

# DataViz:

## Visualise your data effectively and avoid common pitfalls

### Conveners:

**Epari Ritesh Patro** (University of Oulu, Finland)

**Paola Mazzoglio** (Politecnico di Torino, Italy)

**Edoardo Martini** (University of Leipzig, Germany)

**Roshanak Tootoonchi** (Euro-Mediterranean Center on Climate Change, Italy)

**Xinyang Fan** (University of Erlangen-Nuremberg, Germany)

### Invited speaker:

**Dario Treppiedi** (University of Palermo, Italy)



Young  
Hydrologic  
Society

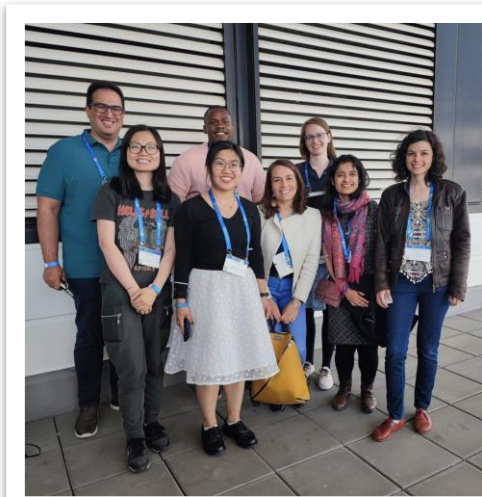


**THE YHS**

# The YHS

The Young Hydrologic Society (YHS) is a bottom-up initiative to stimulate the interaction and participation of young hydrologists within the hydrological community.

Founded in October 2012, the YHS is currently run by a team of early career scientists from several universities across the world.



# The YHS

The Young Hydrologic Society is divided into several committees.

The **Conference Committee** is involved in organizing meetings and activities before and during the main conferences in the field of hydrology, like the EGU, the AGU, or the conferences of the International Association of Hydrological Sciences (IAHS).

The **Blog Committee** manages the website of the YHS and its blog post series. We also publish posts related to upcoming events and we also collect and publish all the materials presented during the Short Courses delivered by members of the YHS during EGU.

The **National Branches Committee** is a group of people that help in the creation of national sections of the YHS. Each section is almost independent, but we support them with some guidelines or by advertising the activities online.

The **Outreach Committee** manages the social networks of the group, mainly LinkedIn and Bluesky.

# The YHS

For more info, please visit our website, <https://younghs.com>



The screenshot shows the homepage of the Young Hydrologic Society. At the top is a banner image of a mountain lake with the text "Young Hydrologic Society" overlaid. Below the banner is a navigation menu with links: News, About, National initiatives, Blog, Resources, Past events, Contact, and Get involved. The main content area features a light blue box with the following text:

**Join us at the annual pre-EGU online networking event!**  
Posted on [March 17, 2025](#) by [Young Hydrologic Society](#)

Are you a young hydrologist heading to the EGU25 General Assembly? Join us at the annual pre-GA networking event on April 11th at 2pm CET! 😊

It's an amazing opportunity to connect with your peers before heading to Vienna, and to learn more about the EGU HS Division as well as the Young Hydrologic Society and the ECS at IAHS (International Association of Hydrological Sciences)!

Register today at

To the right of the main content is a search bar and a section titled "Follow YHS on Twitter" which includes a "Posts from @YoungHydrology" header and a large "X" logo.

We are on LinkedIn, BlueSky and X (the profile is active, but we are not posting).

<https://www.linkedin.com/in/young-hydrologic-society-20353960/>



[@younghydrology.bsky.social](https://younghydrology.bsky.social)



[@YoungHydrology](#)  
[@YHS\\_jobs](#)

# The YHS

## YHS Dataviz short course at the EGUs

EGU23



EGU24



EGU25



Taking selfies with our wonderful audience is a tradition for us every year! :)

# TODAY'S MENU

# The Course structure

Brief history of DataViz

DataViz: how to

Interactive block 1

Colour schemes

Interactive block 2

Climate Data Operators (CDO)

Panoply

AI tools for DataViz

Interactive block 3

Additional resources

Q&A

# **BRIEF HISTORY OF DATAVIZ**

# Brief history of DataViz - France

DataViz is not a new field...

**Cave paintings in the Lascaux cave** (France) of the Upper Paleolithic (50,000 – 12,000 years ago).



Source: [https://en.wikipedia.org/wiki/Lascaux#/media/File:Lascaux\\_painting.jpg](https://en.wikipedia.org/wiki/Lascaux#/media/File:Lascaux_painting.jpg)

# Brief history of DataViz - Egypt

DataViz is not a new field...

The **Turin Papyrus Map** is an ancient Egyptian map, generally considered the oldest surviving map of topographical interest from the ancient world.

The map was drawn around **1150 BCE**.



# Brief history of DataViz – the first world map

DataViz is not a new field...

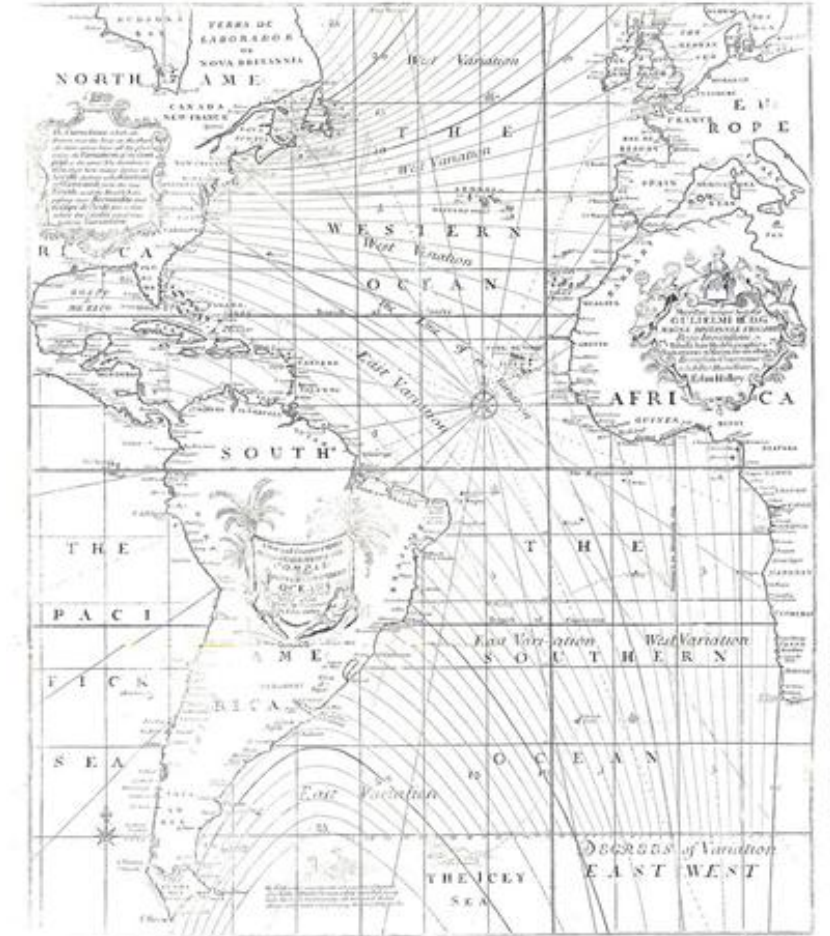


**Typus Orbis Terrarum**, the first world map created by Abraham Ortelius (1570).

# Brief history of DataViz – the first isoline map

DataViz is not a new field...

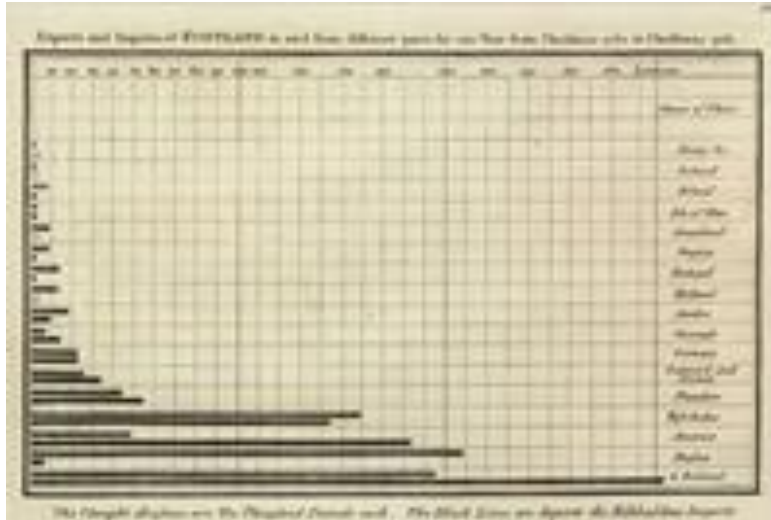
Edmond Halley (1701). **The first known isolines**, showing of equal magnetic declination in the Atlantic Ocean



Source: [https://en.wikipedia.org/wiki/Edmond\\_Halley#/media/File:Halley\\_isogonic\\_1701.jpg](https://en.wikipedia.org/wiki/Edmond_Halley#/media/File:Halley_isogonic_1701.jpg)

# Brief history of DataViz – more plotting types emerge

DataViz is not a new field...



**William Playfair** (1759 – 1823, United Kingdom) was the **founder of graphical methods of statistics**.

He invented several types of diagrams: he introduced the **line, area and bar chart** of economic data, and later he published what were likely the first **pie chart and circle graph**, used to show part-whole relations.

# Brief history of DataViz - epidemiology

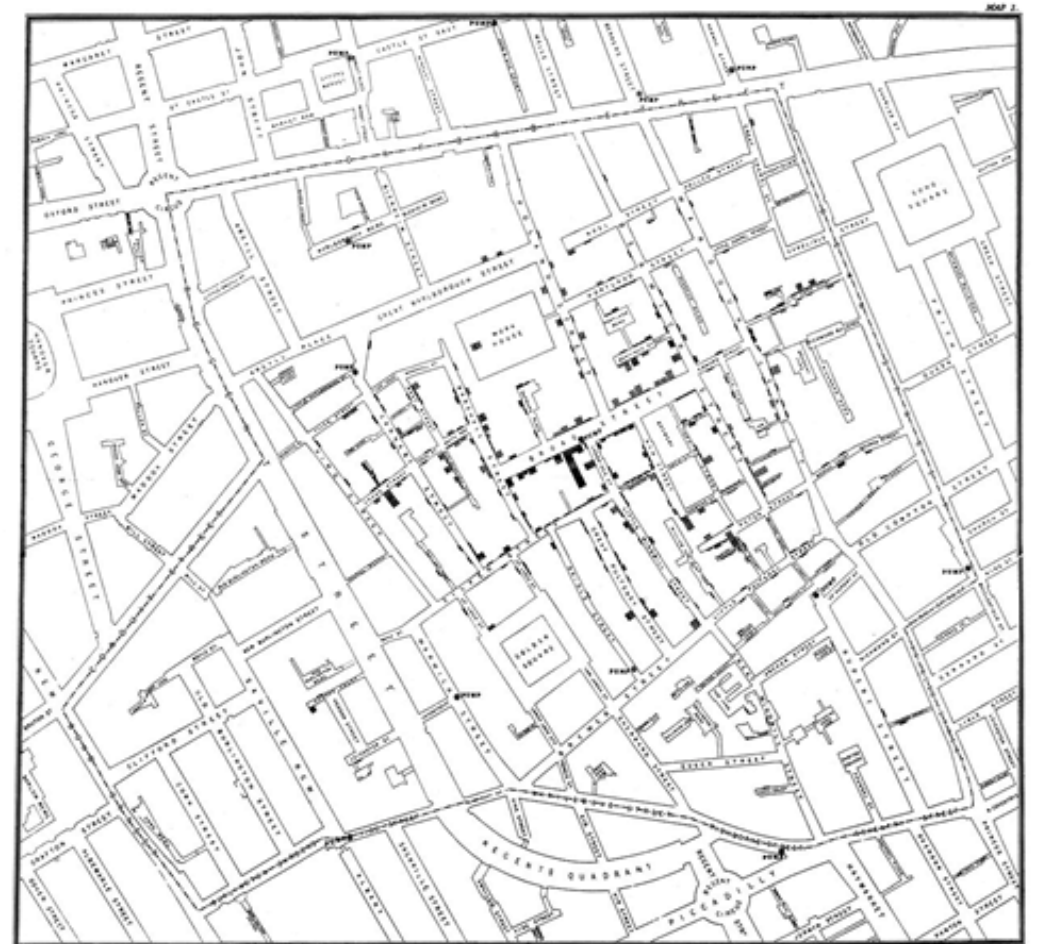
DataViz is not a new field...

**John Snow**, 1854, England.

The map was created to better understand the pattern of **cholera spread** in the 1854 London cholera outbreak.

Cholera cases are highlighted in black, showing the clusters of cholera cases. Snow used it to understand how cholera spread through water systems.

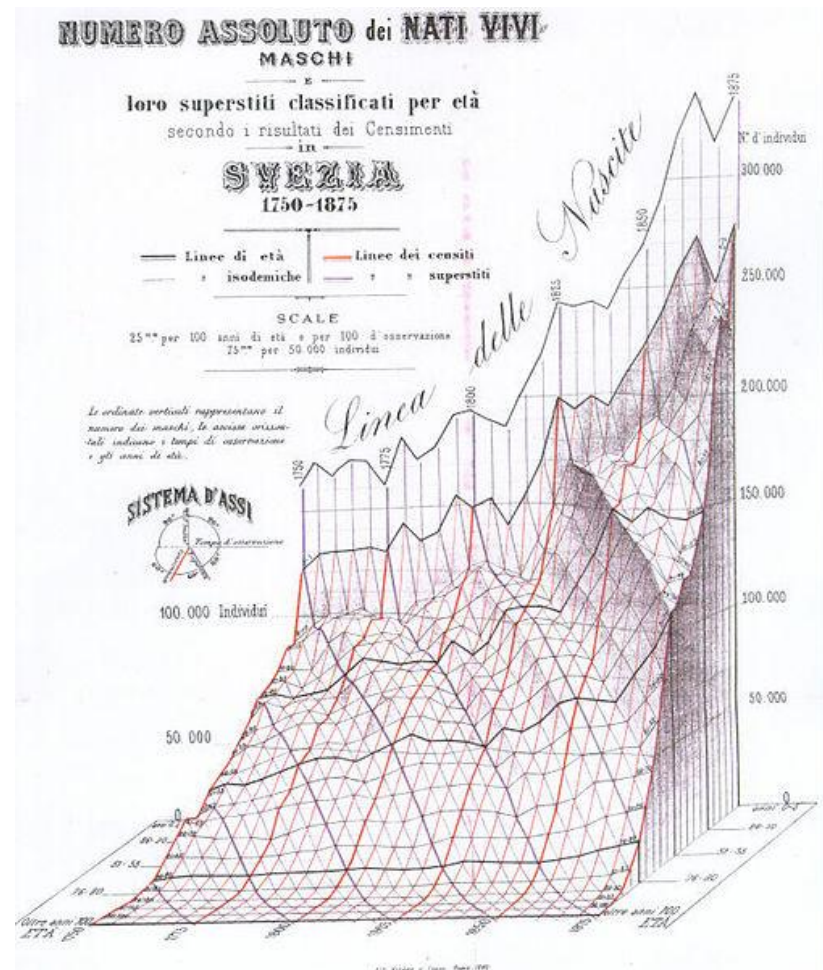
The map marks an important part of the development of epidemiology as a field, and of disease mapping as a whole.



Source: [https://en.wikipedia.org/wiki/John\\_Snow#/media/File:Snow-cholera-map-1.jpg](https://en.wikipedia.org/wiki/John_Snow#/media/File:Snow-cholera-map-1.jpg)

# Brief history of DataViz

DataViz is not a new field...



**Luigi Perozzo** (1856 - 1916, Italy).

Population pyramid: **the first known 3D visualization.**

Swedish population's age distribution between 1750 and 1875 using three variables: census year, age group, and population count

# Brief history of DataViz – color map comes

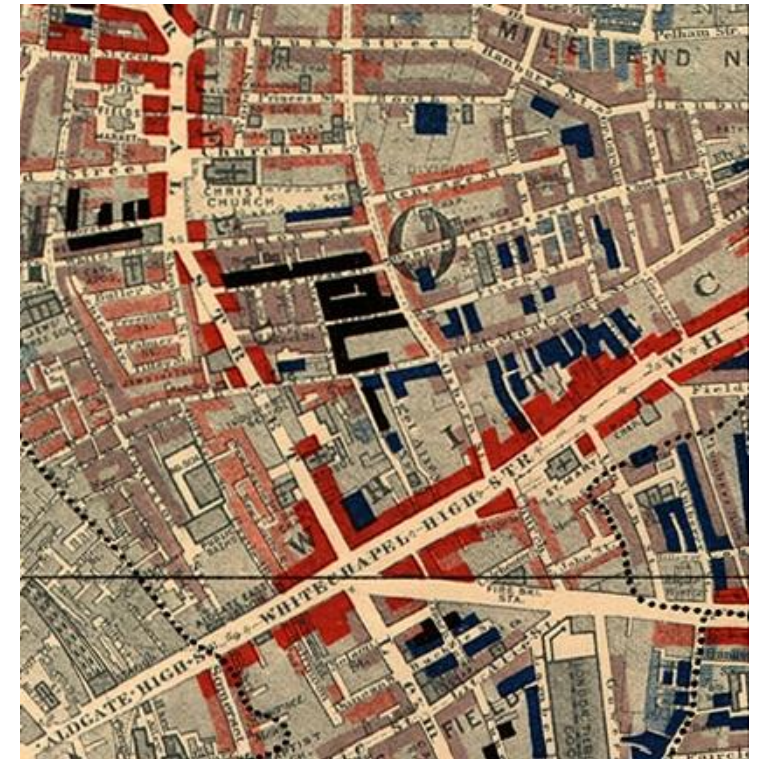
DataViz is not a new field...

