Chasing the Aurora in Michigan

Advice and Q&A with Melissa F. Kaelin

About the Author

Melissa F. Kaelin is a writer, artist and social media guru who moved to Michigan in 2018, after living in Minnesota and Ohio. She has published several books, including a creative anthology and “Below the 45th Parallel: Chasing the Aurora in the Great Lakes Region.”

In 2017, she co-founded the annual Aurora Summit, a retreat that celebrates the art, culture, science and photography of the Northern Lights. She served as an admin of the Great Lakes Aurora Hunters after it was created in 2013, and in 2021, she founded the Michigan Aurora Chasers.

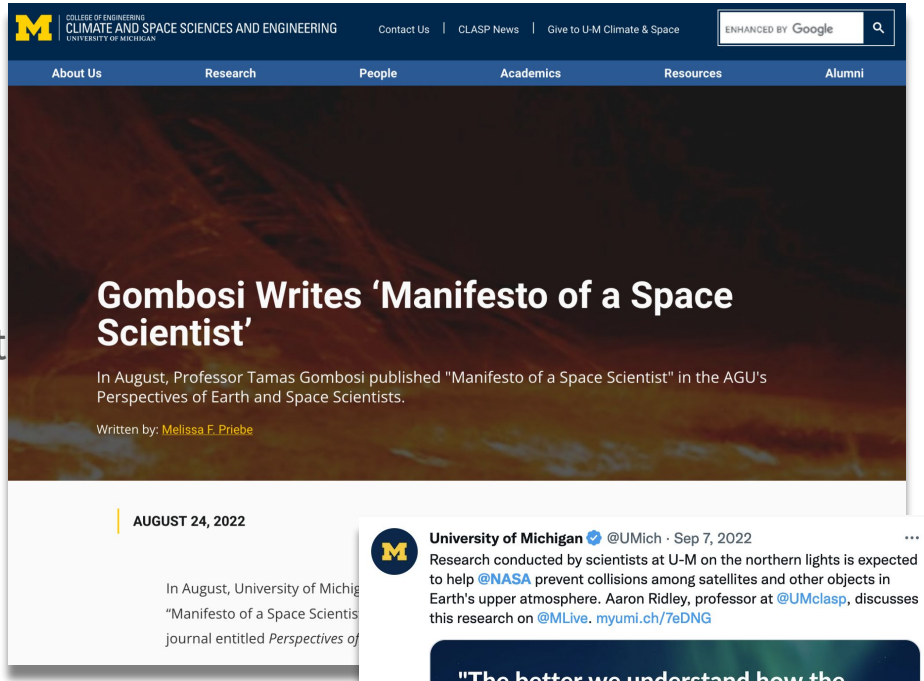
Melissa speaks about Aurora Chasing, writing and social media, and she has been published in many news outlets.

Melissa F. Kaelin
KaelinArt.com

… and Science Communicator!

In the office, Melissa works as Manager of Marketing & Communications for the University of Michigan Department of Climate and Space Sciences.

- Interviews researchers in fields of space weather & climate change
- Writes breaking news in partnership with NASA, NOAA and other agencies
- Manages websites, social media, marketing and press relations at U-M

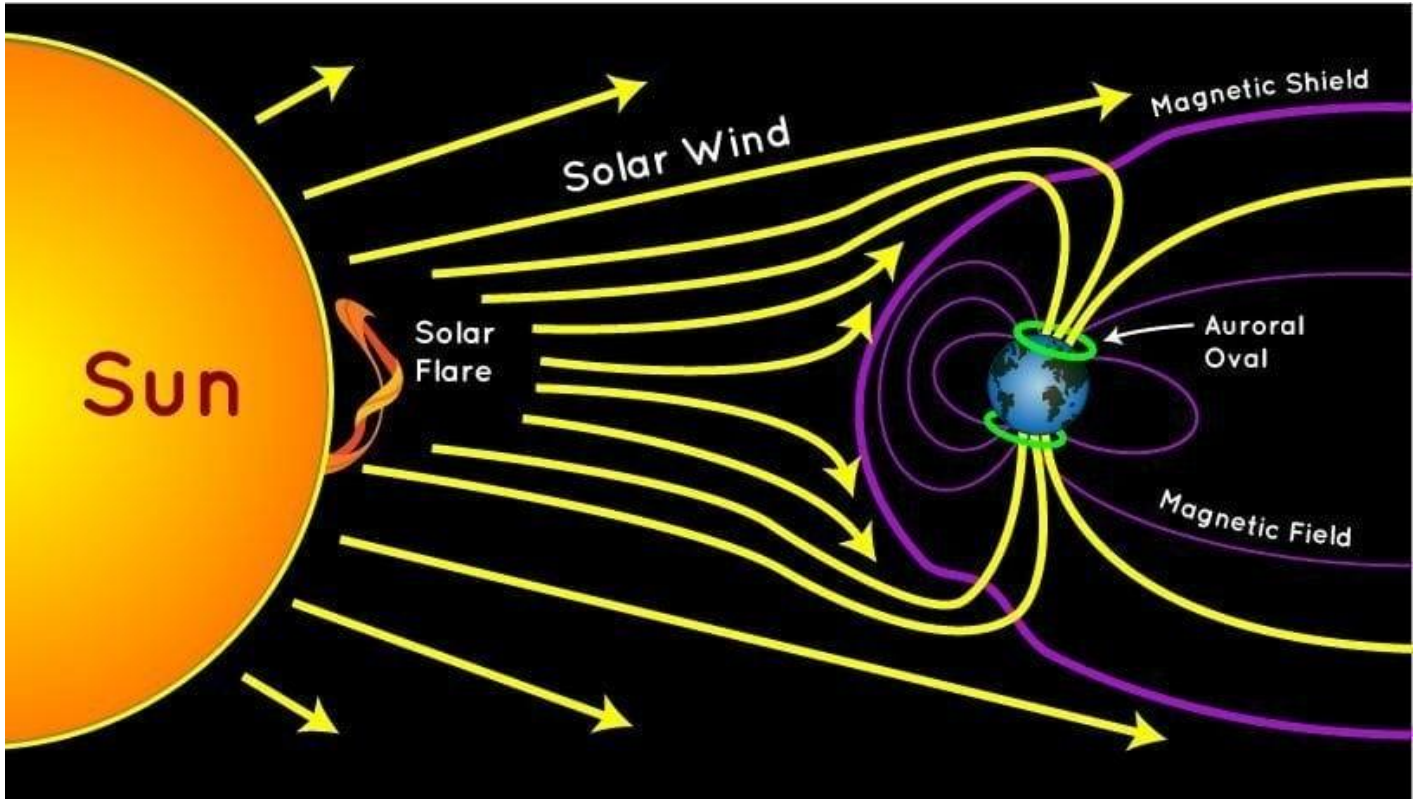


How to Catch the Northern Lights

Understanding What Causes Aurora: The Solar Wind

Solar Activity

- Solar Plasma
- Eruptions
- CMEs
- Coronal Holes
- Sunspots
- Filaments
- Co-rotating Interactive Regions
- Glancing Blow



