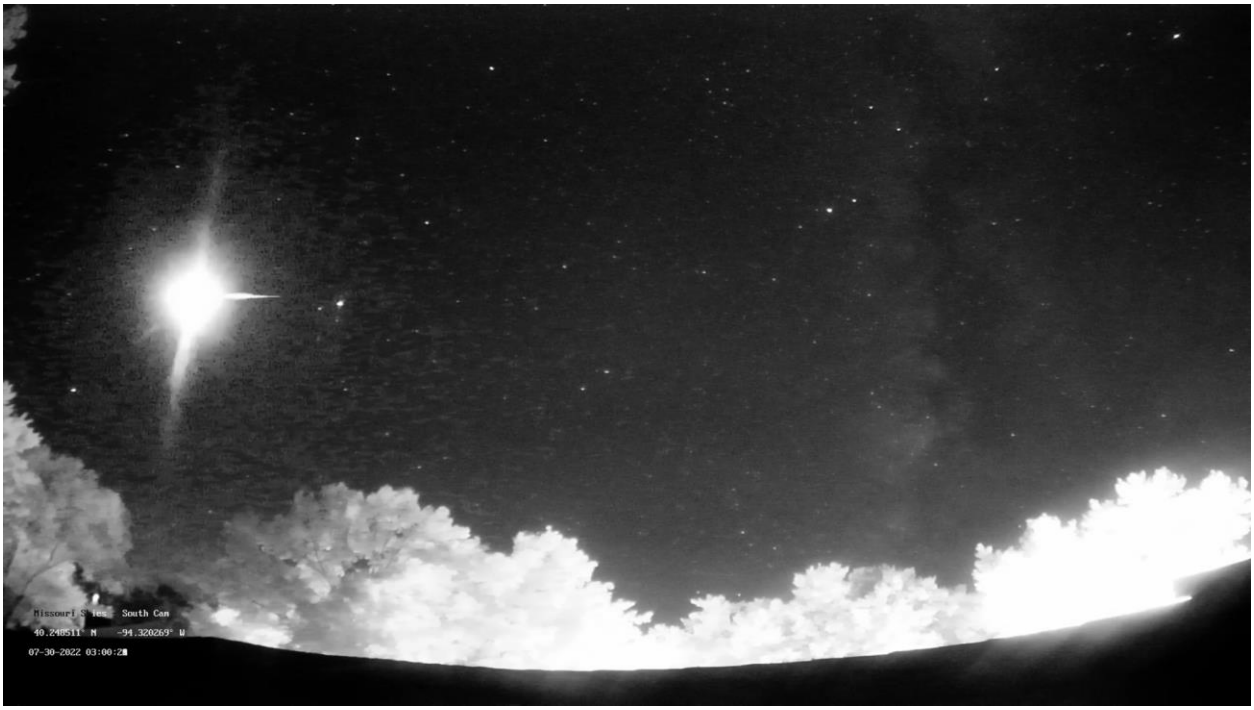
Meteor Activity Outlook for December 31, 2022 - January 6, 2023



Daniel Bush captured this short fireball at 08:01 UT on July 30, 2022 (3:01 CDT), from Albany, Missouri, USA. The bright star to the right of the fireball is Vega (alpha Lyrae). ©Daniel Bush

