

JOURNEY OF A LITTLE PICTURE



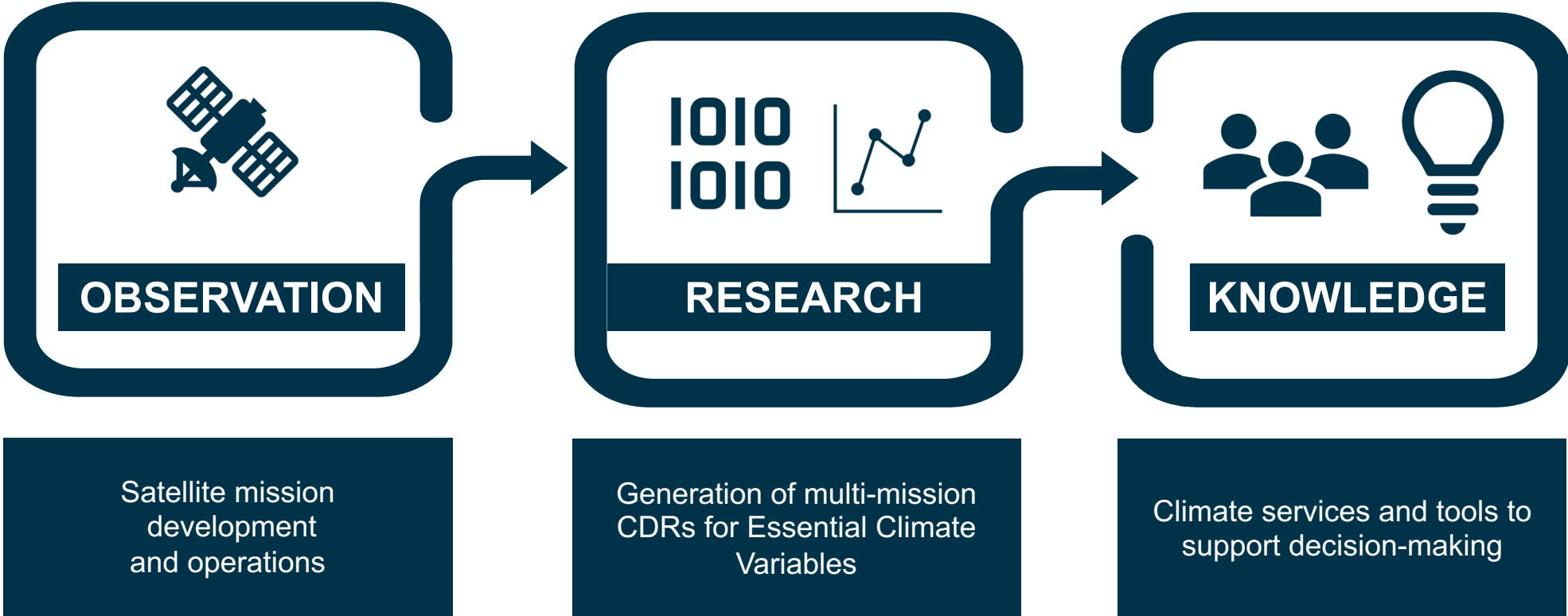
Chris Stewart - ECMWF
Paul Fisher - ESA
Hayley Evers-King - EUMETSAT

23/10/2023

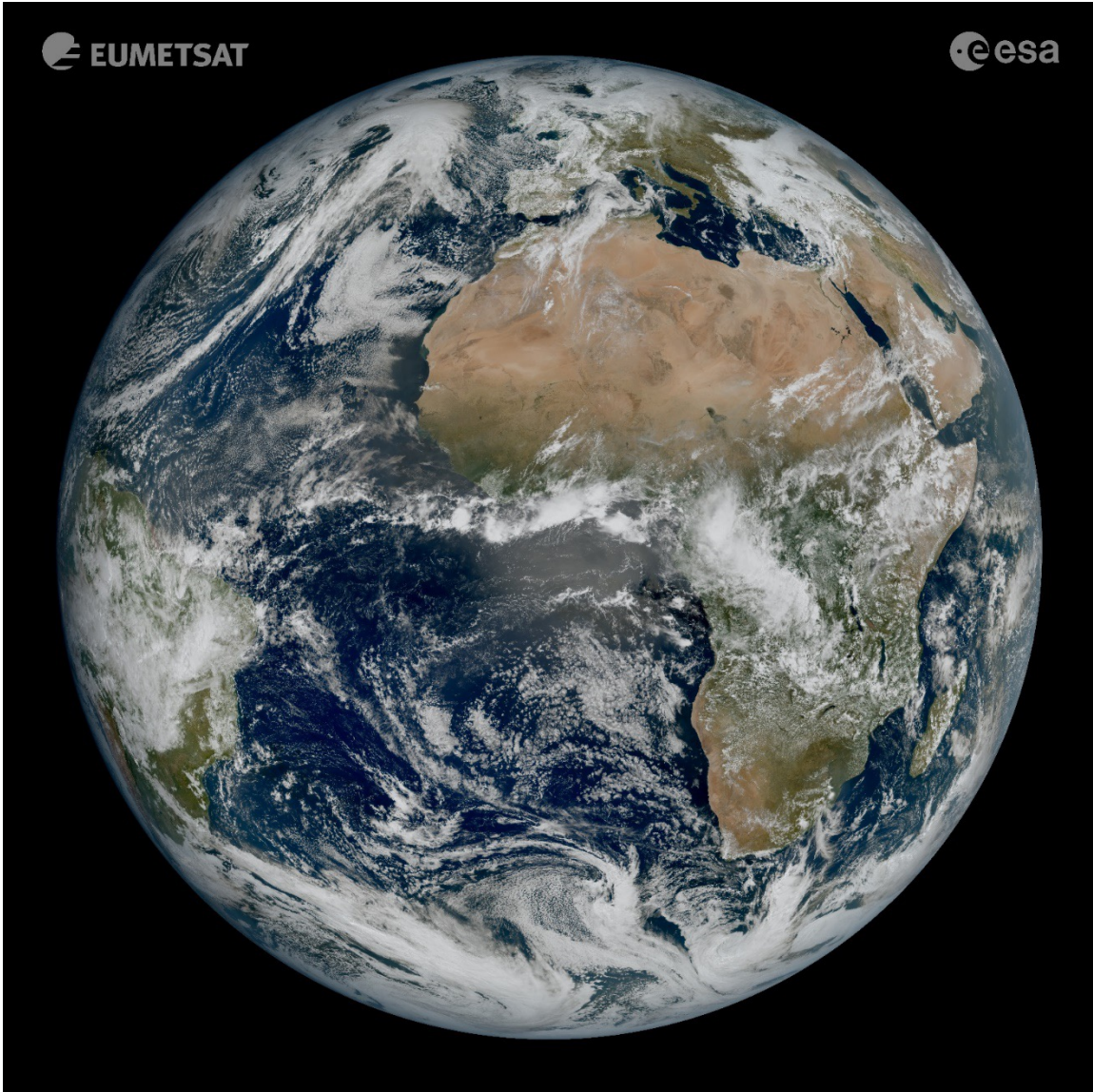
AGENDA

1. The 3 Es: who are we and what do we do
2. Climate data visualization – rationale for using
3. Climate data visualization – lessons learned, tips and examples
 - EUMETSAT/Copernicus best practice guide
 - Little Pictures
4. The Making Of: Cracked Sea Ice Loss
 - Arctic sea ice – the science
 - Data visualisation – the inspiration and process
 - Getting the data
 - Non-coding option for visualization
 - Coding option
5. The Little Picture gallery and competition

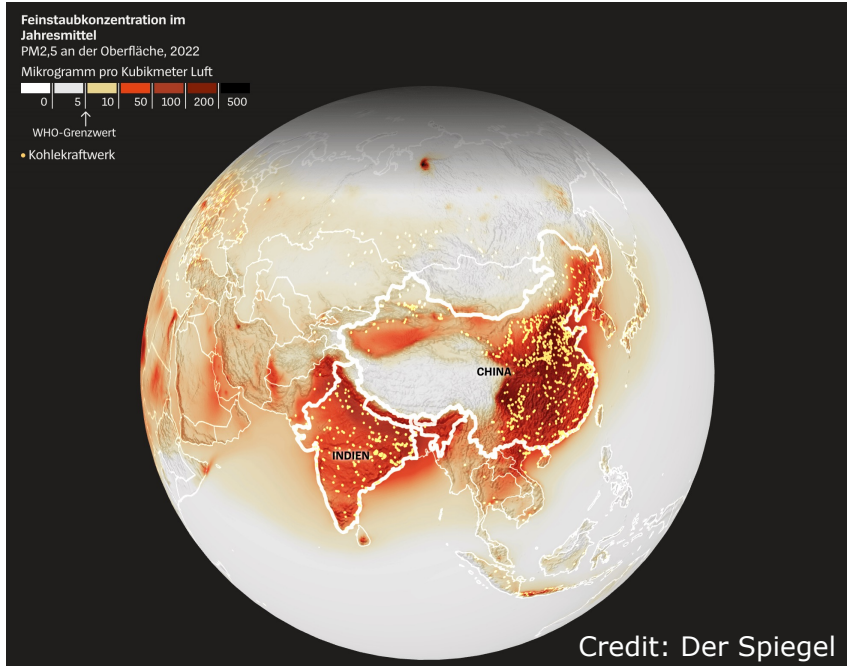
INTRODUCING ESA, EUMETSAT, ECMWF



CLIMATE DATA VISUALIZATION – WHY?



CLIMATE DATA VISUALIZATION – WHY?

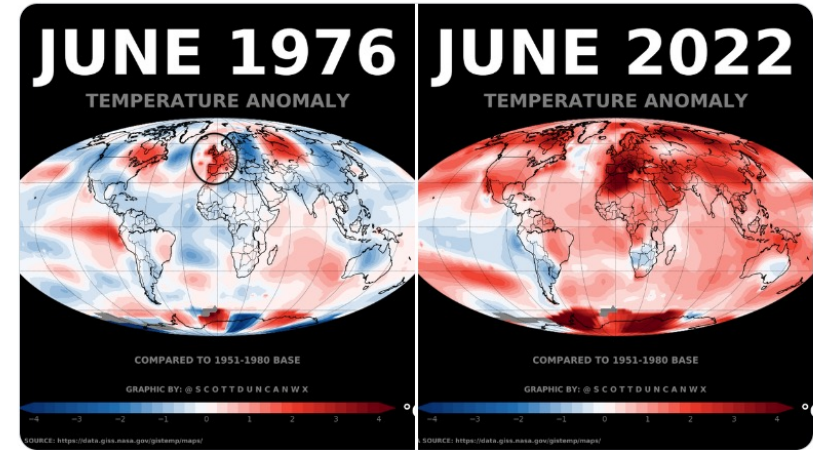


PROGRAMME OF THE EUROPEAN UNION | Copernicus | IMPLEMENTED BY ECMWF | Climate Change Service

Scott Duncan [@ScottDuncanWX](#) · Follow

We have not seen anything like it. We can't compare this looming heat emergency to summer 1976.

A warmer world, thanks to human induced climate change, makes it almost effortless to break extreme heat thresholds. We continue to see this across the planet - not just in Europe.