Source: Space Weather Prediction Center

What it takes to see Aurora

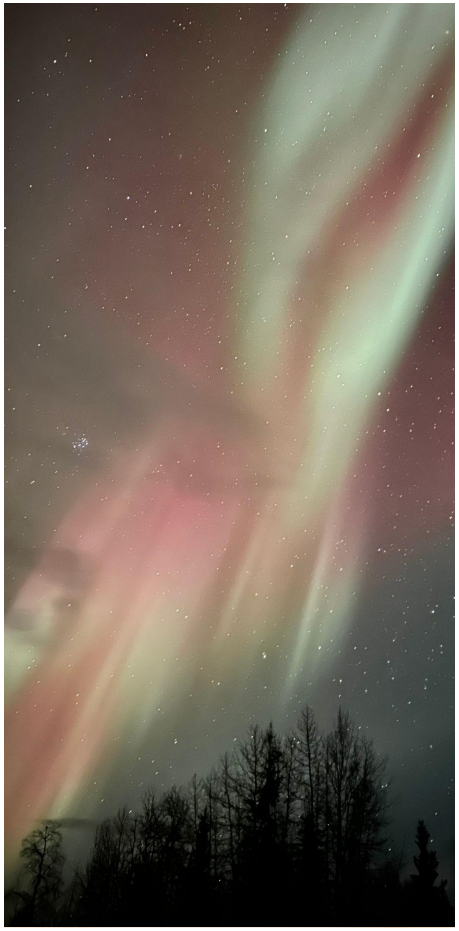
Many factors have to align to create the Northern Lights, on Earth and in Outer Space!

The Right Conditions

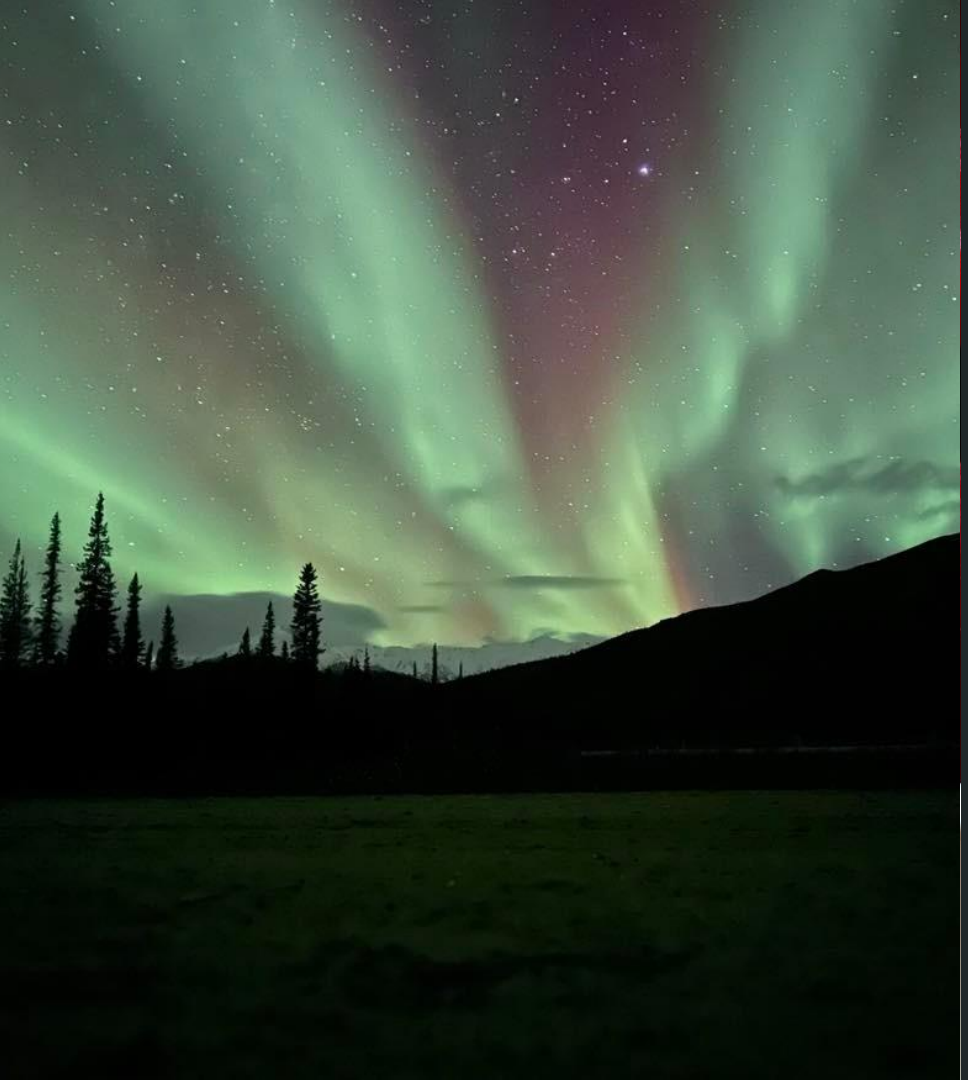
- Aurora strength — From Kp to HPI
- Timing — 2-3 days
- Starry skies
- Northern location
- Eyesight visibility
- That Pesky Bz!

Many Factors Determine Aurora

1. Solar wind speed, Density, Bt, A Index
2. Direction & Earth's rotation
3. Southward (Negative) Orientation of the Interplanetary Magnetic Field



Northern Lights in Michigan



Things to Consider

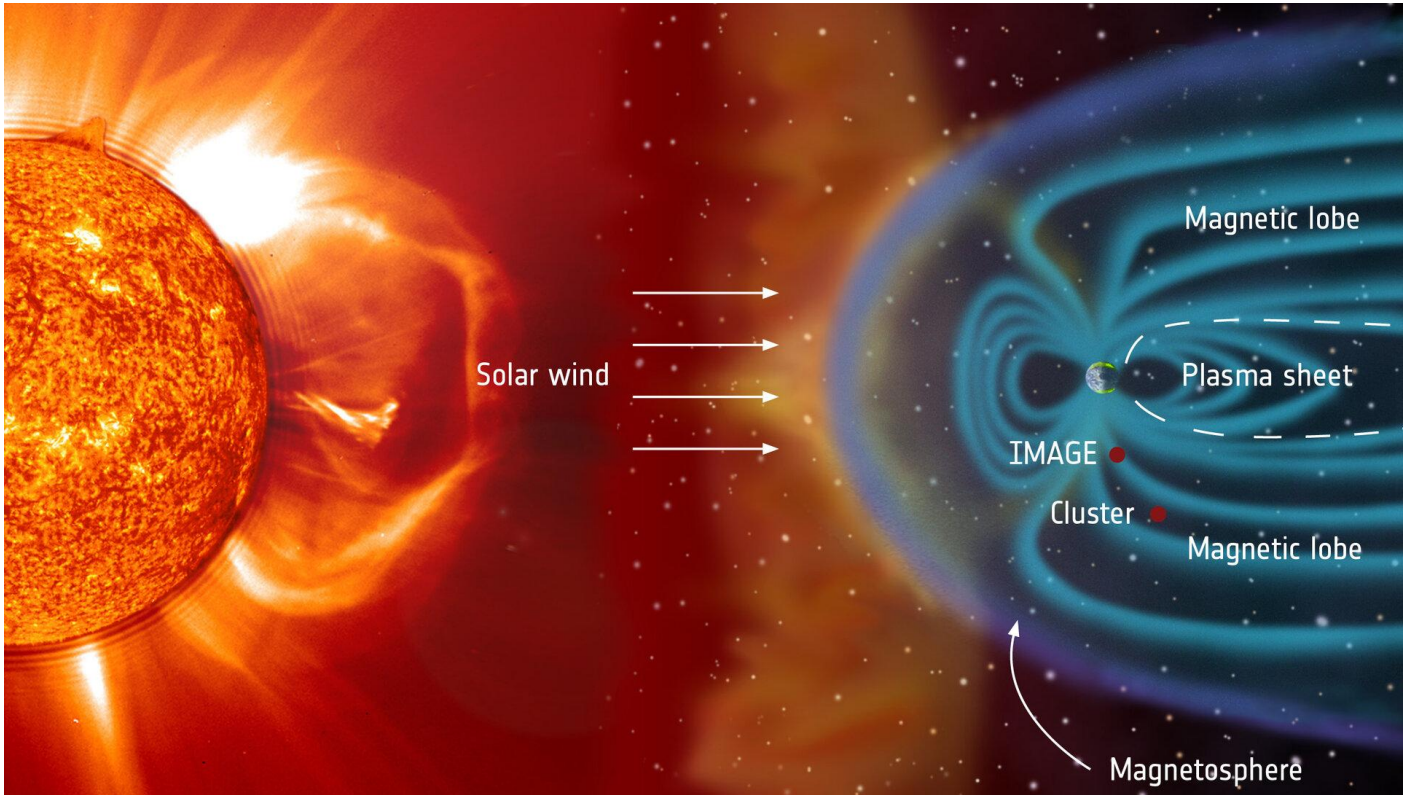
- Scouting Out a Location
- Light Pollution or Dark Sky Maps
- Reliability of Forecast Info
- Patterns of the Northern Lights
- Safety, Sleep & Sanity
- Getting Aced!

