

NISE Network Online Workshop

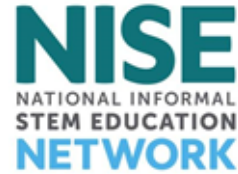
Inspiring Ideas for Interpreting Scientific Data with Artwork

September 29, 2026



Today's Presenters:

- **Sarah VanDenbergh**, Connected Learning Ecosystem Specialist, Gulf of Maine Research Institute, Portland, ME
- **Brian Fitzgerald**, Deputy Director, Mount Washington Observatory, North Conway, NH
- **Kim Stewart**, Director of Curiosity, Maine Discovery Museum, Bangor, ME
- **Alexander Cotnoir**, STEM Education Specialist, Space Telescope Science Institute (STScI), Baltimore, MD
- **Andrew Clark**, Geospatial Software Developer, NASA Langley Crowdsourcing, ADNET Systems, Inc.
- **Carolyn Ng**, NASA Heliophysics Education Activation Team (NASA HEAT) Informal Education & Partnership Lead, NASA Goddard Space Flight Center, Greenbelt, MD



Welcome! As we wait to get started with today's discussion, please...

Introduce yourself! Type your name, institution, and location into the [Chat Box](#)

Questions? Feel free to type your questions into the [Chat Box](#) at any time throughout the webinar. A selection of questions from the chat and workshop registration will be read aloud by moderators for presenters to answer during the Q&A.

Agenda

- **Introduction**

- Why data literacy? (Alexander Cotnoir)
- Why do you want to interpret data with art? (all presenters)

- **Examples of learning experiences you can use with learners** (8 minutes each)

- Brian - Climate data through art and personal storytelling
- Kim - Data literacy and art in different formats (exhibits, teachers, drop-in activities)
- Alexander - Illustrating the Trappist-1 Exoplanets and Painting a Star-forming Nebula, two hands-on activities focused on data literacy skills using art as a way to talk about and create models
- Andrew - Color a Pixel activity using remote sensing data
- Carolyn - Journey through the Heliosphere coloring book with cultural connections

- **Q&A**

Why data literacy?
Why interpret data with art?

What exactly is 'data'?

Data are collected observations or measurements represented as text, numbers, or multimedia.

→ Data gain meaning when we organize, process, structure, and interpret them.



OCEANOGRAPHY

Mapping plate tectonics

Left: Geologist Marie Tharp mapped the ocean floor using depth readings. Her work revealed rift valleys and mid-ocean ridges, supporting theories of seafloor spreading.

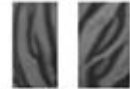
Image courtesy of Lamont-Doherty Earth Observatory.

WILDLIFE ECOLOGY

Tracking tiger populations

Right: Scientists track individual Sumatran tigers in the wild by matching their unique stripe patterns from camera trap photos.

Image courtesy of Figel et al. 2025.



Why data literacy?

Data literacy is the ability to collect, interpret, critically evaluate, and communicate ideas from data.

Data increasingly shape how we understand the world and make decisions, but **only 21% of the global workforce feels confident in their data literacy skills** (Qlik & Accenture 2020).

Data literacy skills can be taught starting at a young age! These skills include:

- Formulating testable questions
- Identifying relevant data (qualitative vs. quantitative, etc.)
- Collecting (close observation) & organizing data
- Identifying patterns & trends
- Comparing datasets
- Recognizing uncertainty and limitations
- Building models & communicating ideas from data
- And many more!



Above: Students devise a method to organize field data tallying benthic macroinvertebrates. *Image courtesy of Alexander Cotnoir.*

Why do you want to interpret data with art?

"Data is a story about something in the real world, and that story has meaning and emotion. And that's what I'm trying to bring into my art."

— Jill Pelto



Art-making uses scientific skills

Above: Jill Pelto sits beside a glacier, using watercolors to map its features.

Image courtesy of Jill Pelto.



Art conveys the stories within data in more meaningful ways

Left: Pelto's watercolor and colored-pencil artwork titled "Currents" transformed real climate data from 1880 to the present day - including CO₂ emissions, global temperature, land ice volume, renewable energy use, and sea-level rise - into a more approachable narrative.

Image courtesy of TIME.com

Why do you want to interpret data with art?

- Alexander Cotnoir
- Sarah VanDenbergh
- Brian Fitzgerald
- Kim Stewart
- Andrew Clark
- Carolyn Ng

