

Hurricane Mapping Demo

Density mapping with [Firefly Symbology](#)

Based on project: [How-To: Hurricane Map](#) by [John Nelson](#)

Description:

How do you turn a pile of historic hurricane points into a whirring, glowing, mega-hurricane? Fire up your mapping engines, and let's get started.

This Cascade [story map](#) will walk you through the cartographic process, both conceptually and practically. The following steps are taken:

- Explore map projections and search for one that best showcases the circuitous nature of hurricanes.
- De-saturate a satellite basemap image to help establish it as a contextual backdrop the doesn't cognitively compete with the thematic layer.
- Conjure up some glowing symbology to honor Waldo Tobler's [First Law of Geography](#) as well as give a reverential wink to the radiant glory of lightsabers.

Related resources:

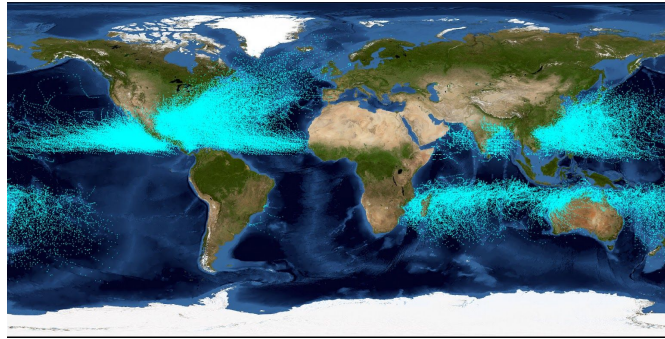
- [World Imagery Firefly](#) (basemap tiles)
- [Firefly Basemap Imagery methodology and example](#) (ArcGIS Pro project package)
- [Glowing Point Symbology](#) (cool-hue image symbols)
- [Glowing Point Symbology](#) (warm-hue image symbols)
- [Firefly Stroke Symbology](#) (instructive Story Map)
- [Firefly Cartography](#) (instructive Story Map)
- [How-To: Hurricane Map](#) (instructive Story Map)

Download the following layers (Video: [Getting started](#))

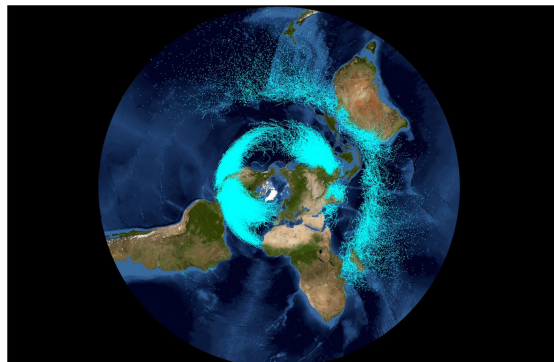
1. Basemap satellite image: [NASA Visible Earth August satellite image](#) (~22 MB)
2. Shapefiles of historic hurricanes: [NOAA Hurricane Shapefiles.zip](#) (~7 MB)
 - Sourced from NOAA's National Centers for Environmental Information
 - Six shapefiles represent the best known historical locations and magnitudes for historic hurricanes and tropical storms. These shapefiles are segregated by Saffir-Simpson hurricane categories 1-5 (and tropical storms).
3. Coastline and graticules: From Natural Earth's data download page
 - Coastline shapefile: [ne_110m_coastline.zip](#)
 - Graticule 20 degree: [ne_110m_graticules.zip](#)
4. Firefly icons: [Firefly Icon Images](#) (6 images)

Pick the right projection (Video 1: [Symbolize and pick projection](#) and Video 2: [Finalize projection](#)):

- Look at basemap image with hurricane data and see if there is a map projection that best communicates something interesting

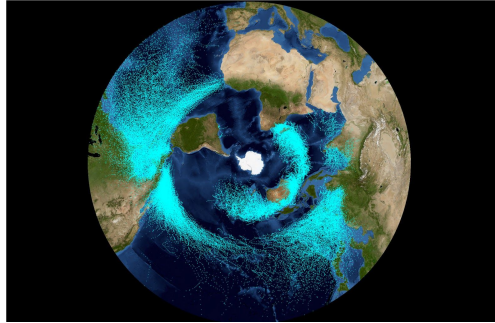


- The de-facto coordinate system for shared GIS files is WGS 84, which projects into this vanilla equirectangular, or Plate Carree, view.
 - Promise me, on everything you hold dear, to never leave your published map in this projection
- Do you see any patterns?
 - Hurricanes carve a well-worn belt right around the planet. A band in the Northern Hemisphere and a band in the Southern Hemisphere.
- Let's look for a projection that better illustrates that ring-edness...