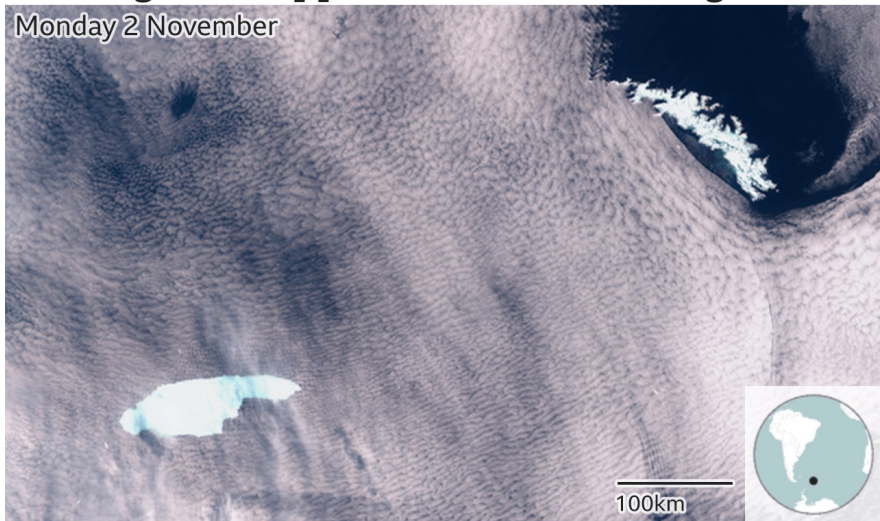
7:56 PM · Jul 17, 2022

19.3K Reply Share

Read 427 replies

Iceberg A68a approaches South Georgia

Monday 2 November

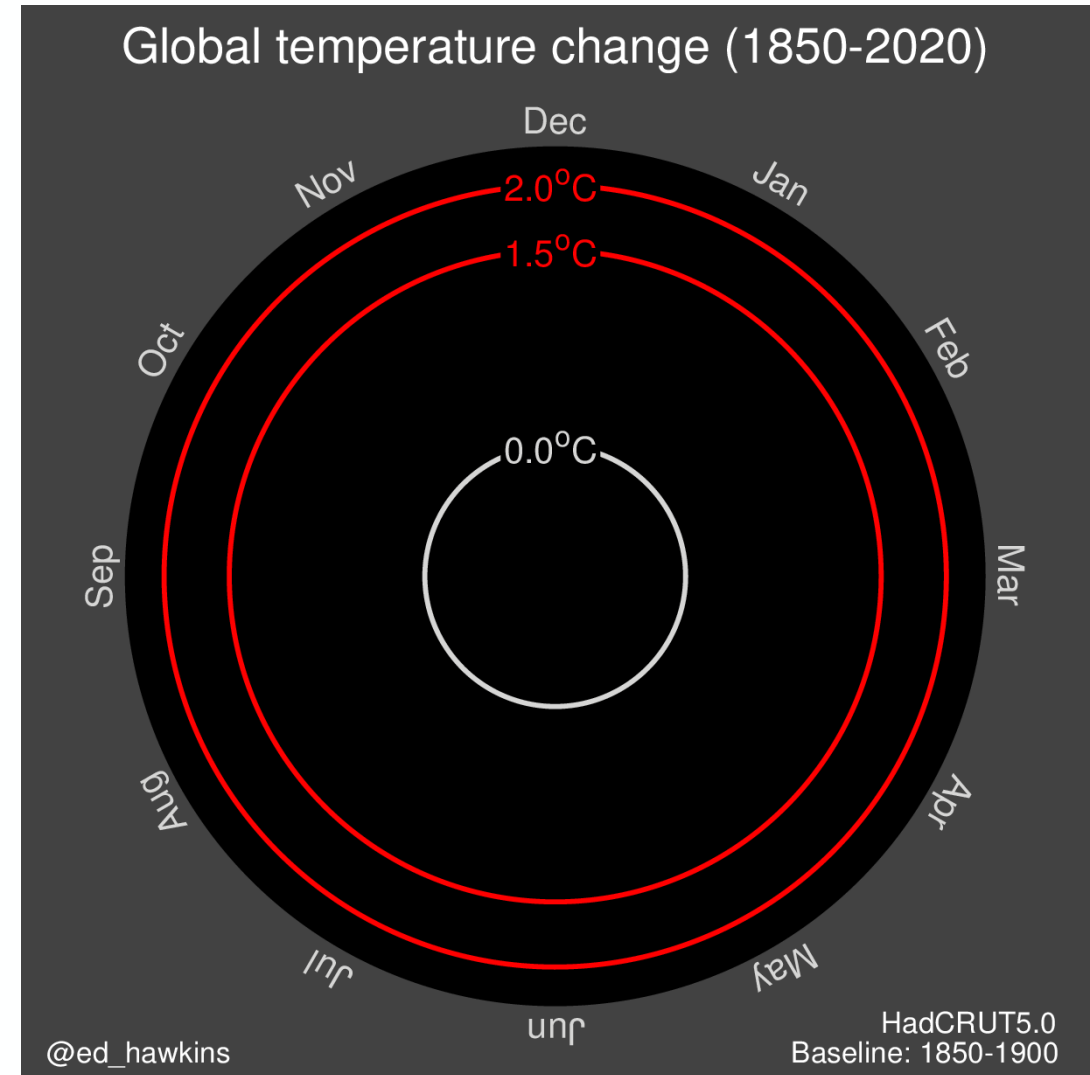
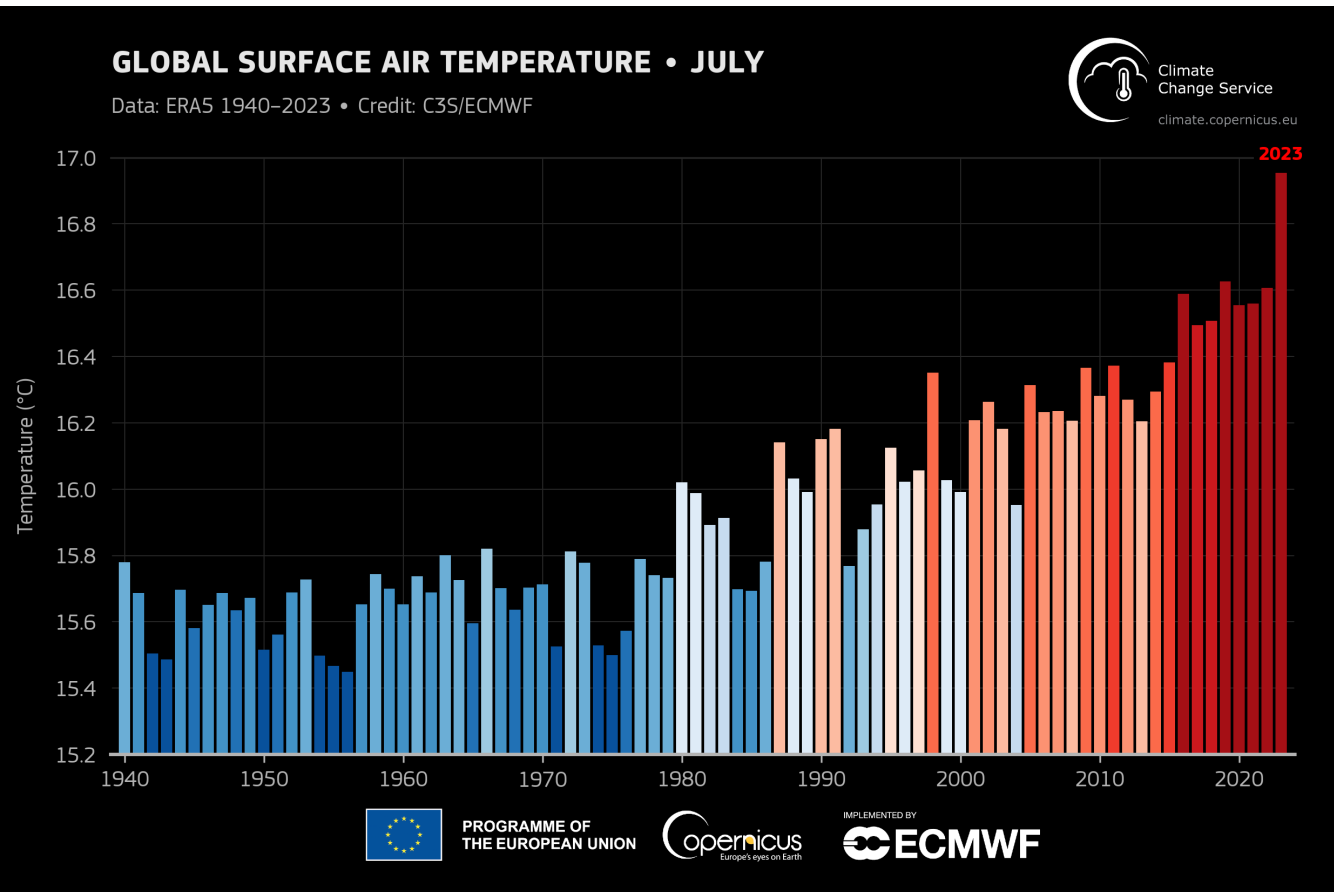


Source: Copernicus Data / Sentinel Hub



CLIMATE DATA VISUALIZATION – WHAT STORY DO WE WANT TO TELL?

Much to tell!



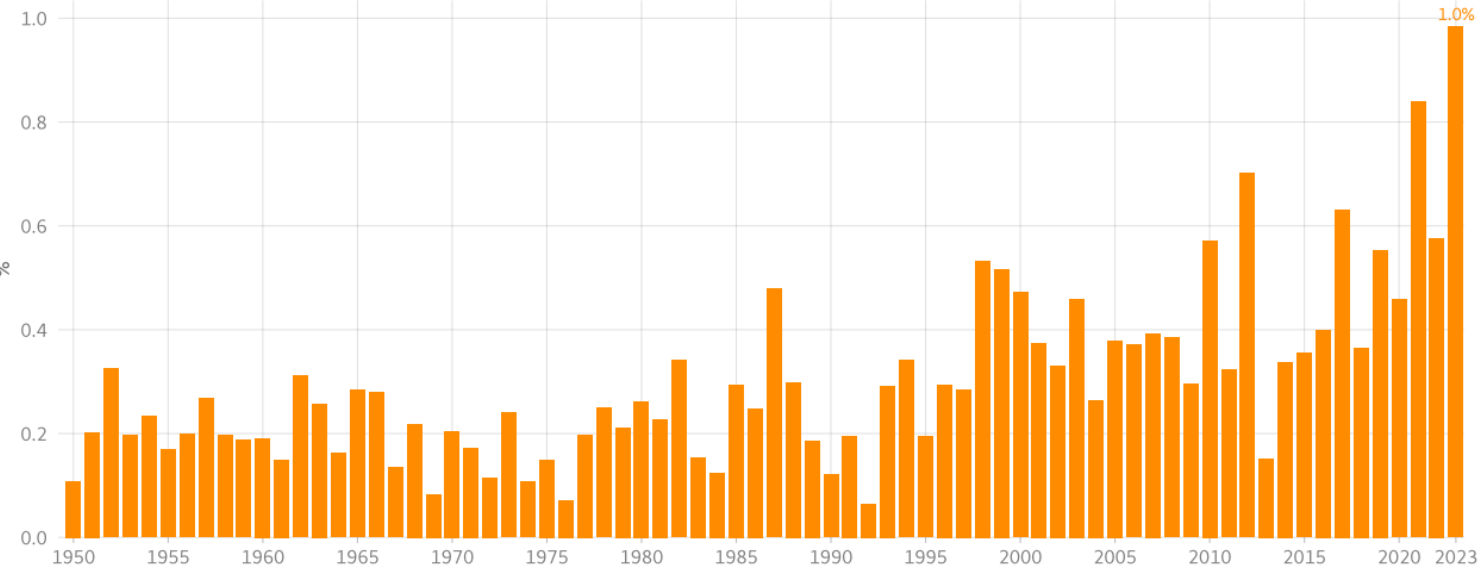
CLIMATE DATA VISUALIZATION – WHAT STORY DO WE WANT TO TELL?

Stories on impacts of global warming

PERCENTAGE OF DAYS WITH EXTREME HEAT STRESS • SUMMER (JJA)

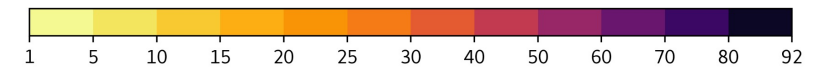
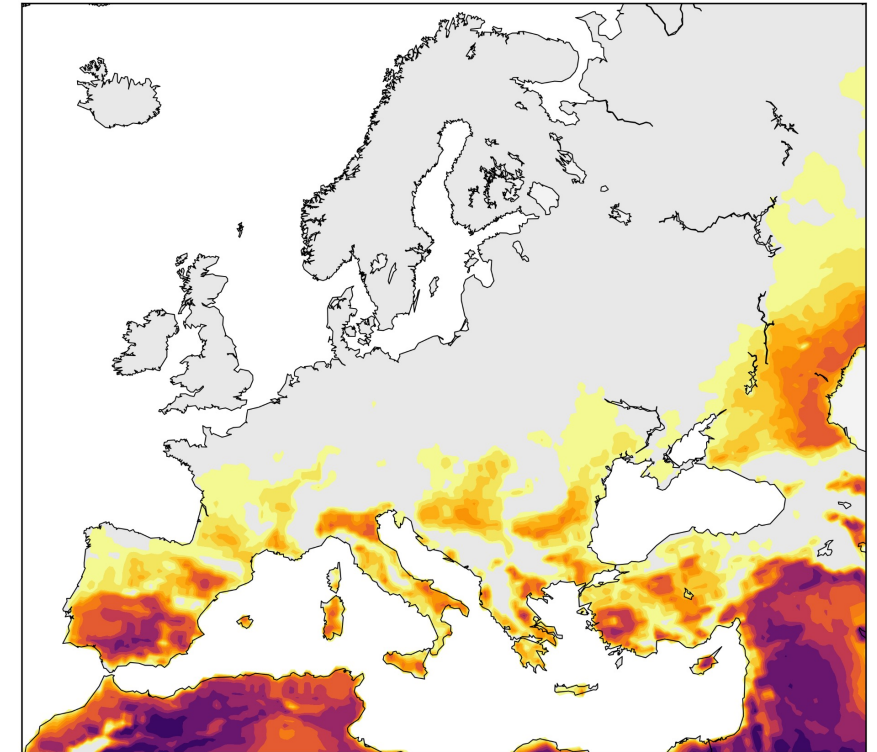
Southern Europe (land area, 25°W-40°E, 34°-45°N)

Data: ERA5-HEAT daily maximum Universal Thermal Climate Index (UTCI) • Credit: ECMWF/C3S



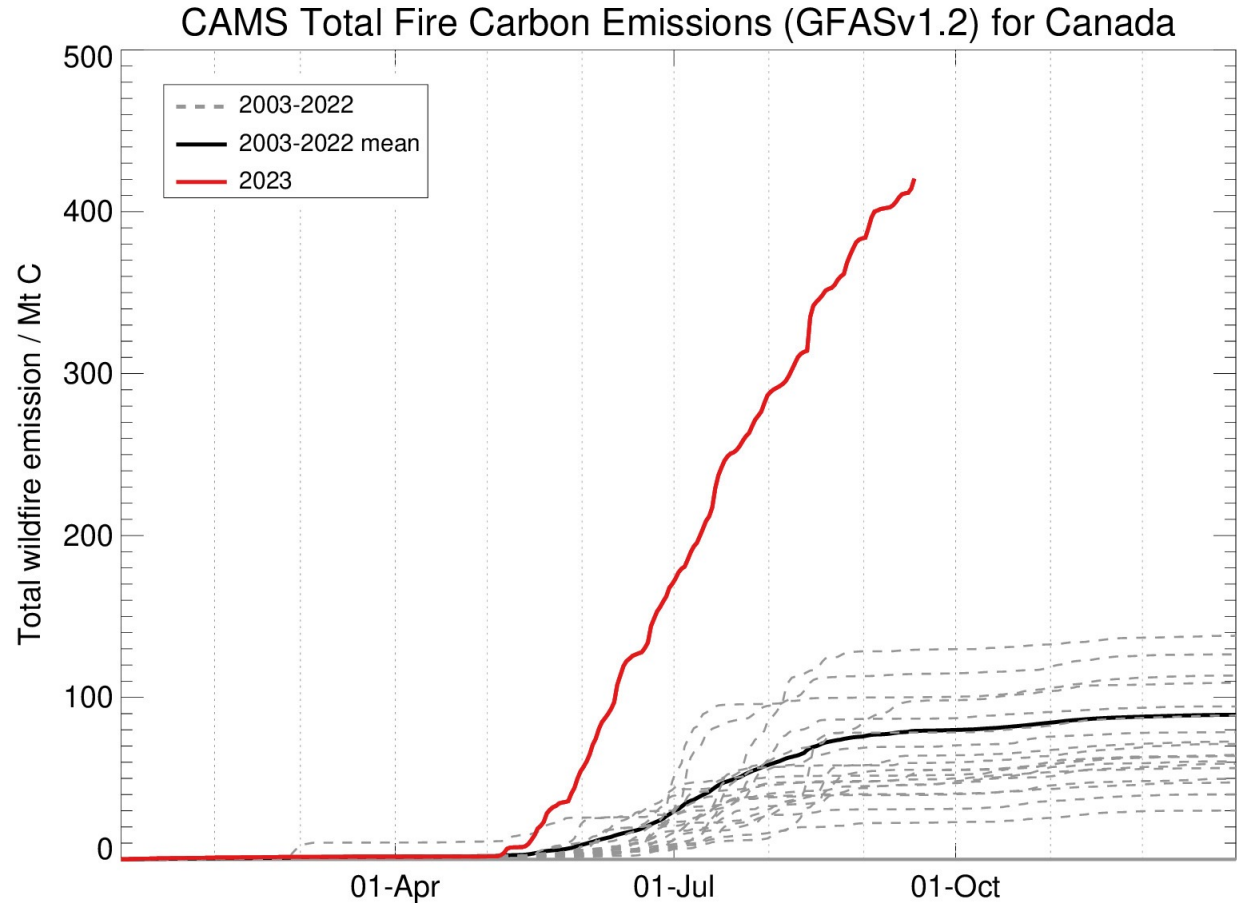
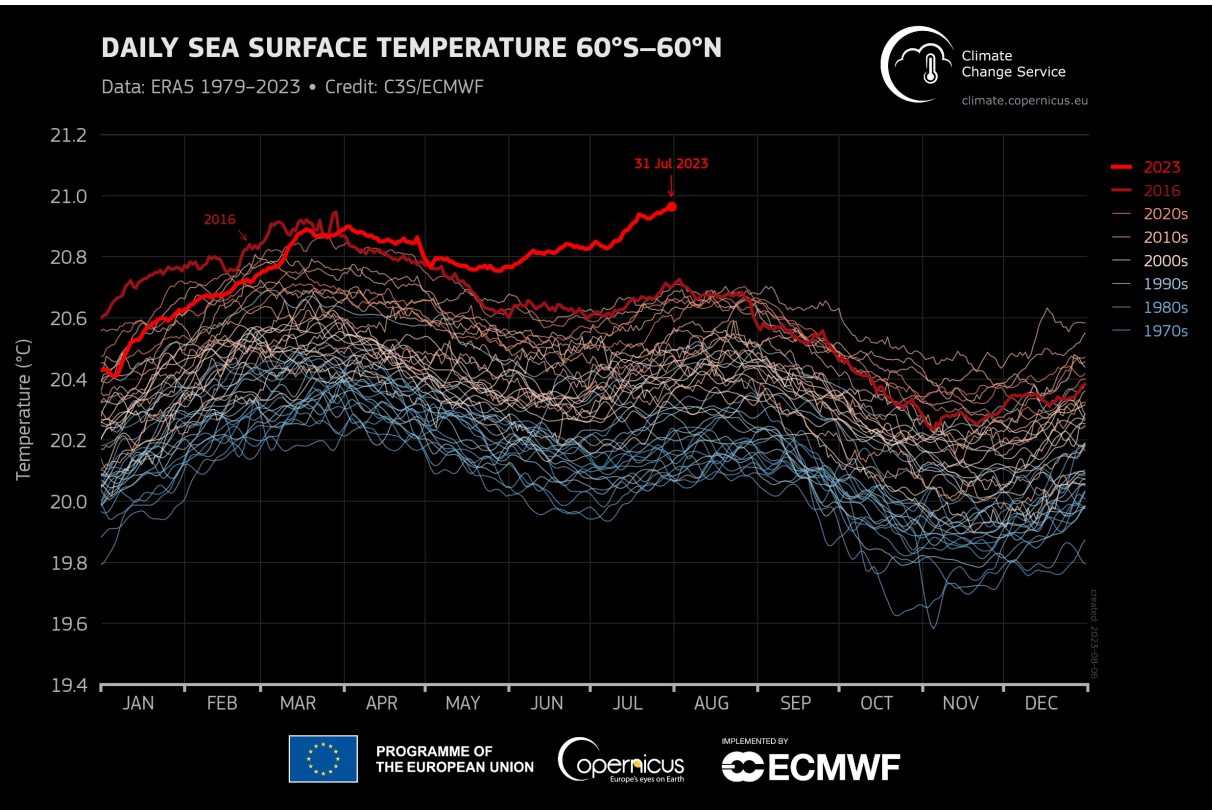
Number of Days with Very Strong Heat Stress • Summer (JJA) 2023

