamma Geminorum). This radiant is best placed in the sky near 0200 LST, when it lies highest above the southern horizon. Rates should be less than 1 per hour no matter your location. With an entry velocity of 41 km/sec., most activity from this radiant would be of medium speed.

The **Monocerotids (MON)** are active from a radiant located at 06:41 (100) +08. This area of the sky is located in northwestern Monoceros, 5 degrees south of the 3<sup>rd</sup> magnitude star known as Alzirr (xi Geminorum). This position is 7 degrees away from the NOO radiant so care must be taken to differentiate between these two showers. This radiant best placed near 0200 LST, when it lies highest in the southern sky. Rates should be near 2 per hour no matter your location. With an entry velocity of 41 km/sec., most activity from this radiant would be of medium speed. This shower is active from November 23<sup>rd</sup> through December 24<sup>th</sup>, with maximum activity occurring on December 11<sup>th</sup>.

The **Geminids (GEM)** are active from November 19<sup>th</sup> through December 24<sup>th</sup>, peaking on December 14<sup>th</sup>. The Geminid radiant is currently located at 07:18 (109) +33. This area of the sky lies in northeastern Gemini, 4 degrees northwest of the 2<sup>nd</sup> magnitude star known as Castor (alpha Geminorum). These meteors are best seen near 02:00 LST, when the radiant lies nearly overhead. Rates are expected to be near 20 per hour this weekend, increasing to 75 per hour by Thursday. Note that these rates are only seen from the northern hemisphere near 02:00, when the radiant lies

highest in the sky. Rates from the southern hemisphere should be near 5 per hour this weekend and near 25 at maximum. With an entry velocity of 33km/sec, most of these meteors would appear to possess a medium velocity.

The **sigma Hydrids (HYD)** are active from a radiant located at 08:27 (127) +02. This area of the sky is located in western Hydra, 3 degrees southwest of the 4<sup>th</sup> magnitude star known as Minchir (sigma hydrae). These meteors are active from November 24 through January 7<sup>th</sup>, with the main maximum activity occurring on December 7<sup>th</sup>. The activity profile is not smooth as there are several minor peaks of activity throughout the activity period. The last peak occurs on Monday morning December 11th. To best see these meteors, face toward the south during the last couple of hours prior to dawn. With an entry velocity of 59km/sec, most of these meteors would appear swift. Expect to see 2 per hour no matter your location.

The **eta Hydrids (EHY)** were recently discovered by members of the Croatian Meteor Network. This radiant is active from November 26 through January 1st with maximum activity occurring on December 12th. The radiant is currently located at 08:55 (134) +02, which places it in western Hydra, 3 degrees southeast of the 4th magnitude star known as eta Hydrae. This position is close to that of the sigma Hydrids so care must be taken to separate the two sources. These meteors are best seen near 0400 LST when the radiant lies highest above the southern horizon. Current rates should be less than 1 per hour no matter your location. With an entry velocity of 62 km/sec., most activity from this radiant would be of swift speed.

The **e Velids (EVE)** are a vast complex of weak radiants located in the constellations of Puppis and Vela. Visual plots and photographic studies have revealed many radiants in this area during November and December. The combined strength of these radiants can produce a ZHR of 10. Actual hourly rates will be much less unless you happen to be observing from the deep Southern Hemisphere. Activity from this source begins around November 23rd. The center of this activity is currently located at 09:01 (135) -48. This position lies in central Vela, 1 degree south of the 4th magnitude star known as C Velorum. Peak rates occur near December 4. These meteors are best seen near 0400 LST when the radiant lies highest above the southern horizon. Observers located in the southern hemisphere have an advantage viewing this shower as the radiant will rise higher into their sky allowing more activity to be seen. Since the radiant lies low in the south for most northern hemisphere observers, meteors seen from north of the equator tend to be long in length and long-lasting. At 43 km/sec. the Puppis-Velids produce meteors of medium velocity. Note: these are also listed as the “**Puppis-Velids (PUP)**” from several sources. The last of these meteors are expected near December 16<sup>th</sup>.