**Charles Booth** (1840-1916, England).

London poverty maps. The streets are coloured to represent the economic class of the residents:

- yellow ("Upper-middle and Upper classes, Wealthy");
- red ("Lower middle class - Well-to-do middle class");
- pink ("Fairly comfortable good ordinary earnings");
- blue ("Intermittent or casual earnings");
- black ("lowest class...occasional labourers, street sellers, loafers, criminals and semi-criminals").

**DataViz meets colours (incl. palette).**



The Streets are coloured according to the general condition of the inhabitants, as under:-

|  |  |
|--|--|
| ■ Lowest class.Vicious, semi-criminal.             | ■ Fairly comfortable.Good ordinary earnings. |
| ■ Very poor, casual. Chronic want.                 | ■ Middle-class.Well-to-do.                   |
| ■ Poor. 18s. to 21s. a week for a moderate family. | ■ Upper-middle and Upper classes.Wealthy.    |
| ■ Mixed.Some comfortable, others poor.             |  |

*A combination of colours— as dark blue and black, or pink and red— indicates that the street contains a fair proportion of each of the classes represented by the respective colours.*

# Brief history of DataViz – GIS & computer software

DataViz is not a new field...

**Harvard Laboratory for Computer Graphics and Spatial Analysis** (1965 to 1991) pioneered early **cartographic and architectural** computer applications that led to integrated geographic information systems (GIS).

**Computer software for the analysis and graphic display of spatial data: first (low cost) printed output.**



Conformant SYMAP



Contour SYMAP



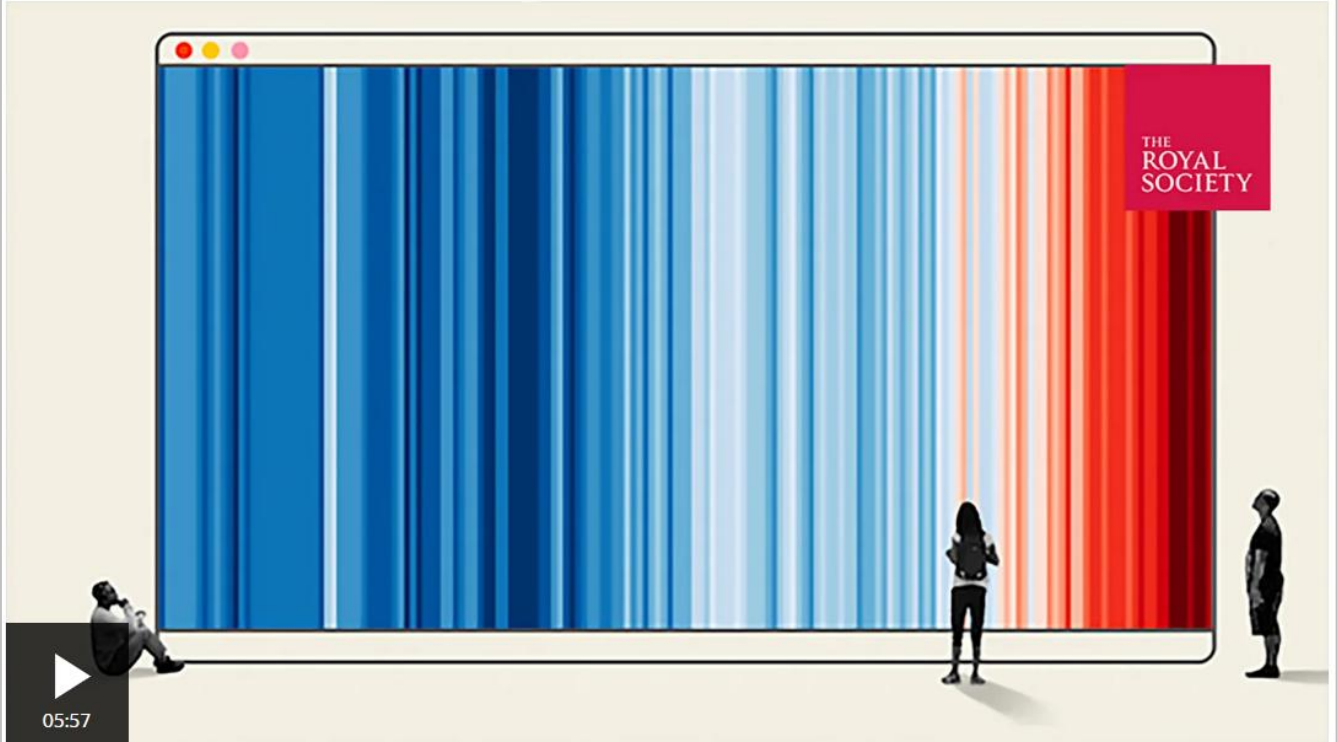
Proximal SYMAP



Trend Surface SYMAP

# Brief history of DataViz – to know more?

**BBC** Sign in Home News Sport Business Innovation Culture



05:57

### Five charts that changed the world

Data visualisation helps us to understand the world. It also has the power to change it.  
Narrated by Adam Rutherford.

Made by BBC Ideas in partnership with the Royal Society

<https://www.bbc.com/videos/cl4ypxnprp0o>



# **DATAVIZ: HOW TO**

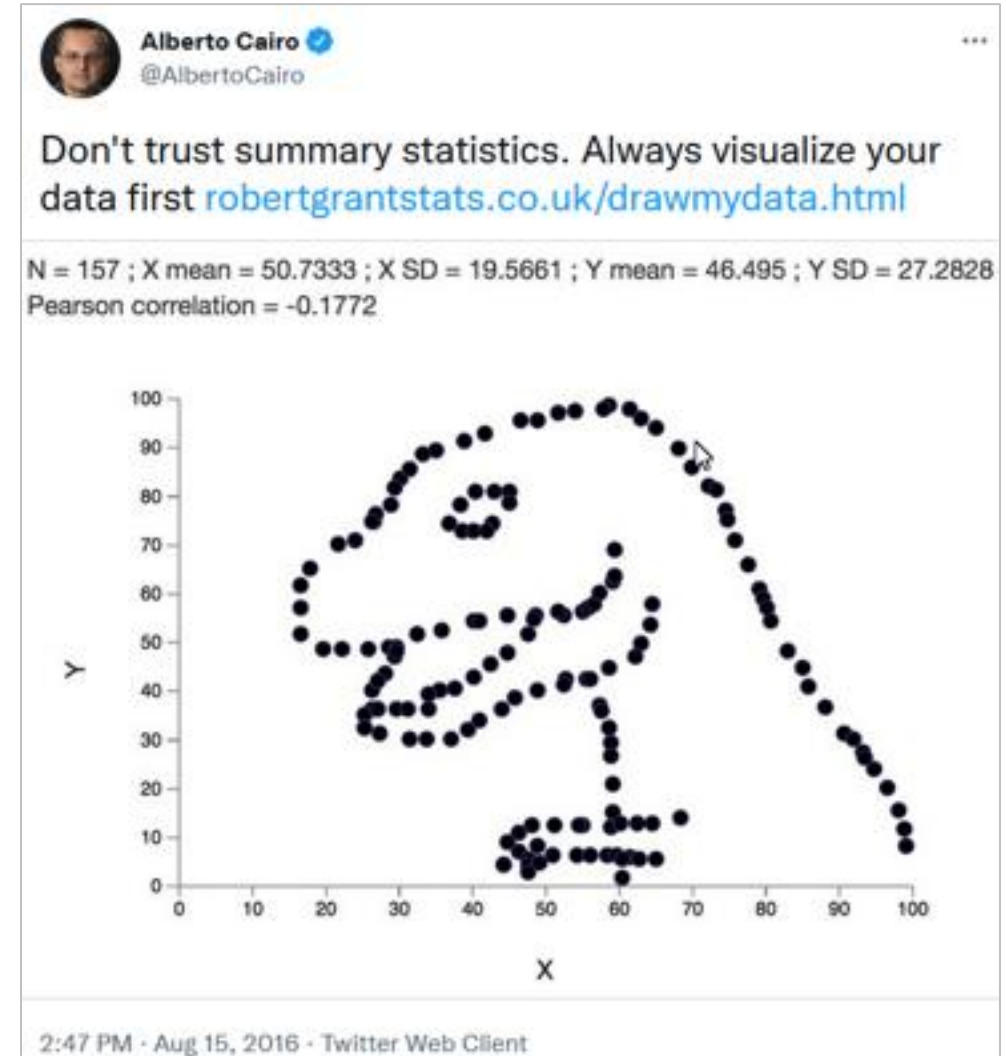
# Why DataViz?

Visualizing data helps us to **comprehend huge amounts of information** by compressing them into a simple and clear visualization.

We use DataViz to **communicate data to the audience**.

It helps us to find hidden patterns or see underlying problems in the data itself which might not have been obvious without a good chart.

The human brain processes information **better** and **quickly** when it is presented visually.



# How to DataViz



## Good DataViz:

- Correct
- Effective
- Accessible



## Bad DataViz:

- Misrepresent the data
- Use inappropriate data
- Too much or too less information
- Inconsistent
- Ignore limits of human perception

# How to DataViz

Before you DataViz, think:

- **Purpose** *Why am I making this visualization?*
- **Audience** *Who am I making it for?*
- **Medium** *How will I use and share it?*
- **Tools** *What can I use to make it?*
- **Message** *What story does it tell?*



# Graphical elements of a plot

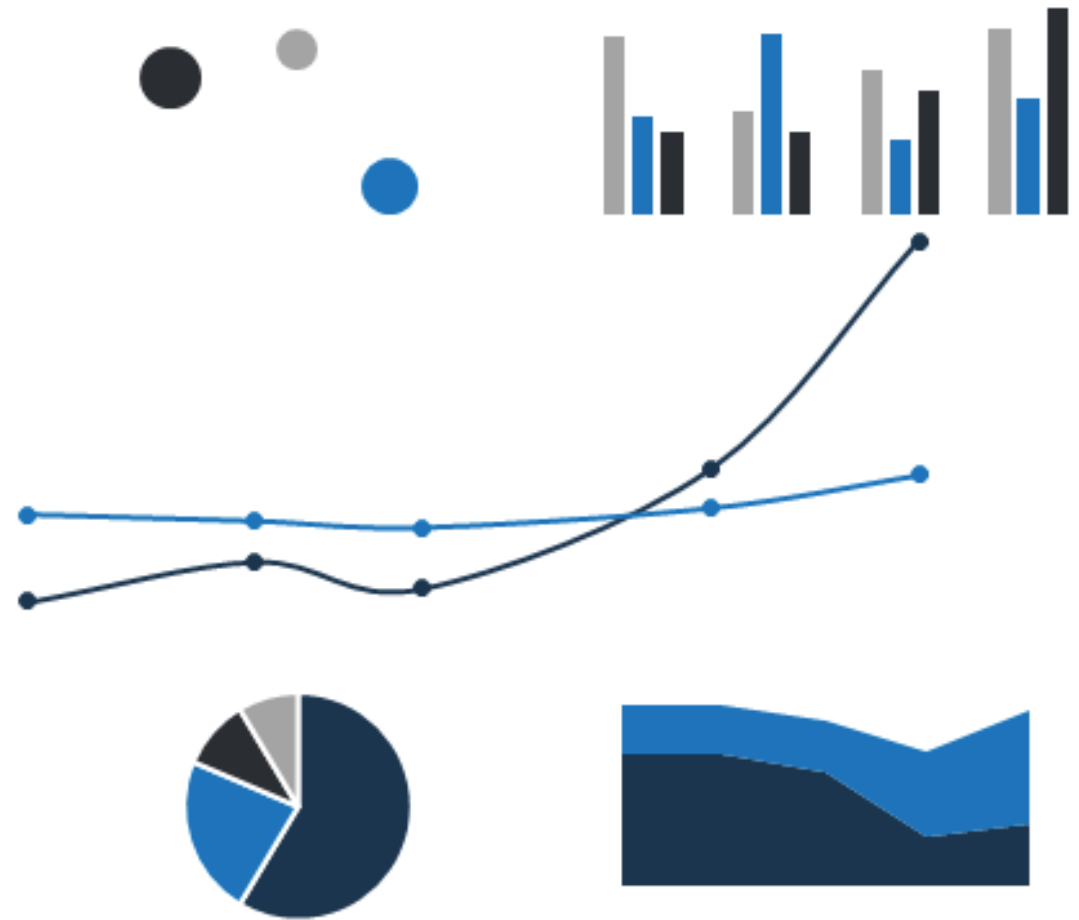
**Marks** and their **attributes** are the building blocks of all data visualizations.

Marks:

- Points
- Lines
- Areas
- Volumes

Attributes:

- Size
- Shape
- Orientation
- Colour

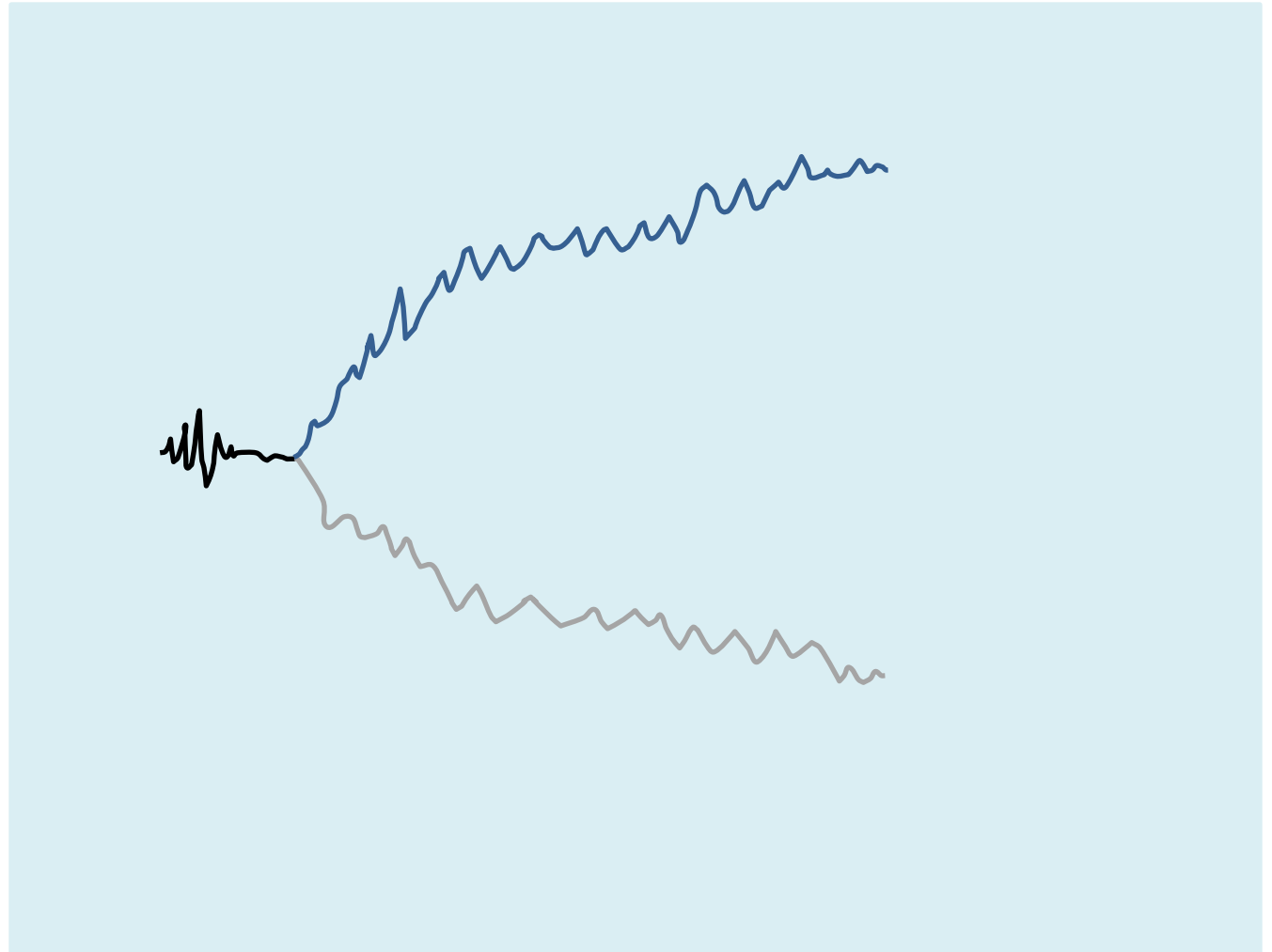


# Graphical elements of a plot

**Marks** and their **attributes** are the building blocks of all data visualizations.



**Alone, they are not sufficient to convey the message!**



# Graphical elements of a plot

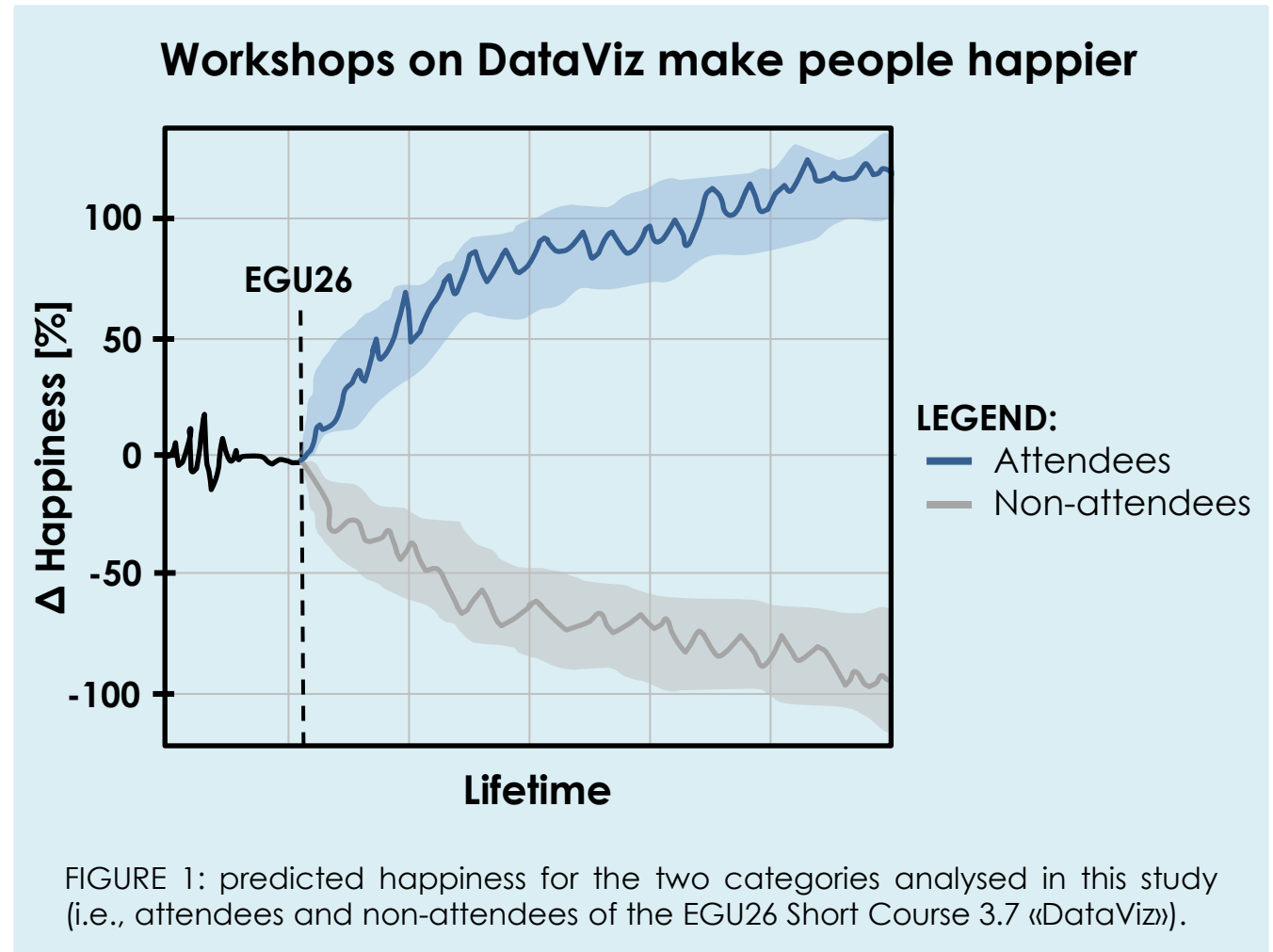
**Marks** and their **attributes** are the building blocks of all data visualizations.



**Alone, they are not sufficient to convey the message!**

We should also insert:

- Axis
- Axis label(s)
- Grid lines and ticks
- Title
- Caption
- Legend
- Layout (blank spaces)



# Choose the right font type

Sans

Serif

this is the "serif"

Sans-Serif font types are:

- more clean
- less formal
- less affected by poor resolution
- better readable?

**Font size:  
at least 9p on paper,  
18p on screen**



# Choose the right font type

|                            |         |
|----------------------------|---------|
| Choose the right font type | Arial   |
| Choose the right font type | Calibri |
| Choose the right font type | Verdana |



Choose the right font type

Times New Roman

Choose the right font type

Georgia

Choose the right font type

Courier New

Choose the right font type

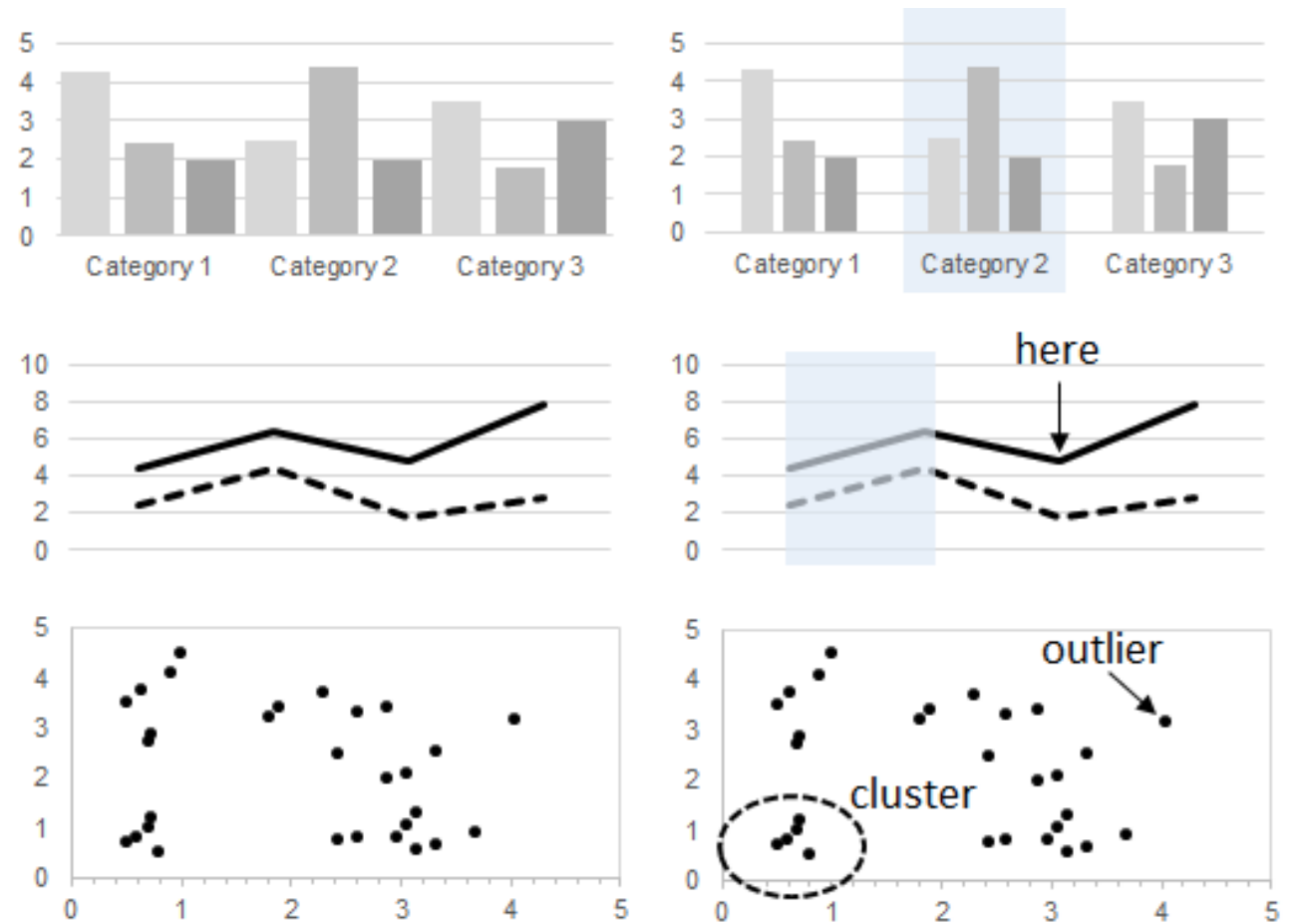
Comic Sans



# Layout (single graph)

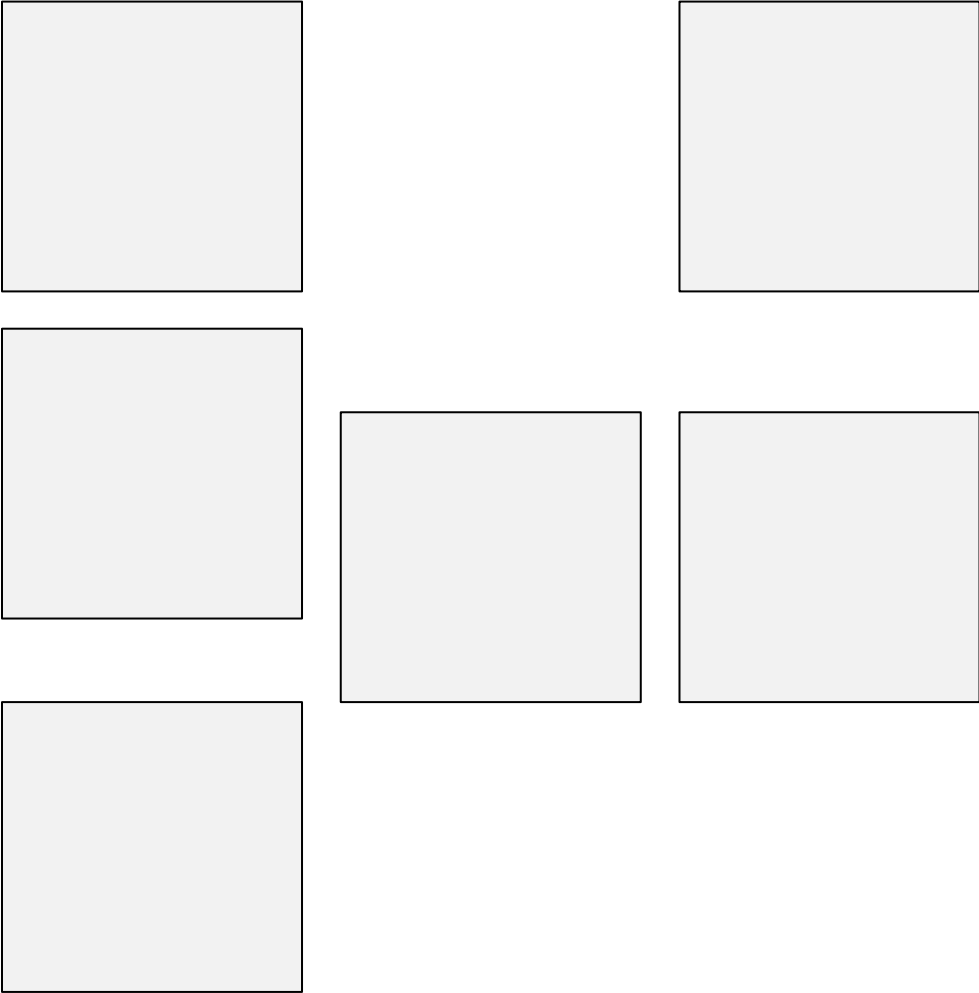
Individual chart elements (including the spatial arrangement) work together to reinforce a unified takeaway message.

Use layout and annotation to highlight and guide the reader.



# Layout (multiple graphs)

Improper arrangement of graph elements can confuse and/or mislead the readers.

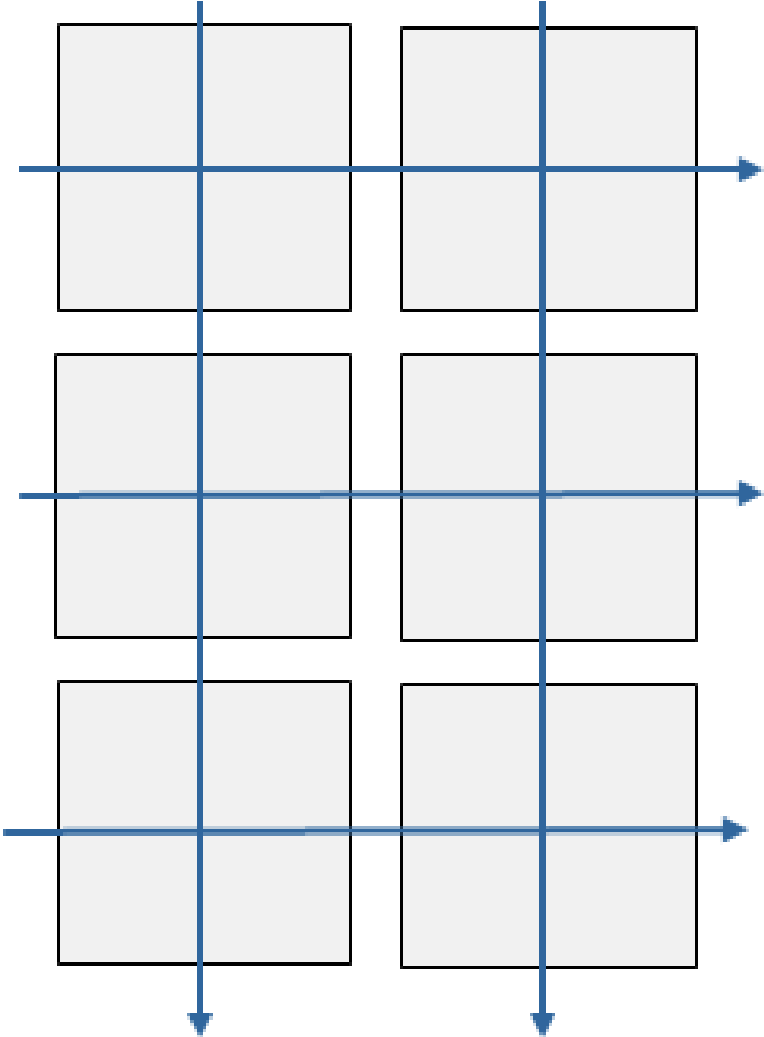


# Layout (multiple graphs)

Improper arrangement of graph elements can confuse and/or mislead the readers.



**Make it intuitive to the reader!**



# Layout (multiple graphs)

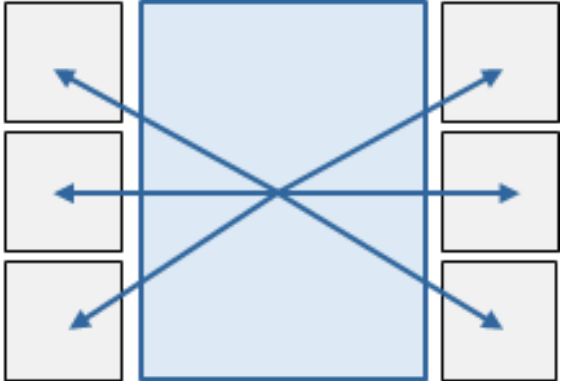
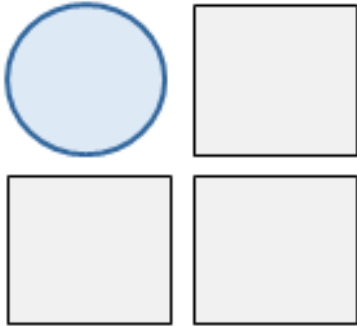
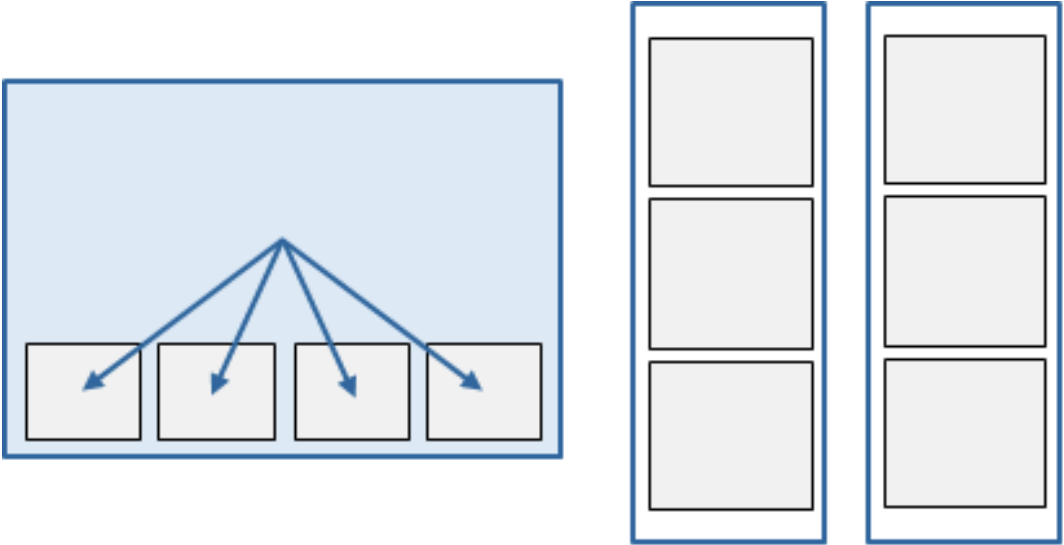
Improper arrangement of graph elements can confuse and/or mislead the readers.