Data: ERA5-HEAT daily maximum Universal Thermal Climate Index (UTCI) • Credit: ECMWF/C3S



CLIMATE DATA VISUALIZATION – WHAT STORY DO WE WANT TO TELL?

Ample material for stories other than air °C



CLIMATE DATA VISUALIZATION – LESSON LEARNED, TIPS & TRICKS

EARTH OBSERVATION DATA VISUALISATION WORKSHOP SERIES



youtube.com/@EUMETSAT1

eo-data-vis-good-practice-guide.readthedocs.io



CLIMATE DATA VISUALIZATION – LESSON LEARNED, TIPS AND TRICKS

Key points for effective data visualization from recent workshop and Little Pictures experiences...

- Data must be appropriate for the story you are telling or...
...the story you are telling must represent the data!
 - Does the data represent change in the right context?
 - Are you able to attribute change?
 - Is the data representative? Globally? Regionally?
- Ask data experts for support. Best data for a story is not always the easiest/most available (we work on this!)
- Technical visualizations should be clear on their own....
....more creative ones can provoke but should not mislead!
- For wide reaching impact, draw on concepts that people know:
 - Comparisons for scale
 - Viral memes
 - Familiar games, cultural references etc

Visualisation Checklist - 10 points to consider

Key points to think about when storytelling with Earth observation data

1. Have you made sure that your image/animation is **simple and easy to understand**. If you can, test it with others before releasing it.
2. Does your image have a simple key, scale bar, and where relevant a background map, so that people understand the context and everything is clear in the image or animation?
3. Try to use a colour scheme that is clear and **appropriate for the data shown**.
4. Have you annotated the main features that you want to show e.g., wildfires? Don't assume that it will be obvious to everyone.
5. If you have labels on your image, try to **keep text to a minimum** and **avoid jargon** or specialised technical terms.
6. Can you include additional supporting information, where possible, to back up your image/animation?
7. If possible can you provide links, for instance, links to scenes in online Earth observation data viewers, so that others can recreate your image?
8. Have you made sure that your image/animation will **work with all mobile formats** for social media channels?
9. If it is a single image, would it be better to animate a series of images to make the focus more easy to see and understand?
10. Where possible, try to blend different types of Earth observation data, e.g., infrared or SAR data, as well as true colour imagery if it will help to highlight the focus of your image or animation.



PROGRAMME OF
THE EUROPEAN UNION



IMPLEMENTED BY EUMETSAT

COLOUR SCHEMES AND ACCESSIBILITY

Colour scales that are often illegible to those who are colour blind and can distort perceptions of data and alter the meaning by creating false boundaries between values. The tools and articles below help select appropriate palette.

Tools

Color Brewer - <https://colorbrewer2.org> – create colour schemes for maps and charts

HCL wizard - <http://hclwizard.org:3000/hclwizard/> - GUI for viewing, manipulating, and choosing HCL (hue-chroma-luminance) colour palettes

Colorgraphical - <http://vrl.cs.brown.edu/color> - generate a palette with n colors

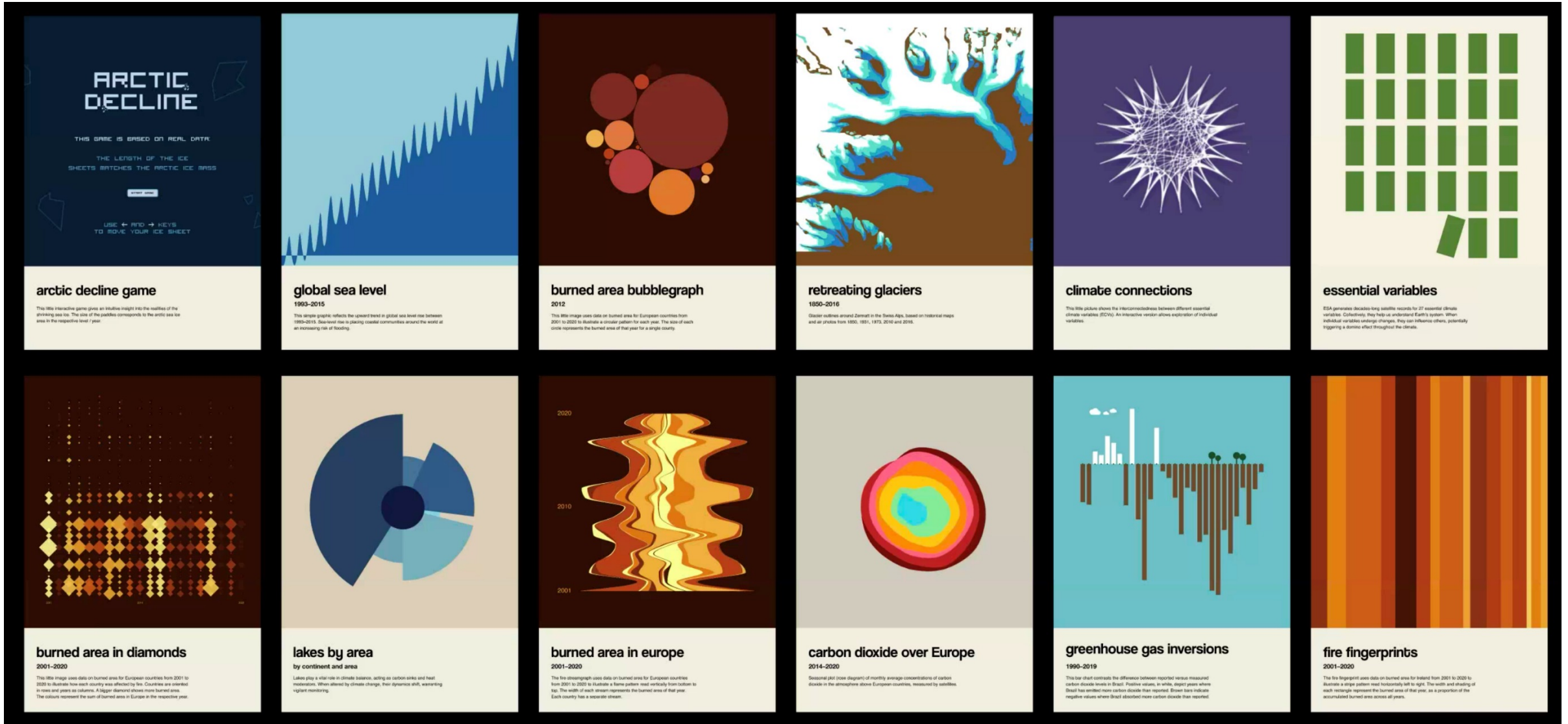
<http://www.vischeck.com/> - see how your figures might appear to those who are colour blind.

Articles

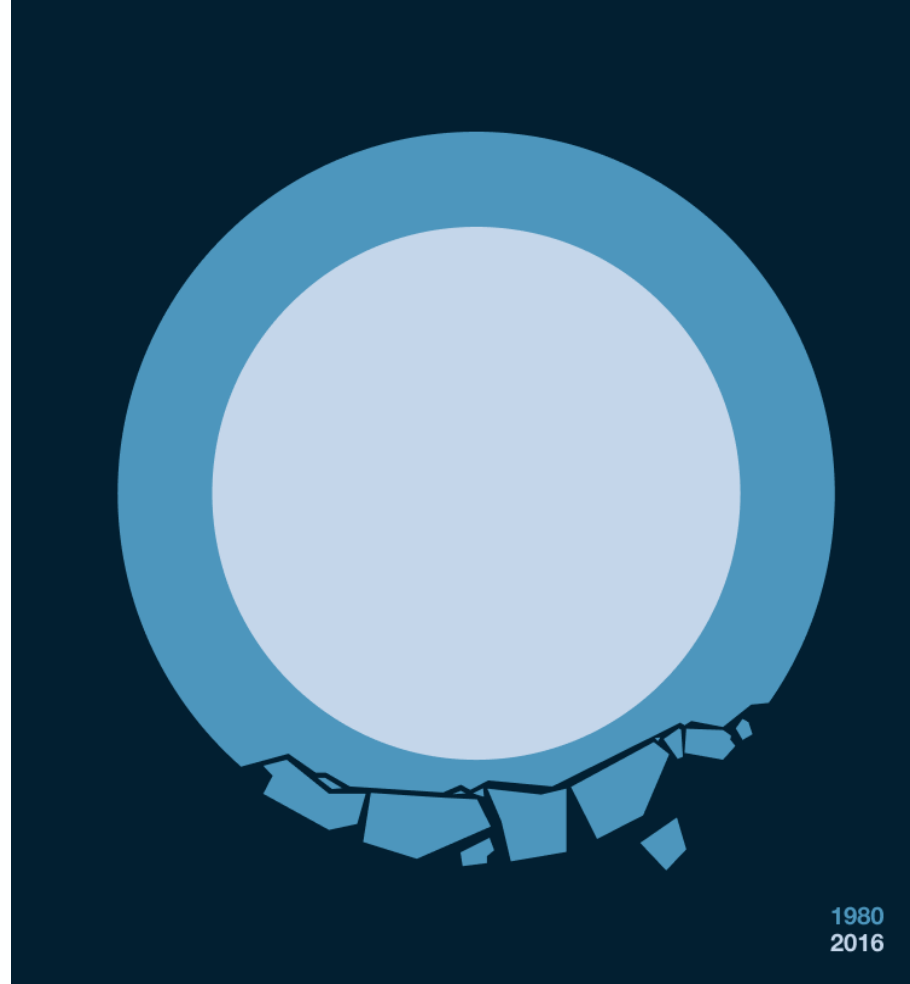
Scrap rainbow colour scales - <https://www.nature.com/articles/519291d> - discussion advocating dropping rainbow colour scales in scientific communication

Visualizing Science: How Color Determines What We See <https://eos.org/features/visualizing-science-how-color-determines-what-we-see>

LITTLE PICTURES



ANATOMY OF A LITTLE PICTURE



sea ice loss

1980 – 2016

This simple graphic depicting the reduction of Arctic sea ice between 1980 and 2016, highlights the urgency of the Arctic sea ice loss crisis. As our planet's temperature continues to rise due to climate change, the Arctic is losing sea ice.

← One message only

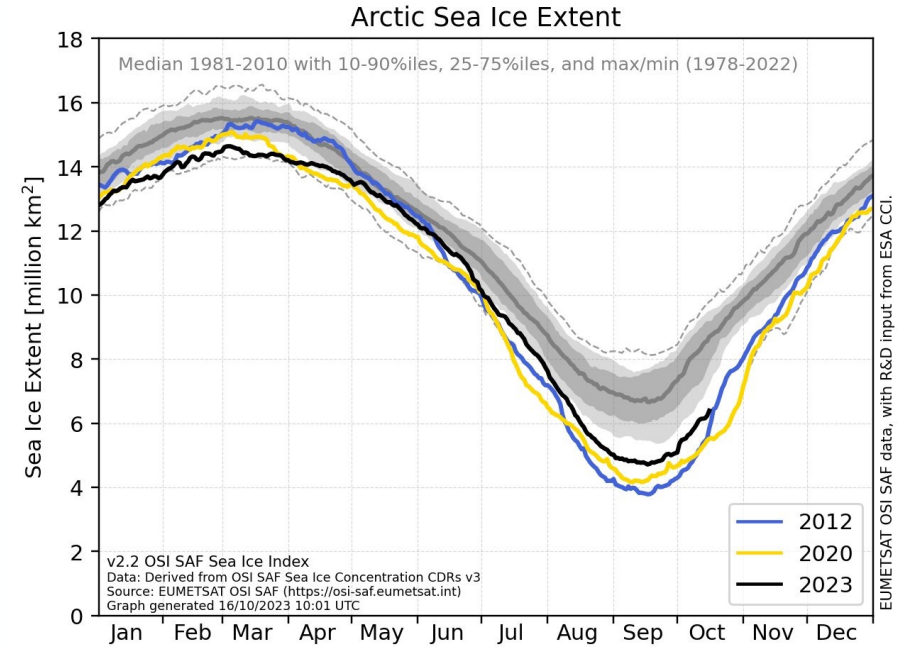
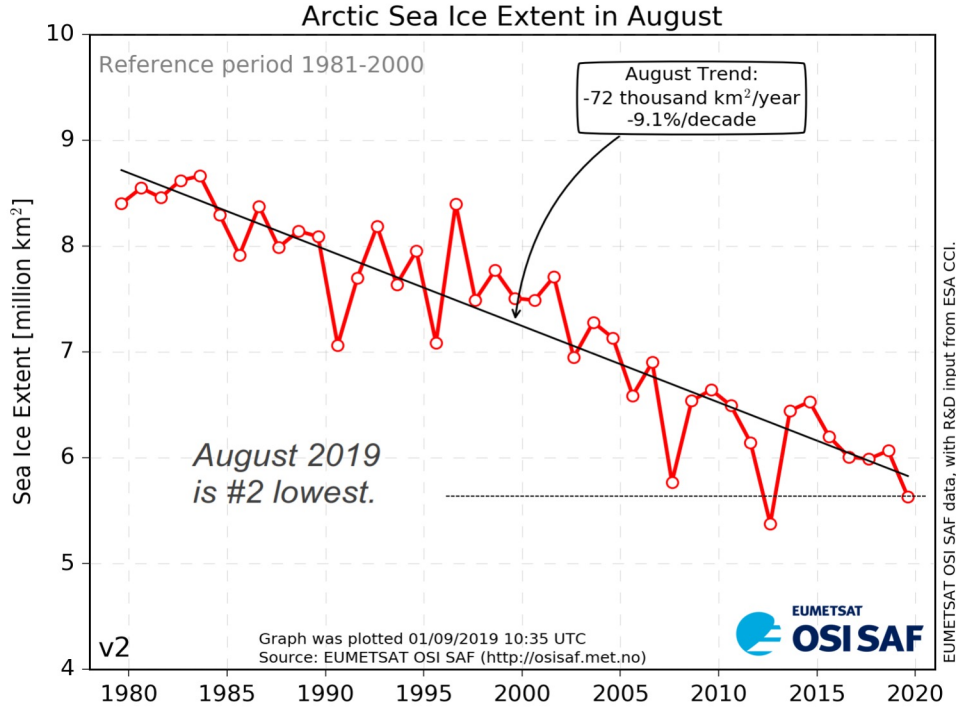
← Graphic design - art