This top-down perspective showcases the circuitous nature of hurricanes well. Unfortunately, most of the action happens in the Northern Hemisphere, which has some cramped quarters in this [North Pole Stereoscopic projection](#).

- What if we flip it?



- Ohhhhh yeahhhh... Here is a South Pole Stereographic Projection. This bottoms-up view of Earth highlights the circular structure of the hundreds of hula-hooping storms, while maximizing the real estate of the denser Northern Hemisphere.

Basemap (Video: [Basemap desaturate](#))

- This high-saturation, high-contrast, image overpowers the hurricane events and steals from the focus of the map. Because our hurricanes are going to be bright and colorful, the basemap helps to promote them by being darker and de-saturated.
- One straightforward way to do this is to add two copies of the satellite imagery to your map.
 - The bottom-most version is the standard full color, set to RGB:

Symbology

NASA Blue Marble

Symbology: RGB

Band Combination

Red	Band_1
Green	Band_2
Blue	Band_3
Alpha	None

Background

☐ Display background value

Nodata:

Stretch

Stretch type: Percent Clip

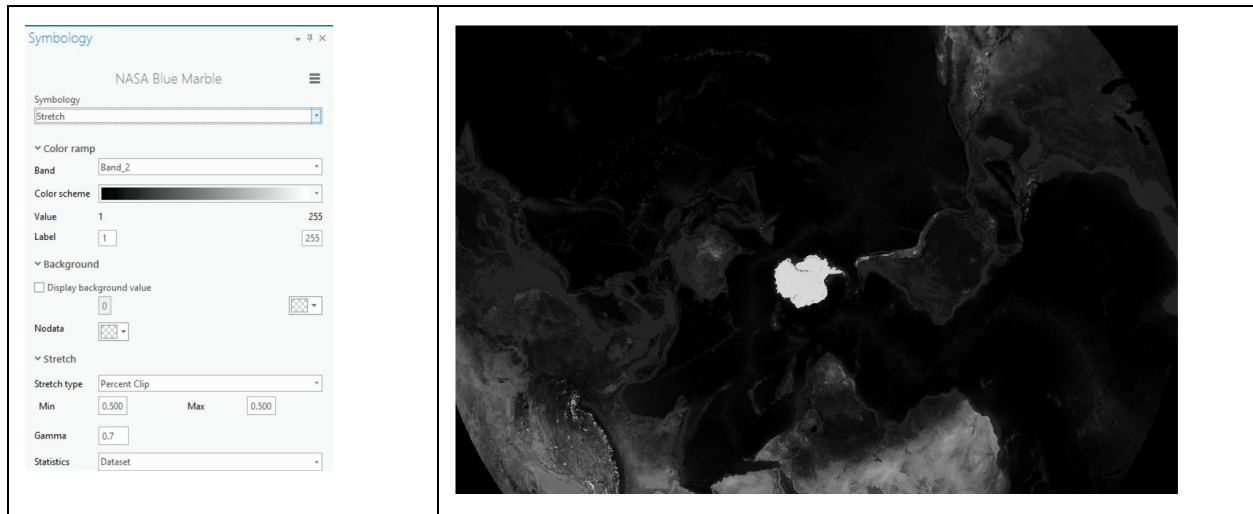
Min: 0.500 Max: 0.500

Gamma: 1.5 1.5 1.5

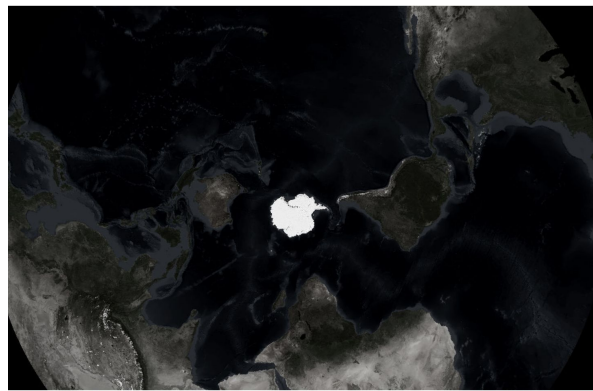
Statistics: Dataset

A map of Earth showing the Southern Hemisphere, similar to the one above but with a dark, desaturated basemap. The landmasses are visible in muted colors, and the oceans are dark blue. The map is centered on the South Pole.