Magnetic Fields, Satellites & Impacts, Oh My!

The What If...

- Monitoring the Sun
- Monitoring the Earth
- All the Data
- Magnetosphere
- Magnetotail
- The dreaded dud

Did you know that Bz naturally protects us?

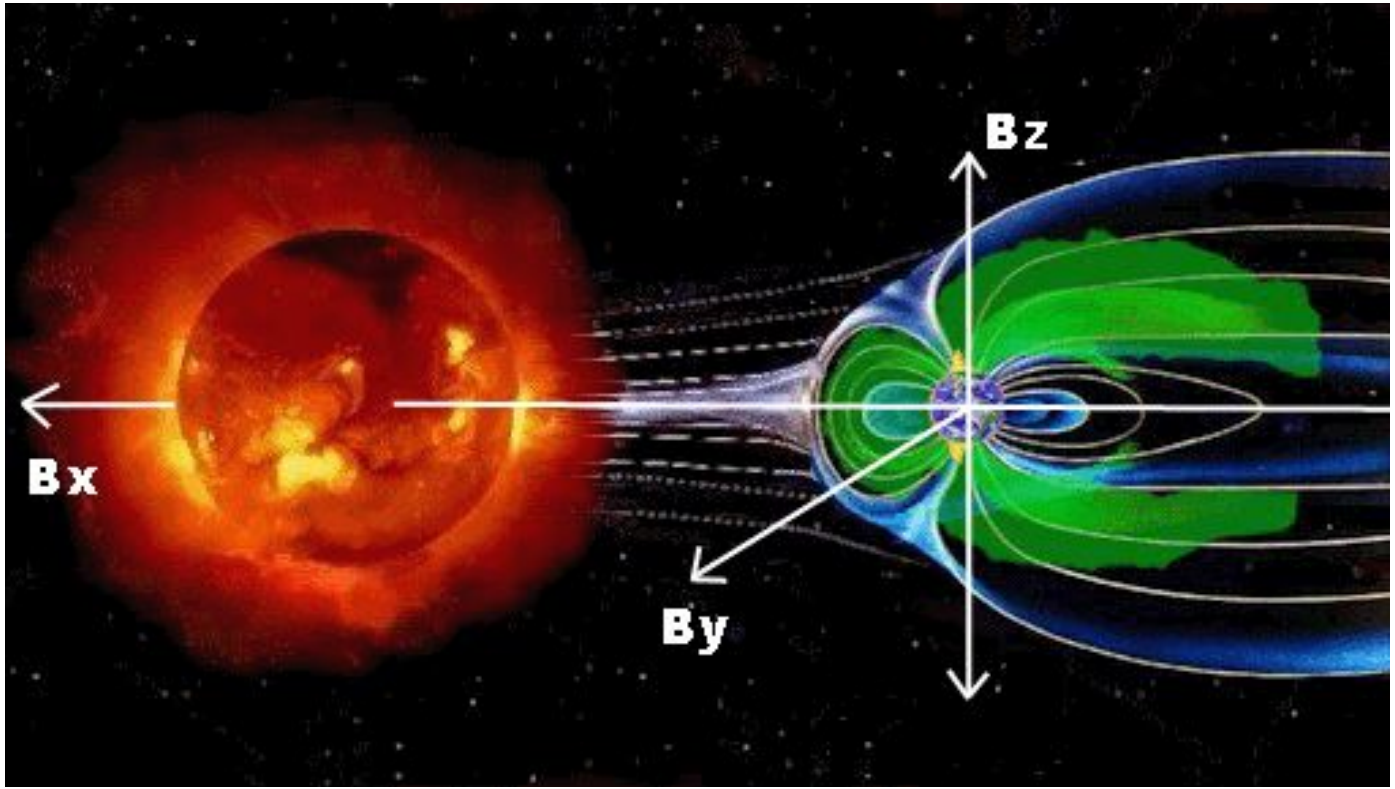


Source: ESA

That Pesky Bz: In Graphics!

On an Axis

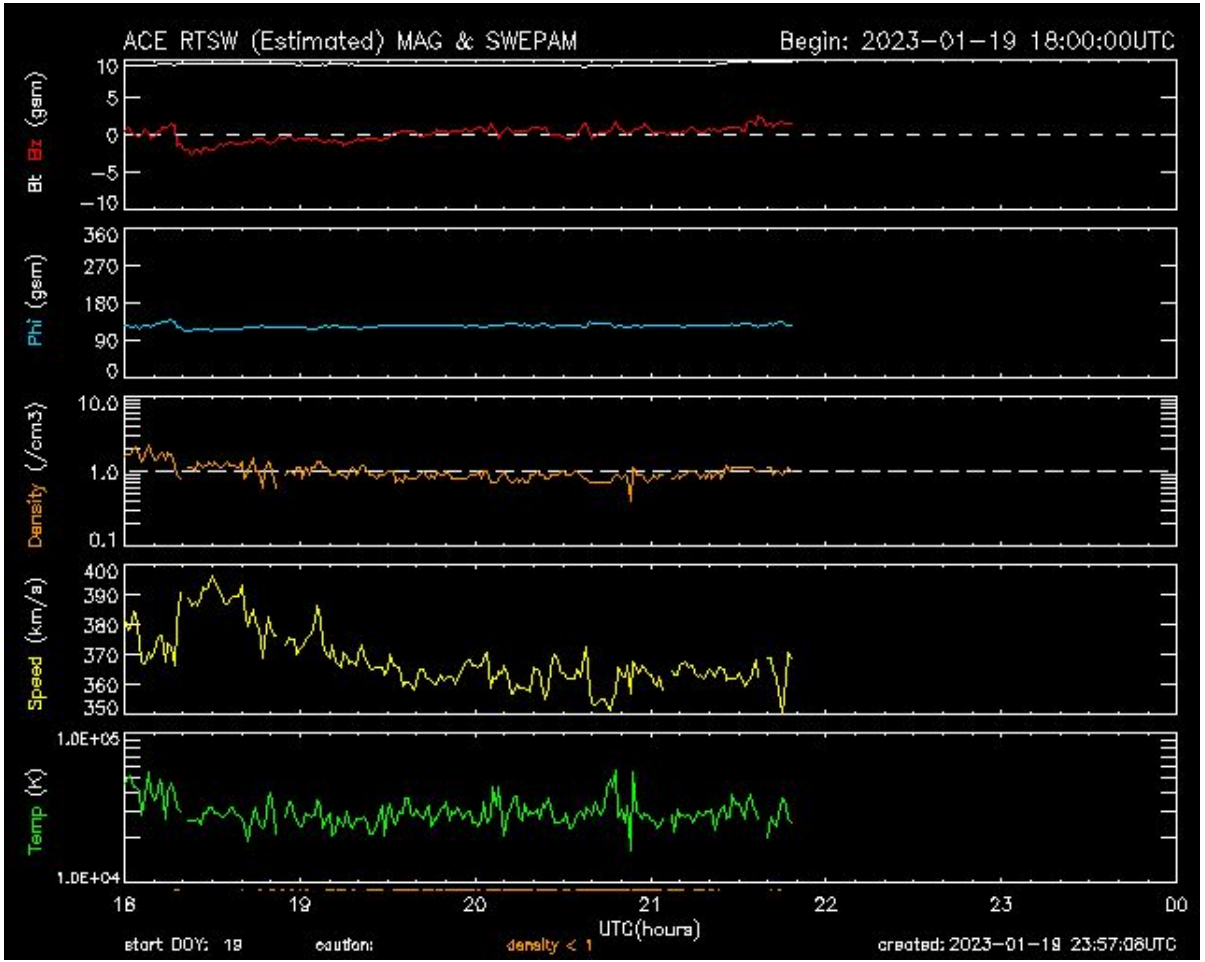
- Like a magnet!
- Southward Bz = Open flow of energy
- Northward Bz = Closed to energy flow
- Oscillating is good
- Trends in data
- Enter the Bt