← Data-driven by climate science data via EUMETSAT and ESA R&D (but don't use numbers)

← Emotive

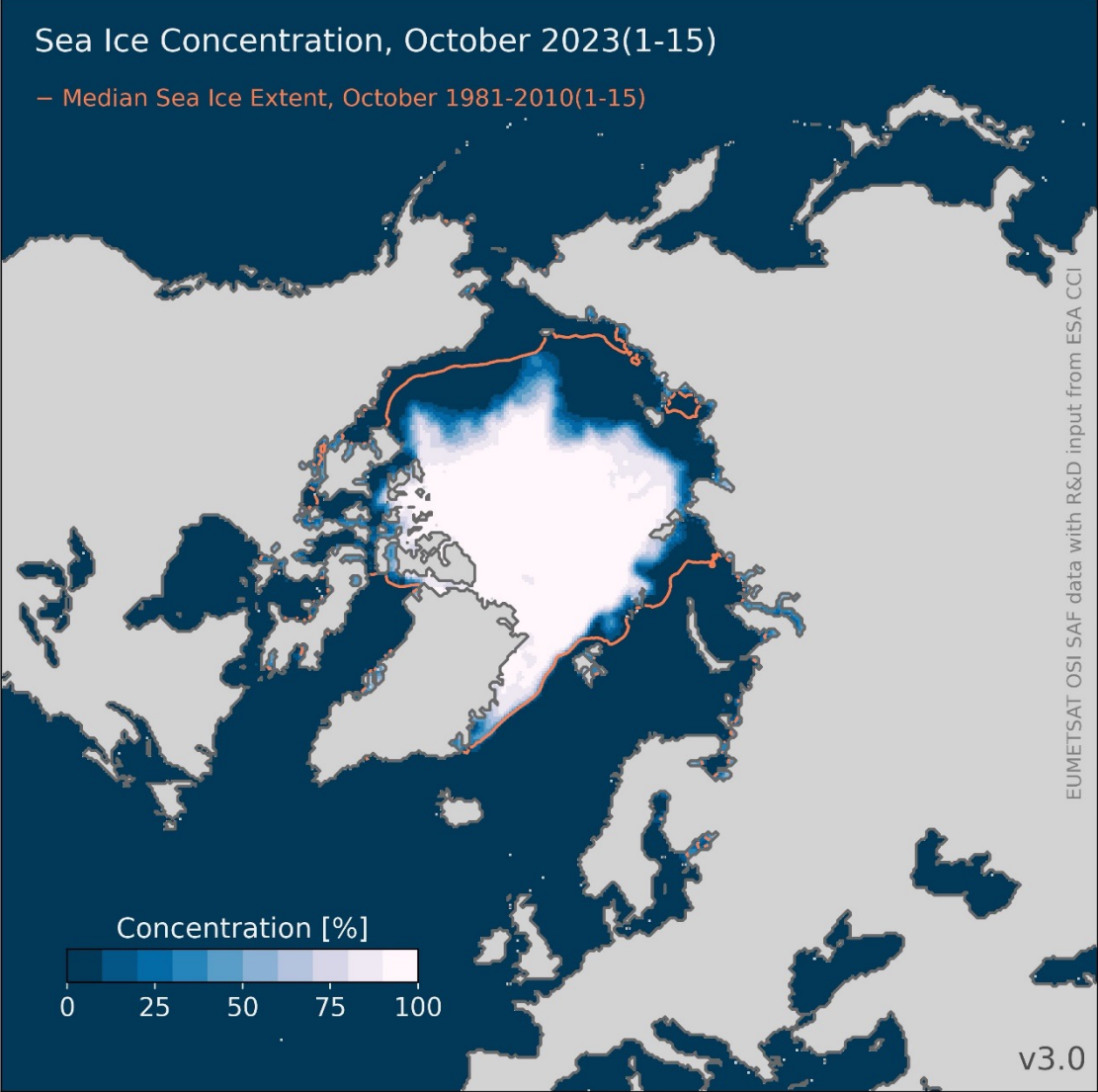
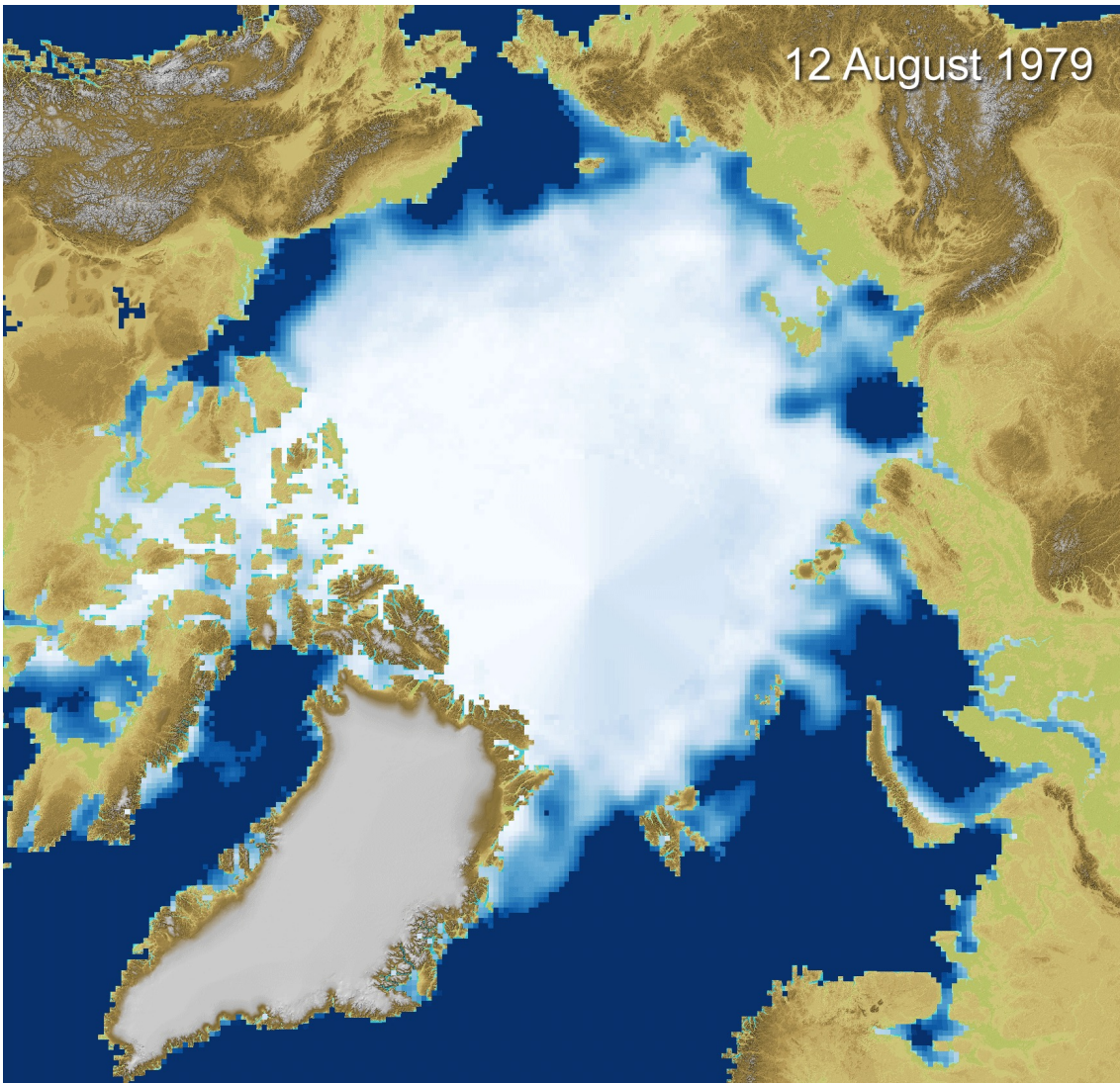
SCIENTIFIC GRAPHS: ARCTIC SEA ICE

Sea Ice Concentration / Area / Extent

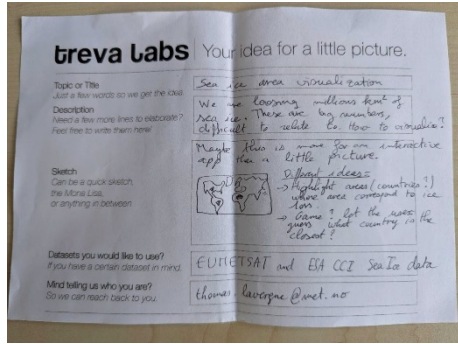


40+ years consistent sea ice extent

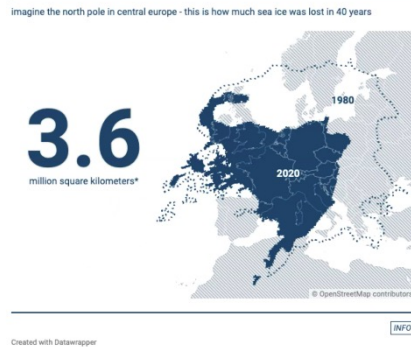
SCIENTIFIC MAPS: ARCTIC SEA ICE



THE MAKING OF: CRACKED SEA ICE LOSS



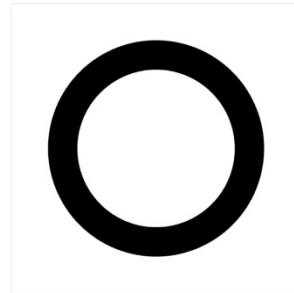
brainstorm



traditional map



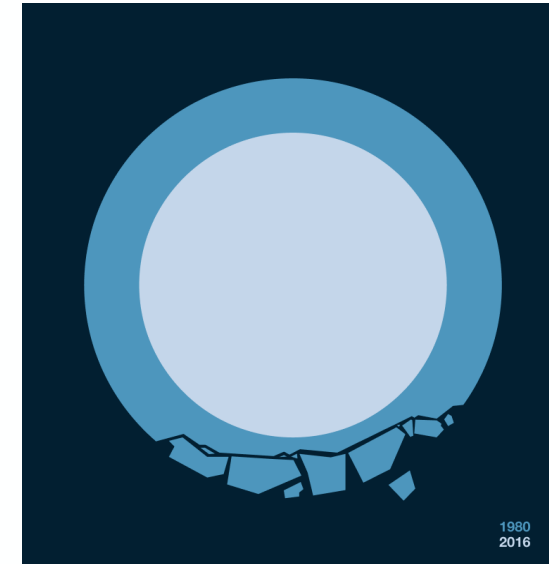
A Treva Labs production
Created with Datawrapper



minimal design



colour scheme

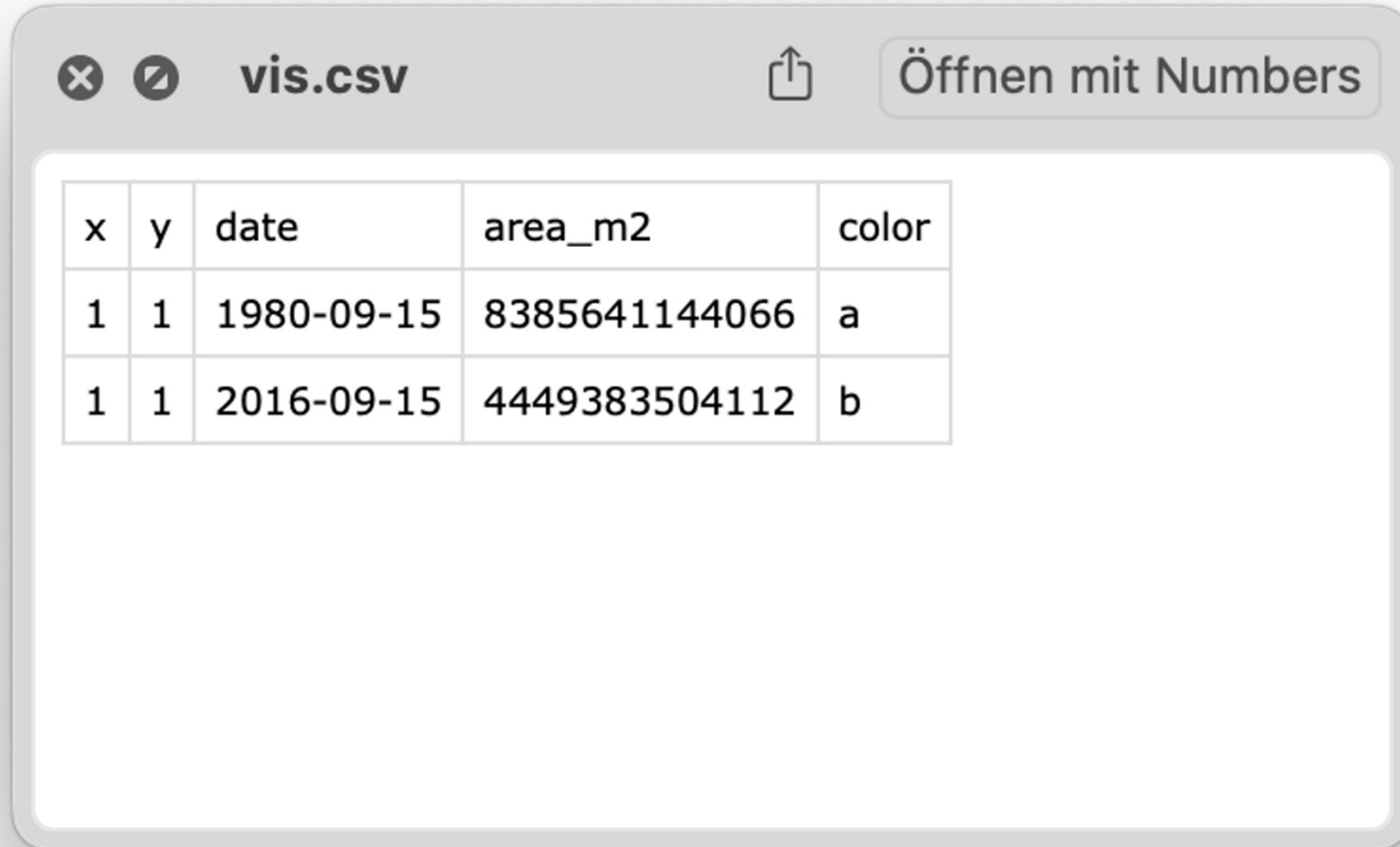


sea ice loss

1980 - 2016

This simple graphic depicting the reduction of Arctic sea ice between 1980 and 2016, highlights the urgency of the Arctic sea ice loss crisis. As our planet's temperature continues to rise due to climate change, the Arctic is losing sea ice.