Brian Fitzgerald

Deputy Director

Mount Washington Observatory

North Conway, NH

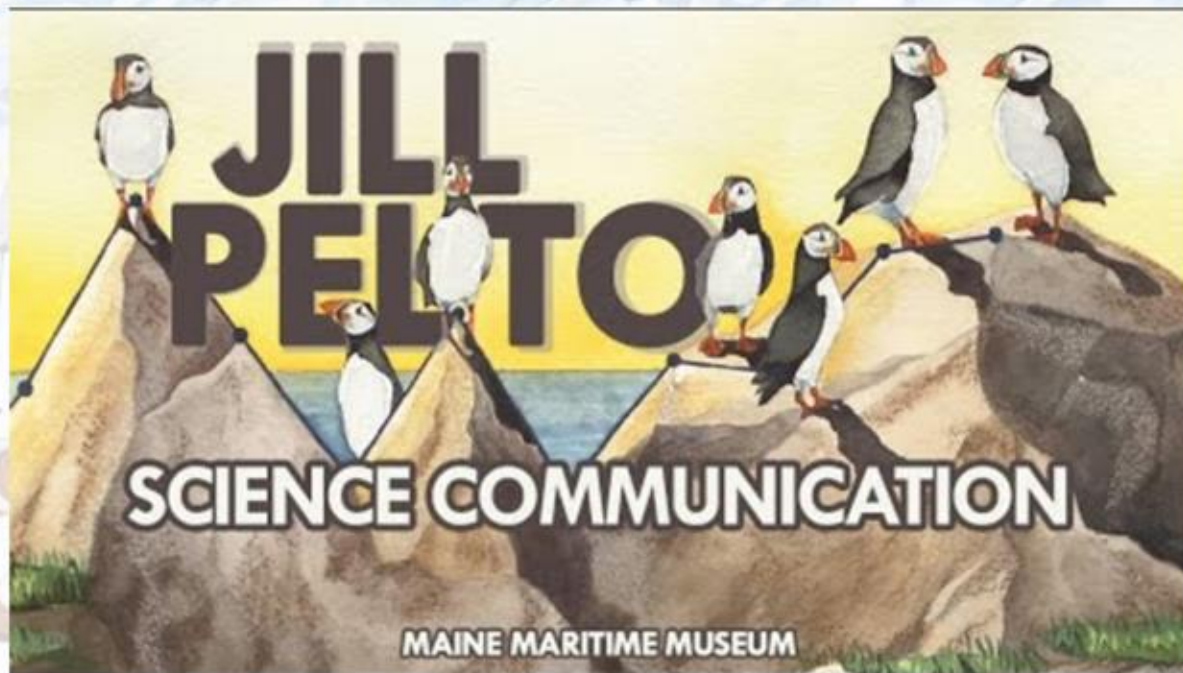
bfitzgerald@mountwashington.org

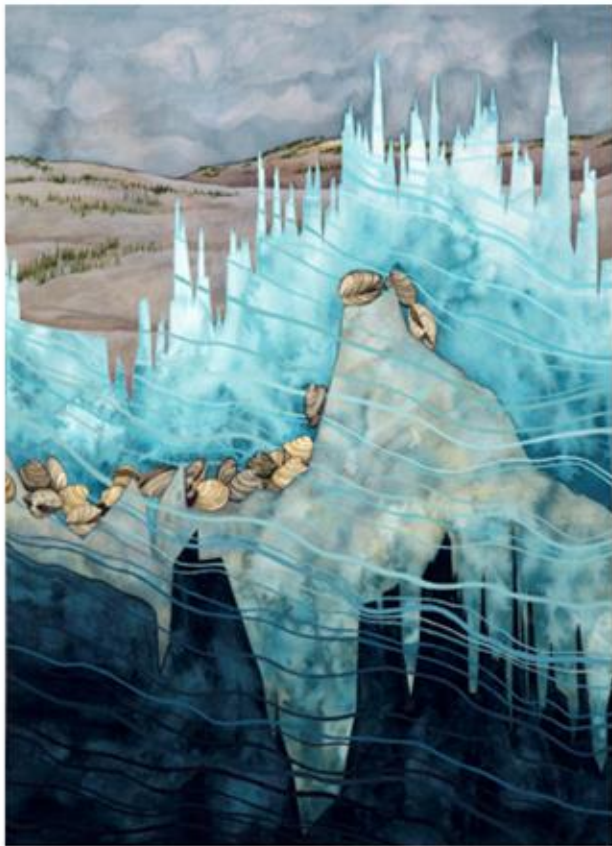
The Beauty of Data



Data Visualization

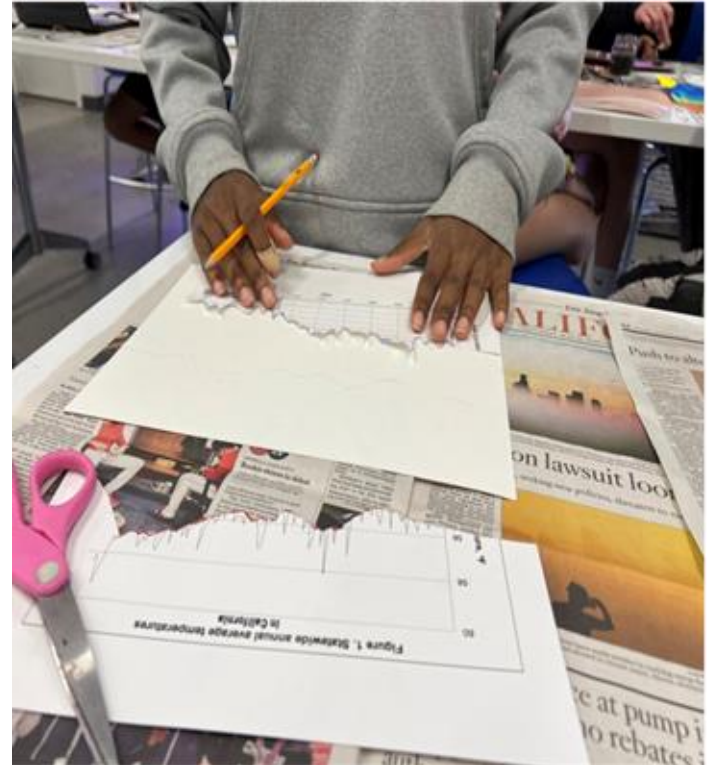
Jill Pelto, Data-Art Education:





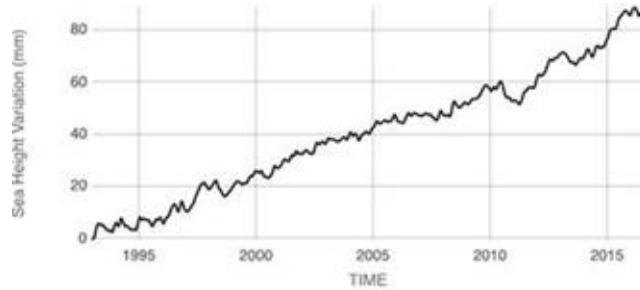
Illustrated Graphs: Using Art to Enliven Scientific Data

- Grade Level: 6th-8th
- Time: 1-2 hrs
- STEM Practices: Analyzing & Interpreting Data
- [Curriculum co-designed by Jill Pelto & Science Friday](#)



Elements of the Activity

- Original Graph
- Illustrated Graph
- Artist's Statement



Source: climate.nasa.gov



Original Graph (Get Your Data!)

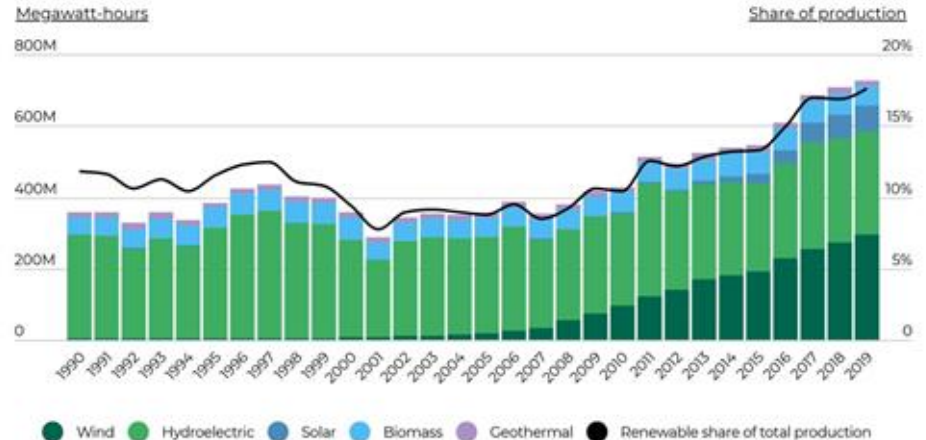
- Many global, regional and local data sets for inspiration:

-[National Climate Assessment](#)

-[NASA's Vital Signs of the Planet](#)

-[CLEAN Network](#)

Electric power generation from renewable sources has increased by over 70% since 2010



Source: U.S. Energy Information Administration's Net Generation by State dataset

Illustrated Graph

- Let your imagination run wild!
 - Trace or draw your data
 - Watercolor, paints, pen and ink, markers, digital mash-ups, collage!



Artist Statement

- **Artist's description of the illustrated graph. Provides the viewer with an explanation of the link between the visual choices made by the artist and the underlying scientific data.**



This piece incorporated two different graphs to highlight sea level rise and the loss of land ice. Artwork by Maddie R.

Resources

- [Curriculum co-designed by Jill Pelto & Science Friday](#)
- **Educators toolbox:**
 - Data examples
 - Drafting an Artist's Statement
 - Illustrated Graph Checklist & Rubric