Source: Aurorasaurus

What's trending?

The NASA Advanced Composition Explorer (ACE) satellite enables SWPC to give advance warning of geomagnetic storms. This 6-hour plot shows the conditions of the solar wind, from speed, density and temperature to Phi, Bz and Bt.



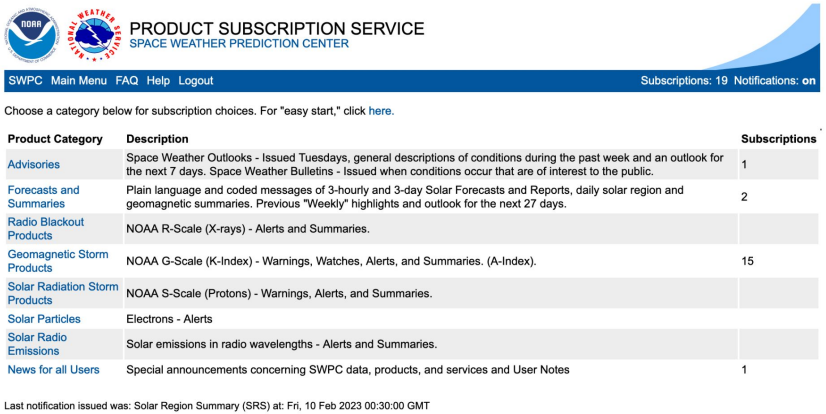
Source: SWPC

Space Weather Prediction Center

Using SWPC Forecasts

Breaking it down

- Universal Time (UT) *Example: 0000-0300*
- Kp is given in 3-hour periods of time.
  Kp is average aurora strength from 0-9.
- It's a forecast — a very difficult one at that!
  Space Weather is an emerging science.
- Understanding the Rationale



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Choose a category below for subscription choices. For "easy start," click here.

Product Category	Description	Subscriptions
Advisories	Space Weather Outlooks - Issued Tuesdays, general descriptions of conditions during the past week and an outlook for the next 7 days. Space Weather Bulletins - Issued when conditions occur that are of interest to the public.	1
Forecasts and Summaries	Plain language and coded messages of 3-hourly and 3-day Solar Forecasts and Reports, daily solar region and geomagnetic summaries. Previous "Weekly" highlights and outlook for the next 27 days.	2
Radio Blackout Products	NOAA R-Scale (X-rays) - Alerts and Summaries.	
Geomagnetic Storm Products	NOAA G-Scale (K-Index) - Warnings, Watches, Alerts, and Summaries. (A-Index).	15
Solar Radiation Storm Products	NOAA S-Scale (Protons) - Warnings, Alerts, and Summaries.	
Solar Particles	Electrons - Alerts	
Solar Radio Emissions	Solar emissions in radio wavelengths - Alerts and Summaries.	
News for all Users	Special announcements concerning SWPC data, products, and services and User Notes	1

Last notification issued was: Solar Region Summary (SRS) at: Fri, 10 Feb 2023 00:30:00 GMT

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Product: 3-Day Forecast
Issued: 2023 Jan 18 1230 UTC
Prepared by the U.S. Dept. of Commerce, NOAA, Space Weather Prediction
Center

A. NOAA Geomagnetic Activity Observation and Forecast

The greatest observed 3 hr Kp over the past 24 hours was 4 (below NOAA
Scale levels).
The greatest expected 3 hr Kp for Jan 18-Jan 20 2023 is 4.00 (below NOAA
Scale levels).

NOAA Kp index breakdown Jan 18-Jan 20 2023

             Jan 18       Jan 19       Jan 20
00-03UT       4.00         3.33         3.00
03-06UT       4.00         3.67         3.00
06-09UT       3.33         3.67         2.67
09-12UT       3.00         2.67         3.00
12-15UT       2.33         2.33         2.33
15-18UT       2.33         3.00         2.67
18-21UT       3.33         3.00         2.33
21-00UT       3.00         2.67         2.33

Rationale: No G1 (Minor) or greater geomagnetic storms are expected.  No
significant transient or recurrent solar wind features are forecast.
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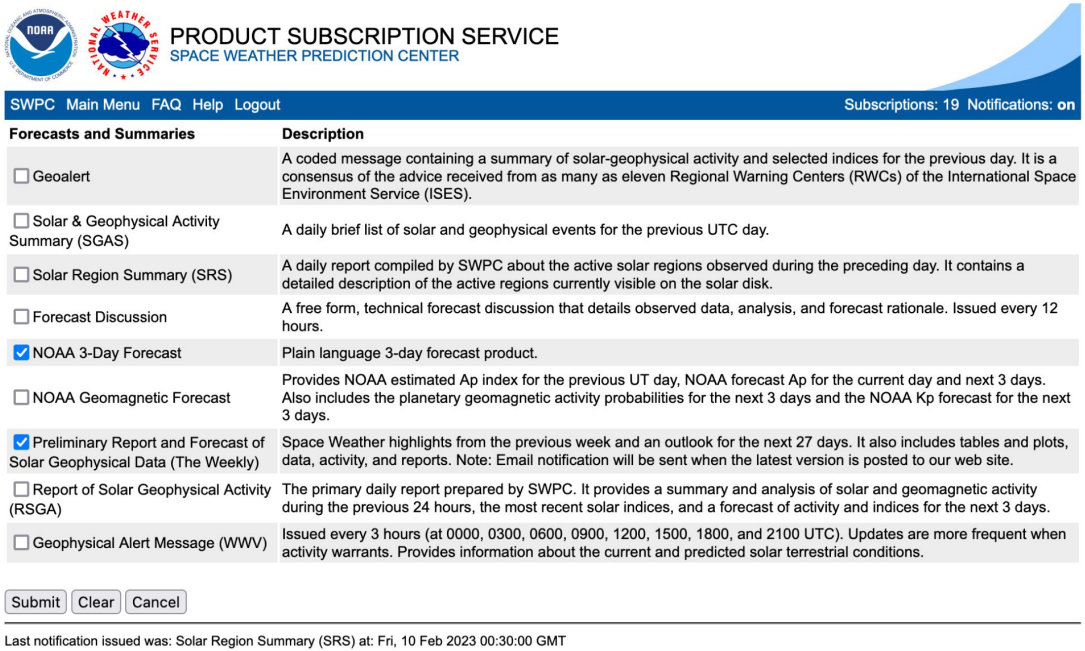
How to Subscribe to SWPC Alerts