ACCESSING THE DATA



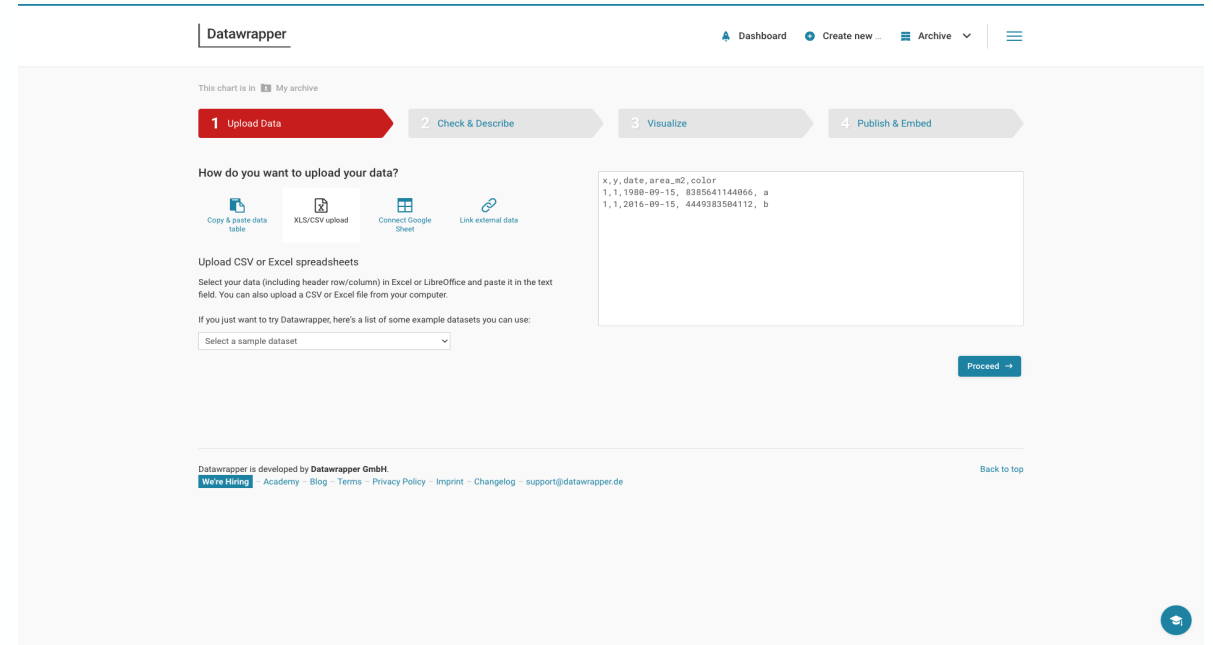
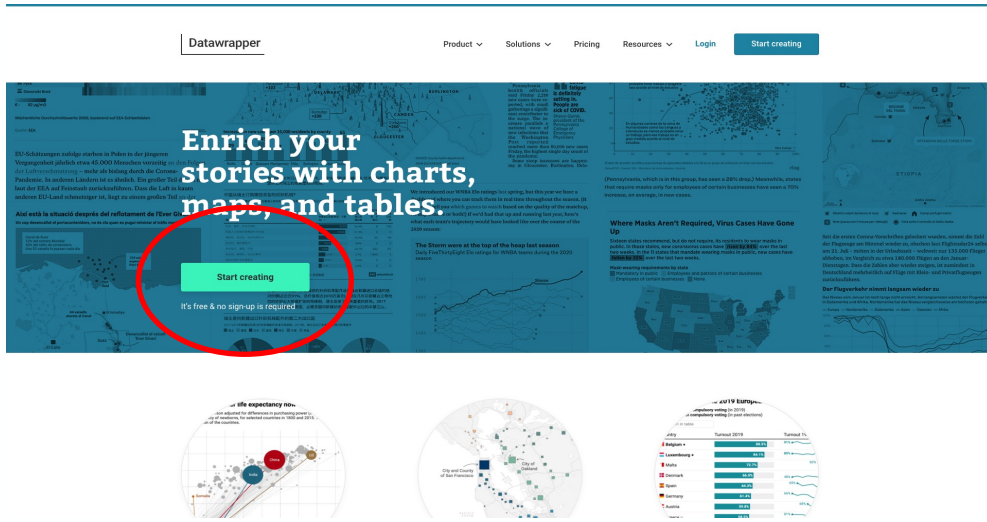
The image shows a file viewer window for a CSV file named 'vis.csv'. The window has a title bar with a close button, a share icon, and a button that says 'Öffnen mit Numbers'. The main content area displays a table with the following data:

x	y	date	area_m2	color
1	1	1980-09-15	8385641144066	a
1	1	2016-09-15	4449383504112	b

→ eumetsat.int/eumetsat-data-store (full dataset)

→ climate.esa.int/littlepicturescompetition/ (github repository)

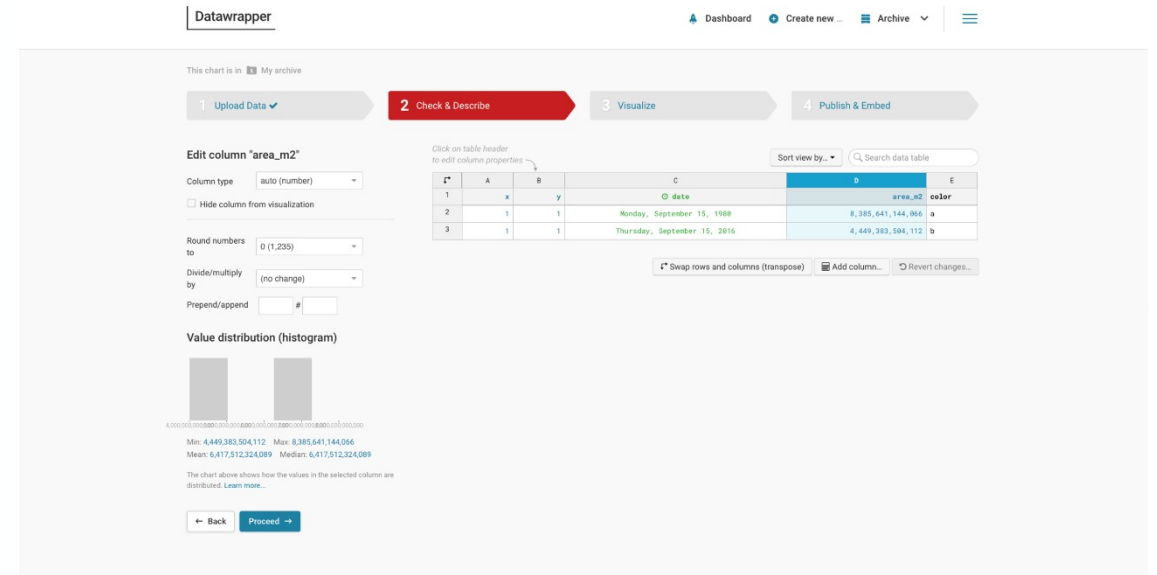
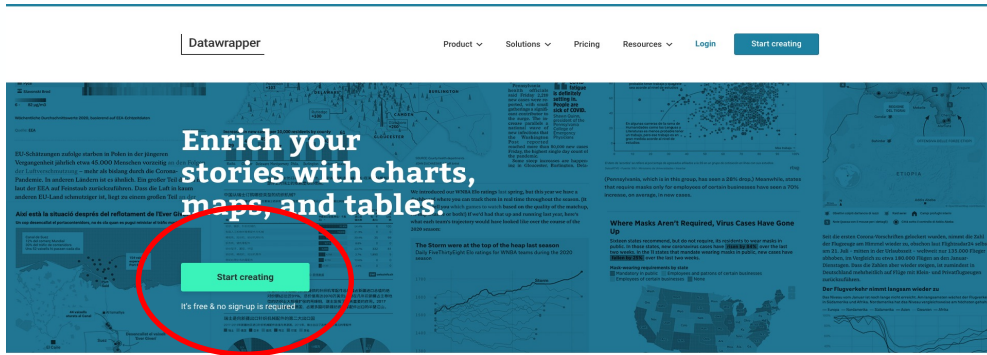
NO CODING VISUALISATION: DATAWRAPPER



4-step approach

1. **Add data** - copy n paste csv; check & describe, is it parsed correctly?
2. **Visualise** - Scatter Plot. Refine in the “Size” and the “Color” sections. Experiment with other settings to create different results
3. **Annotate**
4. **Publish & Embed** embed link or png for social media

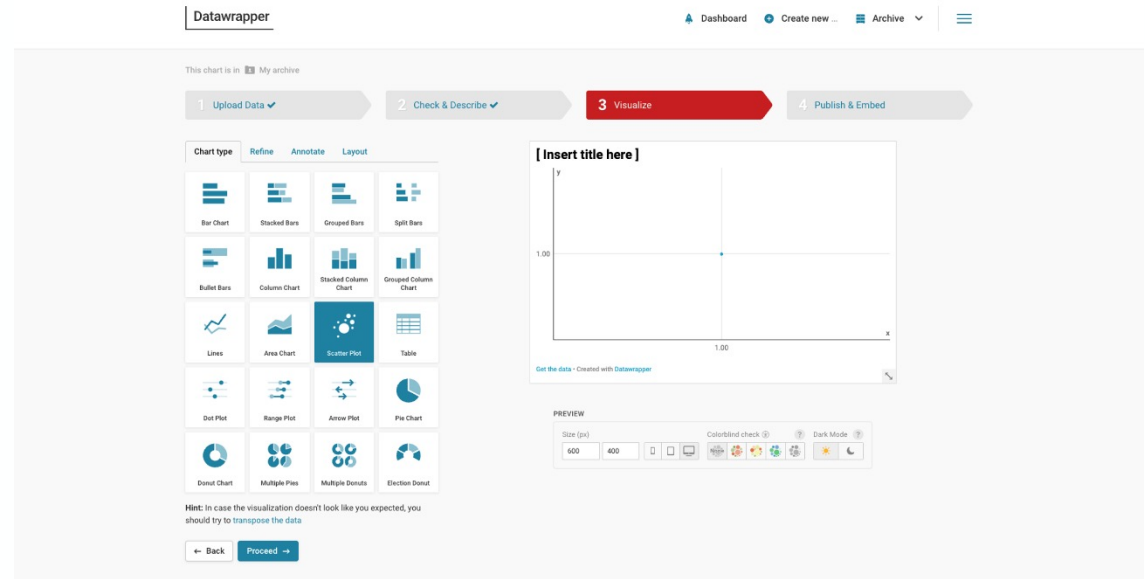
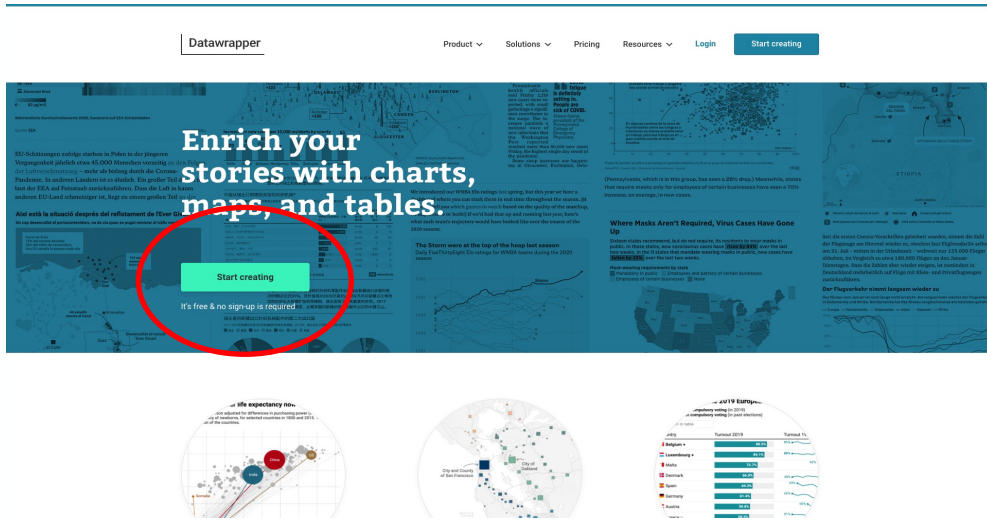
NO CODING VISUALISATION: DATAWRAPPER



4-step approach

1. **Add data** - copy n paste csv; check & describe, is it parsed correctly?
2. **Visualise** - Scatter Plot. Refine in the “Size” and the “Color” sections. Experiment with other settings to create different results
3. **Annotate**
4. **Publish & Embed** embed link or png for social media