Kim Stewart

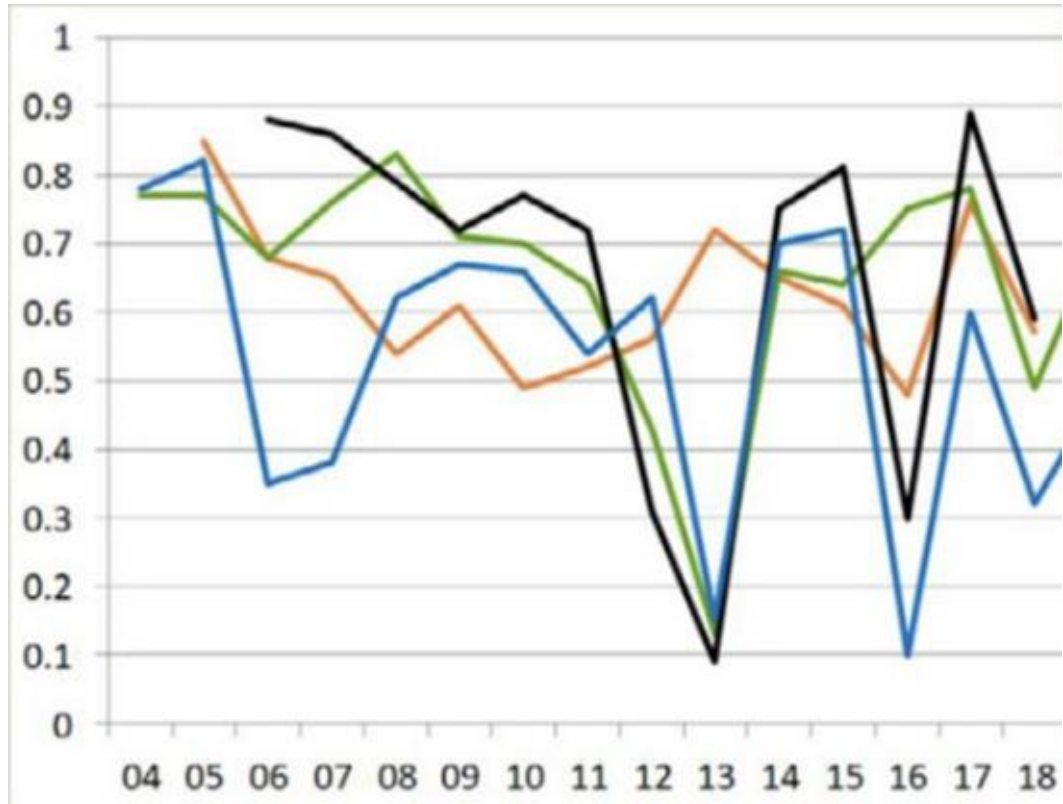
Director of Curiosity

Maine Discovery Museum

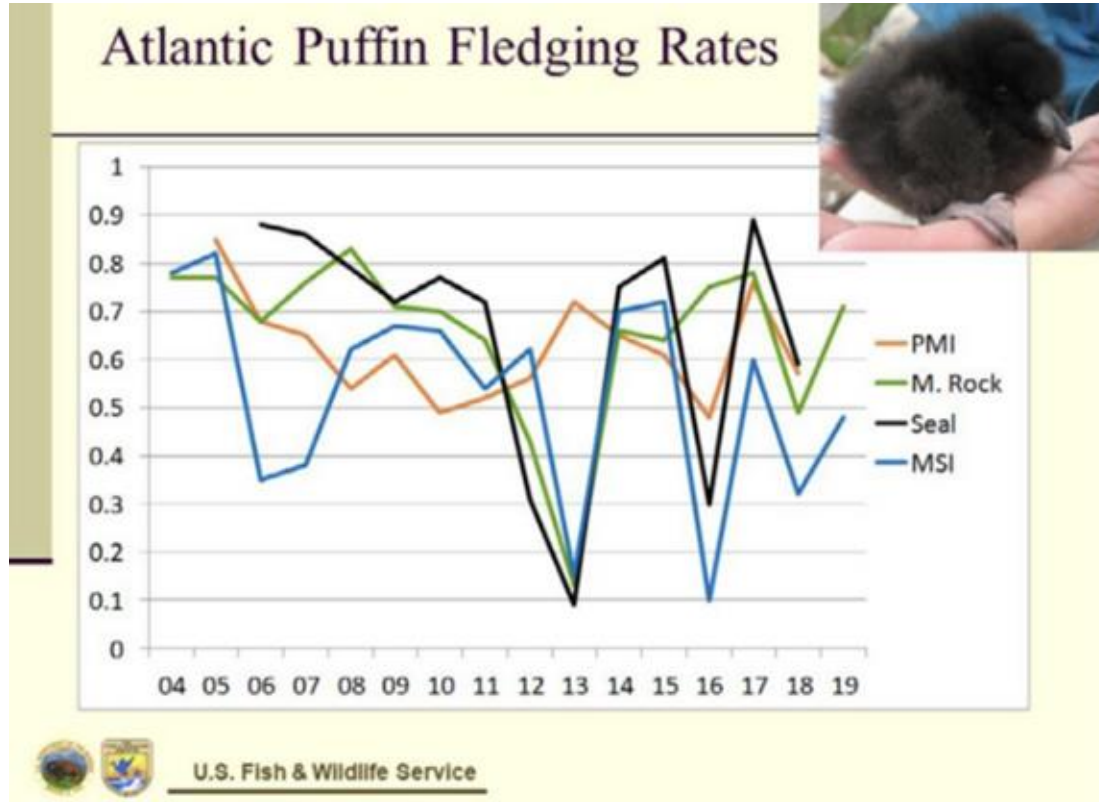
Bangor, ME

kstewart@mainediscoverymuseum.org

Does this graph make you feel anything?



Does this graph make you feel anything?



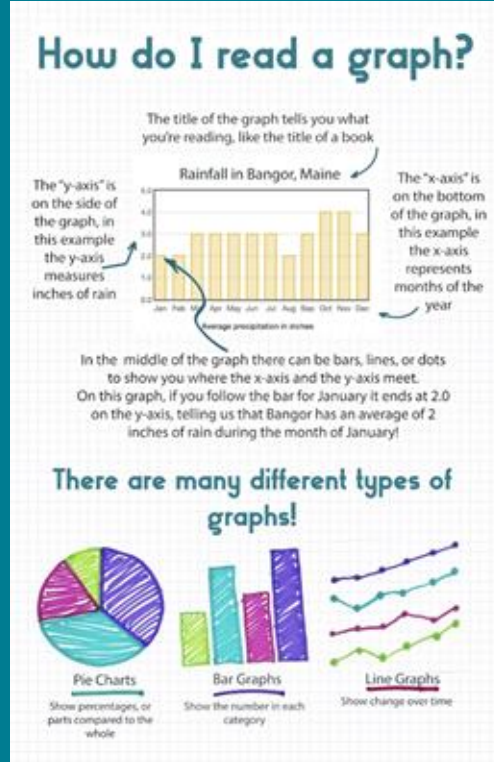
Does this graph make you feel anything?



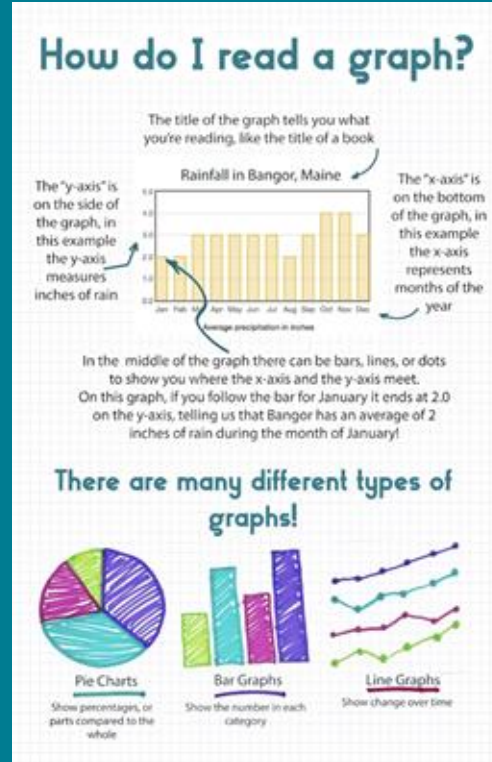
Examples in Different Contexts



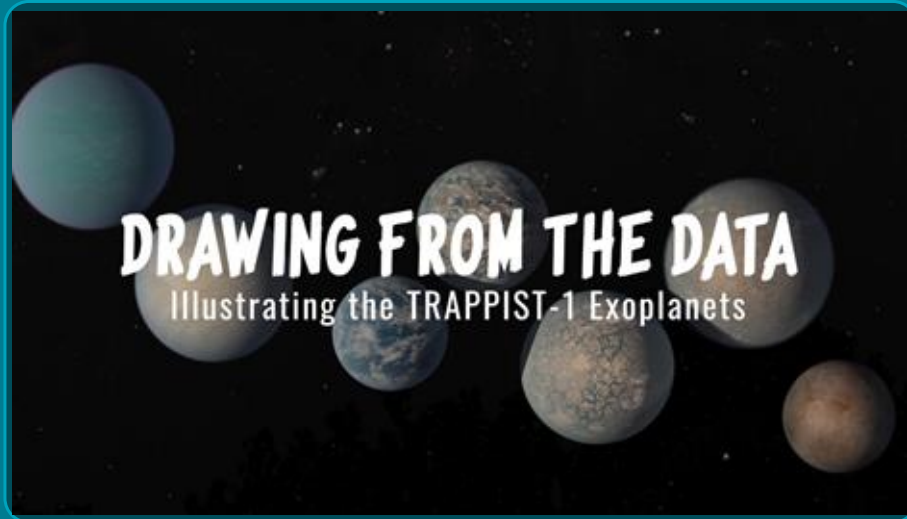
Examples in Different Contexts



Examples in Different Contexts



Alexander Cotnoir
STEM Education Specialist
Space Telescope Science Institute (STScI)
NASA's Universe of Learning program
Baltimore, MD
acotnoir@stsci.edu



TARGET AGE: Middle school – adults

TIME: 45–90 minutes

DATA SKILLS

- Interpreting data
- Comparing data
- Making evidence-based inferences
- Recognizing uncertainty & limitations
- Translating data into visuals



Activity instructions (and video)

Part of our *Cosmic Canvas: Exoplanets Program Guide*

Part 1. Introduce the context (and data) by building a scale model



TRAPPIST 1f



Distance from Star: 3,400,000 miles (5,500,000 km) 0.037 AU

Diameter: 8,230 miles (13,300 km) 1.04 Earths

Orbital Period: 9.21 days

Planet Mass: 0.68 Earths

Distance from star at scale: 28 inches (720mm)

Diameter at scale: 0.067 inches (1.7mm)

TRAPPIST 1f



(habitable zone)

TRAPPIST-1f Detail Cards

Participants:

- Learn **why** studying exoplanets is important (and what questions remain)
- Learn **how** we study exoplanets by measuring light from the system
- Create a model showing relative sizes and orbital distances for the TRAPPIST-1 planets
- Discuss the limitations & benefits of each model
- Compare the model to our Solar System

Part 2. Identify and discuss how (and hypothesize why) the data and illustrations have changed over time



Participants:

- Learn that illustrators create depictions of what exoplanets might be like (based on data)
- Compare illustrations (and data tables) of the seven exoplanets from 2017 and 2021 to identify what's changed
- Discuss why they think the illustrations have changed

Part 3. Hear how astronomers “draw from the data”



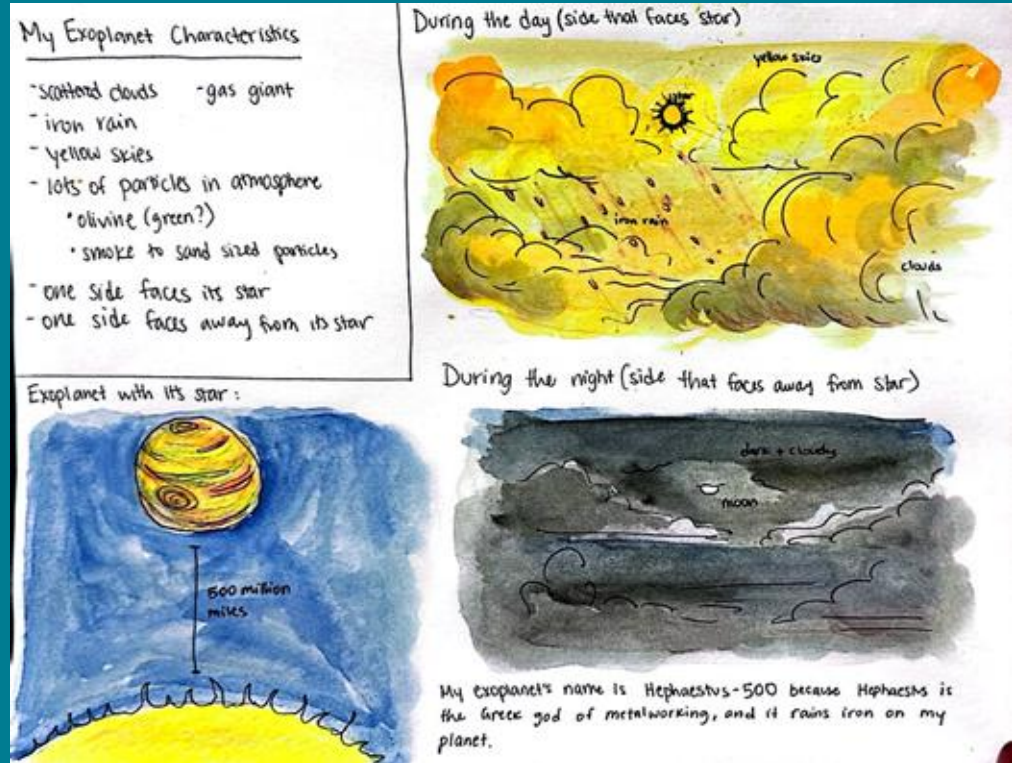
Participants learn how:

- Additional observations & new data provide more precise measurements of the planets' sizes, masses, orbital distance, surface temperatures, etc. over time
- Astronomer & scientific illustrator Robert Hurt factors these data points (and certainty) into his depictions of each planet

Extension: Create your own exoplanet model

Participants:

- Generate a plausible planet description (physical, geologic, and atmospheric characteristics)
- Create an artistic model representing their exoplanet
- Share their creations & explain how their depictions drew from data (and where they took artistic liberties)





TARGET AGE: Middle school – adults

TIME: 60 minutes

DATA SKILLS

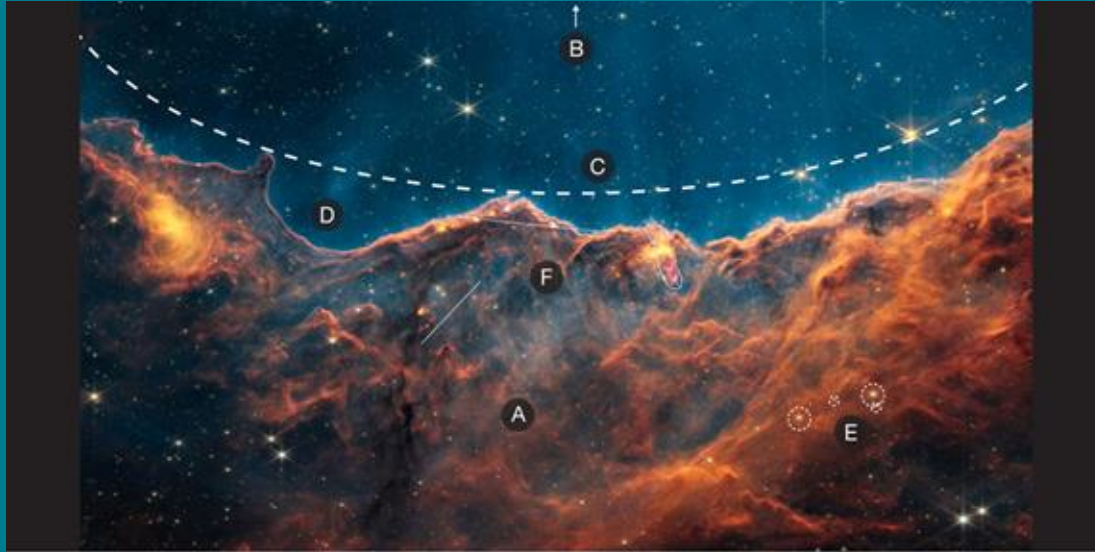
- Interpreting visual data
- Identifying patterns & relationships
- Using evidence to construct a model



Activity instructions (and video)

Part of our *Cosmic Canvas: Stellar Evolution Program Guide*

Part 1. Identify and interpret the features in telescope images



"Cosmic Cliffs" in the Carina Nebula

Star-forming Nebula

At the edge of a cavity within the nearby star-forming region NGC 3324 is the Cosmic Cliffs. This area is on the outskirts of the Carina Nebula, located about 7,600 light-years away. The cavernous area has been carved from the nebula by a few extremely massive, hot, young stars located above the area shown in this image.

Image Credit: NASA, ESA, CSA, STScI, Megan Reiter (rice University), Joseph DePasquale (STScI), Anton M. Koekemoer (STScI)

Key Features

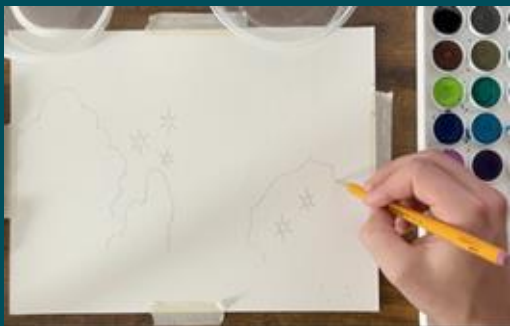
- A. Irregularly shaped clouds
Orange mountain-like peaks and valleys
- B. Hot stars
Out of frame, above the image in the center of the cavity
- C. Cavity
Dark blue area above the "mountains," dotted with stars
- D. Streamers of gas and dust
Misty "smoke" rising from the "mountains" into the cavity
- E. Protostars embedded in the nebula
Yellow dots embedded in the "mountains" (a few are circled)
- F. Protostellar jets and stellar outflows
Red features (marked by dotted lines)

Participants learn:

- **Why** we study star-forming nebulae (to better understand how stars & planets form and change over time, and how molecules essential for life originate)
- **How** to identify and interpret features in astronomical images to tell a story of what's happening within a nebula

Part 2. Create a watercolor model depicting structures and the forces shaping a star-forming nebula

01 Sketch



- Young, hot embedded stars
- Diffraction spikes
- Dense dust-filled “pillars”
- Distant stars