**Make it intuitive to the reader!**



**Use layout to set priorities!**



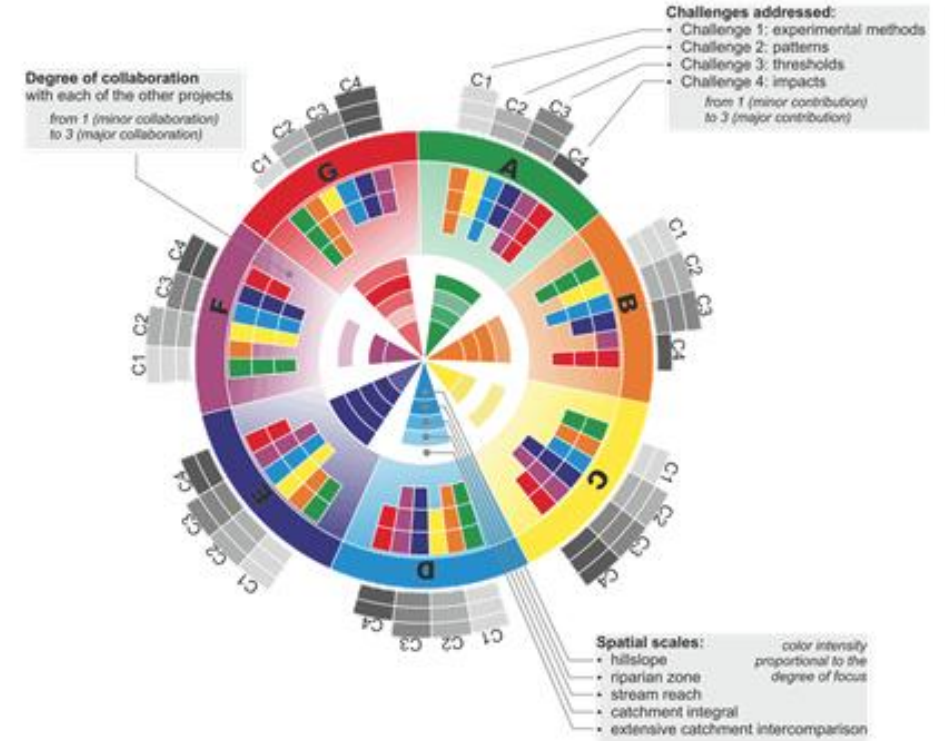
# Simplicity vs creativity

## Keep it simple!

- Do not overload.
- Aim to one clear message vs many.
- “Must have” vs “nice to have”.

## Or help the reader navigate the graph!

- Split the content into sub-figures.
- Create a hierarchy/sequence (group, highlight, annotate, ...).



# INTERACTIVE BLOCK 1

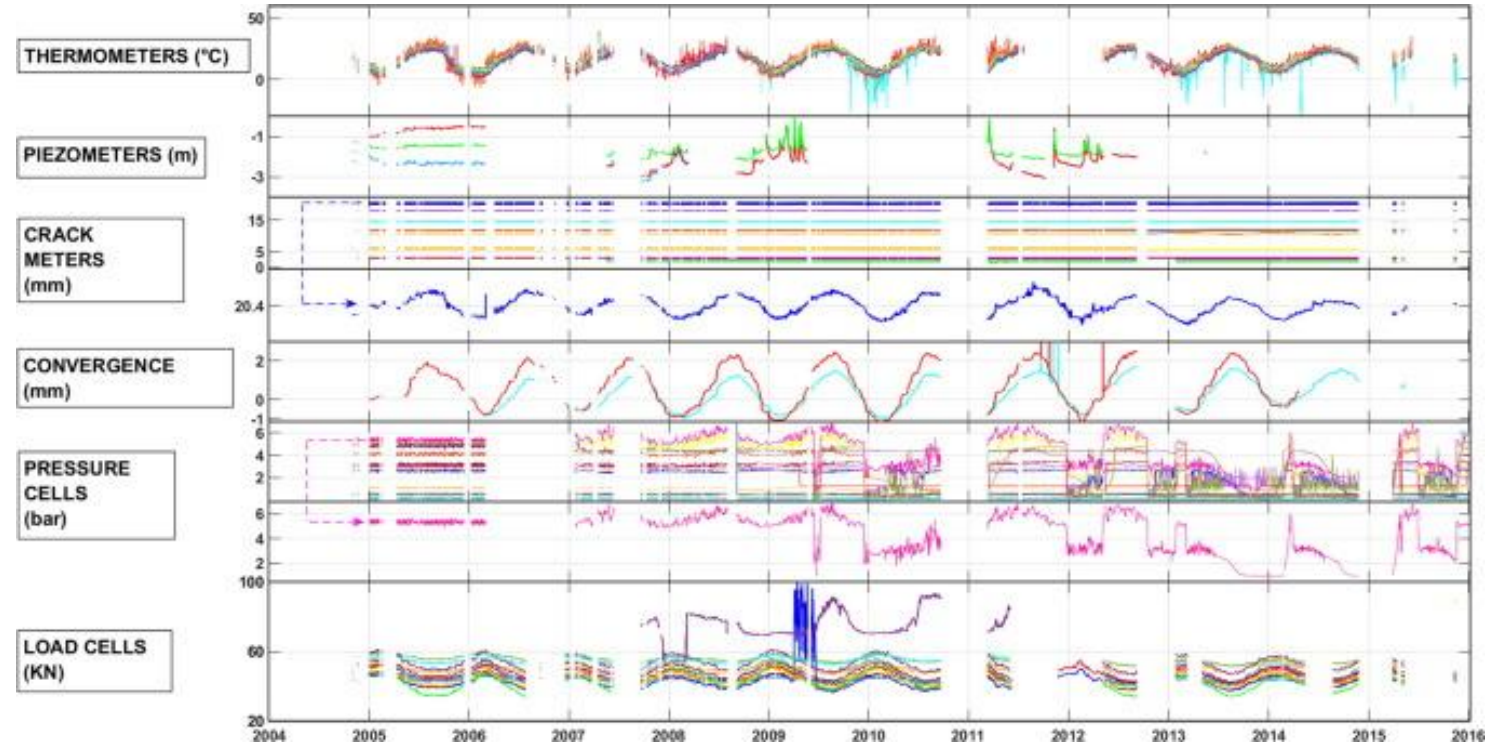
**Raise your hand  
if you agree with the statements/question.**



# Example 1

## What's your thoughts?

- Information content is overloaded.
- Legend needed.



Ceravolo et al., 2021, YMSSP

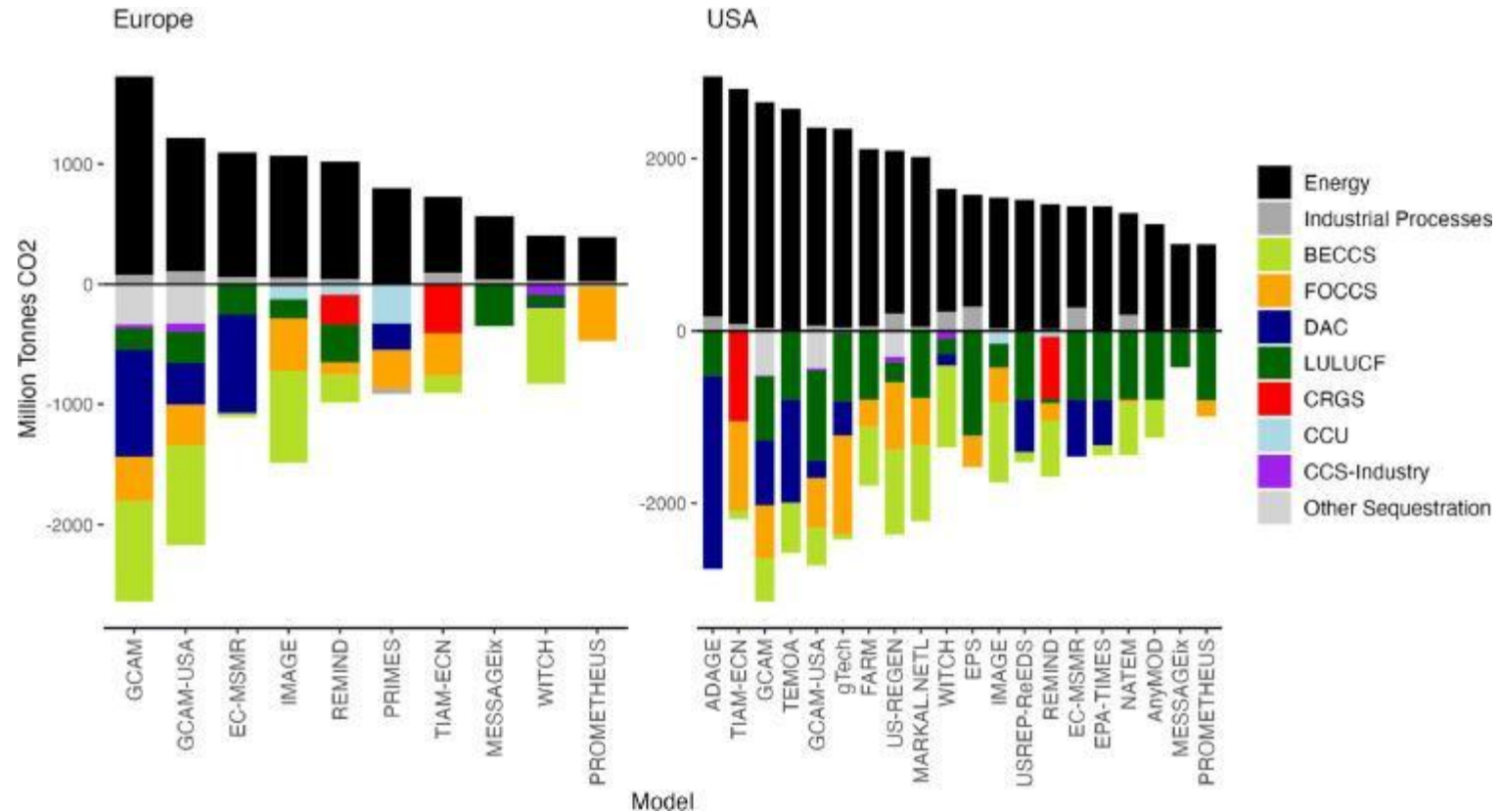
<https://doi.org/10.1016/j.ymssp.2020.107460>

Fig. 7. Static monitoring system. From the top to the bottom: thermometers, piezometers, crack meters (all and a selected time series), convergence, pressure cells (all and a selected time series), load cells.

# Example 2

## What's your thoughts???

- The chart type is correct.
- The legend is self-explanatory.
- Axis labels are self-explanatory.



Sarmiento et al., 2024, (<https://doi.org/10.1016/j.egycc.2024.100144>)

Fig. 5. Net Zero Difference in Sources of Emissions and Sequestration for Participating Models (2050).

**PLOTS, COLOUR SCHEMES &  
POSTERSSS**

# Choosing the right chart is not trivial

Navigation: ALL FAMILY INPUT FUNCTION SHAPE Search 100

by **ferdio**

### Alluvial Diagram

An alluvial diagram showing the flow of data between three categories: A, B, and C. The flows are represented by grey ribbons connecting vertical bars for each category.

### Sankey Diagram

A Sankey diagram showing flows between six categories: A, B, C, D, E, and F. Category A is the source, and the flows are represented by red and dark blue blocks and curved lines.

### Line Graph

A line graph with a red line showing data points over a range of 0 to 10. The y-axis ranges from 0 to 1000.

### Donut Chart

A donut chart with three segments labeled A, B, and C. Segment A is red, B is dark blue, and C is red.

### Bar Chart (Vertical)

A vertical bar chart with four bars labeled A, B, C, and D. The y-axis ranges from 0 to 1000.

### Exploded View Drawing

An exploded view drawing of a mechanical assembly with four parts labeled A, B, C, and D. Part A is a large red flange, B is a bolt, C is a washer, and D is a nut.

### Polar Area Chart

A polar area chart with nine segments labeled A through I, radiating from a central point. The segments are colored in shades of red and dark blue.

### Radial Bar Chart

A radial bar chart with three segments labeled A, B, and C. The segments are colored in shades of red and dark blue. The y-axis ranges from 0 to 1200.

### Sunburst Diagram

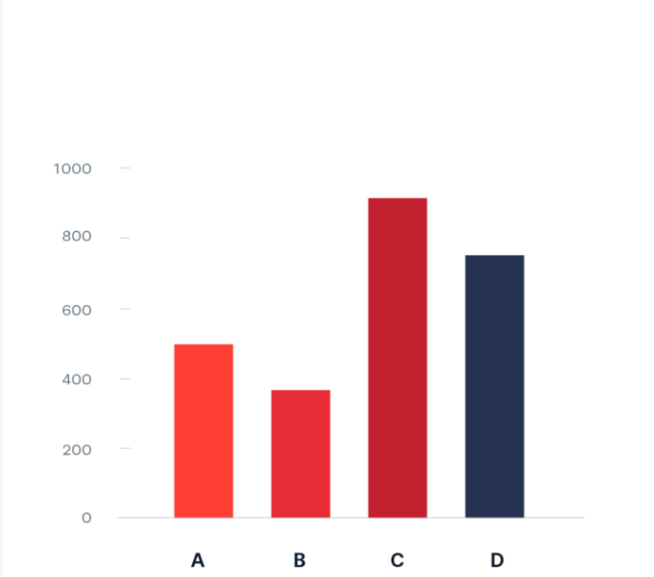
A sunburst diagram with multiple levels of segments, colored in shades of red and dark blue, radiating from a central point.

### Pictorial Percentage Chart

A pictorial percentage chart showing 75% with a person icon. The person is colored red, and the percentage is indicated by a horizontal line.

# Choosing the right chart is not trivial

**Bar Chart (Vertical)** Also called: Bar Chart, Bar Graph



A bar chart is a chart with rectangular bars with lengths proportional to the values that they represent. One axis of the chart shows the specific categories being compared, and the other axis represents a discrete value.

Bar charts provide a visual presentation of categorical data. Categorical data is a grouping of data into discrete groups, such as months of the year, age group, shoe sizes, and animals. These categories are usually qualitative. Bars on the chart may be arranged in any order.