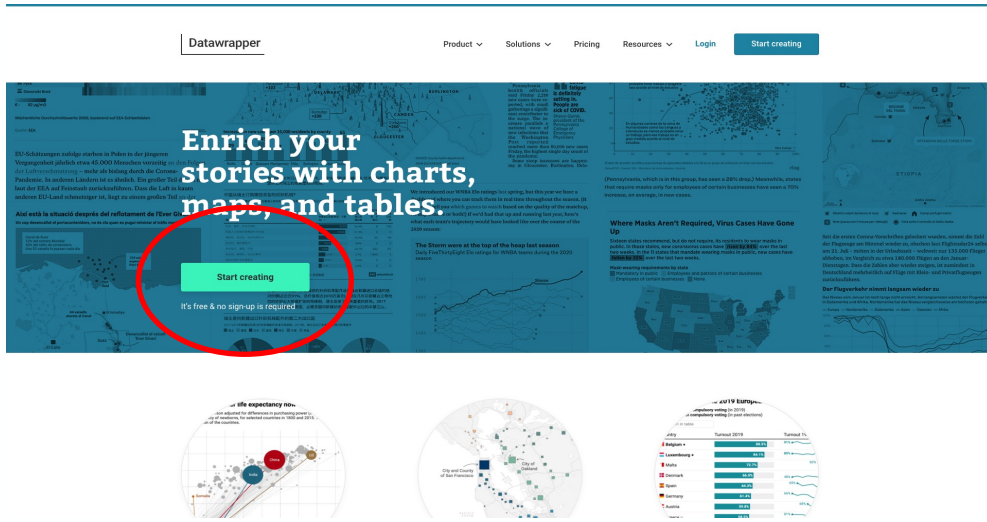
NO CODING VISUALISATION: DATAWRAPPER



4-step approach

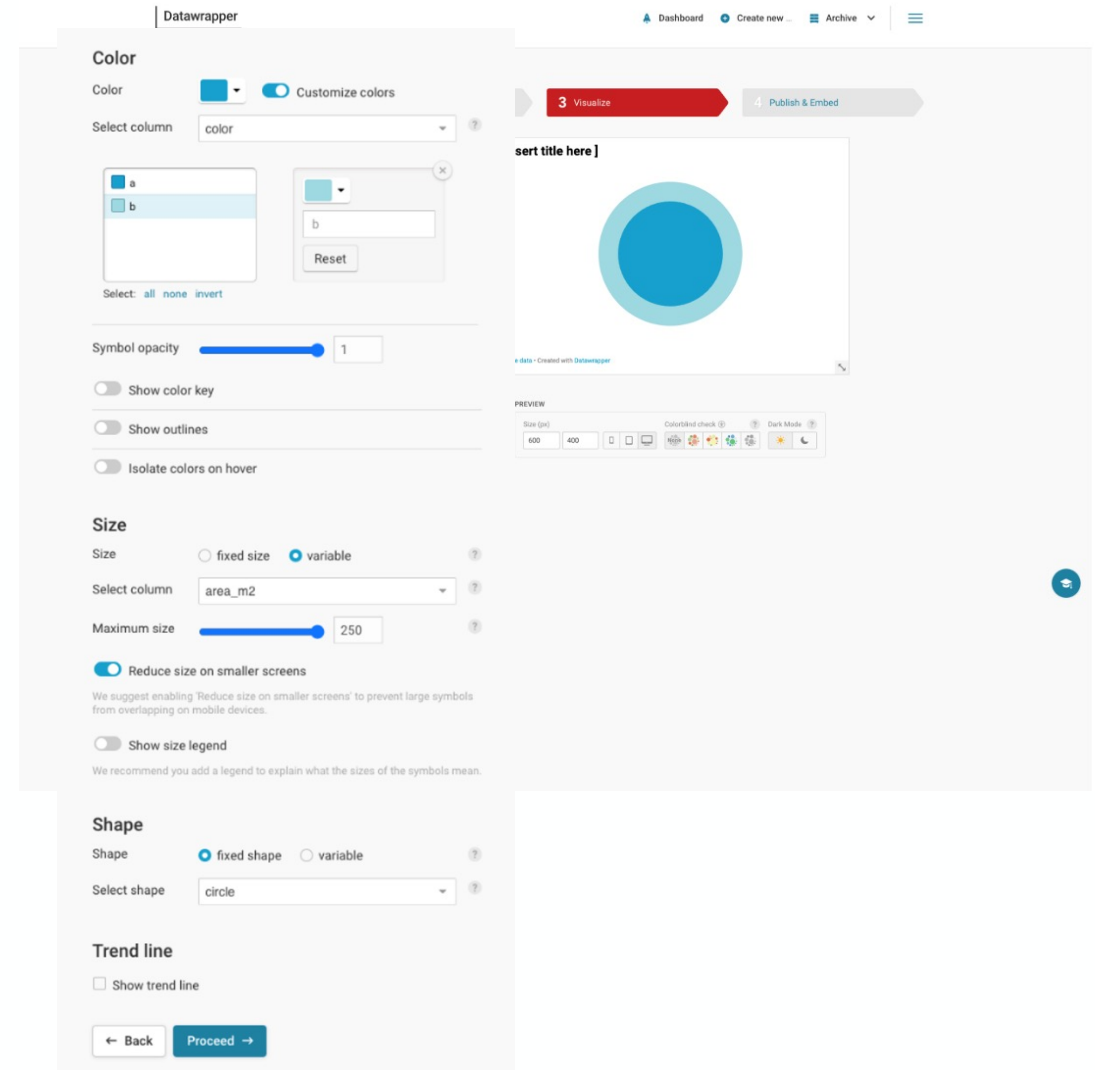
1. **Add data** - copy n paste csv; check & describe, is it parsed correctly?
2. **Visualise** - Scatter Plot. Refine in the “Size” and the “Color” sections. Experiment with other settings to create different results
3. **Annotate**
4. **Publish & Embed** embed link or png for social media

NO CODING VISUALISATION: DATAWRAPPER

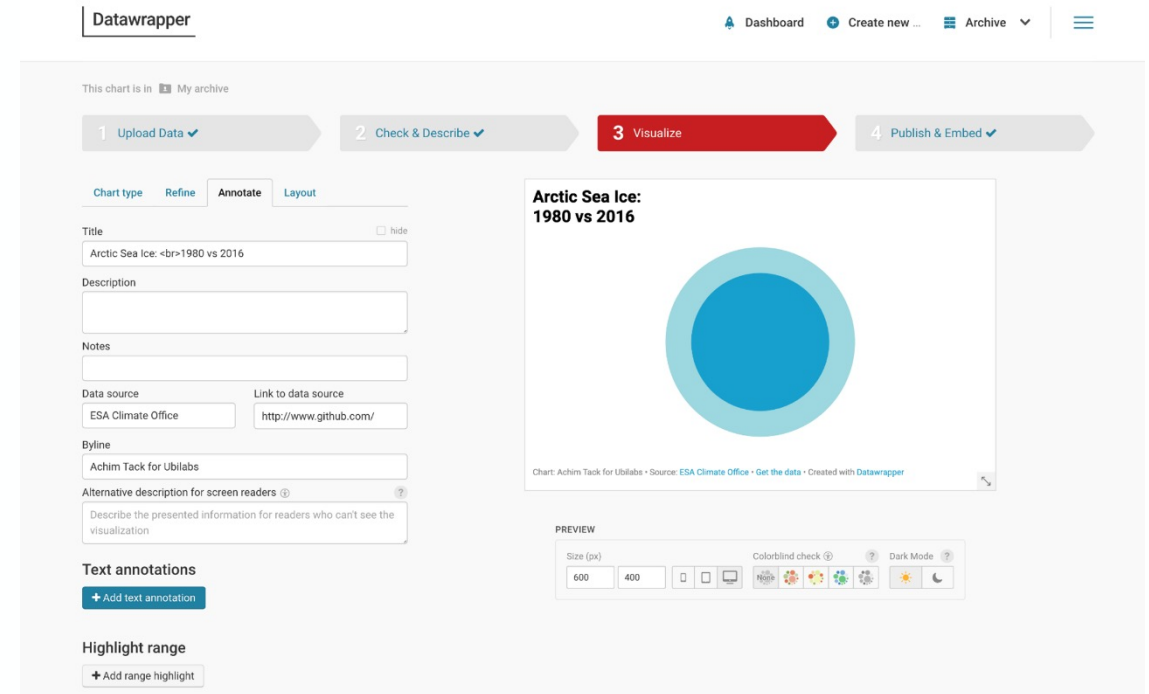
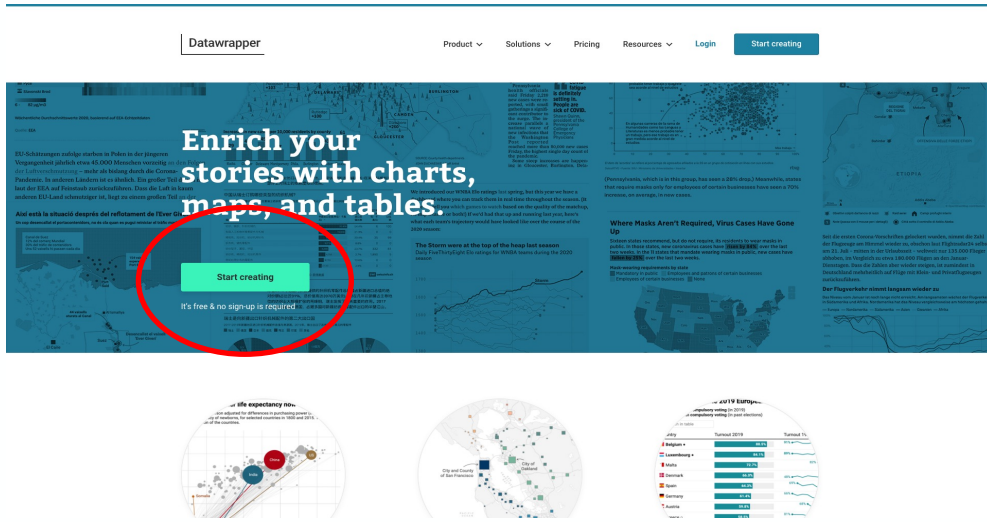


4-step approach

1. **Add data** - copy n paste csv; check & describe, is it parsed correctly?
2. **Visualise** - Scatter Plot. Refine in the “Size” and the “Color” sections. Experiment with other settings to create different results
3. **Annotate**
4. **Publish & Embed** embed link or png for social media



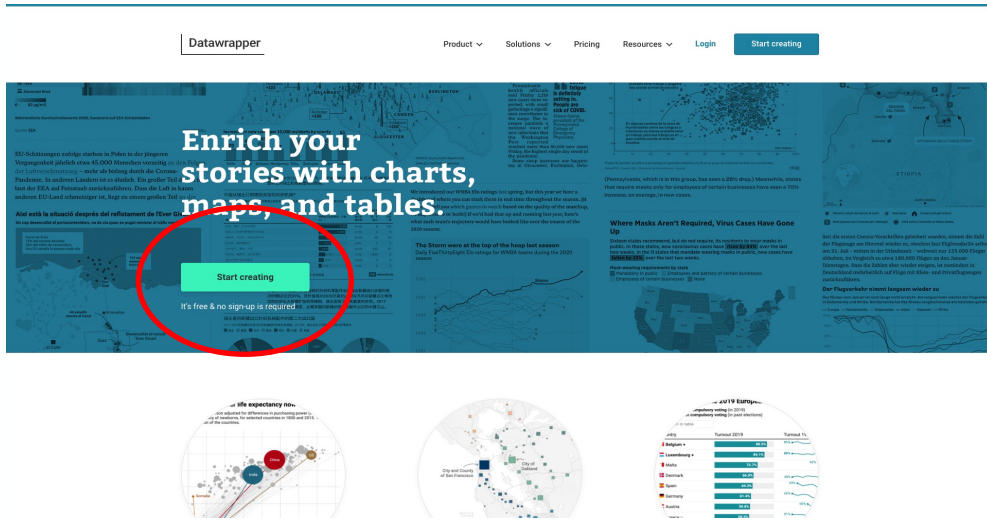
NO CODING VISUALISATION: DATAWRAPPER



4-step approach

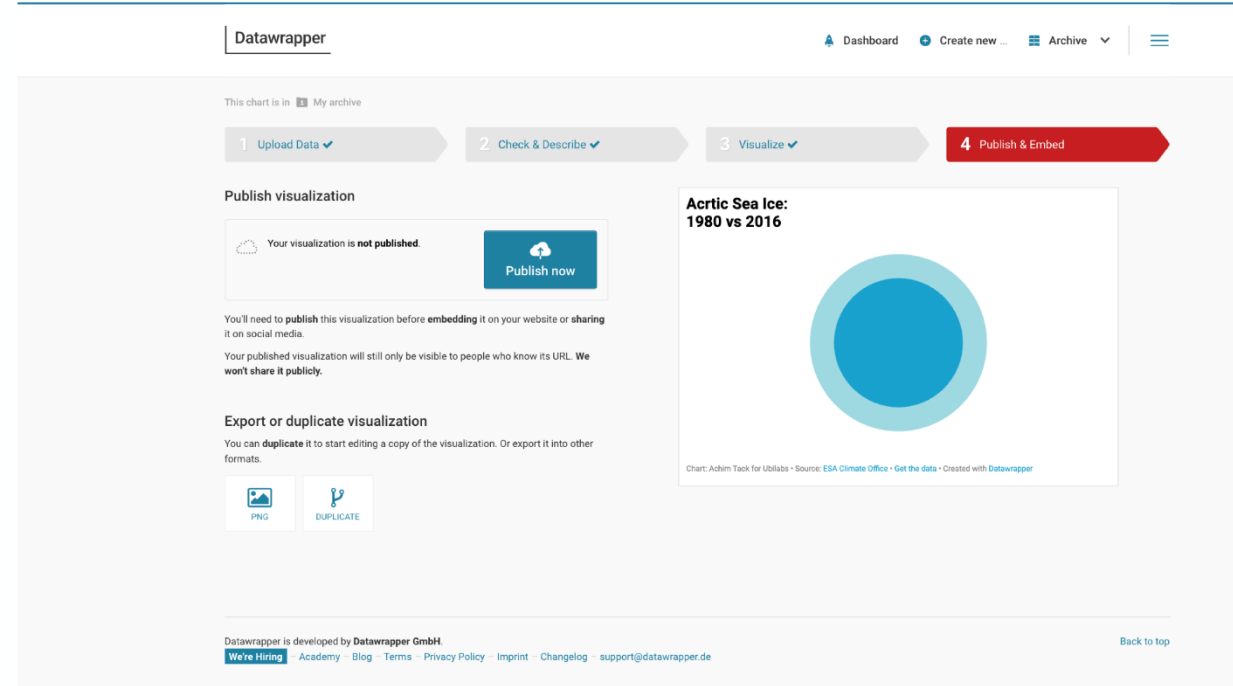
1. **Add data** - copy n paste csv; check & describe, is it parsed correctly?
2. **Visualise** - Scatter Plot. Refine in the “Size” and the “Color” sections. Experiment with other settings to create different results
3. **Annotate**
4. **Publish & Embed** embed link or png for social media

NO CODING VISUALISATION: DATAWRAPPER



4-step approach

1. **Add data** - copy n paste csv; check & describe, is it parsed correctly?
2. **Visualise** - Scatter Plot. Refine in the “Size” and the “Color” sections. Experiment with other settings to create different results
3. **Annotate**
4. **Publish & Embed** embed link or png for social media



CODING YOUR LITTLE PICTURE - USE A PYTHON SCRIPT



```
import altair as alt
import pandas as pd

[ ] # read csv file provided in data folder
df = pd.read_csv('SealceLossTheIceBreakerLittlePicture.csv.csv')

# create km2 column from m2
df['area_km2'] = df['area_m2'] / 1000000

# convert the area_km2 values to integer
df['area_km2'] = df['area_km2'].astype('int')

# create a tooltip column by concatenating the 'arctic sea ice in ', year from the date column,
# and the area_km2 values formatted with a comma separator and no decimal places
df['tooltip'] = 'arctic sea ice in ' + df['date'].str[:4] + ': ' + df['area_km2'].map('{:,0f}'.format).astype('string') + 'km2'

df.head()
```

x	y	date	area_m2	color	area_km2	tooltip
0	1	1980-09-15	8385641144066	a	8385641	arctic sea ice in 1980: 8,385,641km2
1	1	2016-09-15	4449383504112	b	4449383	arctic sea ice in 2016: 4,449,383km2

```
[ ] # main chart
color_scale = alt.Scale(domain=['1980-09-15', '2016-09-15'], range=['black', 'white'])

chart = alt.Chart(df).mark_circle(opacity=1).encode(
    x=alt.X('x', title=None, scale=alt.Scale(domain=[0, 2]), axis=None),
    y=alt.Y('y', title=None, scale=alt.Scale(domain=[0, 2]), axis=None),
    size=alt.Size('area_km2', scale=alt.Scale(range=[0, 2000000]), legend=None),
    color=alt.Color('date:N', scale=color_scale, legend=None),
    tooltip = 'tooltip'
).properties(
    width=600,
    height=600
)

chart
```