02 Paint



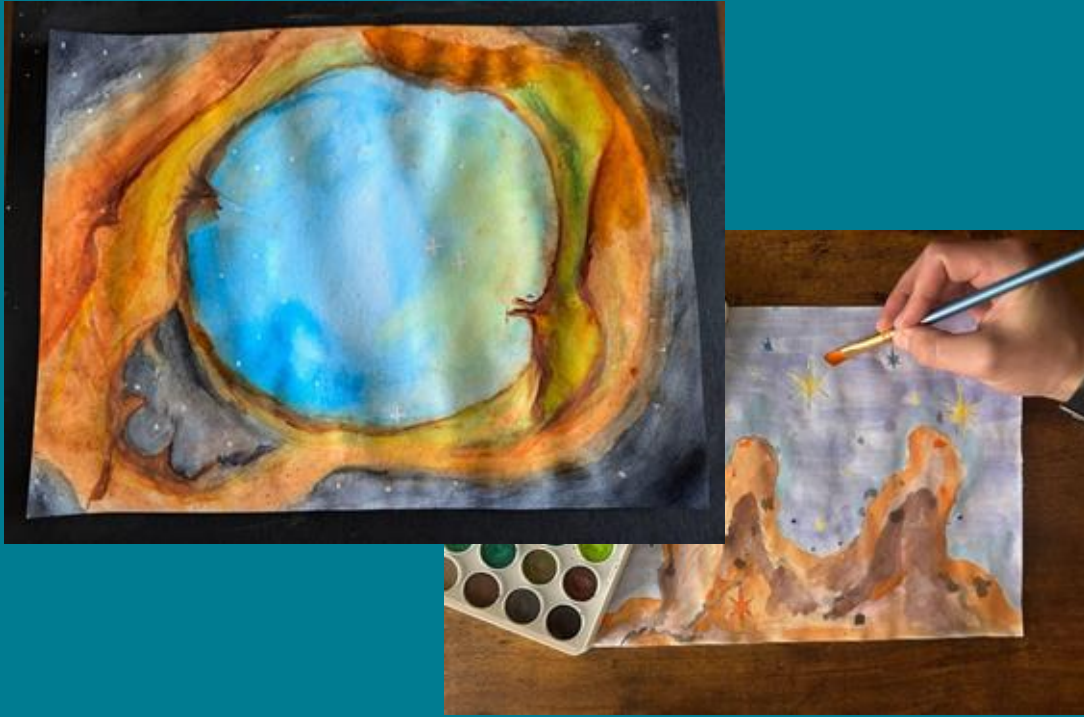
- Glowing cavities
- Gas & dust clouds
- Gas streamers (carried by stellar winds)

03 Add details



- Embedded protostars
- Stellar jets
- Bow shocks

Part 3. Share & reflect



Reflection questions:

- How did you consider the real ways that stars, gas, and dust interact to create your depiction of a nebula? What are other ways that artists use scientific concepts to add realism to their work? **(Examples could include:** anatomy, animal behavior, reflection/refraction/scattering of light, and the physics of how things move.)
- What type of information can we collect through images? Can you think of other areas of study that use images as a form of data?

Andrew Clark

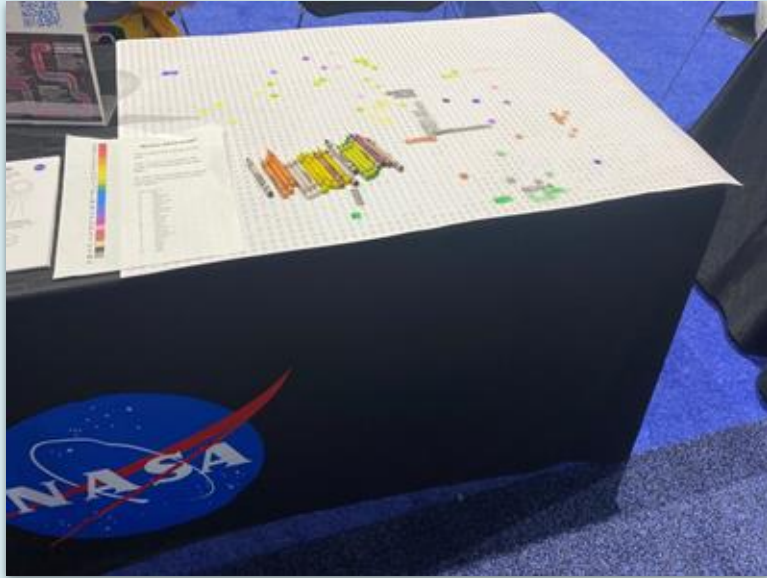
Geospatial Software Developer

NASA Langley Crowdsourcing

ADNET Systems, Inc.

andrew.d.clark@nasa.gov

Color-a-Pixel: What is it?



- A web-based tool to generate collaborative color-by-numbers style poster activities, initially developed for use with satellite imagery as a tabletop attraction and conversation starter at informal outreach events

Color-a-Pixel: What does it do?



Image Credit: Earth to Sky, Brandi Stewart



Image Credit: NPS, Kurt Moses

- Takes any photo and reduces it to a coarse grid with each grid square mapped to a specific color in the 120-color set of Crayola crayons
- Several testing iterations led to the current format:
 - 3' x 2' poster of ½" square pixels (72x48 pixel resolution)

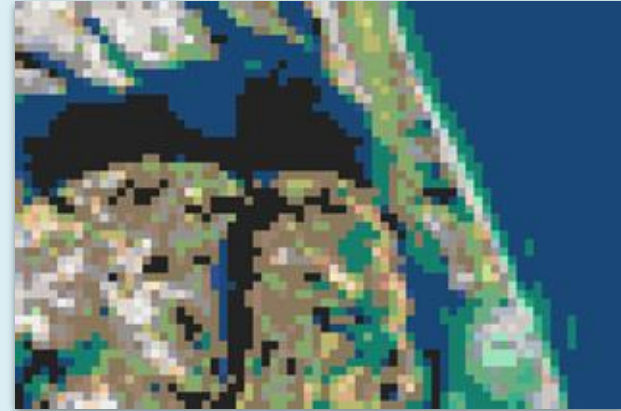
Color-a-Pixel: What does it do?



44	107	119	90
78	41	107	79
85	88	72	41



44		Cadet Blue
50		Midnight Blue
59		Pine Green
60		Tropical Rain Forest
62		Jungle Green
66		Sea Green
67		Forest Green
71		Granny Smith Apple
72		Asparagus
74		Yellow Green
78		Olive Green



Color-a-Pixel: How to use it?

- 1 Upload Image**
Select and upload a source photo or satellite image
- 2 Select Region**
Crop and define the exact region of interest
- 3 Preview Solution**
Preview the coarse gridded recolored image
- 4 Evaluate Color Legends**
Check color frequency and Crayola palette matches
- 5 Generate PDF**
- 6 Activity Files**
Export printable poster grid and multi-page handouts
- 7 Context Images**
Access comparison views and original reference photos



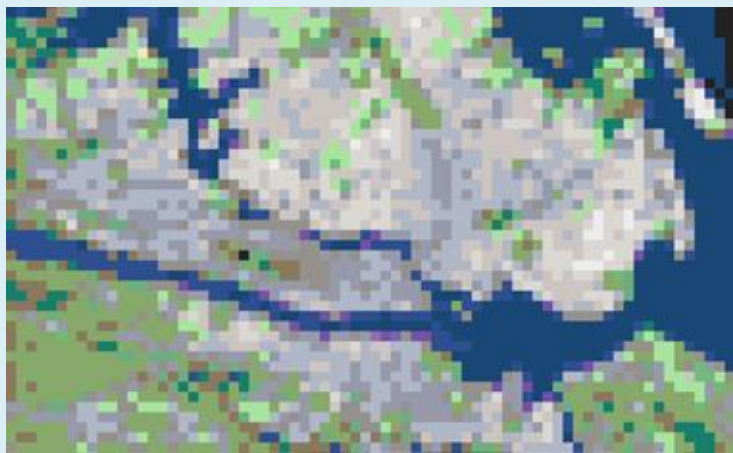
Color-a-Pixel: Practical Tips

- Crayons are packed randomly by the manufacturer (left photo)
- Sort crayons by color, using paper wrapper as a guide (middle photo)
- Download and print master key, sort 120 crayons using key (right photo)



Color-a-Pixel: Practical Tips

Print the color key generated for your image and only put out the crayon colors for that image. Share/post the original image (printed, iPad, etc.)