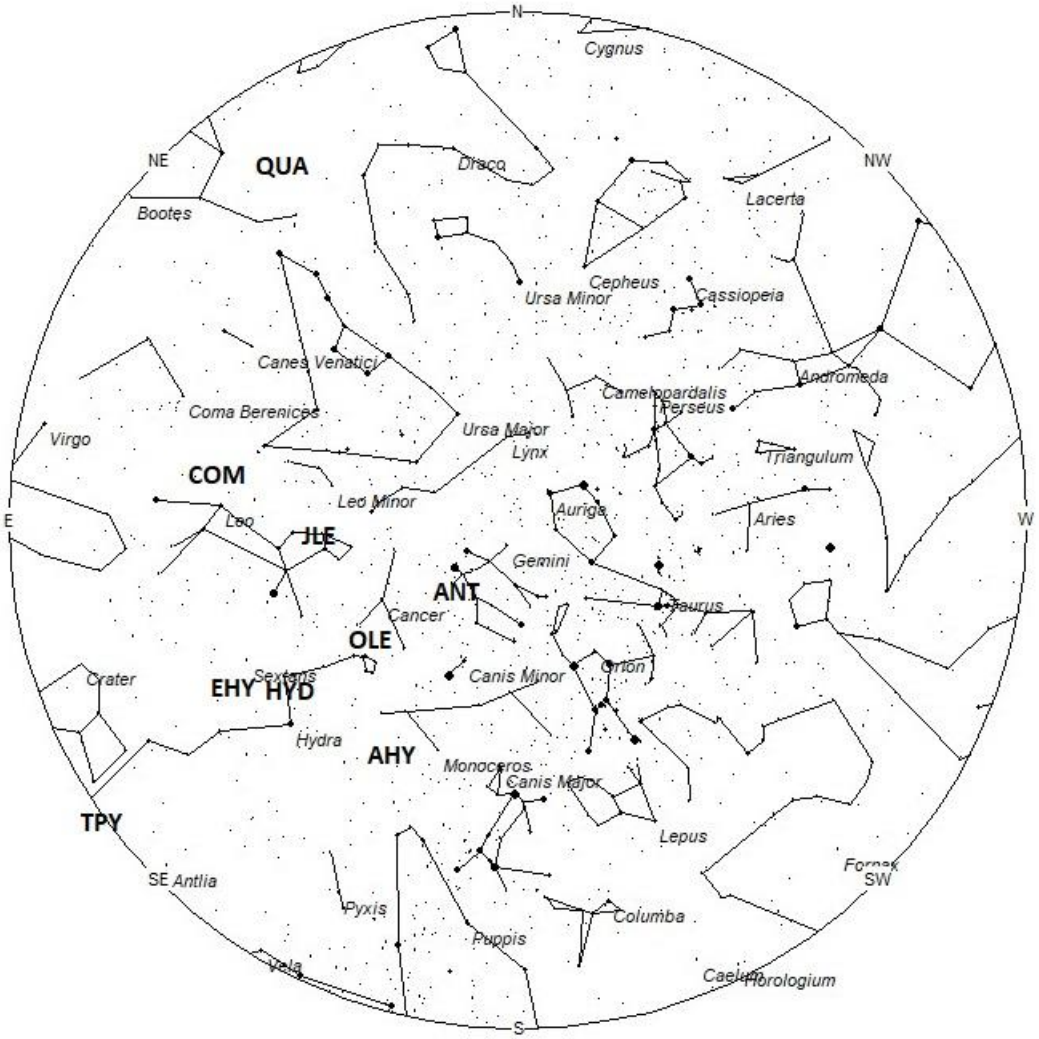
January is best known for the Quadrantids, which have the potential of being the best shower of the year. Unfortunately, this shower is short lived and occurs during some of the worst weather in the northern hemisphere. Due to the high northern declination (celestial latitude) and short summer nights, little of this activity can be seen south of the equator. There are many very minor showers active throughout the month. Unfortunately, most of these produce less than 1 shower member per hour and do not add much to the overall activity total. Activity gets interesting as seen from the Southern Hemisphere as ill-defined radiants in Vela, Carina, and Crux become active this month. This activity occurs during the entire first quarter of the year and moves eastward into Centaurus in February and ends in March with activity in Norma and Lupus. Sporadic rates are generally similar in both hemispheres this month. Sporadic rates are falling though for observers in the Northern Hemisphere and rising as seen from the Southern Hemisphere.

During this period, the moon waxes from being half illuminated to nearly full by the end of the period. This weekend the waxing gibbous moon will set during the early morning hours and will not interfere with meteor watching in the hours just prior to dawn when activity is most plentiful. The estimated total hourly rates for evening observers this week should be near 3 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 13 as seen from mid-northern latitudes (45N) and 9 as seen from tropical southern locations (25S). The actual rates will also depend on factors such as personal light and motion perception, local weather conditions, alertness, and experience in watching meteor activity. Rates are reduced during this due to interfering moonlight. 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.