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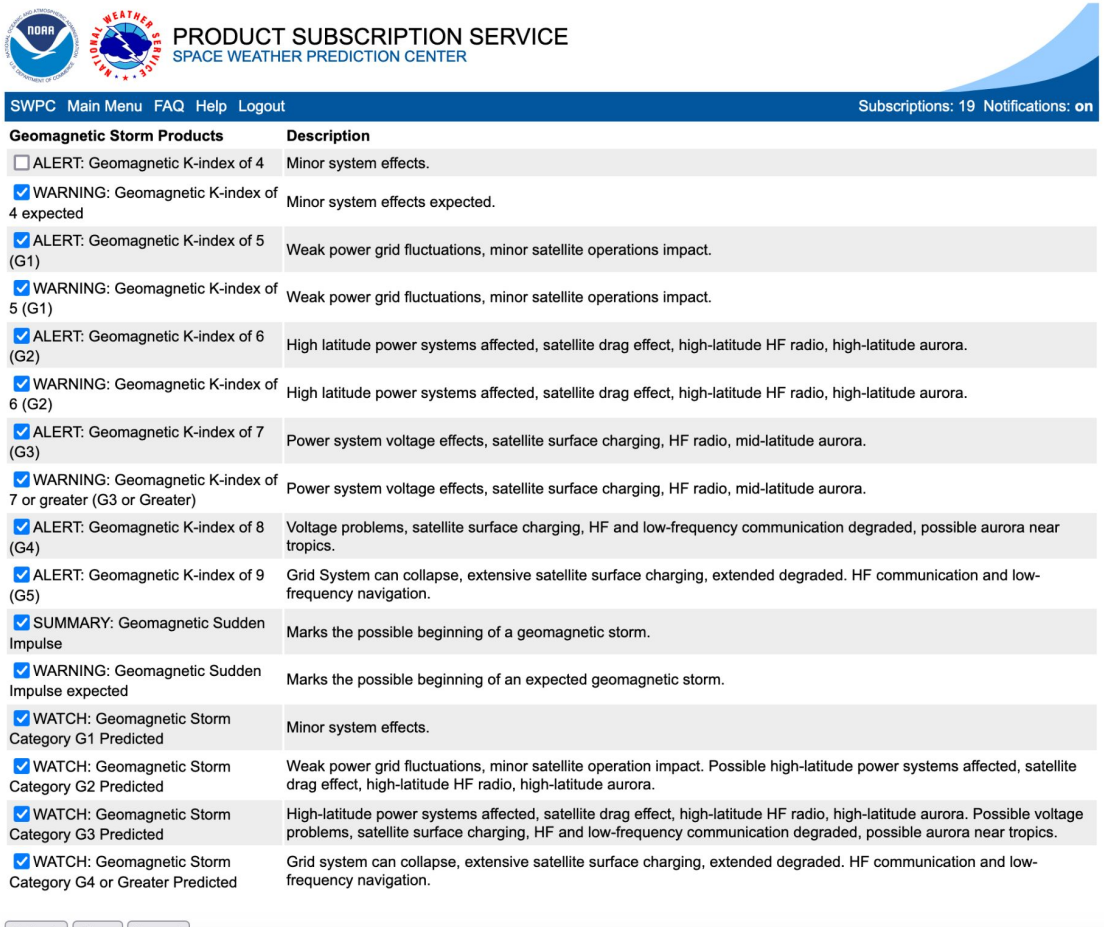
Forecasts and Summaries	Description
☐ Geoalert	A coded message containing a summary of solar-geophysical activity and selected indices for the previous day. It is a consensus of the advice received from as many as eleven Regional Warning Centers (RWCs) of the International Space Environment Service (ISES).
☐ Solar & Geophysical Activity Summary (SGAS)	A daily brief list of solar and geophysical events for the previous UTC day.
☐ Solar Region Summary (SRS)	A daily report compiled by SWPC about the active solar regions observed during the preceding day. It contains a detailed description of the active regions currently visible on the solar disk.
☐ Forecast Discussion	A free form, technical forecast discussion that details observed data, analysis, and forecast rationale. Issued every 12 hours.
☑ NOAA 3-Day Forecast	Plain language 3-day forecast product.
☐ NOAA Geomagnetic Forecast	Provides NOAA estimated Ap index for the previous UT day, NOAA forecast Ap for the current day and next 3 days. Also includes the planetary geomagnetic activity probabilities for the next 3 days and the NOAA Kp forecast for the next 3 days.
☑ Preliminary Report and Forecast of Solar Geophysical Data (The Weekly)	Space Weather highlights from the previous week and an outlook for the next 27 days. It also includes tables and plots, data, activity, and reports. Note: Email notification will be sent when the latest version is posted to our web site.
☐ Report of Solar Geophysical Activity (RSGA)	The primary daily report prepared by SWPC. It provides a summary and analysis of solar and geomagnetic activity during the previous 24 hours, the most recent solar indices, and a forecast of activity and indices for the next 3 days.
☐ Geophysical Alert Message (WWV)	Issued every 3 hours (at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 UTC). Updates are more frequent when activity warrants. Provides information about the current and predicted solar terrestrial conditions.

Submit Clear Cancel

Last notification issued was: Solar Region Summary (SRS) at: Fri, 10 Feb 2023 00:30:00 GMT