Pixelated image of New York City uses 20 different colors shown in key

34	Violet (Purple)
36	Royal Purple
38	Bluetiful
41	Manatee
43	Wild Blue Yonder
44	Cadet Blue
46	Blue Violet
50	Midnight Blue
60	Tropical Rain Forest
67	Forest Green
68	Fern
71	Granny Smith Apple
72	Asparagus
79	Spring Green
85	Shadow
88	Gray
89	Timberwolf
107	Silver
119	White
120	Black



Above: Original ASTER (TERRA) image of New York City
(Credit NASA/GSFC/MITI/ERSDAC/JAROS)

Color-a-Pixel: Practical Tips (repeats)

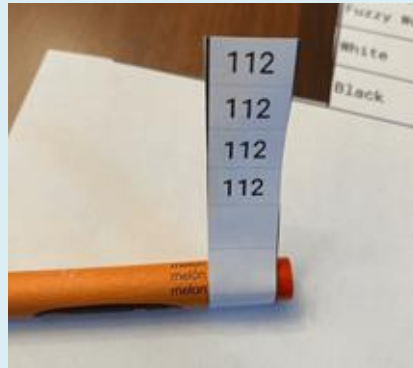
Label crayons with numbers, utilizing the master key

1. Cut out labels



112	112	112	112	112			Melon	
113	113	113	113	113			Bittersweet	
114	114	114	114	114			Sunset Orange	
115	115	115	115	115			Red Orange	

2. Wrap label around end of Crayon, use glue stick or tape to secure



Color-a-Pixel: Pre-Generated Posters



Pre-generated Color-a-Pixel Activity Files

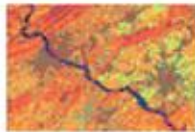
This page exists in support of the [Color-a-Pixel Activity Generator](#), and offers a selection of ready-to-use activities generated from satellite imagery of regions across the country.

The bare minimum required to download and print in order to have a usable activity are the universal [Color Label PDF](#), and either the [Poster PDF](#) or [Multi-Page PDF](#) for the region of interest. If using the multi-page PDF, the universal [Grid Layout](#) image serves as a guide for how to recombine the pages into a single poster. The other images can provide additional visual references for discussion (Selected Region in Original Color, High Resolution Recolored Image, Solution Preview), and targeted legends specific to the region of interest.



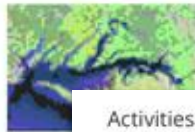
Cape Cod
MA

- Background URL
- Original Color
- Solution Preview
- Hi-Res Recolored Image
- Named Legend
- Frequency Legend
- Poster PDF
- Multi-page Handout PDF



Susquehanna River
PA

- Background URL
- Original Color
- Solution Preview
- Hi-Res Recolored Image
- Named Legend
- Frequency Legend
- Poster PDF
- Multi-page Handout PDF



Chesapeake Bay
MD, DC

- Background URL
- Original Color
- Solution Preview
- Hi-Res Recolored Image
- Named Legend
- Frequency Legend
- Poster PDF
- Multi-page Handout PDF



Activities from Earth to Sky

The following pre-generated Color-a-Pixel activities were created and shared by the Earth to Sky Partnership, and include some out-of-this-world applications!



Nisqually Watershed –
Landsat
WA



Death Valley – Before the
Badwater Flood
CA



Death Valley – Post Flood
CA

Color-a-Pixel: Bring your Own Image

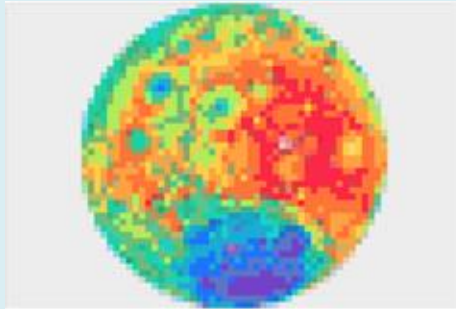
Well-suited images:

- Contain recognizable shapes (even at low resolution) and a diversity of colors.
- The tool also generates a legend with color frequency, indicating how many squares use each color. If there's a color that is strongly over-represented, it might not be the best image for the activity

41		29		Manatee
44		25		Cadet Blue
50		1054		Midnight Blue
59		10		Pine Green
60		289		Tropical Rain Forest
62		17		Jungle Green
66		28		Sea Green
67		55		Forest Green
71		22		Granny Smith Apple
72		363		Asparagus
74		7		Yellow Green
78		111		Olive Green
79		31		Spring Green
85		516		Shadow
86		12		Gold
88		139		Gray
89		41		Timberwolf
90		27		Almond
96		19		Tumbleweed
98		9		Desert Sand
100		22		Beaver
107		117		Silver
119		35		White
120		478		Black

Color-a-Pixel: The Sky's the Limit

- It's a general purpose tool, and can be used for any image relevant to your specific audience.
- It leaves the context and framing open - use your imagination!
- [Earth to Sky](#) has used it for astronomical imagery to great effect:



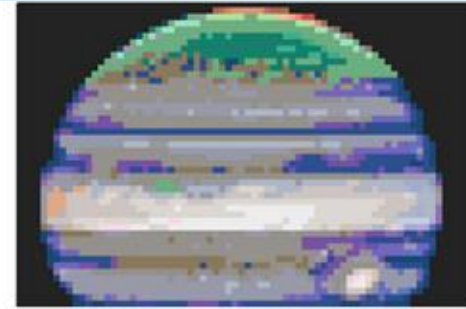
Lunar Topography (LRO)

Far side of the Moon



Cosmic Cliffs (JWST)

Carina Nebula



Jovian Aurora (JWST)

Jupiter

- How do you envision using it? What will you be bringing to the table?

Color-a-Pixel: Resource URLs

- Girl Scout Patch: <https://www.nasa.gov/ames-earth-science-girl-scout-patches/color-a-pixel/>
- NASA Science Blog Post: <https://science.nasa.gov/learning-resources/science-activation/nasa-fuels-discovery-from-earth-to-sky-one-crayon-at-a-time/>
- Earth to Sky Activities: <https://docs.google.com/document/d/17N3AqKtm9JGR-pNlreNf5xzycmfP49rTl7nliBW6NxM>
- Satellite Image sources:
 - [Landsat Galleries](#)
 - [Earth to Sky Images](#)
 - [NASA Earth Observatory](#) Image of the Day
 - Search by location using the [EO Explorer](#)
- ~~Blog post explaining tool use: <https://strategies.org/products/color-a-pixel-activity>~~
- Pre-generated activities: <https://strategies.org/color-a-pixel-pregenerated>
- Master key: <https://strategies.org/wp-content/uploads/2024/12/Colors-and-Labels.pdf>
- Poster generator tool: <https://color-a-pixel.streamlit.app/>

Questions or issues? Email me! andrew.d.clark@nasa.gov

Carolyn Ng

**NASA Heliophysics Education Activation Team
(NASA HEAT)**

Informal Education & Partnership Lead

NASA Goddard Space Flight Center

Greenbelt, MD

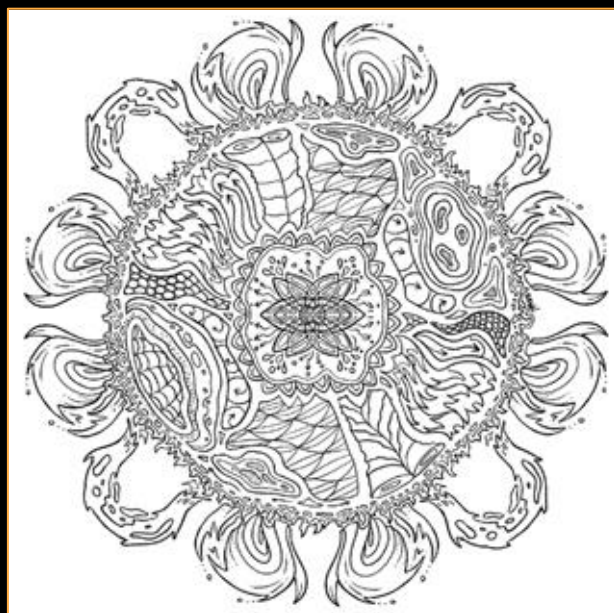
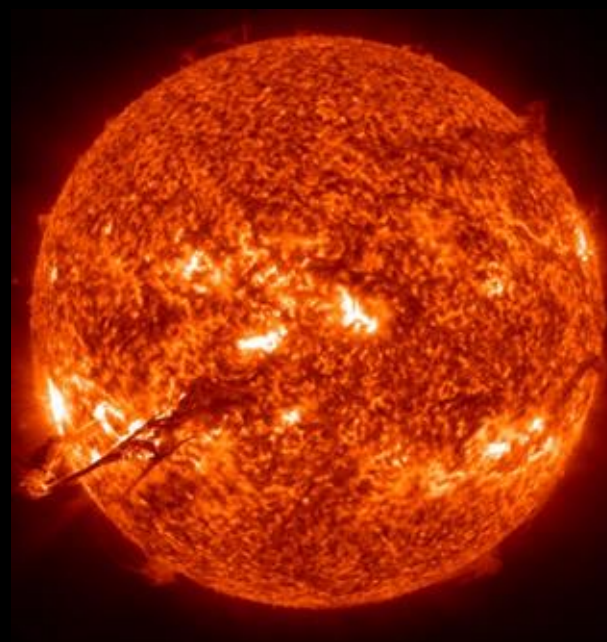
carolyn.y.ng@nasa.gov