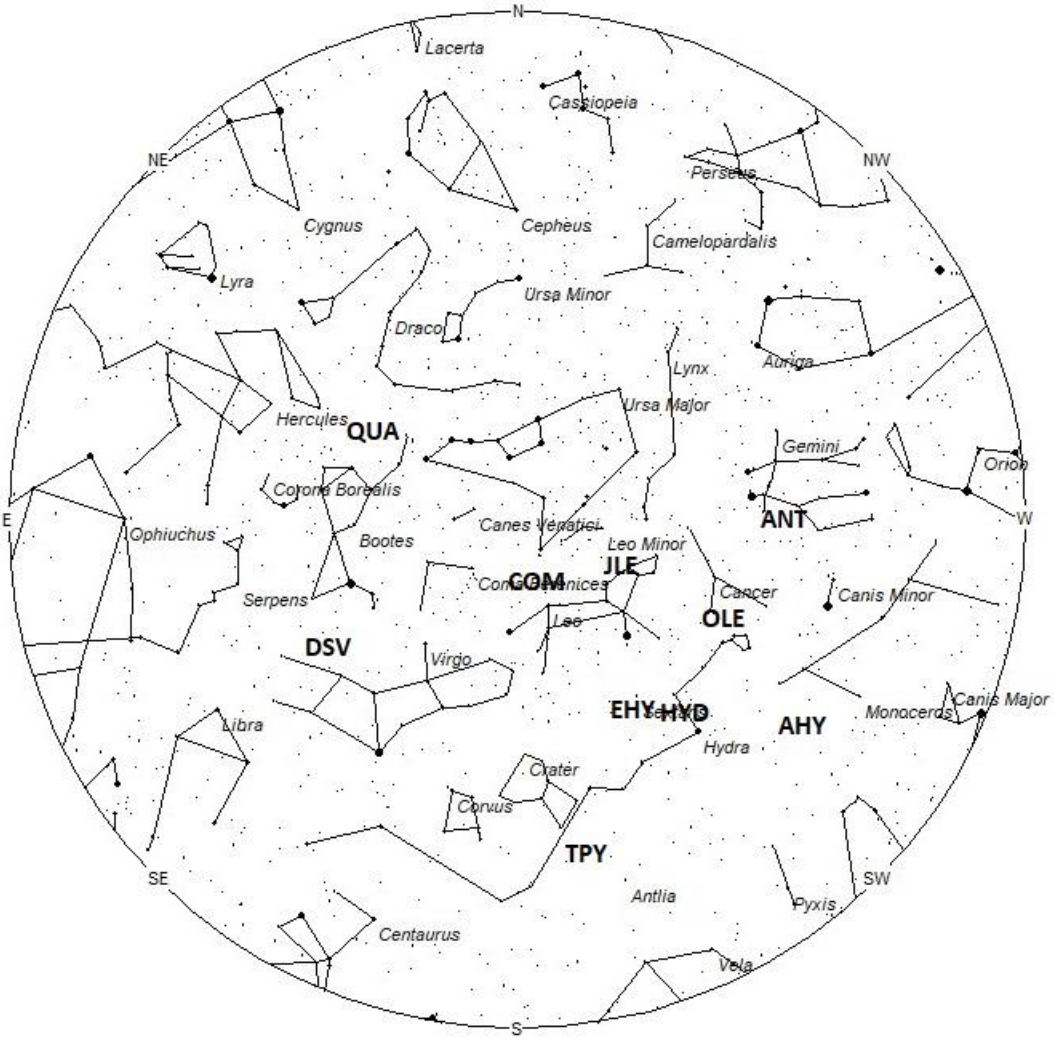
The radiant (the area of the sky where meteors appear to shoot from) positions and rates listed below are exact for Saturday night/Sunday morning December 31/January 1. These positions do not change greatly day to day so the listed coordinates may be used during this entire period. Most star atlases (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. It must be remembered that meteor activity is rarely seen at the radiant position. Rather they shoot outwards from the radiant, so it is best to center your field of view so that the radiant lies at 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.