The **theta Pyxidids (TPY)** consists of two weak showers that peak two weeks apart. The later version is active from December 8 through January 8, with maximum occurring on December 18th. The radiant is currently located at 09:44 (146) -23. This area of the sky is located in southwestern Hydra, 7 degrees south of the 4<sup>th</sup> magnitude star known as upsilon<sup>1</sup> Hydrae. These meteors are best seen near 0500 LST when the radiant lies highest above the southern horizon. Rates are expected to be less than 1 no matter your location. At 61 km/sec. the theta Pyxids would produce mostly swift meteors.



The **Comae Berenicids (COM)** are a long duration shower active from December 5th through February 4th. Maximum activity occurs on December 16th. The radiant is currently located at 10:08 (152) +35, which places it in Leo Minor, near the spot occupied by the 4<sup>th</sup> magnitude star known as 21 Leonis Minoris. These meteors would be best seen near 05:00 LST, when the radiant lies highest in the eastern sky. Current rates would be near 2 per hour as seen from the northern hemisphere and near one as seen from south of the equator. At 63km/sec., these meteors would produce mostly swift meteors.

The **last of the psi Ursa Majorids (PSU)** are expected this week from a radiant located at 11:41 (175) +40. This position lies in southeastern Ursa Major, 8 degrees southeast of the third magnitude star known as psi Ursae Majoris. This area of the sky is best placed during the last hour before dawn, when it lies highest above the northern horizon in a dark sky. Current hourly rates would be less than 1 no matter your location. At 61km/sec., the average psi Ursa Majorid meteor would be swift.

The first **Ursids (URS)** are expected this week from a radiant located at 12:16 (184) +77. This area of the sky is located in extreme northeastern Camelopardalis, 8 degrees northwest of the 4th magnitude star known as 5 Ursae Minoris. The Ursids are active from December 13-24, with maximum activity occurring on the 22<sup>nd</sup>. Current rates are expected to be less than 1 per hour. These meteors are best seen during the last few hours prior to dawn when it is situated highest above the northern horizon. At 37km/sec., these meteors are of medium velocity. Due to the high northern location, these meteors are not visible from the southern hemisphere.

The **December chi Virginids (XVI)** are another shower discovered in Japan by observers using data from SonotaCo. This source is active from November 26 through December 30 with maximum occurring on December 12<sup>th</sup>. The radiant is currently located at 12:32 (188) -09, which places it in southwestern Virgo, near the spot occupied by the faint star known as 21 Virginis. Hourly rates should be less than 1 no matter your location. These meteors are best seen during the last dark hour before dawn, when the radiant lies highest above the eastern horizon in a dark sky. At 68 km/sec. the December chi Virginids would produce mostly swift meteors.

The **December rho Virginids (DRV)** are active from November 29 through December 22 with peak rates occurring near December 5th. The current radiant location is at 12:39 (190) +12, which places it in northern Virgo, 2 degrees north of the faint star known as rho Virginis. Current hourly rates would be less than 1 no matter your location. These meteors are best seen during the last dark hour before dawn, when the radiant lies highest above the eastern horizon in a dark sky. At 68 km/sec. the December rho Virginids would produce mostly swift meteors.

The **last of the December kappa Draconids (DKD)** are expected this week from a radiant located at 13:07 (197) +67. This position lies in western Draco, 8 degrees northwest of the 4th magnitude star known as Thuban (alpha Draconis). While the radiant lies above the horizon all night for most of the northern hemisphere, it is best placed during the last hour before dawn, when it lies highest above the northern horizon in a dark sky. Rates are now less than 1 per hour no matter your location. Due to the high northerly declination of the radiant these meteors are not visible from most of the southern hemisphere. At 43km/sec., the average December kappa Draconid meteor would be of medium velocity.

The **December sigma Virginids (DSV)** is a source of long duration discovered by John Greaves using the data from SonotaCo. This source is active from November 26 through January 24 with peak rates occur near December 21st. The current radiant location is at 13:09 (197) +07, which places it in northern Virgo, 4 degrees southeast of the 3<sup>rd</sup> magnitude star known as Vindemiatrix (epsilon Virginis). Current hourly rates would be less than 1 no matter your location. These meteors are best seen during the last dark hour before dawn, when the radiant lies highest above the eastern horizon in a dark sky. At 66 km/sec. the December Sigma Virginids would produce mostly swift meteors.