- On the upper-most version of the image, apply a "stretched" symbology with a black-to-white color ramp. Giving us a gray-scale image, like this:

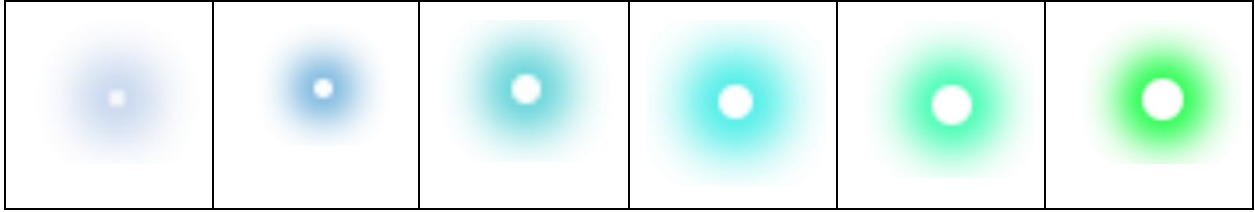


- Then, apply a slight transparency to this gray-scale image (8 - 10% transparent), so just a bit of the color of the lower image comes through. A cheap trick, but it results in a powerful basemap image, ready to stage some vivid data.



Icons (Video: [Apply firefly icon symbology](#))

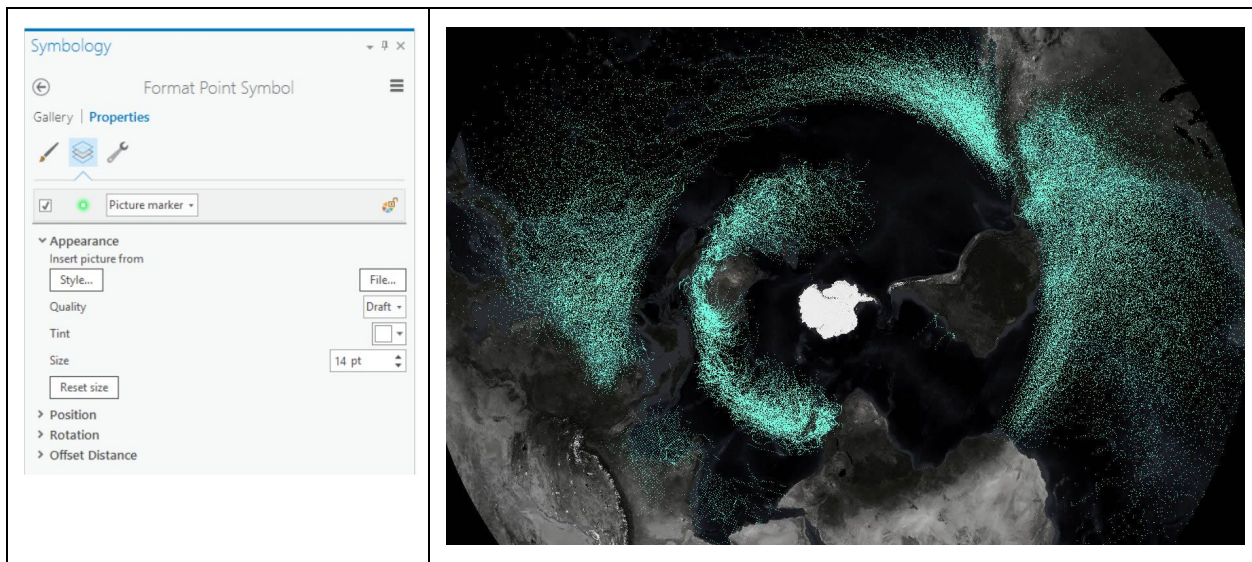
- Anyone who's been in or near a hurricane can tell you that a rigidly precise flat symbol like a point or a line isn't necessarily true to the broad, fuzzy-edged nature of a moving storm.
- Using a symbol with a blurry edge helps illustrate [Tobler's First Law](#), plus I think it looks really cool. I call it firefly cartography. Glowing bright symbols over a dark basemap. You can call it whatever you want.