See also: Horizontal bar chart

**Chart**

**Comparison**

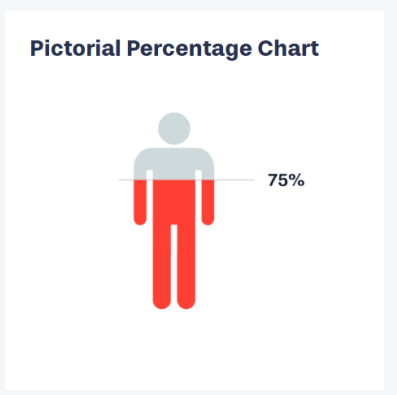
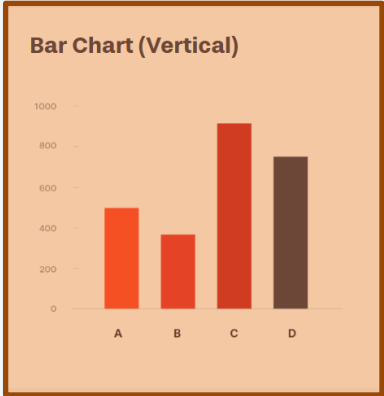
**Trend over time**

**SHAPE**

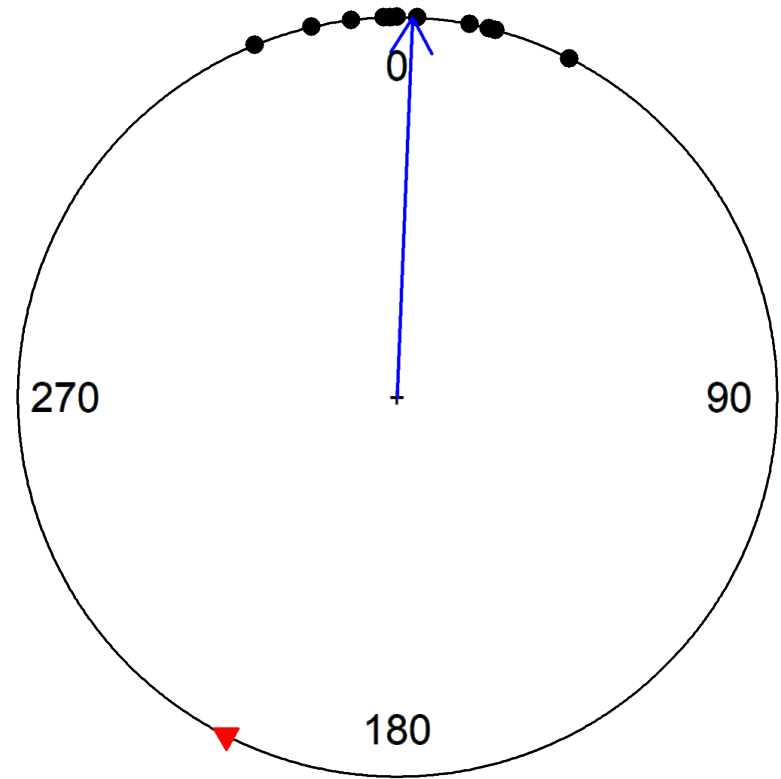
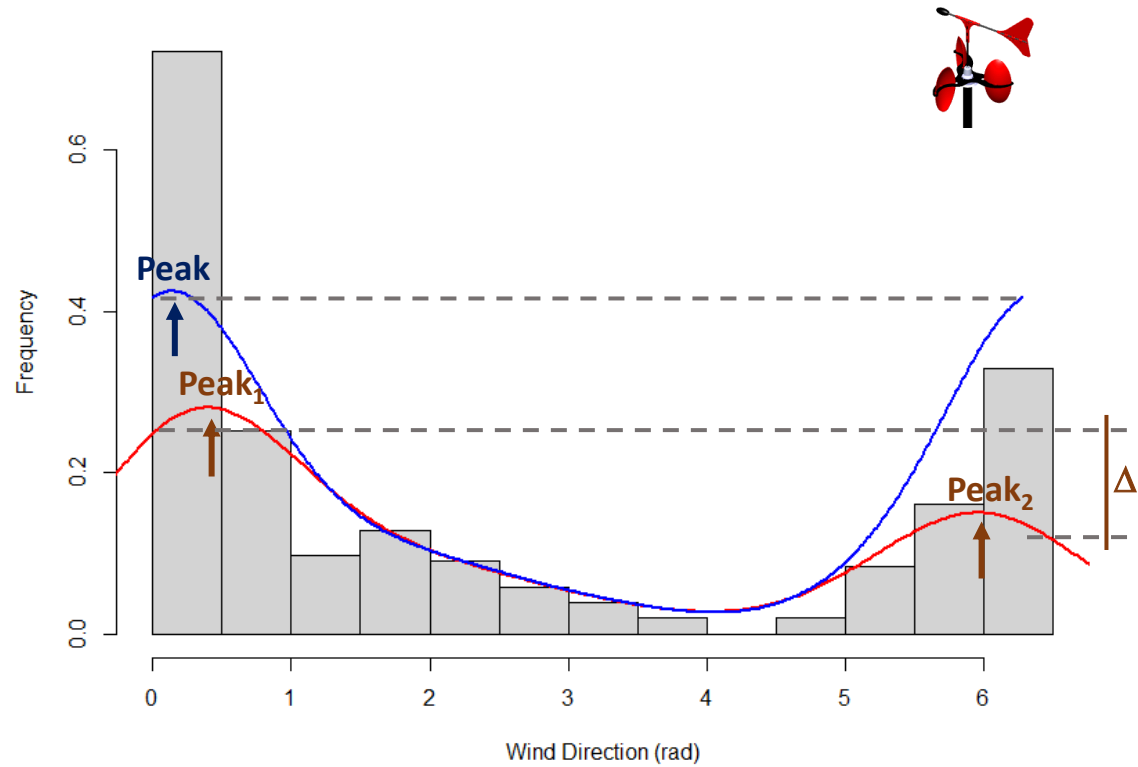


**INPUT**

|   |    |
|---|----|
| A | 14 |
| B | 16 |
| C | 12 |
| ▼ |    |

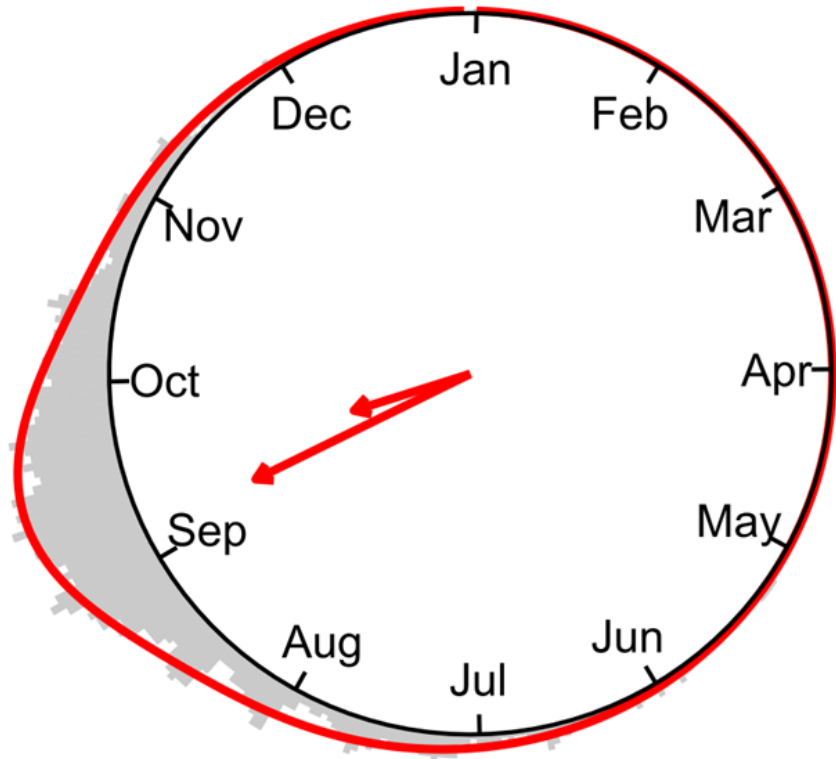


# Different space, different chart

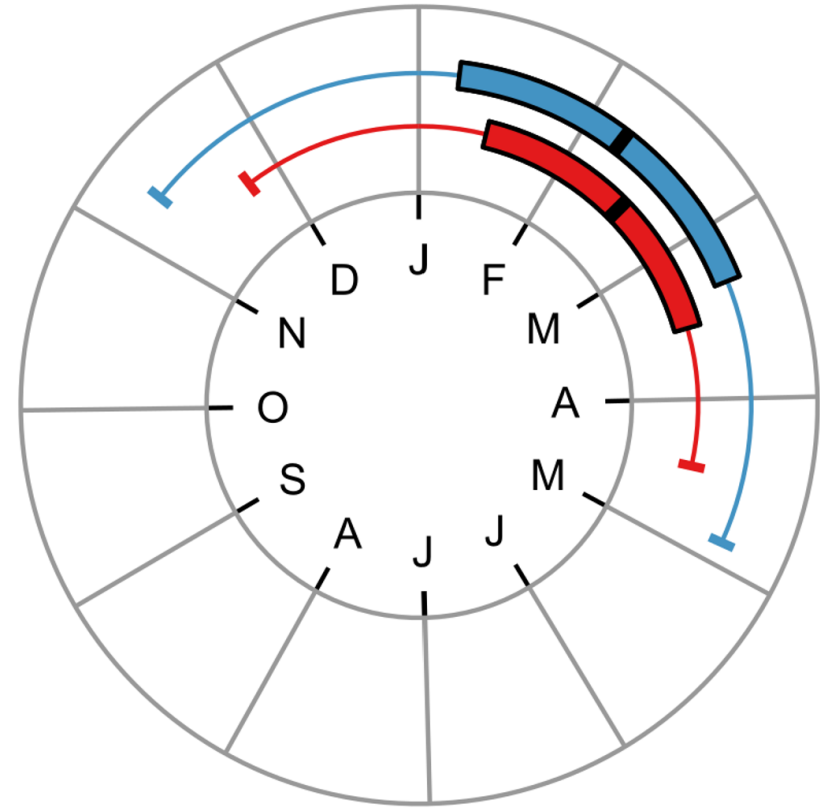


# Different space, different chart

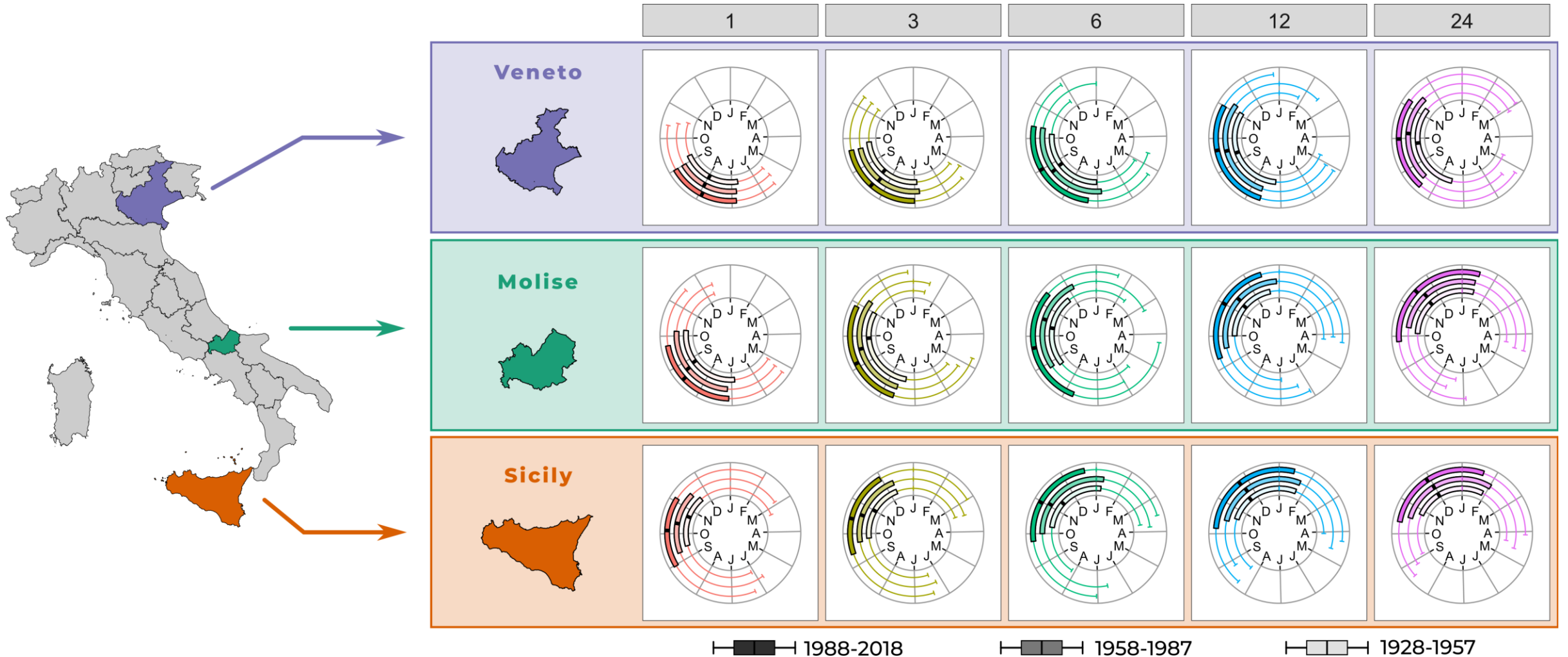
Circular Density Plot



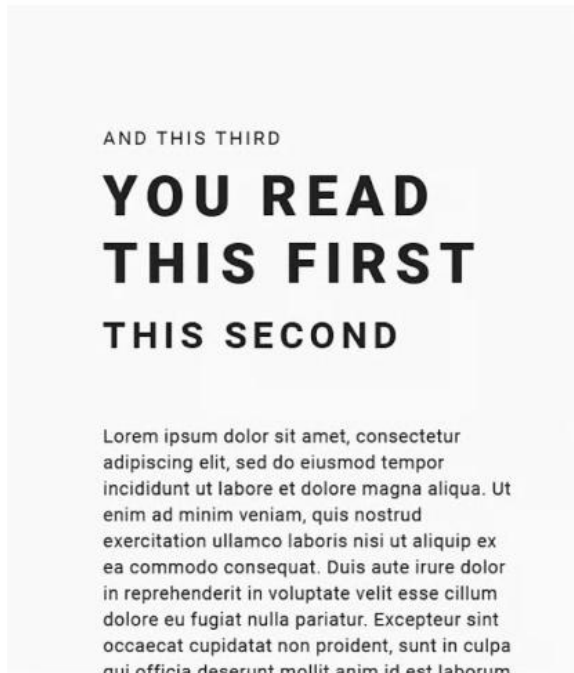
Circular Boxplot



# Different space, different chart



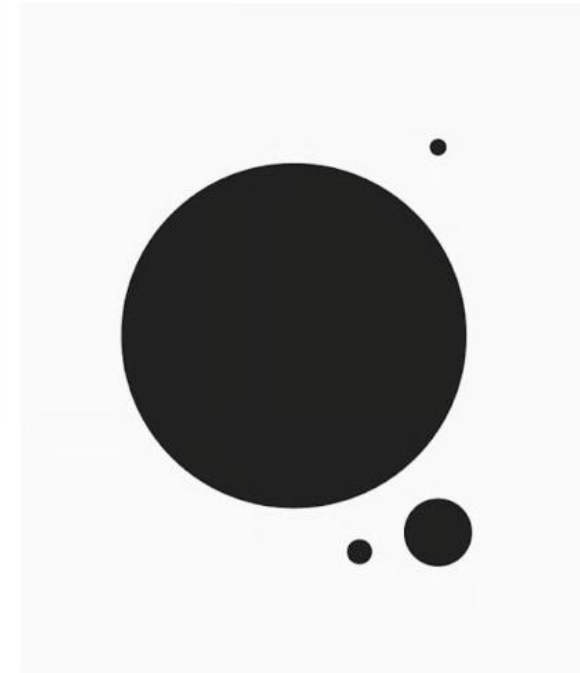
# Emphasize what you want readers to see with color