**Sporadic** meteors are those meteors that cannot be associated with any known meteor shower. All meteor showers are evolving and disperse over time to the point where they are no longer recognizable. Away from the peaks of the major annual showers, these sporadic meteors make up the bulk of the activity seen each night. As seen from the mid-Northern Hemisphere (45N) one would expect to see during this period approximately 10 sporadic meteors per hour during the last hour before dawn as seen from rural observing sites. Evening rates would be near 3 per hour. As seen from the tropical Southern latitudes (25S), morning rates would be near 7 per hour as seen from rural observing sites and 2 per hour during the evening hours. Locations between these two extremes would see activity between these listed figures. Morning rates are slightly reduced due to moonlight.

You can keep track of the activity of these meteor showers as well as those beyond the limits of visual observing by visiting the [NASA Meteor Shower Portal](#). You can move the sky globe to see different areas of the sky. Colored dots indicate shower meteors while white dots indicate sporadic (random) activity. The large orange disk indicates the position of the sun so little activity will be seen in that area of the sky.

The list below offers the information in tabular form of the showers that I feel are within reach of the visual observer to discern. Hourly rates are often less than 1 but noting parameters such as the duration, radiant distance and the elevation of each meteor, one can compute the probability of shower association. Most showers discovered by video means have rates less than 1 meteor per **night** away from maximum, so the showers listed in these articles are not as weak as they seem. Rates and positions are exact for Saturday night/Sunday morning.

SHOWER	DATE OF MAXIMUM ACTIVITY	CELESTIAL POSITION	ENTRY VELOCITY	CULMINATION	HOURLY RATE	CLASS
		RA (RA in Deg.) DEC	Km/Sec	Local Standard Time	North- South	
46P/Wirtanen	Dec 12	00:29 (007) -39	10	19:00	?	III
Southern chi Orionids (ORS)	Dec 02	05:42 (085) +18	26	00:00	3 - 2	IV



November Orionids (NOO)	Nov 30	06:34 (099) +15	41	01:00	<1 - <1	II
Monocerotids (MON)	Dec 11	06:41 (100) +08	41	01:00	1 - 1	II
Geminids (GEM)	Dec 14	07:18 (109) +33	33	02:00	20- 5	I
sigma Hydrids (HYD)	Dec 07	08:27 (127) +02	59	03:00	2- 2	II
eta Hydrids (EHY)	Dec 12	08:55 (134) +02	62	04:00	<1 - <1	III
e Velids (EVE)	Dec 04	09:01 (135) -48	43	04:00	<1- 2	II
theta Pyxidids (TPY)	Dec 18	09:44 (146) -23	61	05:00	<1- <1	IV
Comae Berenicids (COM)	Dec 16	10:08 (152) +35	63	05:00	2- 1	II
psi Ursa Majorids (PSU)	Dec 04	11:41 (175) +40	61	06:00	<1- <1	IV
Ursids (URS)	Dec 22	12:16 (184) +77	37	07:00	<1 - <1	I
December chi Virginids (XVI)	Dec 12	12:32 (188) -09	68	07:00	<1- <1	IV
December rho Virginids (DRV)	Dec 05	12:39 (190) +12	68	07:00	<1- <1	IV
December kappa Draconids (DKD)	Dec 03	13:07 (197) +67	43	08:00	<1 - <1	IV
December sigma Virginids (DSV)	Dec 21	13:09 (197) +07	66	08:00	<1 - <1	IV

**Class Explanation:** A scale to group meteor showers by their intensity:

- **Class I:** the strongest annual showers with Zenith Hourly Rates normally ten or better.
- **Class II:** reliable minor showers with ZHR's normally two to ten.
- **Class III:** showers that do not provide annual activity. These showers are rarely active yet have the potential to produce a major display on occasion.
- **Class IV:** weak minor showers with ZHR's rarely exceeding two. The study of these showers is best left to experienced observers who use plotting and angular velocity estimates to determine shower association. These weak showers are also good targets for video and photographic work. Observers with less experience are urged to limit their shower associations to showers with a rating of I to III.