Now that the activity from particles produced by comet 2P/Encke have ceased encountering the Earth, the Taurid showers for 2022 are over and we resume reporting activity from the **Anthelion (ANT)** radiant. This is not a true radiant but rather activity caused by the Earth's motion through space. As the Earth revolves around the sun it encounters particles orbiting in a pro-grade motion that are approaching their perihelion point. They all appear to be radiating from an area near the opposition point of the sun, hence the name Anthelion. These were once recorded as separate showers throughout the year, but it is now suggested to bin them into a category separate from true showers and sporadics. This radiant is a very large oval some thirty degrees wide by fifteen degrees high. Activity from this radiant can appear from more than one constellation. The position listed here is for the center of the radiant which is currently located at 07:32 (113) +22. This position lies in central Gemini, 3 degrees east of the 4th magnitude star known as Wasat (delta Geminorum). This radiant is best placed near 01:00 local standard time (LST) when it lies on the meridian and is highest in the northern sky. Rates at this time should be near 3 per hour as seen from the northern hemisphere and 2 per hour as seen from south of the equator. With an entry velocity of 30 km/sec., the average Anthelion meteor would be of slow velocity.

The **alpha Hydrids (AHY)** were discovered by Dr. Peter Brown and are mentioned in his article "A meteoroid stream survey using the Canadian Meteor Orbit Radar". This shower is active from December 15 through January 22 with maximum activity occurring on January 5th. The radiant is currently located at 08:19 (125) -08. This position lies in western Hydra, 6 degrees southeast of the 4th magnitude star known as zeta Monocerotis. These meteors are best seen near 0200 LST when the radiant lies highest above the northern horizon. At 44 km/sec. the alpha Hydrids produce meteors of medium velocity. Expected rates this week are less than 1 per hour no matter your location.

The **Volantids (VOL)** are a weak shower active from December 27 through January 4. They are best known for outbursts of activity near the new year. On December 31st, the radiant is located at 08:02 (121) -72. This position lies in central Volans, 4 degrees south of the 4th magnitude star known as epsilon Volantis. These meteors are not visible north of 20 N latitude. These meteors are best seen near 0200 LST when the radiant lies highest above the southern horizon. At 28 km/sec. the Volantids produce meteors of medium-slow velocity. Expected rates this week are less than 1 per hour no matter your location.

The **Omicron Leonids (OLE)** were also discovered by Damir Šegon and the Croatian Meteor Network team based on studying SonotaCo and CMN observations (SonotaCo 2007-2011, CMN 2007-2010). These meteors are active from December 20 through January 22. Maximum activity occurs on January 10th. The radiant is currently located at 08:37 (129) +11. This position lies in southern Cancer, 3 degrees southwest of the 4th magnitude star known as Acubens (alpha Cancri). These meteors are best seen near 0200 LST when the radiant lies highest above the northern horizon. At 40 km/sec. the omicron Leonids produce meteors of medium velocity. Expected rates this week are less than 1 per hour no matter your location.

The **sigma Hydrids (HYD)** are active from a radiant located at 09:38 (145) -03. This area of the sky is located in western Hydra, 2 degrees south of the 4th magnitude star known as iota Hydrae. These meteors are active from November 24 through January 7th, with maximum activity occurring on December 7th. These meteors are best seen near 03:00 LST, when the radiant lies highest in the northern sky. Rates should be less than 1 per hour no matter your location. With an entry velocity of 57 km/sec, most of these meteors would appear swift.

The **C Velids (CVE)** is a continuation of the Puppid/Velid activity this time of year. Unlike the two-week activity during the first half of December, the C Velids are only active on 6 nights centered on December 28th. This segment of the Puppid/Velids is not as strong as the previous one and rates are low, even at maximum activity. At maximum, the radiant is located at 09:20 (140) -54. This area of the sky lies in southern Vela, 2 degrees north of the 2nd magnitude star known as Markeb (kappa Velorum). These meteors are best seen near 0400 LST when the radiant lies highest above the southern horizon. At 39 km/sec. the C Velids produce meteors of medium velocity. Like all sources of the Puppid/Velid complex, these meteors are not well seen from the northern hemisphere. They are best seen from the deep southern hemisphere where the sources are found high in the sky during the southern summer mornings. Activity from this complex is weak in January with barely discernible radiants in Carina and Crux. Activity increases in February with several radiants spread across Centaurus. This complex weakens again in March with the last traces appearing in the Lupus/Norma region of the sky.

The **January Leonids (JLE)** were discovered by Dr. Peter Brown and are mentioned in the same publication as the Alpha Hydrids. This shower is active from December 28 through January 07 with maximum activity occurring on January 2nd. The radiant is currently located at 09:45 (146) +24. This position lies in northwestern Leo, near the spot occupied by the 3rd magnitude star known as Algenubi (epsilon Leonis). These meteors are best seen near 0300 LST when the radiant lies highest above the northern horizon. At 52 km/sec. the January Leonids produce meteors of swift velocity. Expected rates this week are near 1 per hour as seen from the Northern Hemisphere and less than 1 as seen from south of the equator.