National Aeronautics and
Space Administration



JOURNEY THROUGH THE HELIOSPHERE

The Sun-Earth System in Color



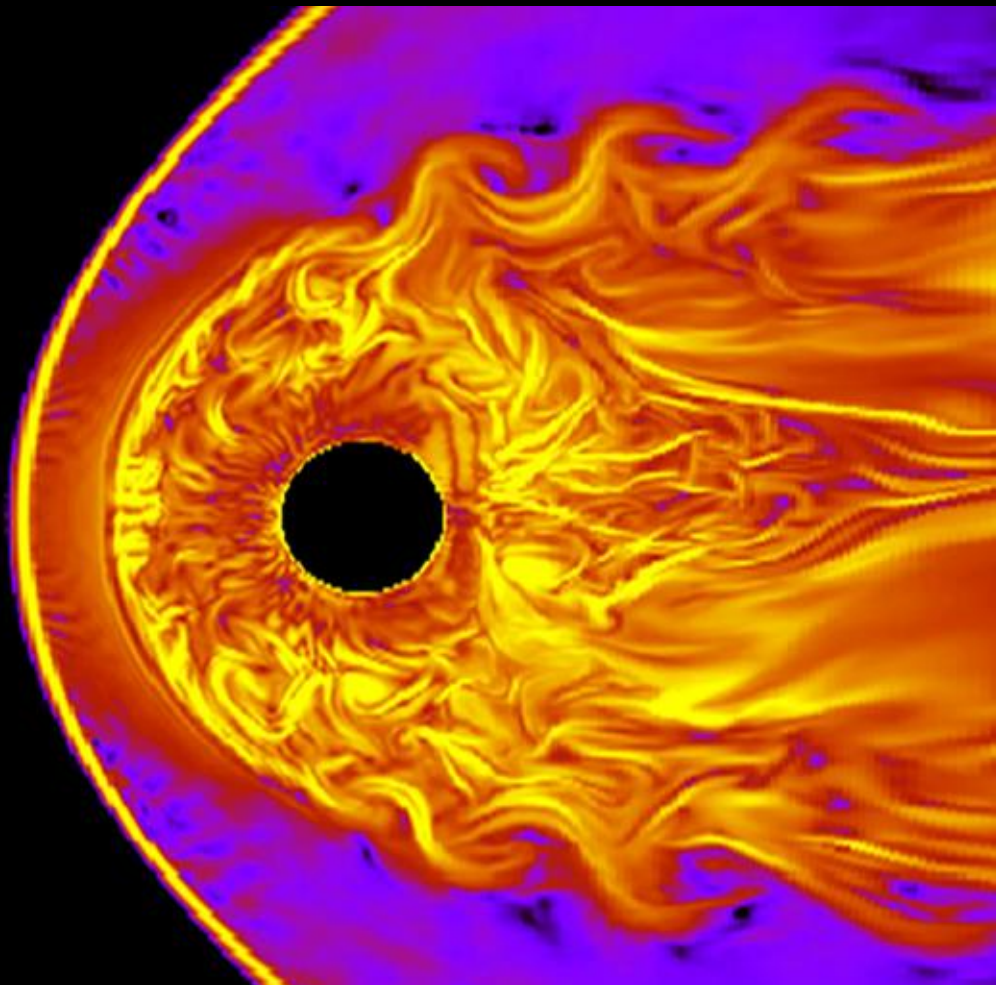
Connecting People and Science Using Art

People everywhere have a connection to the Sun.

Interacting with **art** brings people together.

Science helps people understand the universe.



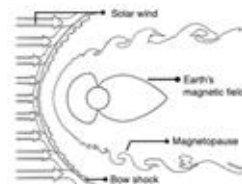


Solar Wind

The Sun does more than just give out light. It also sends out a stream of charged particles called the **solar wind**. This wind travels from the Sun all the way to Earth and throughout the solar system. Fortunately, our planet is protected by the **magnetosphere**, an invisible shield created by **Earth's magnetic field**. When the solar wind reaches Earth, it crashes into this shield and is forced to flow around it.

The point where the solar wind first meets Earth's magnetic field is called the **bow shock**, kind of like the wave that forms in front of a moving boat. Just beyond that is the **magnetopause**, the boundary where the pressure from the solar wind and Earth's magnetic field balance out. This protective system keeps most of the solar wind from reaching Earth's surface.

The solar wind also runs up against the **interstellar medium** which permeates the space between stars. This creates a bow shock similar to the one created by Earth's magnetosphere, only much much bigger. Everything inside this bubble or "shock" is called the **heliosphere**.

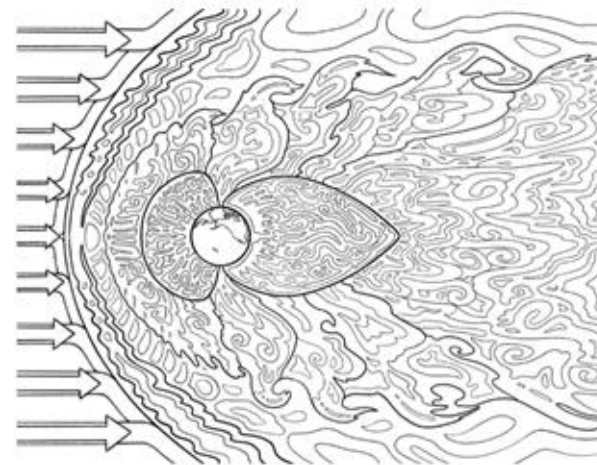


Speaking of the Heliosphere...

We cannot see the solar wind with our eyes, but people living in high latitudes can often see the effects of its presence. Charged particles in the solar wind cause beautiful auroras to occur in the night sky. Have you ever witnessed these phenomena that are caused by solar wind?



In Alaska's Aleutian/Sugliens language, the word for particles is *petal* (literally short or arched). To hear the word *petal* and other Aleutian/Sugliens language words spoken, scan the QR code.



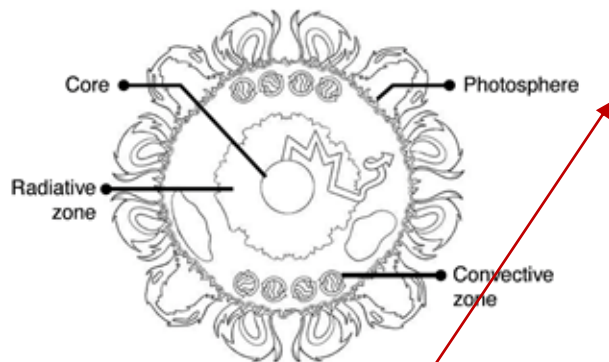
The Sun

The Sun is a giant ball of hot, glowing gas consisting of electrically charged particles called plasma that gives Earth light and energy. At its center is the **core**, where extreme pressure and temperature cause hydrogen atoms to fuse and release energy through a process called nuclear fusion. This energy moves outward through the **radiative zone**, where it slowly travels as radiation, bouncing around for thousands of years.

Next, it reaches the **convective zone**, where hot gases rise and cooler gases sink in a churning motion that helps move energy toward the surface.

The part of the Sun we can actually see is the **photosphere**, a glowing surface that sends sunlight to Earth. Beyond that is the outermost layer of the Sun's atmosphere, called the corona. It is usually hidden by the brightness of the photosphere, but is visible during a total solar eclipse.

The Sun becomes more and then less active over a repeating, roughly 11-year period called the solar cycle. When the Sun reaches solar maximum, there are many sunspots caused by its agitated magnetic field. This time is also when space weather is most common, with events like solar flares and Coronal Mass Ejections (CMEs) leading to the auroras here on Earth.



Speaking of the Heliosphere...

People have observed the Sun for millennia. The Sun influences all other objects in our solar system, and is the primary source of energy on Earth. The Sun is also integral to how Arctic peoples live their lives. What activities are dependent on the **Sun** where you live?



In the Alaska Upper Kobuk dialect of Iñupiaq, the word for **Sun** is **siqiniq**. Scan the QR code to learn how to say siqiniq in Iñupiaq.