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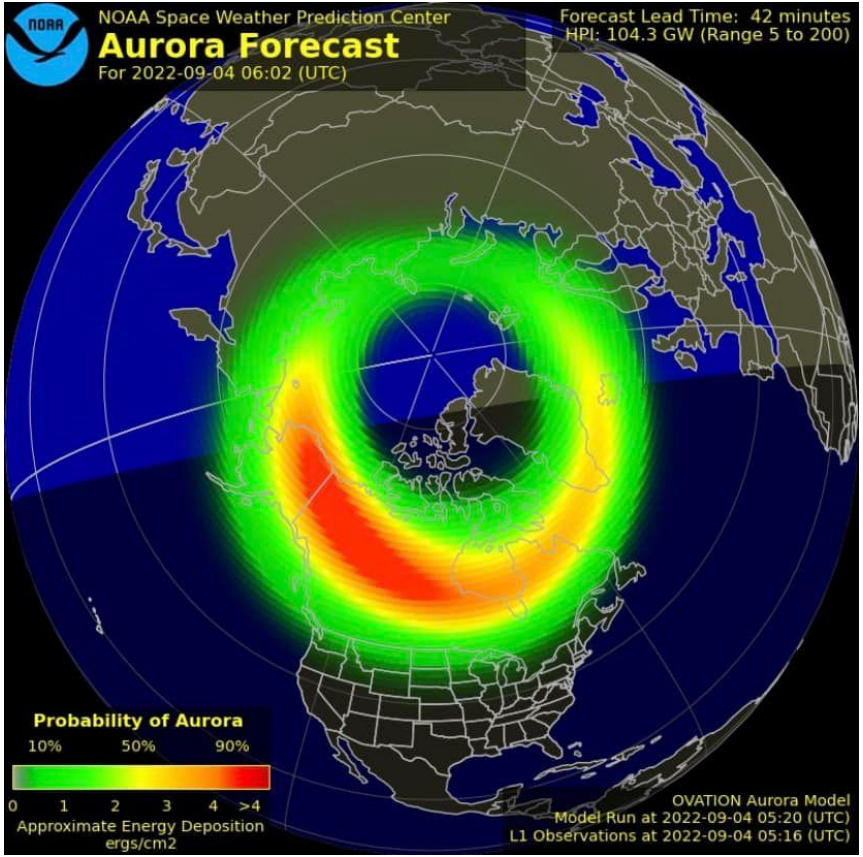
Geomagnetic Storm Products	Description
☐ ALERT: Geomagnetic K-index of 4	Minor system effects.
☑ WARNING: Geomagnetic K-index of 4 expected	Minor system effects expected.
☑ ALERT: Geomagnetic K-index of 5 (G1)	Weak power grid fluctuations, minor satellite operations impact.
☑ WARNING: Geomagnetic K-index of 5 (G1)	Weak power grid fluctuations, minor satellite operations impact.
☑ ALERT: Geomagnetic K-index of 6 (G2)	High latitude power systems affected, satellite drag effect, high-latitude HF radio, high-latitude aurora.
☑ WARNING: Geomagnetic K-index of 6 (G2)	High latitude power systems affected, satellite drag effect, high-latitude HF radio, high-latitude aurora.
☑ ALERT: Geomagnetic K-index of 7 (G3)	Power system voltage effects, satellite surface charging, HF radio, mid-latitude aurora.
☑ WARNING: Geomagnetic K-index of 7 or greater (G3 or Greater)	Power system voltage effects, satellite surface charging, HF radio, mid-latitude aurora.
☑ ALERT: Geomagnetic K-index of 8 (G4)	Voltage problems, satellite surface charging, HF and low-frequency communication degraded, possible aurora near tropics.
☑ ALERT: Geomagnetic K-index of 9 (G5)	Grid System can collapse, extensive satellite surface charging, extended degraded. HF communication and low-frequency navigation.
☑ SUMMARY: Geomagnetic Sudden Impulse	Marks the possible beginning of a geomagnetic storm.
☑ WARNING: Geomagnetic Sudden Impulse expected	Marks the possible beginning of an expected geomagnetic storm.
☑ WATCH: Geomagnetic Storm Category G1 Predicted	Minor system effects.
☑ WATCH: Geomagnetic Storm Category G2 Predicted	Weak power grid fluctuations, minor satellite operation impact. Possible high-latitude power systems affected, satellite drag effect, high-latitude HF radio, high-latitude aurora.
☑ WATCH: Geomagnetic Storm Category G3 Predicted	High-latitude power systems affected, satellite drag effect, high-latitude HF radio, high-latitude aurora. Possible voltage problems, satellite surface charging, HF and low-frequency communication degraded, possible aurora near tropics.
☑ WATCH: Geomagnetic Storm Category G4 or Greater Predicted	Grid system can collapse, extensive satellite surface charging, extended degraded. HF communication and low-frequency navigation.

Watches, Warnings & Alerts for NOAA Scales

Ovation Model



Source: Space Weather Prediction Center

Components of the Ovation

The model uses the solar wind velocity and interplanetary magnetic field measured at the L1 orbit position, located one million miles from Earth, to calculate three types of electron precipitation and proton precipitation which strongly correlate with the aurora. (SWPC)

- Simpler than it looks, beginning with labels & dates
- Top left: Agency name, Forecast, Date of Forecast
- Top right: Covers important aurora strength details
- HPI (Hemispheric Power Index) — Hemispheric Power is another measure of aurora strength.
- Lead Time
- Bottom right: Times of the last model run and actual observations
- Bottom left: Legend with colors showing the probability
- Energy Deposition: Measures the energy flux or amount of energy Aurora is putting into the atmosphere

Michigan Aurora Chasers

Ways to Use the Michigan Aurora Chasers

Resources

- Visual Resources Album
- Featured Section
- FAQ
- Links & Tutorials
- Topics or Hashtags
  #MIAuroraCameraTips
  #Guides
  #Essentials
  #ViewingLocations
  #LiveChase

What will your approach to Aurora Chasing be?

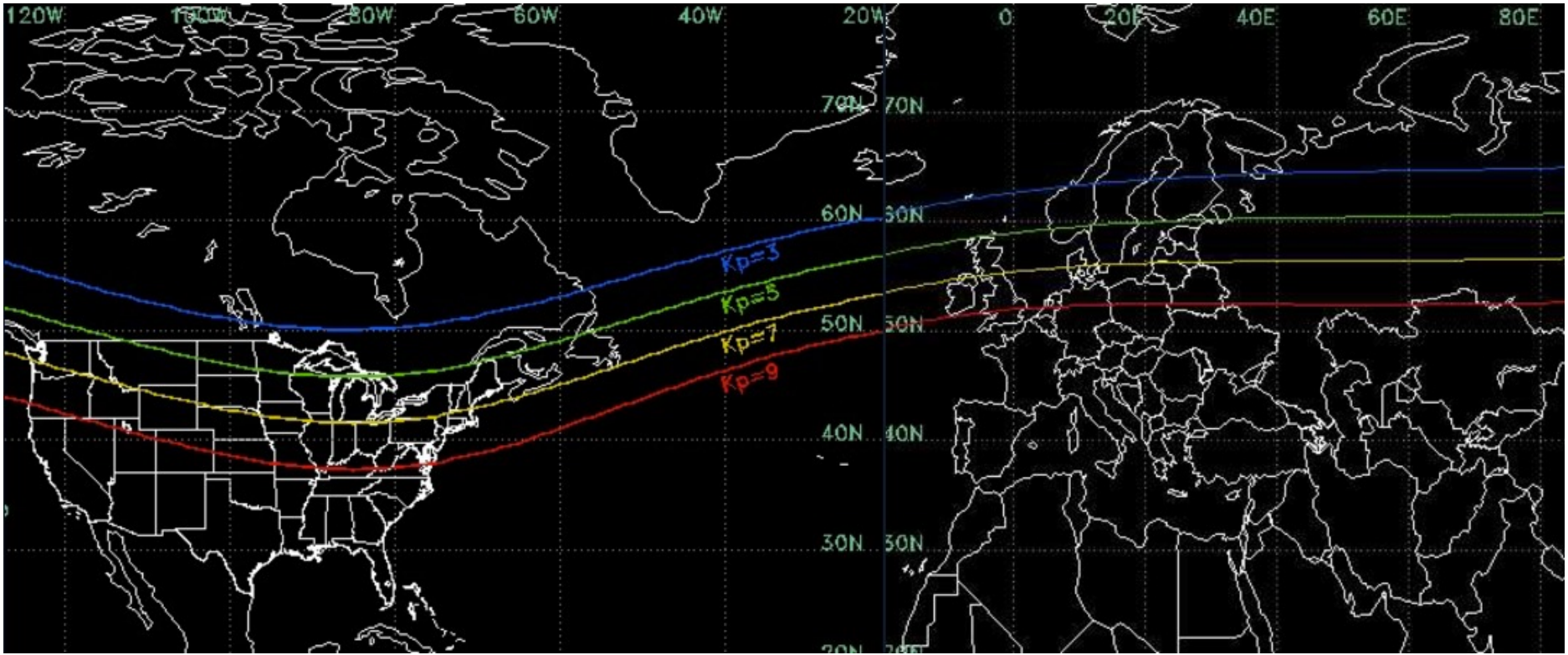
When in doubt, watch for live sightings! This is the only way to know for sure that Aurora are present, and you can post your own if you live in a dark location.