FONT SIZE & STYLE

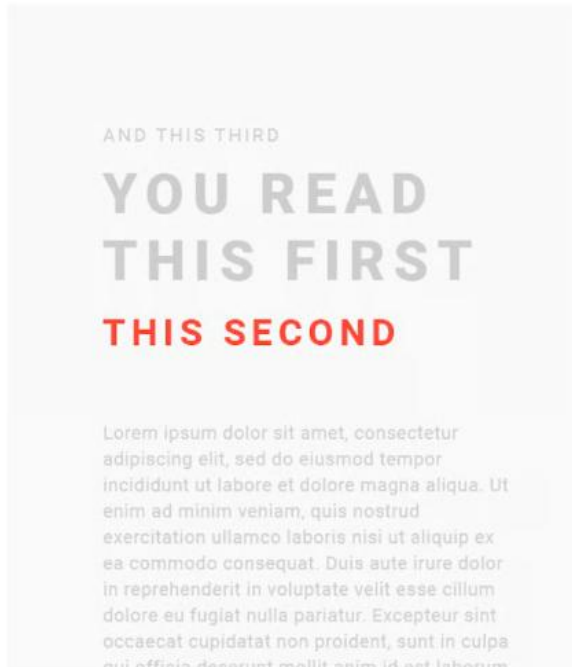


LINE WIDTH

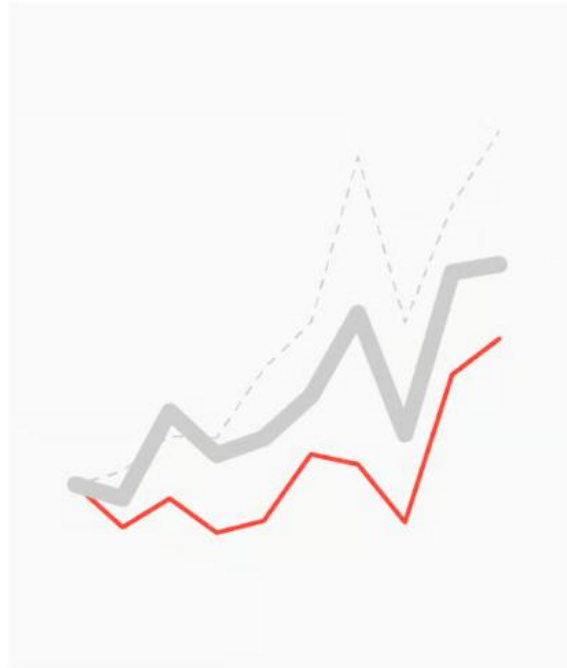


AREA SIZE

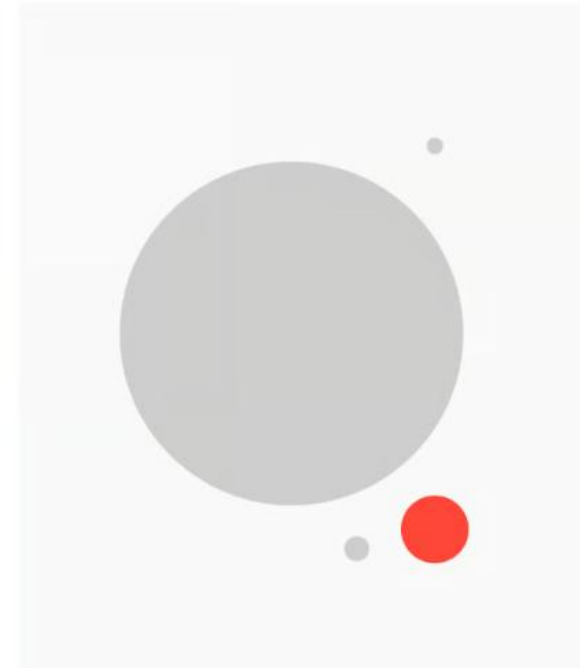
# Emphasize what you want readers to see with color



FONT SIZE & STYLE



LINE WIDTH



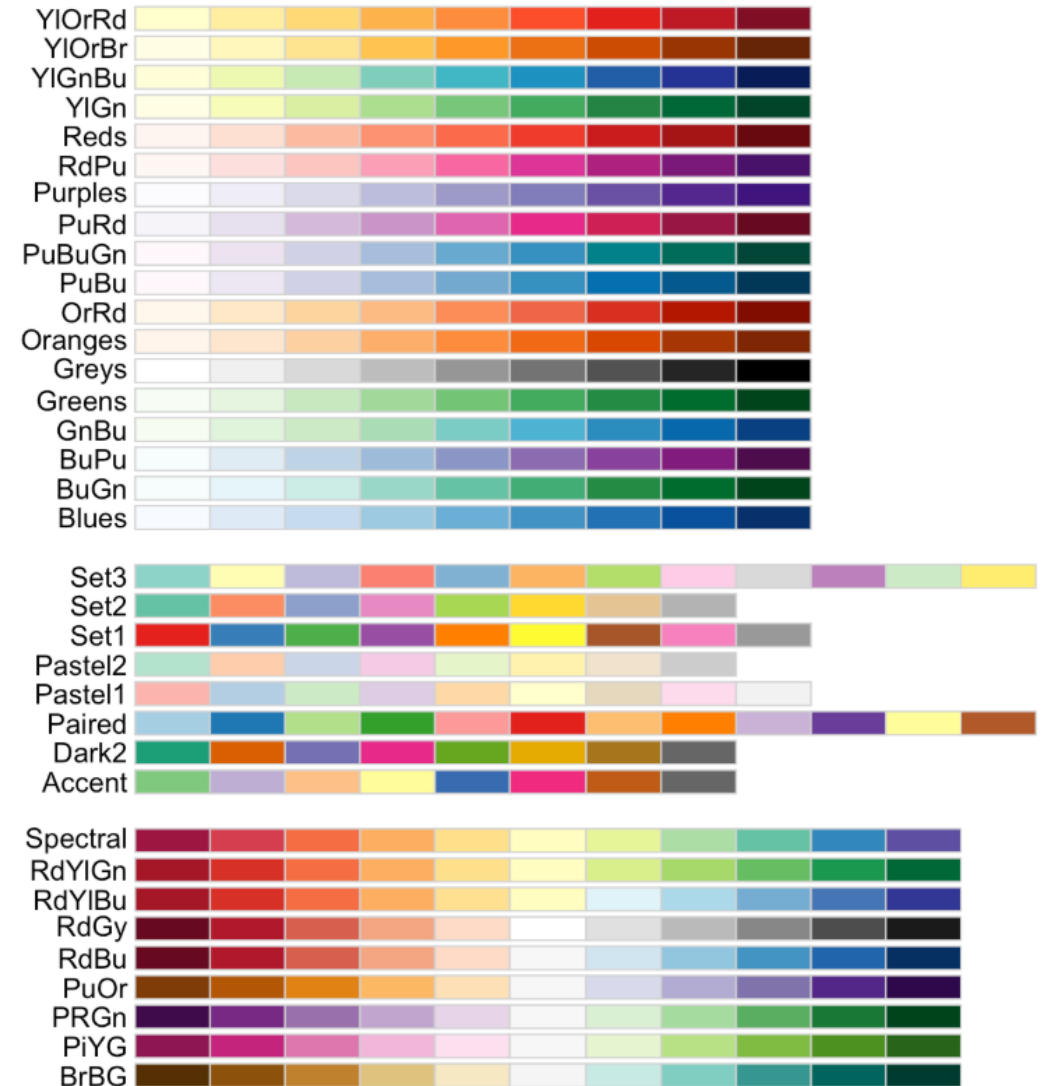
AREA SIZE

# Different goals require different palettes

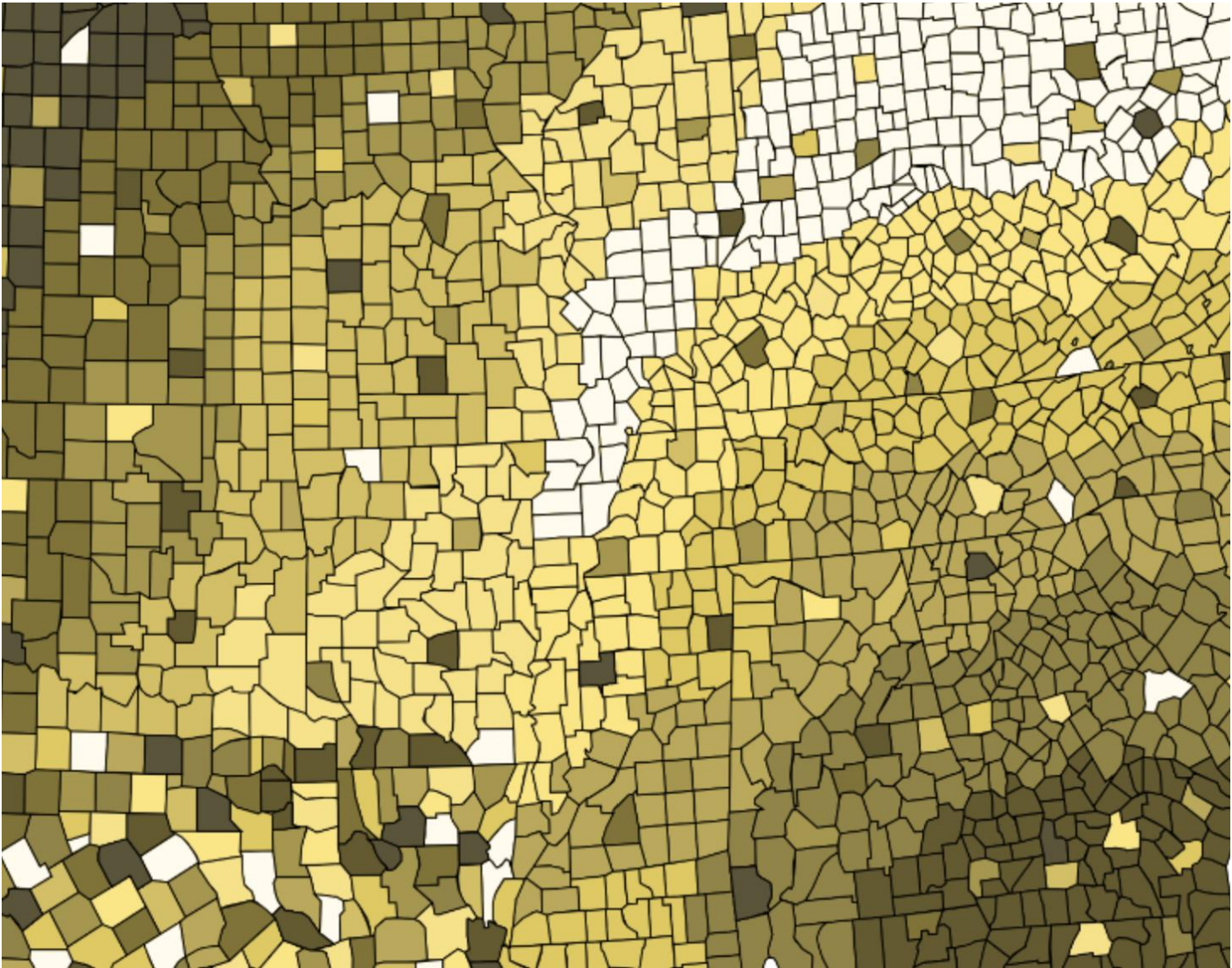
**Sequential palettes** are suited to ordered data that **progress from low to high**. Lightness steps dominate the look of these schemes, with light colors for low data values to dark colors for high data values

**Qualitative palettes** do not imply magnitude differences between classes. Hues are used to create the primary **visual differences between classes**. Qualitative schemes are suited to representing nominal or categorical data

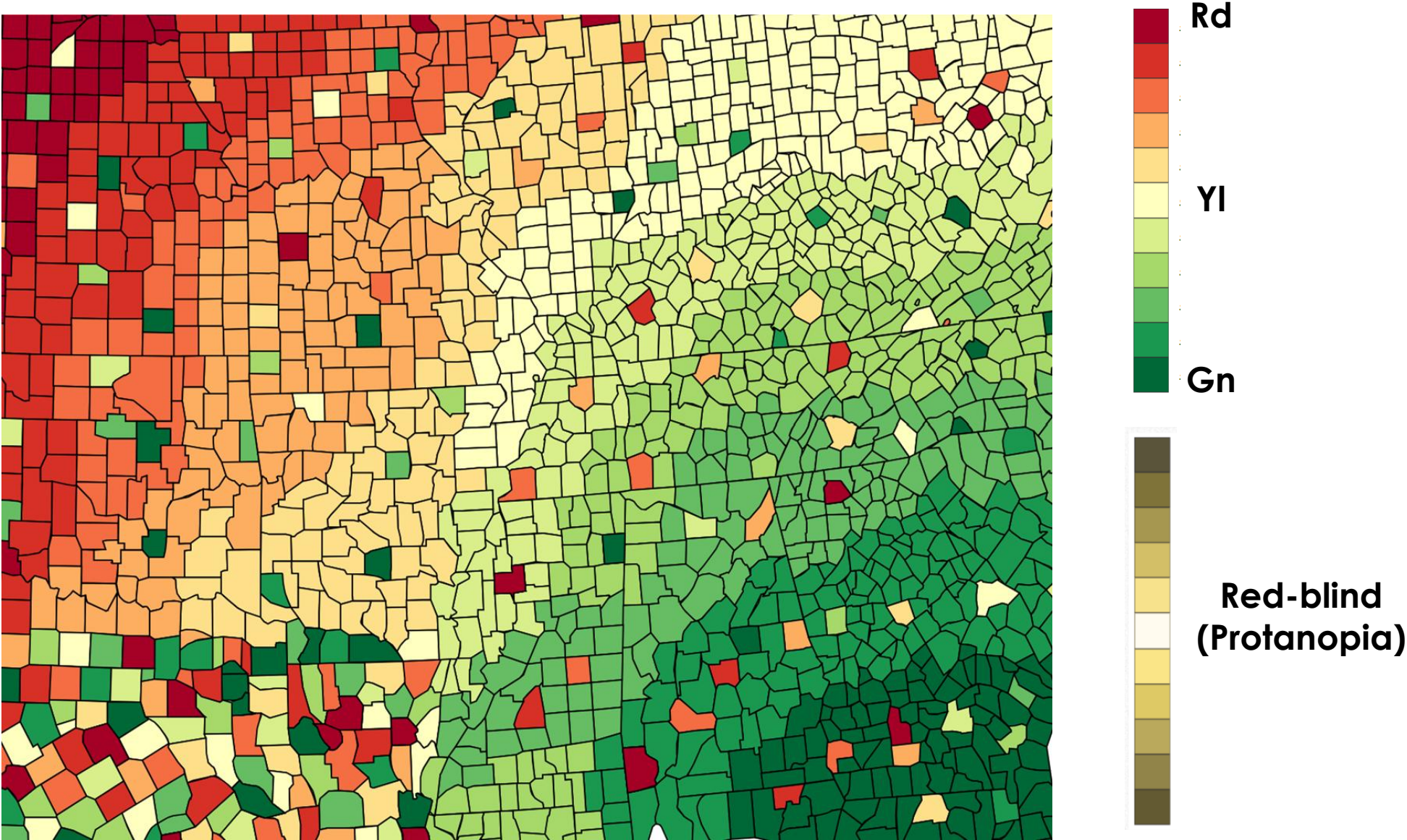
**Diverging palettes** put equal emphasis on mid range critical values and extremes at both ends of the data range. **The critical class or break in the middle of the legend is emphasized with light colors** and low and high extremes are emphasized with dark colors that have contrasting hues



# How to choose colors



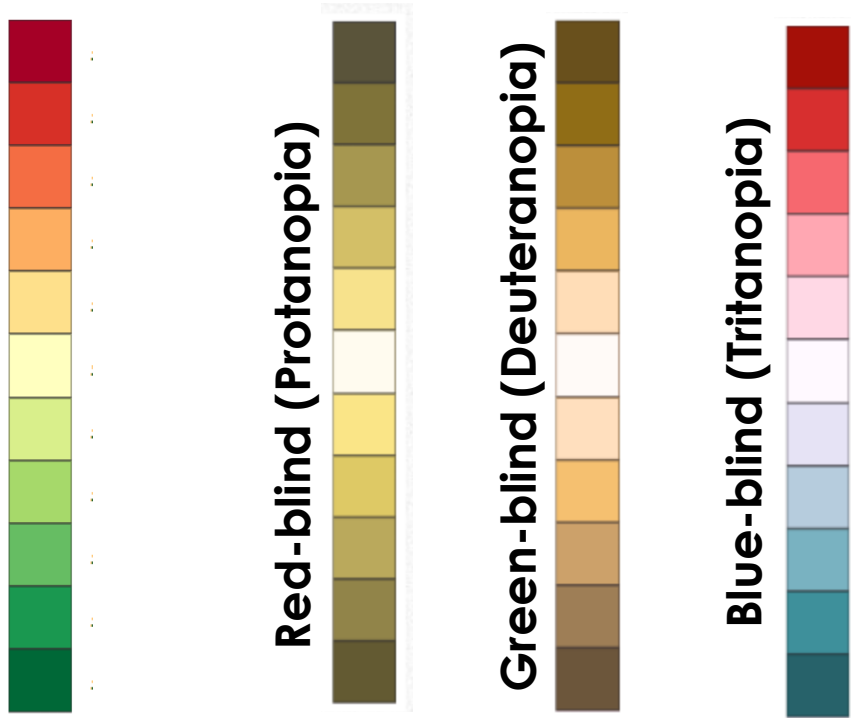
# How to choose colors



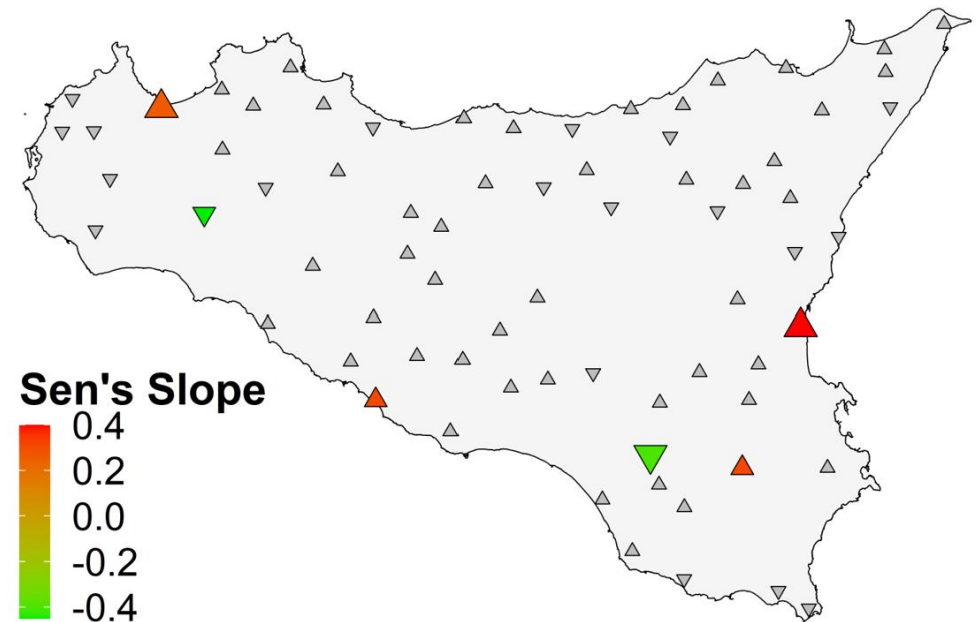
Sources: <https://r-graph-gallery.com/38-colorbrewers-palettes.html>

# Color Vision Deficiency

Color vision deficiency affects the ability to **distinguish certain colours**, making some visualizations difficult or impossible to interpret for part of the audience.