Journey through the Heliosphere: The Sun-Earth System in Color

Learn key Upper Kobuk Iñupiaq vocabulary related to the Sun



siġa (atmosphere)



uqaqtaaq (blue)



Nuna (Earth)



suġaaqtaaq (green)



uunnaq (heat)



mularuq (Coastal - it is eclipsing)



pularuq (Upper Kobuk - it is eclipsing)



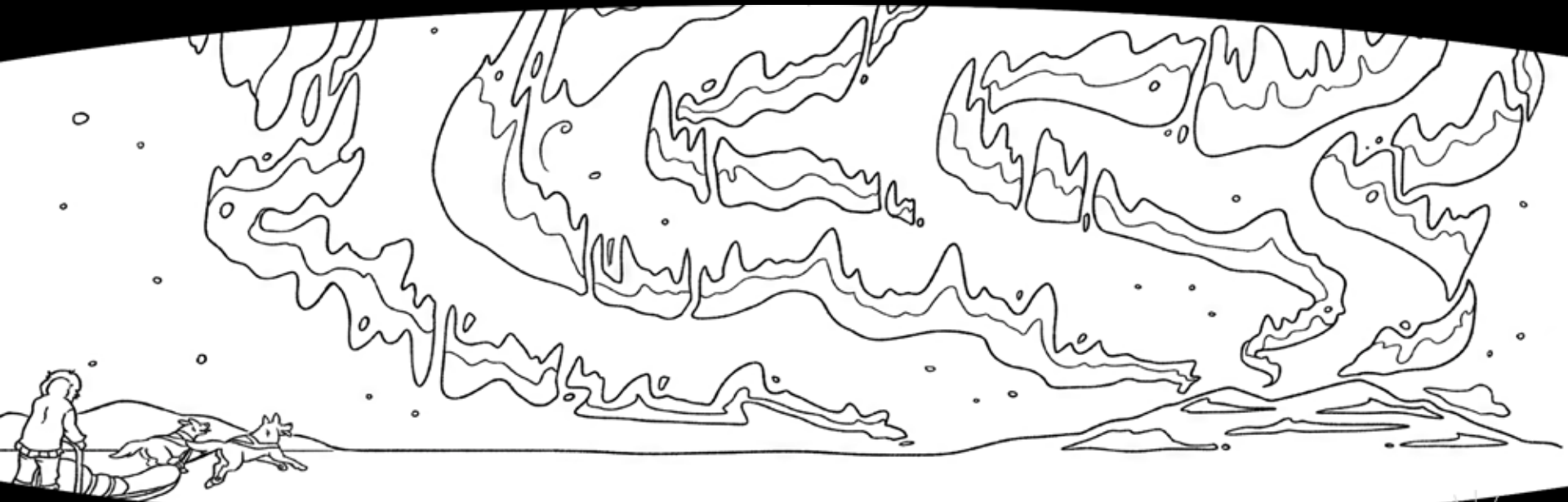
An Alaskan Point of View

Summer Midnight Sun

Winter Solstice

Aurora Borealis

Northern landscape is intrinsic to its culture and language.





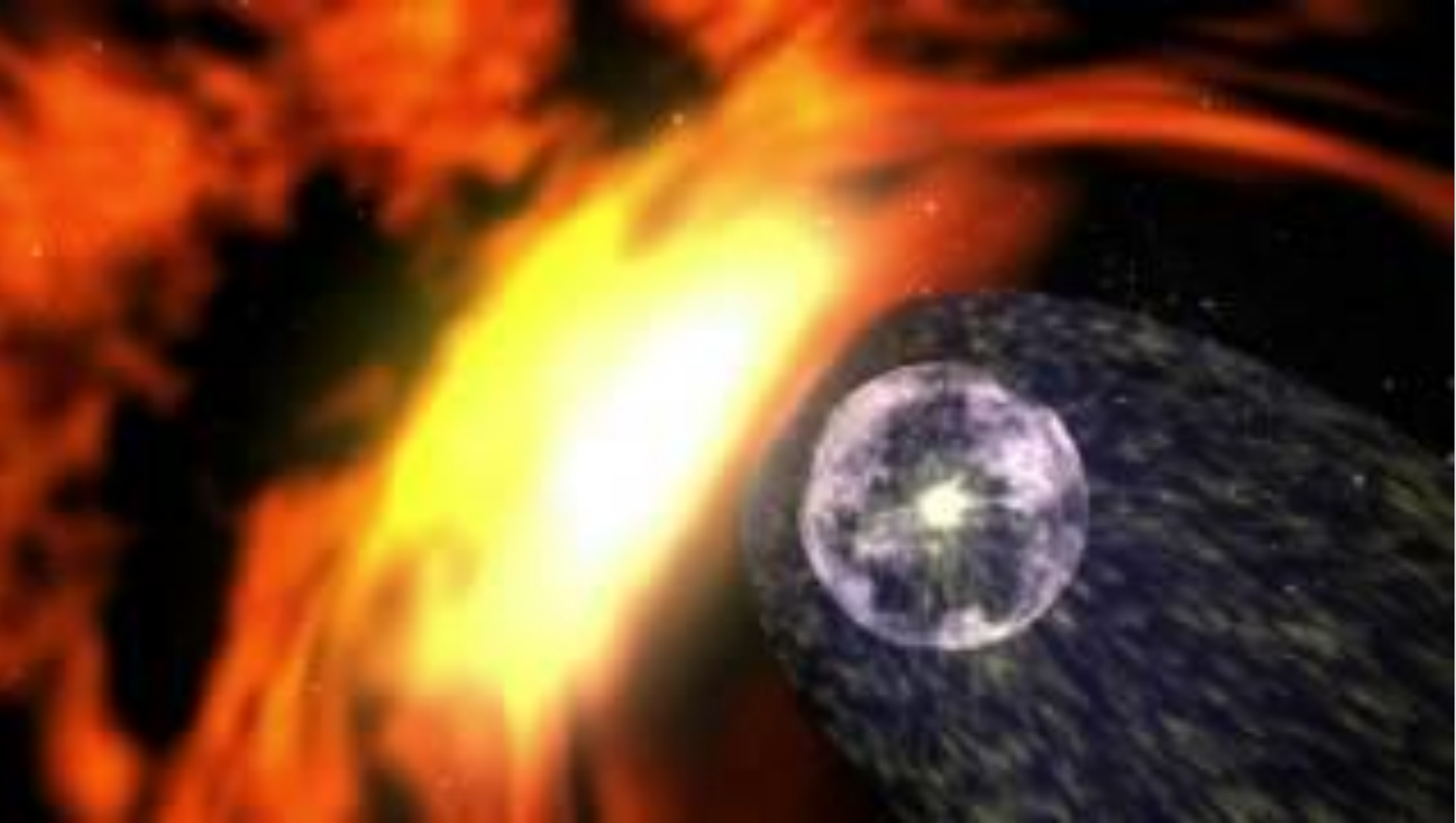
2013-03-17
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Arctic Perspectives Through Language

The life experiences, traditions, and cultures of Alaska's people often and multigenerational observations and knowledge about these phenomena.

Culture and language are intertwined and inseparable.





NASA's Scientific Visualization Studio

Blend of Science and Art

What do you imagine
the heliosphere
looks like?

<https://svs.gsfc.nasa.gov>

How would you draw the solar wind?



The Sun is really big and influences all objects in the solar system.

The Sun is active and can impact technology on Earth via space weather.

The Sun's energy drives Earth's climate, but the climate is in a delicate balance and is changing due to human activity.

Life on Earth has evolved with complex diversity because of our location near the Sun. It is just right!

The Sun defines the space around it, which is different from interstellar space.

The Sun is the primary light source in the solar system.

The Sun is made of churning plasma, causing the surface to be covered with complex, tangled magnetic fields.

Energy from the Sun is created in the core and travels outward through the Sun and into the heliosphere.

Our Sun, like all stars, has a life cycle.

National Aeronautics and
Space Administration



JOURNEY THROUGH THE HELIOSPHERE

The Sun-Earth System in Color

Contact:
Carolyn Ng

Heliophysics Education Specialist
carolyn.y.ng@nasa.gov



<https://science.nasa.gov/learn/heat/>

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Resources, Reminders and Q&A

NISE Network Related Resources

- NISE Network - Interpreting Scientific Data resources
<https://www.nisenet.org/interpreting-scientific-data>
- NISE Network - STEAM - Creative Expression resources
[nisenet.org/steam](https://www.nisenet.org/steam)
- NISE Network - Color resources
<https://www.nisenet.org/color>



Resources & Opportunities



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See you next time!

Upcoming Online Workshops...

Tuesdays; 2pm-3pm Eastern / 11am-
12pm Pacific

Stay tuned for upcoming workshops



Learn more and register at nisenet.org/events

Thank You



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