Use the short-term and long-term forecasts. Pay attention to upcoming dates that seasoned chasers are watching. Insider Tip: The Spring & Fall Equinox! ;-)

Stay out all night long or join a Live Chase. Did you know some Aurora have only lasted 15 minutes? The best way to catch it is to be prepared for anything!

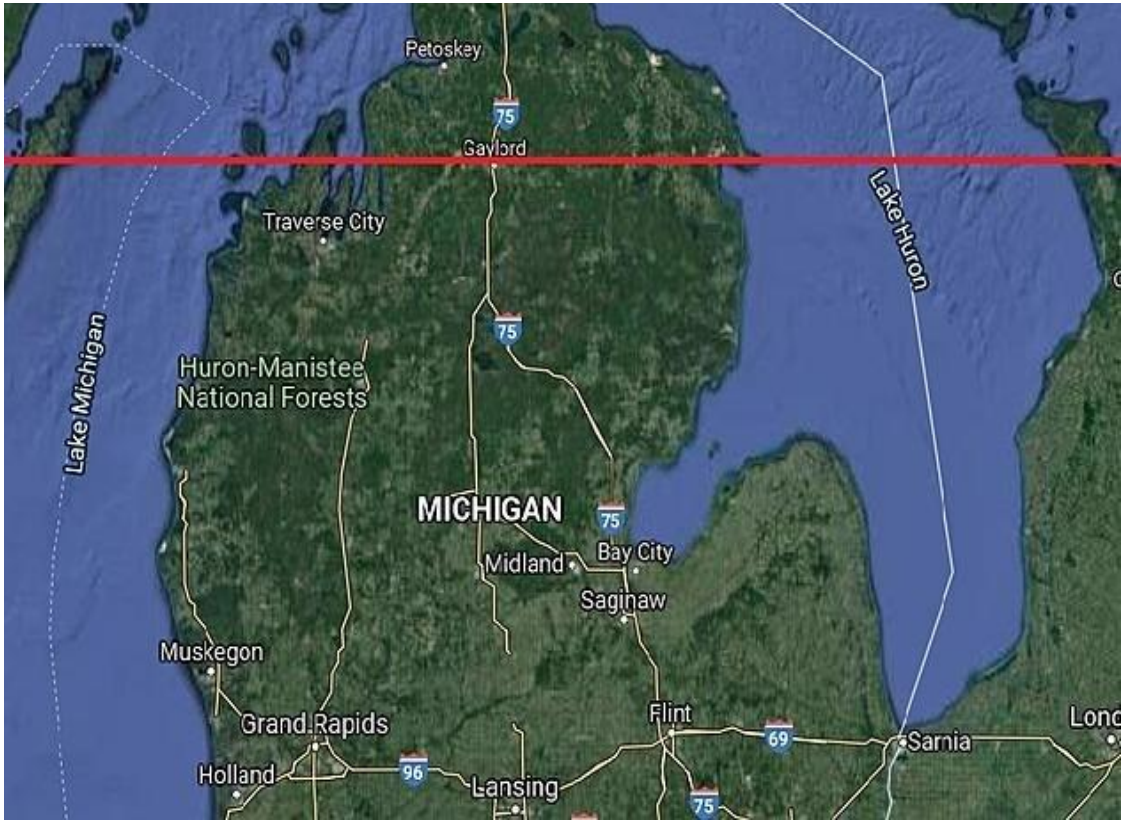
Plan a trip, but try to think beyond Michigan. While the Upper Peninsula is a great place to catch Aurora, this region has many limitations too.