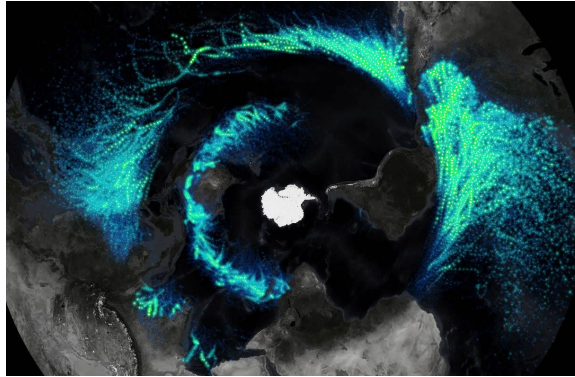
- Notice how they have a white-hot center, and only the glow effect has the color encoded?



- Apply these icons as point symbology to hurricanes. You can tweak the size of the icon to an overall density that looks best to you. Just avoid scaling it up higher than the image's native resolution or else you could get some pixelation.

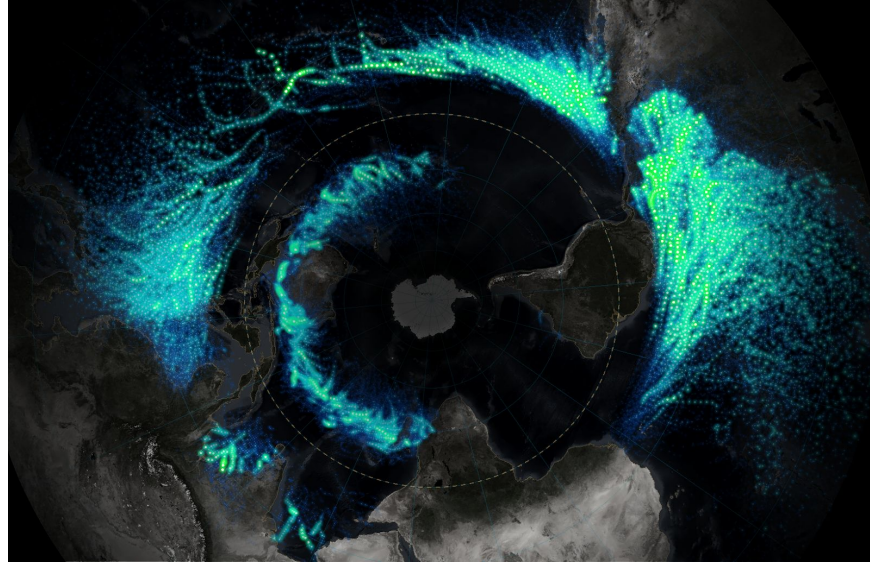


- Tier the results by severity:



Composition (Video: [Finishing touches](#))

- The heavy lifting on this sucker is done. Now all there is to do is add in some minor shape details and soften the hard-edges of the layout with a vignette..
- Adding in a coastal reference goes a long way towards giving map readers some bearing when looking at an unusual, bottoms-up, perspective of the world. I gave mine a very thin width, an earthy color of 255, 211, 127 (rgb), then set the layer to 80% transparent.
- For some reason, faint graticule lines provide a sense of order and cinematic coolness. These lines are a cool slate color of 0,132,168 (rgb), and set to 70% transparent.
- Because the concept of the equator is so important to the nature of hurricanes, it deserves a place in the layout.
 - I used the same earthy color of 255, 211, 127 (rgb) to help contrast it from the hurricane points, and pushed it back to 70% transparent.
 - It also has a dashed effect to help illustrate that it is a reference, and not an actual physical feature.
 - I then added a second version of this line, but with a much thicker stroke and a transparency of 80%. This provides a really subtle, hacked, glow effect.
- The abrupt edge of the map at the corners, and the bright imagery at the periphery, distract from the layout.
 - In the project Layout, you can add a rectangle atop the map, and apply a radial gradient fill (fully opaque black at the outside and fully transparent at center) to burn the edges.
 - A vignette adds a portrait-like quality to the composition, helping to focus the eye.
- Lastly, the brightness of Antarctica, and the visual noise of the graticules converging at center, need to be pushed back. I've added a second vignette overlay, this time reversed, so the center of the radius is darker.



Topics covered: Projection exploration, an image symbology and de-saturation hack, using picture markers for point symbols, using transparency for context layers, and creating vignette effects with radial fills in a layout.

To add the Firefly styles to your ArcGIS Pro project:

1. First download the [Firefly.stylex](#) file and save it to your machine.
2. From your project's Catalog panel, right-click the [Styles](#) category and choose to *add a style*.