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 10:06 (152) -02, which places it in western Sextans, 1 degree south of the 4th magnitude star known as alpha Sextantis. 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 northern horizon. Current rates should be less than 1 per hour no matter your location. With an entry velocity of 61 km/sec., most activity from this radiant would be of swift speed.

The **theta Pyxidids (TPY)** consist of two weak showers that peak two weeks apart. The late version is active from December 8 through January 8, with maximum occurring on December 18th. The radiant is currently located at 11:11 (168) -27. This area of the sky is located in central Hydra, 4 degrees south of the 4th magnitude star known as beta Crateris. These meteors are best seen near 0500 LST when the radiant lies highest in the southern sky. At 64 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 11:28 (172) +26, which places it in northeastern Leo, 6 degrees northeast of the 3rd magnitude star known as Zosma (delta Leonis). These meteors would be best seen near 04:00 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 1 as seen from south of the equator. At 63km/sec., these meteors would produce mostly swift meteors. These meteors are also known as the December Leonis Minorids.

The **December sigma Virginids (DSV)** is a source of long duration discovered by John Greaves using the data of SonotaCo. This source is active from November 26 through January 24 with peak rates occur near December 21st. The current radiant location is at 14:22 (215) +03, which places it in northeastern Virgo, 4 degrees northeast of the 4th magnitude star known as Heze (tau 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.

The **Quadrantids (QUA)** are active from December 26th through January 16th. Maximum occurs on January 4th near 3:40 Universal Time*. The radiant is currently located at 15:10 (228) +50. This position lies in northern Bootes, roughly half-waybetween 3rd magnitude Edasich (iota Draconis) and Nekkar (beta Boötis). 2nd magnitude Alkaid (eta Ursae Majoris), the bright star at the end of the Big Dipper's handle, lies 15 degrees to the west. These meteors are best seen during the last hour before dawn when the radiant lies highest above the northeastern horizon in a dark sky. At 41 km/sec. the Quadrantids produce meteors of moderate velocity. These meteors are visible from the southern tropics but not seen from the deep southern hemisphere. For more information on this shower visit: Viewing the Quadrantids in 2023.

*Juergen Rendtel, 2023 IMO Meteor Shower Calendar, Page 4

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 7 sporadic meteors per hour during the last hour before dawn as seen from rural observing sites. Evening rates would be near 2 per hour. As seen from the tropical Southern latitudes (25S), morning rates would be near 6 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. Rates are reduced during this period 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 available at: https://meteorshowers.seti.org/ 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 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 per **night** away from maximum, so the showers listed in these outlooks are not as weak as they seem. Rates and positions are exact for Saturday night/Sunday morning except where noted in the shower descriptions.

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	
Anthelions (ANT)	-	07:32 (113) +22	30	01:00	3 - 2	II
alpha Hydrids (AHY)	Jan 05	08:19 (125) -08	44	02:00	<1 - <1	IV
Volantids (VOL)	Dec 31	08:02 (121) -72	28	02:00	<1 - <1	III
omicron Leonids (OLE)	Jan 10	08:37 (129) +11	40	02:00	<1 - <1	IV
sigma Hydrids (HYD)	Dec 07	09:38 (145) -03	57	03:00	<1 - <1	II
C Velids (CVE)	Dec 28	09:20 (140) -54	39	03:00	<1 - <1	IV
January Leonids (JLE)	Jan 02	09:45 (146) +24	52	03:00	1 - <1	IV
eta Hydrids (EHY)	Dec 12	10:06 (152) -02	61	04:00	<1 - <1	IV
theta Pyxidids (TPY)	Dec 18	11:11 (168) -27	64	05:00	<1 - <1	IV
Comae Berenicids (COM)	Dec 16	11:28 (172) +26	63	05:00	2 - 1	II
December sigma Virginids (DSV)	Dec 21	14:22 (215) +03	66	08:00	<1 - <1	IV

Quadrantids (QUA)	Jan 04	14:48 (222) +50	41	09:00	<1 - <1	I

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.