Mapping Out the Chase: Part I



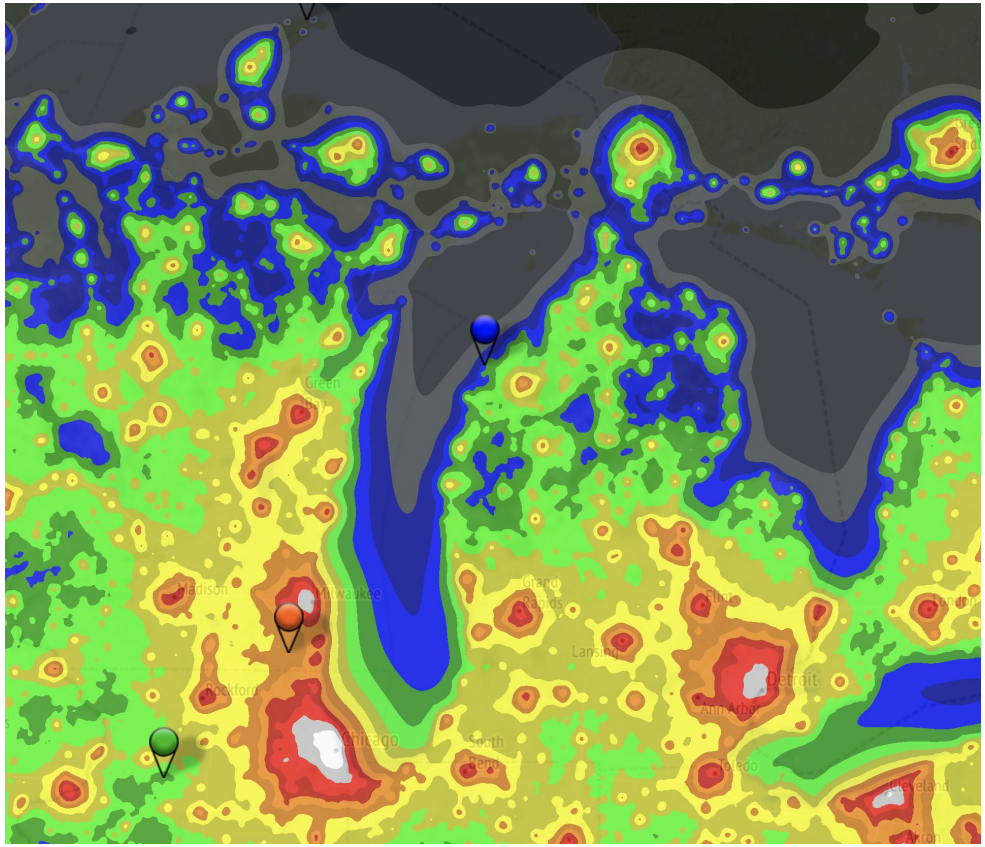
Source: Space Weather Prediction Center

Mapping Out the Chase: Part II

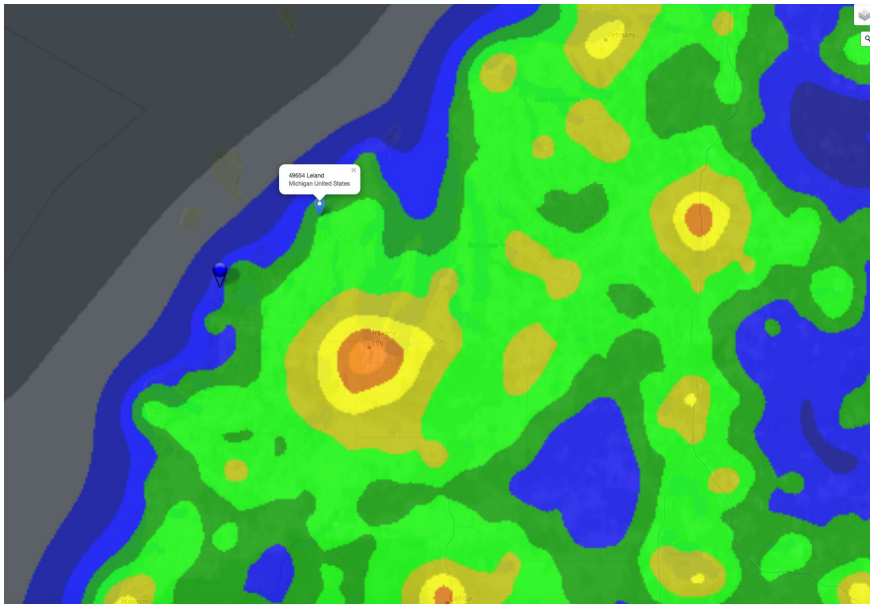


What parallel do you live near? The 45th Parallel is regarded as a magical line where northern life happens. But we believe that Aurora can frequently be seen as low as the 44th Parallel, in a line from Manistee to Cadillac to Houghton Lake to Tawas City.

Mapping Out the Chase: Part III



Light pollution around Leland, Michigan.
Search your area at DarkSiteFinder.com



Featuring the Michigan Aurora Chasers

Melissa F. Kaelin
September 5, 2022 ·

Our Michigan Aurora Chasers have been dancing like no one's watching, with the Northern Lights dancing above them September 3-5! We've had several nights of exciting chases, with Aurora captured all the way from the Keweenaw Peninsula in Michigan's Upper Peninsula down to Cleveland, Ohio! We even captured an unusually vivid and distinctive appearance of STEVE, the sub-auroral arc, and its "picket fence" as it stretched directly overhead in the Michigan night.

My own chase was plagued by clouds, but finally ended in a successful Aurora sighting in the sand dunes of Ludington after 2am Monday morning. It was a gorgeous night, with millions of stars and the Milky Way glimmering above Lake Michigan.

Congratulations to all of the photographers and viewers who caught the Northern Lights, and especially to those who found Aurora for the first time!

Photos by Pamela Hofacker Teachout, Lucas McIlvenna, Lucy McClellan-Hunter, Karen Farrell, Jeremiah Chappelle, Alicea Howell, Travis Stevens, Matt Honold, Luke Lauderback, Lisa Hunter, Tracy Gray Keck III, and Matt Shiffler.

#MiAurora #10YearsofAurora
Melissa F. Kaelin: Writer, Artist & Stargazer

Looking forward to The 5th Annual Aurora Summit!

LINK

Featuring the Michigan Aurora Chasers

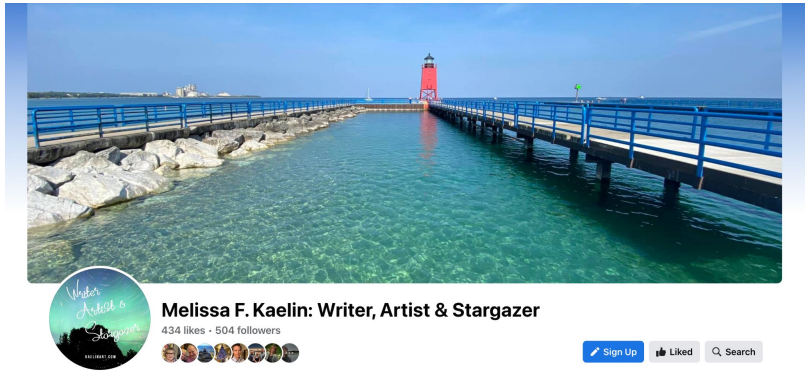
Melissa F. Kaelin
August 18, 2022 ·

Congratulations to all of the Michigan Aurora Chasers who caught the Northern Lights on August 17-18! It was a tough chase, but Aurora did appear above the 45th Parallel in Michigan, mostly on camera. Here are just a few of the early photos.

With no geomagnetic storm conditions, we had no luck at the 43rd Parallel Live Chase.

#MiAurora #LiveChase

LINK



Join us!

Congratulations to the Photographers Featured!

- The Weather Channel
- The Washington Post
- Northern Michigan Woman
- Click on Detroit

Upcoming Events

Virtual Aurora Chasing Talk & Book Launch
February 23, 7:30pm, Virtual on Zoom

Aurora Chasing Program & Book Signing
March 2, 6pm, Ann Arbor, Michigan

Aurora Chasing Talk & Book Signing
March 18, Time TBD, Petoskey, Michigan

International Dark Sky Week Presentation
April 21, Keweenaw International Dark Sky Park, Michigan

Fox Observatory Sky Party
August 17-20, Pottersville, Michigan

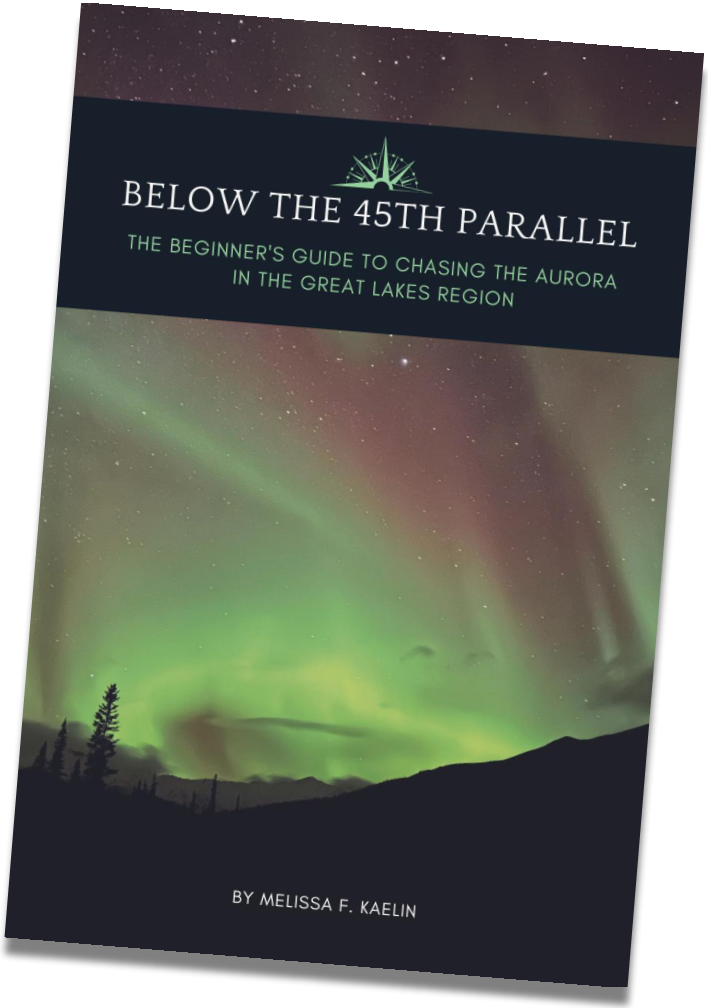
6th Annual Aurora Summit
November 3-5, Red Cliff, Wisconsin
Register: TheAuroraSummit.com

Below the 45th Parallel

New Guidebook!
Released in December, this book is designed for those who are new to the adventure, with advice to help you beat the dozens of obstacles Aurora Chasers face.

The guidebook will give you the information you need to finally catch an Aurora display near your home, complete with a Digital Resource Guide.

Now Available on Amazon and BN.com!
KaelinArt.com/45thParallel



Q & A