*Referee:* b) Please change the colormap to something which is better for those with visual impairment (e.g. <https://colorbrewer2.org/#type=diverging&scheme=BrBG&n=6>).



# Colorbrewer

6-class RdBu

HEX

- #b2182b
- #ef8a62
- #fddbc7
- #d1e5f0
- #67a9cf
- #2166ac

6-class RdYlGn

HEX

- #d73027
- #fc8d59
- #fee08b
- #d9ef8b
- #91cf60
- #1a9850

Number of data classes: 6

Nature of your data:  
 sequential  diverging  qualitative

Pick a color scheme:

Only show:  
 colorblind safe  
 print friendly  
 photocopy safe

Context:  
 roads  
 cities  
 borders

Background:  
 solid color  
 terrain

color transparency

6-class RdBu

HEX

- #b2182b
- #ef8a62
- #fddbc7
- #d1e5f0
- #67a9cf
- #2166ac

how to use | updates | downloads | credits

**COLORBREWER 2.0**  
color advice for cartography



EXPORT


# Leonardo Color



Leonardo [Home](#) [Sequential](#) [Diverging](#) [Qualitative](#) WCAG level **AA** Background color

**Scale name**  
My diverging scale

**Key colors**

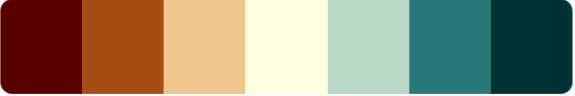
Start colors   +

Middle color 

End colors   +


**Interpolation options**  
Color space **CAM02**  Smooth

**Output**  
Quantity  Format **Hex**  Quotes

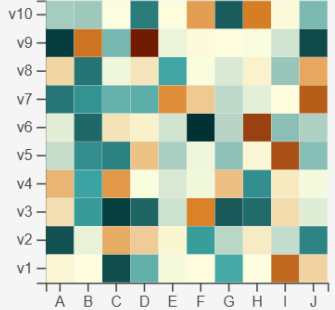
  
#580000, #a54d15, #edc58d, #ffffe0, #b9d6c7, #297878, #003233

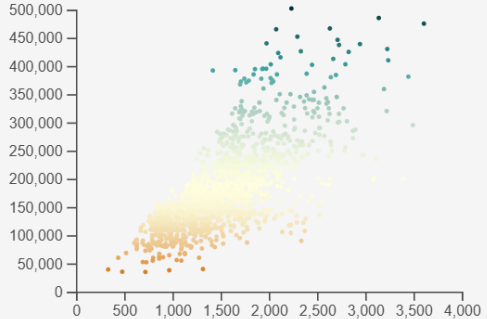
**Export**  
[Tableau \(XML\)](#) [SVG colors](#) [SVG gradient](#)

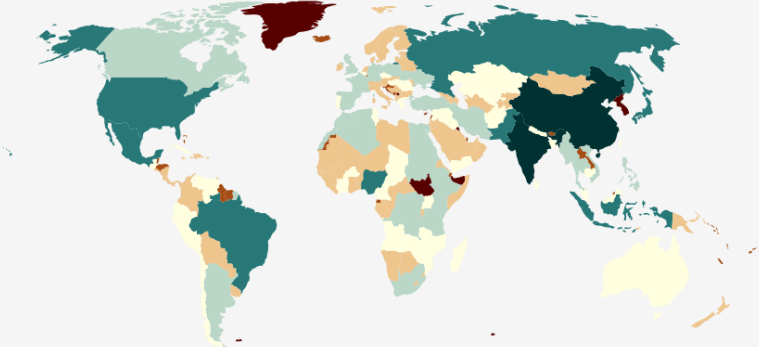
**Color scale**



[Visualize](#) [Analyze](#) [Model](#) **Accessibility**

  
v10  
v9  
v8  
v7  
v6  
v5  
v4  
v3  
v2  
v1  
A B C D E F G H I J

  
500,000  
450,000  
400,000  
350,000  
300,000  
250,000  
200,000  
150,000  
100,000  
50,000  
0  
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000



# Leonardo Color

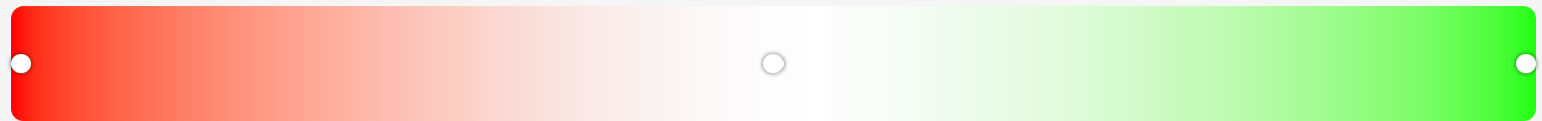
## Color scale



Visualize Analyze Model Accessibility

| COMPARED COLORS             | PREVIEW | STATUS | CONTRAST |
|-----------------------------|---------|--------|----------|
| Start color vs Background   |         | Pass   | 13.97:1  |
| Middle color vs Background  |         | Fail   | 1.04:1   |
| End color vs Background     |         | Pass   | 13.15:1  |
| Start color vs Middle color |         | Pass   | 14.58:1  |
| Middle color vs End color   |         | Pass   | 13.72:1  |

## Color scale



Visualize Analyze Model Accessibility

| COMPARED COLORS             | PREVIEW | STATUS | CONTRAST | COLOR DIFFERENCE |
|-----------------------------|---------|--------|----------|------------------|
| Start color vs Background   |         | Pass   | 3.76:1   | Delta E  44.86   |
| Middle color vs Background  |         | Fail   | 1.06:1   | Delta E  1.4     |
| End color vs Background     |         | Fail   | 1.29:1   | Delta E  32.74   |
| Start color vs Middle color |         | Pass   | 4:1      | Delta E  45.81   |
| Middle color vs End color   |         | Fail   | 1.37:1   | Delta E  33.03   |

# S-ink



s-ink Series Gallery Resources Contribute About   

## s-ink

*Making up-to-date and high-quality science graphics accessible.*

[Read about it in Crameri et al. \(2022\)](#)



### Science-proof

Quality checked by the s-ink scientist team. Reviewed by the entire scientific community.



### Eye-catching

Created and refined by the s-ink graphic designer team. Supported by digital artists around the world.



### Accessible

One collection. Fully colour-blind friendly. Easily reachable via an effective FM search engine.



### Open and free

Exclusively open-access graphical products. Provided for free as a community contribution.

# S-ink

**Sequential gradients**

batlow, batlowW, batlowK, glasgow, lipari, navia, hawaii, buda, imola, oslo, grayC, nuuk, devon, lajolla, bamako, davos, bilbao, lapaz, acton, turku, tokyo

Continuous palettes

Discrete palettes

Categorical palettes

Perceptually uniform  
Perceptually ordered  
Colour-vision deficiency friendly  
Readable in black&white

Widely compatible  
Accessible and free  
Versioned & citable

By the community, for the community.

**Diverging gradients**

broc, cork, vik, lisbon, tofino, berlin, bam, roma, vanimo, managua

**Cyclic gradients**

romaO, bamO, brocO, corkO, vikO

www.fabiocrameri.ch/colourmaps

Scientific Colour Maps


# Coblis - Color Blindness Simulator

color-blindness.com/coblis-color-blindness-simulator/

Drag and drop or paste your file in the area below or:  Nessun file selezionato

**Trichromatic view:**  Normal  
**Anomalous Trichromacy:**  Red-Weak/Protanomaly  
 Green-Weak/Deuteranomaly  
 Blue-Weak/Tritanomaly  
**Dichromatic view:**  Red-Blind/Protanopia  
 Green-Blind/Deuteranopia  
 Blue-Blind/Tritanopia  
**Monochromatic view:**  Monochromacy/Achromatopsia  
 Blue Cone Monochromacy

Use lens to compare with normal view:  No Lens  Normal Lens  Inverse Lens  
[Reset View](#)

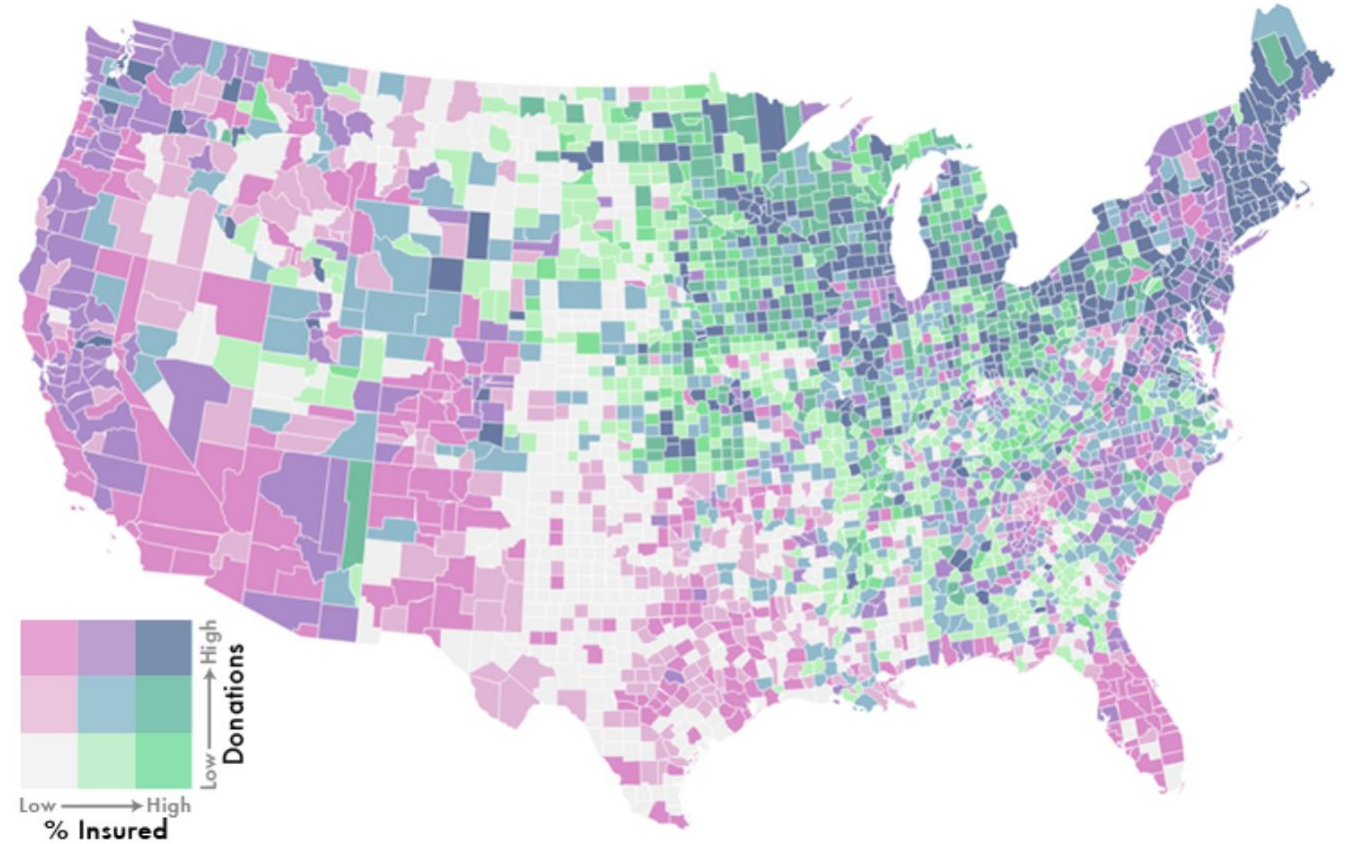
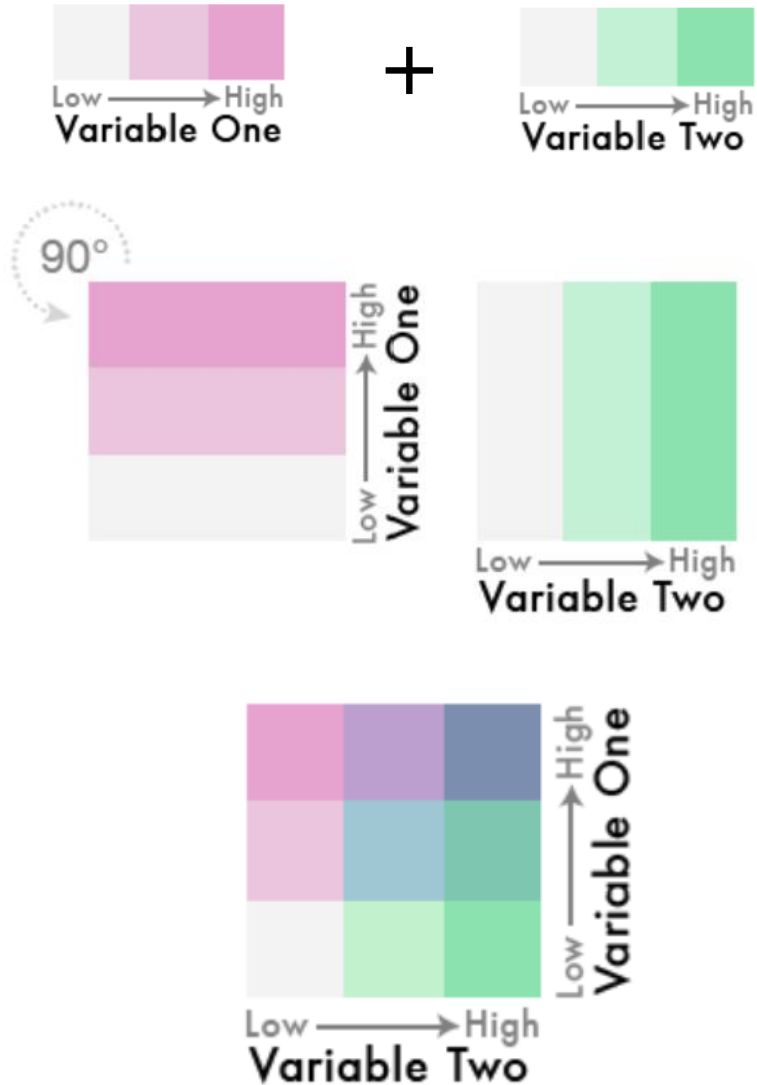


**Trichromatic view:**  Normal  
**Anomalous Trichromacy:**  Red-Weak/Protanomaly  
 Green-Weak/Deuteranomaly  
 Blue-Weak/Tritanomaly  
**Dichromatic view:**  Red-Blind/Protanopia  
 Green-Blind/Deuteranopia  
 Blue-Blind/Tritanopia  
**Monochromatic view:**  Monochromacy/Achromatopsia  
 Blue Cone Monochromacy

Use lens to compare with normal view:  No Lens  Normal Lens  Inverse Lens  
[Reset View](#)



# Because one variable was not enough



# Bivariate palette package

## Bivariate Palettes

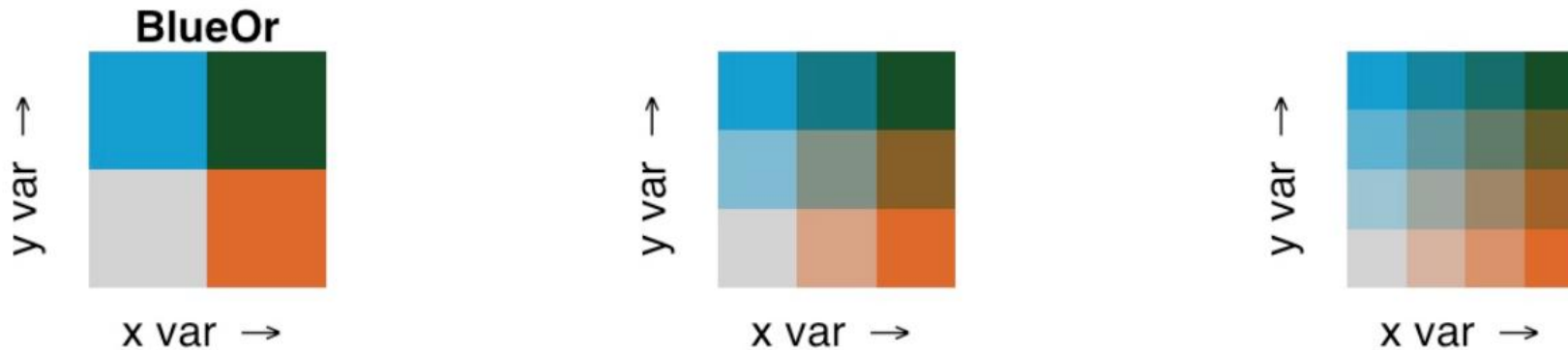
Christopher Prener, Ph.D. and Branson Fox