1. Download & Open Jupyter notebook
 2. Local or cloud environment (Google Colab or noteable.io)
 3. Install [altair python library](#) - for creating and tweaking the charts
 4. Add the data from the CSV
 5. Select “run all cells”
- in-line commands and markup helps to guide you

CODING YOUR LITTLE PICTURE - USE A PYTHON SCRIPT

clip_SealceLossTheIceBreakerLittlePicture.csv.ipynb ☆

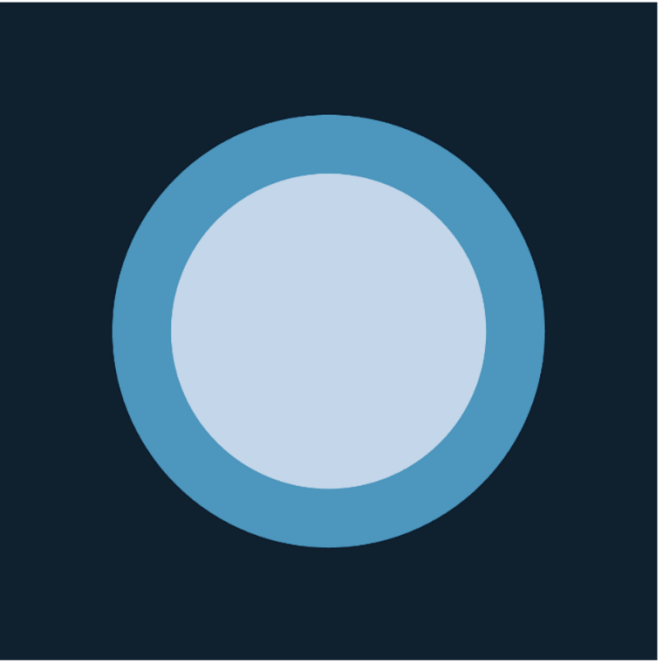
Datei Bearbeiten Anzeige Einfügen Laufzeit Tools Hilfe Alle Änderungen wurden gespeichert

Kommentar Teilen

RAM Laufwerk

Dateien

- sample_data
- SealceLossTheIceBrea...



```
[ ] ## Bauhaus Style Poster

# main chart
color_scale = alt.Scale(domain=['1980-09-15', '2016-09-15'], range=['#4d96bd', '#c4d6ea'])

chart = alt.Chart(df).mark_circle(opacity=1).encode(
  x=alt.X('x', title=None, scale=alt.Scale(domain=[0, 2]), axis=None),
  y=alt.Y('y', title=None, scale=alt.Scale(domain=[0, 2]), axis=None),
  size=alt.Size('area_km2', scale=alt.Scale(range=[0, 200000]), legend=None),
  color=alt.Color('date:N', scale=color_scale, legend=None),
  tooltip = 'tooltip'
```

Laufwerk 84.44 GB verfügbar

CODING YOUR LITTLE PICTURE - USE A PYTHON SCRIPT

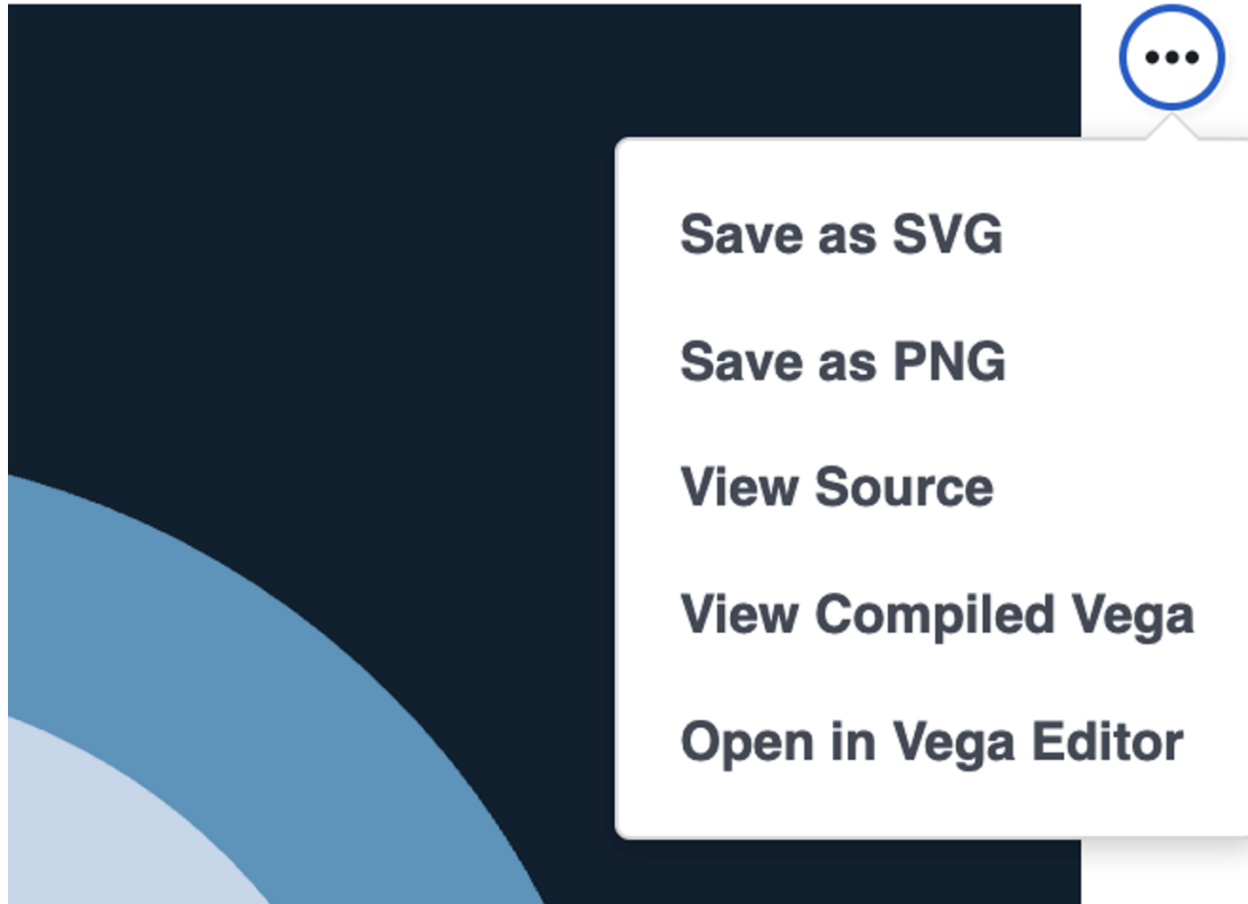
The screenshot shows a Jupyter Notebook interface. At the top, the title is "clip_SealceLossTheIceBreakerLittlePicture.csv.ipynb". Below the title, there are navigation options: "Datei", "Bearbeiten", "Anzeige", "Einfügen", "Laufzeit", "Tools", "Hilfe", and "Alle Änderungen wurden gespeichert". On the right, there are options for "Kommentar", "Teilen", and a user profile icon. Below the navigation bar, there are tabs for "Dateien", "+ Code", and "+ Text". The "Dateien" tab is active, showing a file explorer with a folder named "sample_data" and a file named "SealceLossTheIceBrea...". The main area of the notebook is divided into two sections: a code cell and an output cell. The code cell contains the following Python code:

```
[ ] ## Bauhaus Style Poster

# main chart
color_scale = alt.Scale(domain=['1980-09-15', '2016-09-15'], range=['#4d96bd', '#c4d6ea'])

chart = alt.Chart(df).mark_circle(opacity=1).encode(
  x=alt.X('x', title=None, scale=alt.Scale(domain=[0, 2]), axis=None),
  y=alt.Y('y', title=None, scale=alt.Scale(domain=[0, 2]), axis=None),
  size=alt.Size('area_km2', scale=alt.Scale(range=[0, 200000]), legend=None),
  color=alt.Color('date:N', scale=color_scale, legend=None),
  tooltip = 'tooltip'
```

The output cell shows a circular visualization. The visualization consists of a light blue circle in the center, surrounded by a darker blue ring, all set against a dark blue background. A green arrow points from the code cell to the output cell, indicating the relationship between the code and the visualization.



Save as SVG

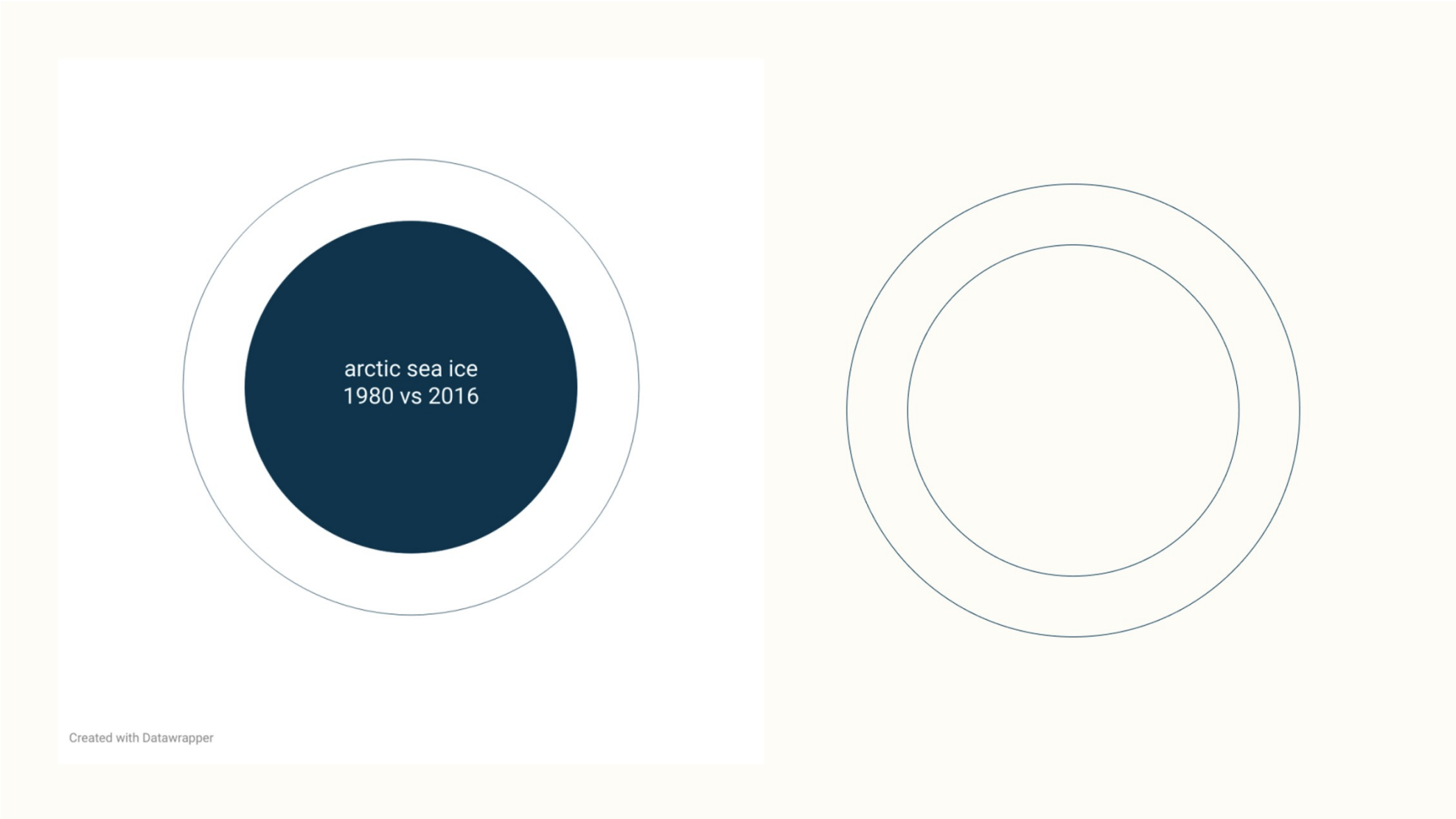
Save as PNG

View Source

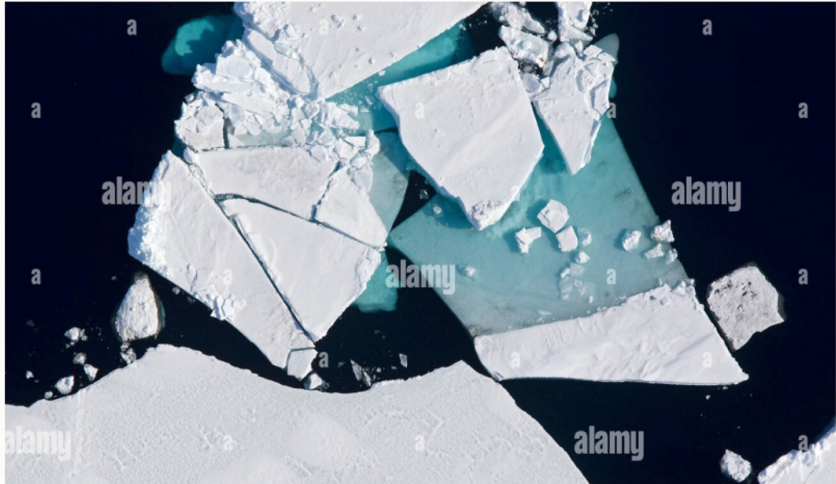
View Compiled Vega

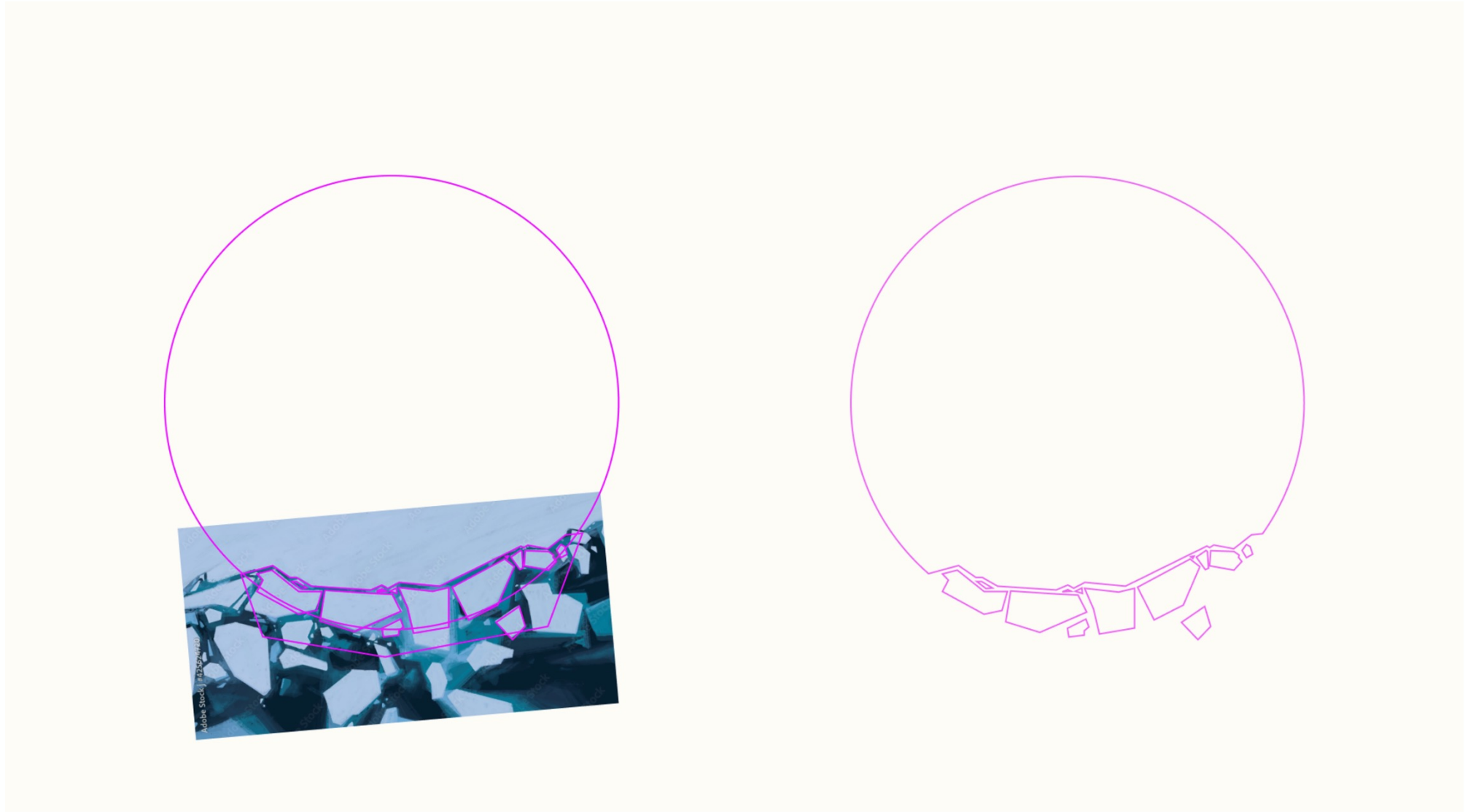
Open in Vega Editor

SPICE THINGS WITH AN EMOTIONAL HOOK

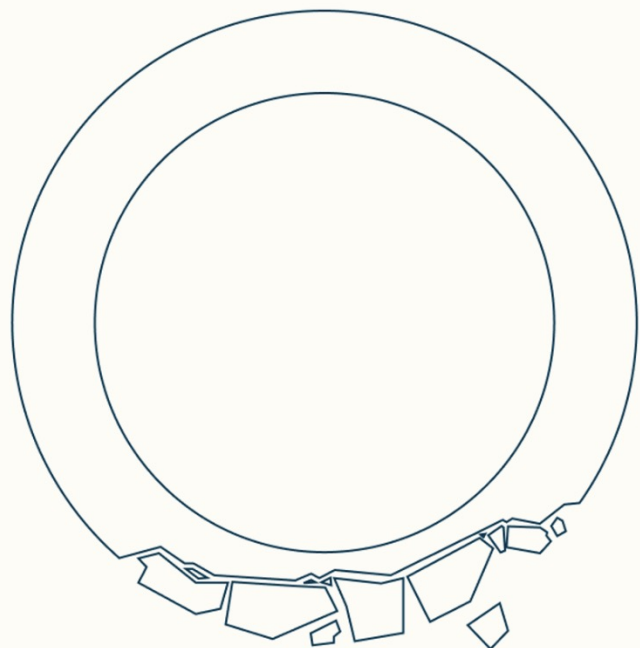


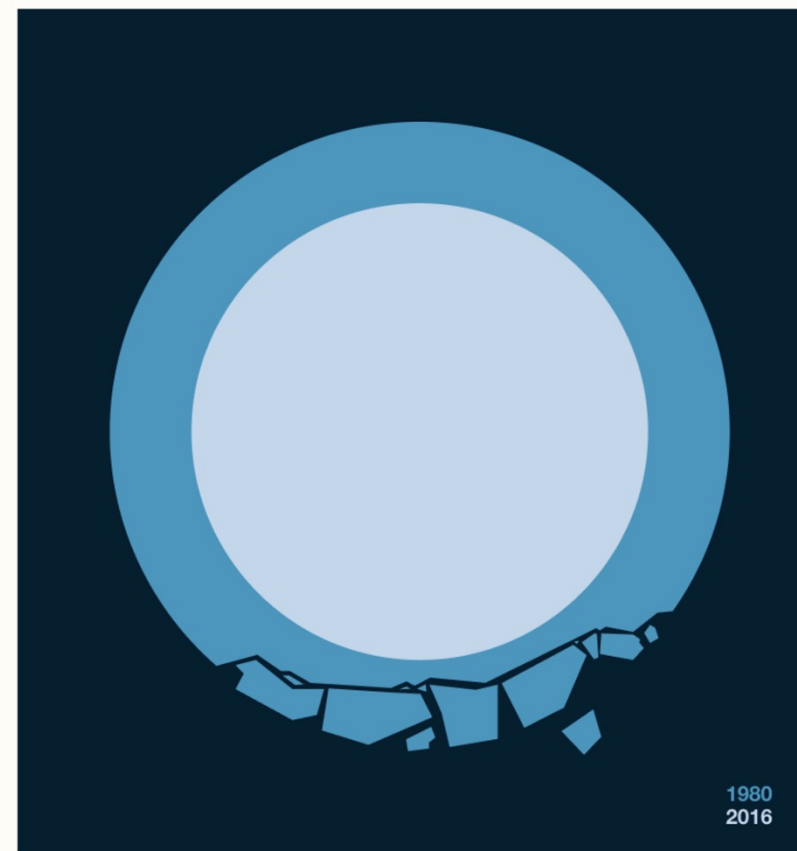
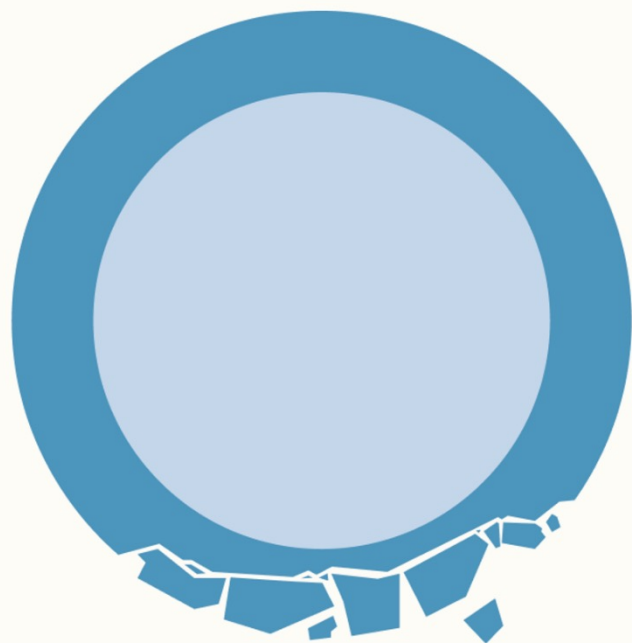
SPICE THINGS WITH AN EMOTIONAL HOOK






Free vector graphic packages eg Inkscape or GIMP






TUTORIALS

ESA UNCLASSIFIED - For ESA Official Use Only



The Making Of: Cracked Sea Ice Loss




sea ice loss
1980 - 2016


The simple graphic depicting the reduction of Arctic sea ice between 1980 and 2016, highlights the jagged edge of the Arctic sea ice loss. As our planet's temperature continues to rise due to climate change, the Arctic is losing sea ice.

THE EUROPEAN SPACE AGENCY

ESA UNCLASSIFIED - For ESA Official Use Only




Python Setup for Little Pictures



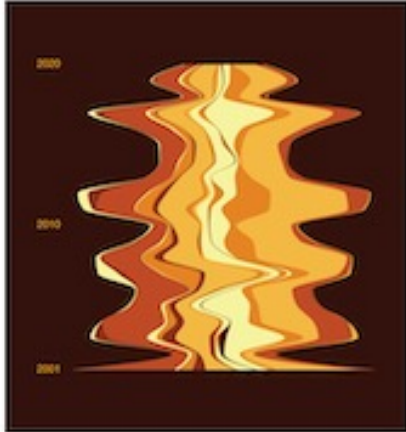
python setup
for Little Pictures

THE EUROPEAN SPACE AGENCY

ESA UNCLASSIFIED - For ESA Official Use Only



The Making Of: Fire Streamgraph

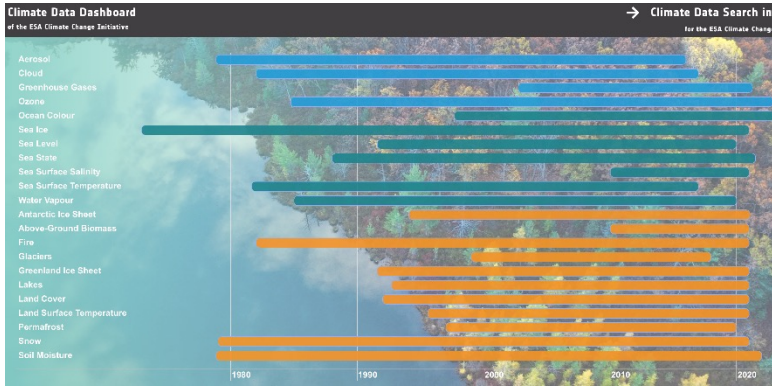


burned area in europe
2001 - 2020

The fire streamgraph uses data on burned area for Europe from 2001 to 2020. It features a wavy pattern that undulates from top to bottom. The height and shading of each rectangle represents the burned area of that year, as a proportion of the accumulated burned area across all years.

THE EUROPEAN SPACE AGENCY

ACCESSING CLIMATE DATA



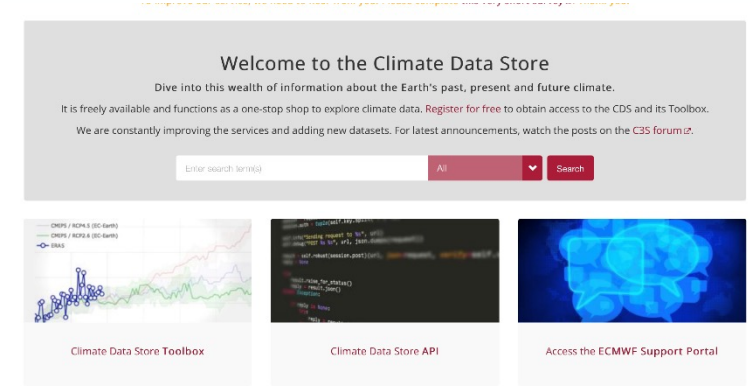
- 25+ satellite CDRs
- Pre-operational prototypes
- R&D focus - latest algorithms

→ climate.esa.int/data



- Met, climate & ocean satellite data
- Near-Real Time, historic data & CDRs
- Extended operationally

→ eumetsat.int/eumetsat-data-store

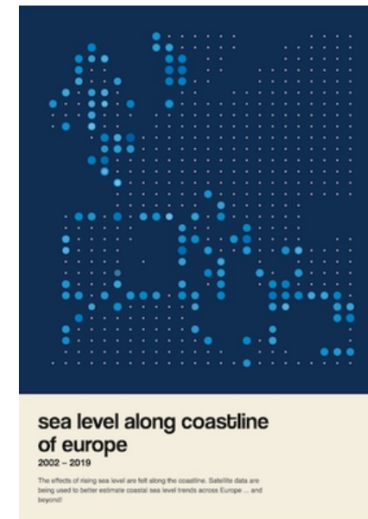
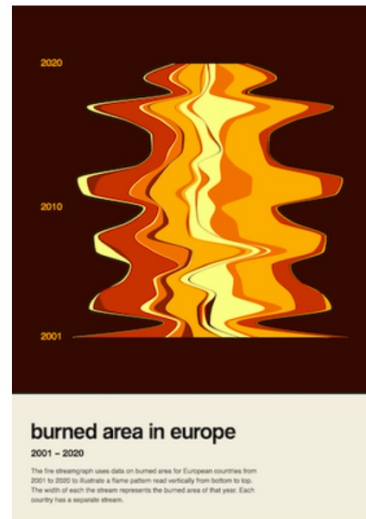
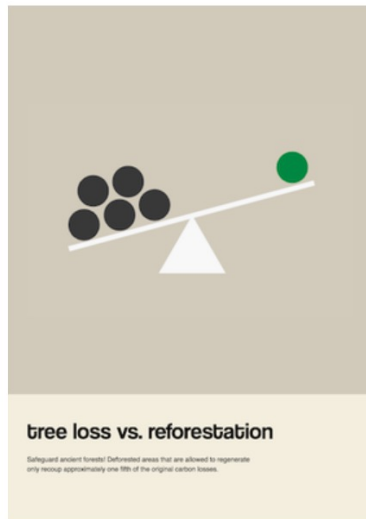
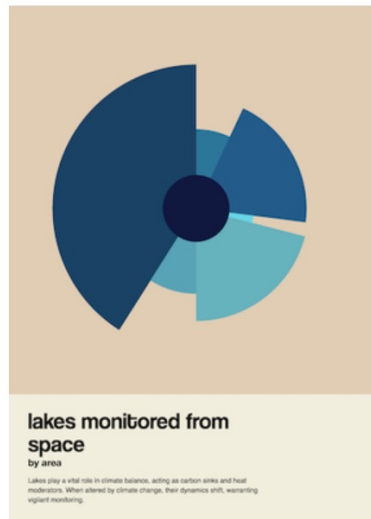
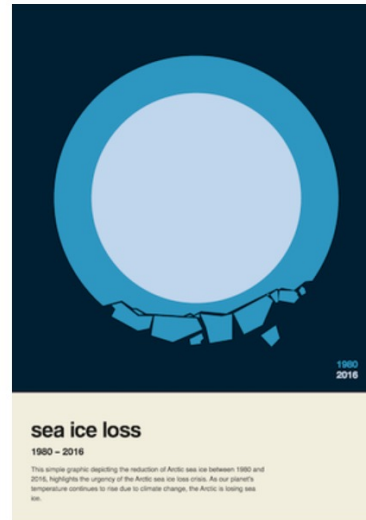
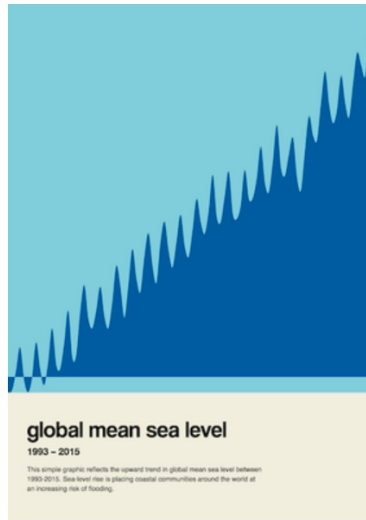


- Past, present & future
- Observations and model data
- Operational – temporal up-to-date

→ cds.climate.copernicus.eu



COMPETITION TIME – OVER TO YOU



Data

ESA, EUMETSAT, C3S/ECMWF

Winner

Displayed at COP28

Invited to ESA dataviz team (nr Rome)

10 runners up added to gallery

Judges inc.

Ed Hawkins #Showyourstripes

Mattias Stahl, Der Spiegel

Deadline - 20 November

→ climate.esa.int/littlepicturescompetition





w climate.esa.int/littlepicturescompetition
e: climate.office@esa.int