2025-08-31

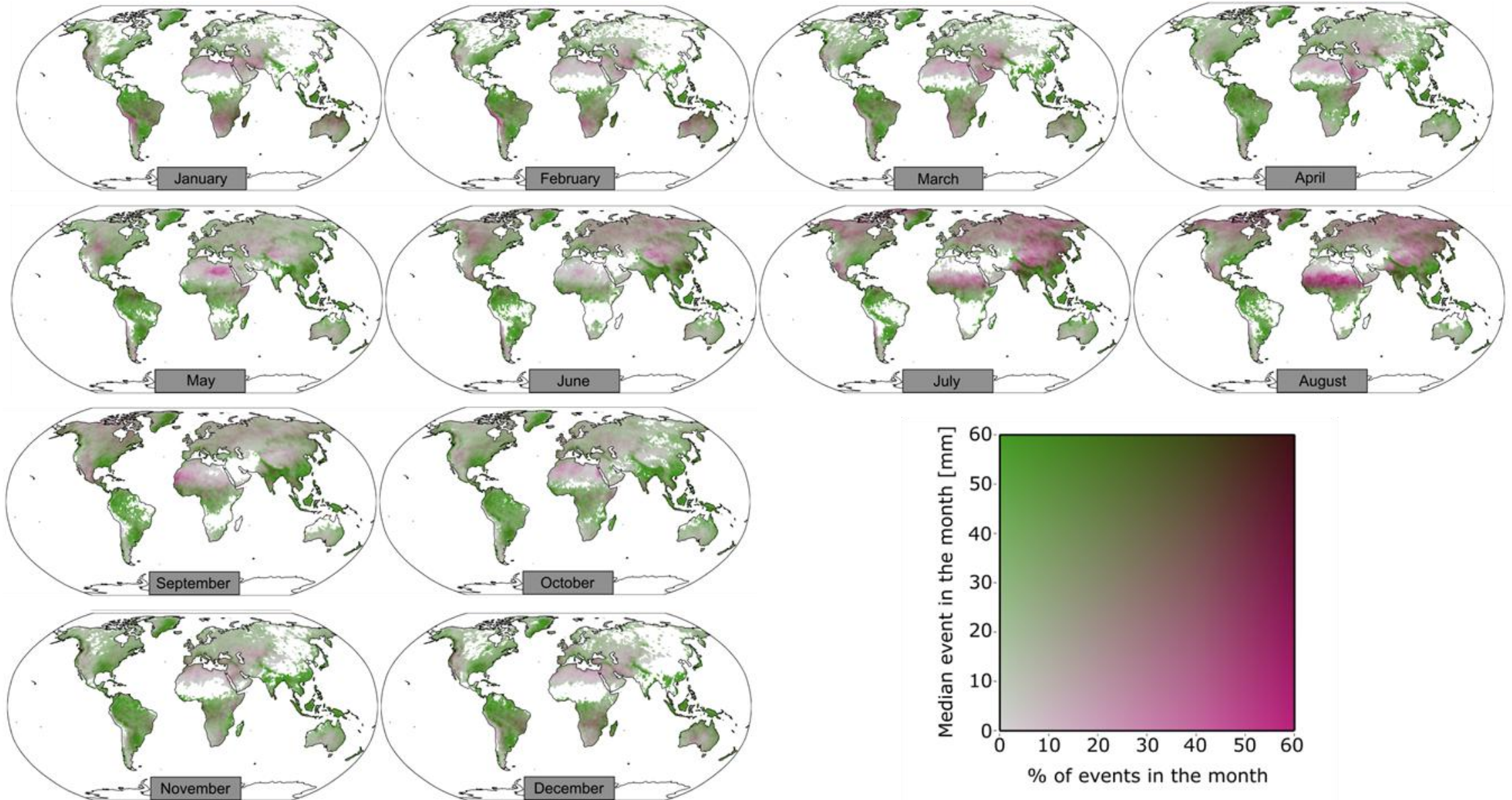
One of the important aspects of cartography and data visualization is color choice. This vignette illustrates the palettes included with `biscale`, provides an overview of palette manipulation tools, and describes the revised approach to utilizing custom palettes.

### Included Palettes

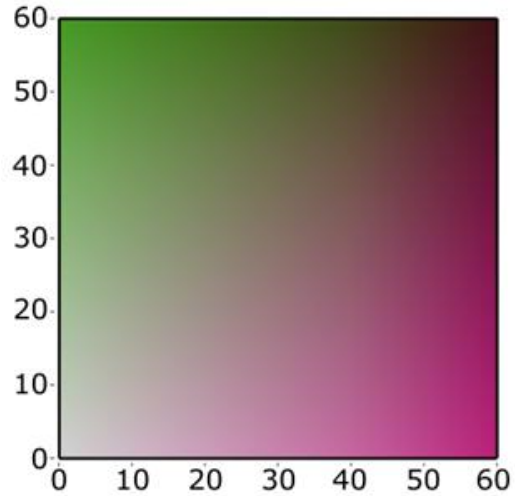
As of `v1.0.0`, `biscale` supports a dozen built-in palettes and expanded ability to utilize custom palettes. For five of these palettes, there are both “primary” versions and “legacy versions.”



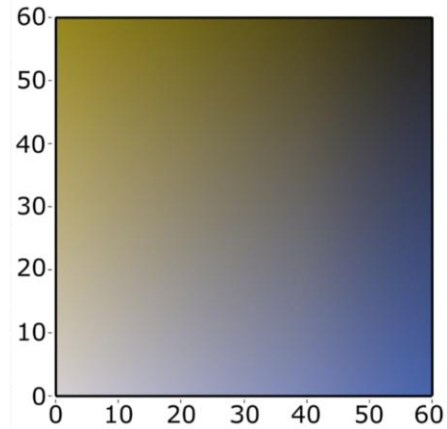
# Bivariate palettes can also be continuous



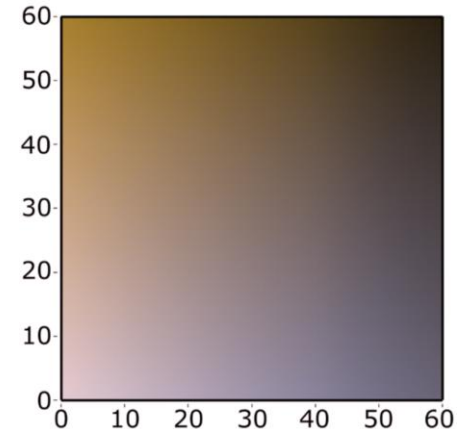
# But always remember to check CVD



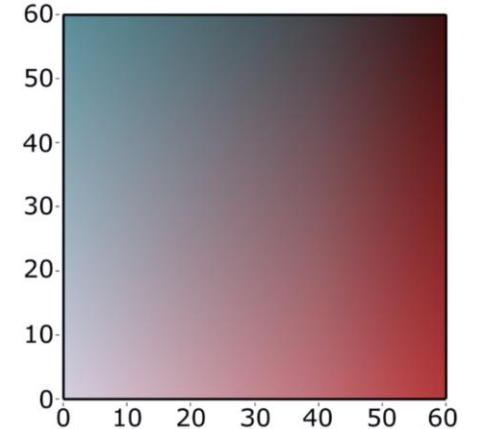
**Red-blind  
(Protanopia)**



**Green-blind  
(Deuteranopia)**



**Blue-blind  
(Tritanopia)**



# Poster vs Presentation

1. The **message** you want to communicate

A focus on your key results

A narrative flow for your (complex) story

2. The **stage** of your work

Preliminary results

Mature story with strong conclusions

3. The **interaction** you want

1-to-1

1-to-N

4. Your **goal**

Get feedback, networking

Increase visibility

5. Last but not least... Your **communication style!** 😊

Direct interactions

Structured storytelling

You must...

**attract**

**control**

...people's attention

# How many posters do you actually remember?

**Thousands** of posters compete for attention

Most attendees will only spend a **few seconds** looking

People generally scan posters while **walking**



<https://blogs.egu.eu/geolog/2023/07/07/my-unbiased-critique-of-egus-evolving-general-assembly/>

Your poster is **seen** even before your research is **understood**



# The title of your work

You, Author B, Author C, Author D

Your Affiliation, Affiliation B, Affiliation C

## Introduction

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur. Quis aute iure reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint obcaecat cupiditat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur.

## Methods

**Figure 1**

**Figure 2**

**Figure 3**

## Results

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**Figure 4**

**Figure 5**

**Figure 6**

**Figure 7**

## Conclusion

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# Before everything, the font type

Sans **Serif** this is the "serif"

Times New Roman

The title of your work  
You, Author B, Author C, Author D  
Your Affiliation, Affiliation B, Affiliation C

Montserrat 

The title of your work  
You, Author B, Author C, Author D  
Your Affiliation, Affiliation B, Affiliation C

# Your best friend, **visual hierarchy**

Not all information should have the **same visual importance**. Readers should immediately know:

1. **Where** to look first
2. **What** matters most

But you'll probably never read this

**This for  
second**

Now, if I've caught your attention,  
you'll start reading this text, but  
you'll still follow the same rule: you'll  
read the text in **color** and **bold** first

**THIS FIRST**

# Your best friend, **visual hierarchy**

Not all information should have the **same visual importance**. Readers should immediately know:

1. **Where** to look first
2. **What** matters most

But you'll probably never read this

But you'll probably never read this

**This for**

**THIS**

Now, if I've caught your attention, you'll start reading this text, but you'll still follow the same rule: you'll read the text in **color** and **bold** first

**FIRST**

# Your best friend, **visual hierarchy**

## Font weight

Thin 100

Extra light 200

Light 300

Regular 400

Medium 500

**SemiBold 600**

**Bold 700**

**ExtraBold 800**

**Black 900**

## Font Size

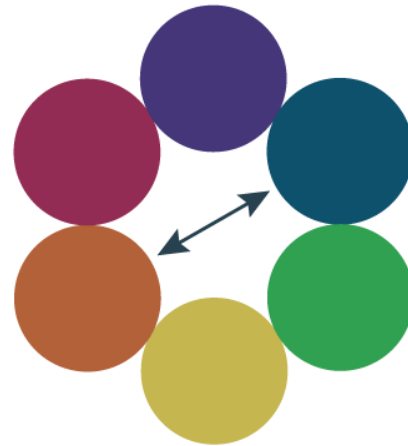
Heading (24pt)

Subheading (14pt)

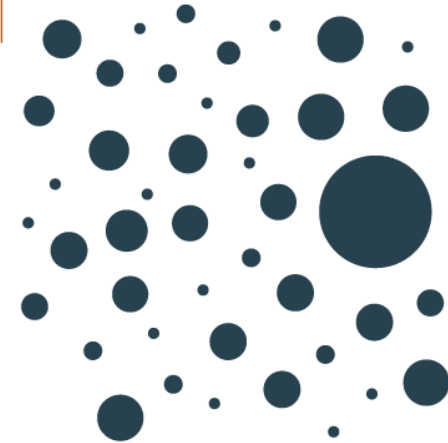
Main text (10pt)

## Colour

Lorem ipsum dolor sit amet, consectetur adipiscing elit, Lorem ipsum **dolor sit amet**, consectetur adipiscing elit, sed diam Lorem ipsum sed dolor sit amet, consectetur adipiscing elit, sed diam rbn nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat gpdiut volutpat. Ut wisi enim ad



## Size



## Spacing



k<sup>o</sup>WLEGIBLEdesigns

# Your best friend, **visual hierarchy**

## Font weight

Thin 100

Extra light 200

Light 300

Regular 400

Medium 500

**SemiBold 600**

**Bold 700**

**ExtraBold 800**

**Black 900**



## Font Size

Heading (24pt)

Subheading (14pt)

Main text (10pt)

You do not need many fonts to create **hierarchy**, just use:

1. **Weight**

2. **Size**

3. Spacing

# Your best friend, **visual hierarchy**

## Font weight

Thin 100

Extra light 200

Light 300

Regular 400

Medium 500

**SemiBold 600**

**Bold 700**

**ExtraBold 800**

**Black 900**

## Font Size

Heading (24pt)

Subheading (14pt)

Main text (10pt)

For **Weight** skip at least one weight to highlight contrast



Not all fonts have weights in PowerPoint by default, **but** you can always download them.

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Search Noto fonts

Specimen

About

License

Glyphs & languages

Get font

## Montserrat

Designed by [Julieta Ulanovsky](#), [Sol Matas](#), [Juan Pablo del Peral](#), [Jacques Le Bailly](#).

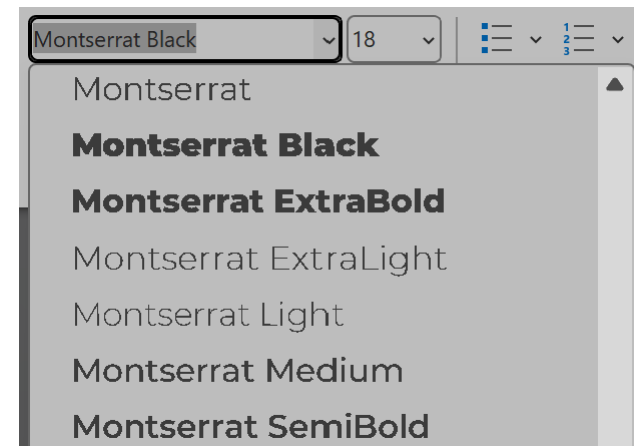
Copyright 2024 The Montserrat.Git Project Authors

(<https://github.com/JulietaUla/Montserrat.git>)

This Font Software is licensed under the [SIL Open Font License, Version 1.1](#). This license is copied below, and is also available with a FAQ at:

<https://openfontlicense.org>

[SIL OPEN FONT LICENSE Version 1.1](#) - 26 February 2007



# Your best friend, **visual hierarchy**

## Colour

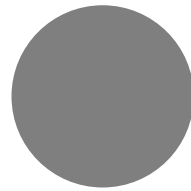
Lorem ipsum dolor sit amet, consectetur adipiscing elit, Lorem ipsum **dolor sit amet**, consectetur adipiscing elit, sed diam Lorem ipsum sed dolor sit amet, consectetur adipiscing elit, sed diam rbn nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat gpdut volutpat. Ut wisi enim ad



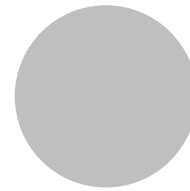
Build a **simple color** system.

**Do not choose colors randomly**

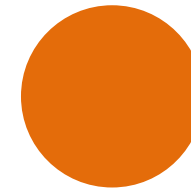
With just **4 colours**, you can create a clean and high-contrast colour scheme:



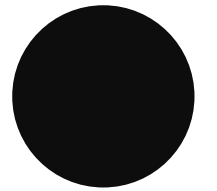
Primary



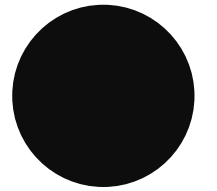
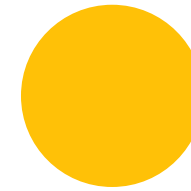
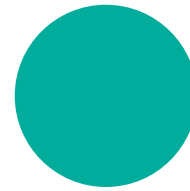
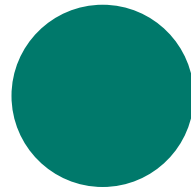
Secondary



Accent



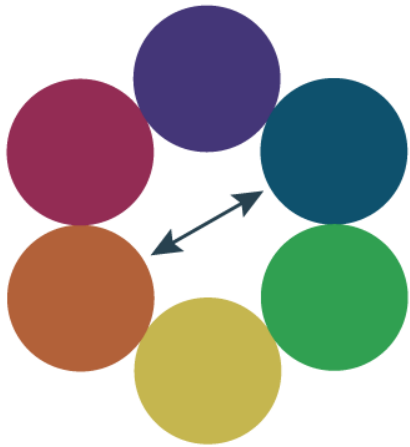
Text



# Your best friend, visual hierarchy

## Colour

Lorem ipsum dolor sit amet, consectetur adipiscing elit, Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam Lorem ipsum sed dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat gpdium volutpat. Ut wisi enim ad



material design palette [Learn to code with SheCodes](#)

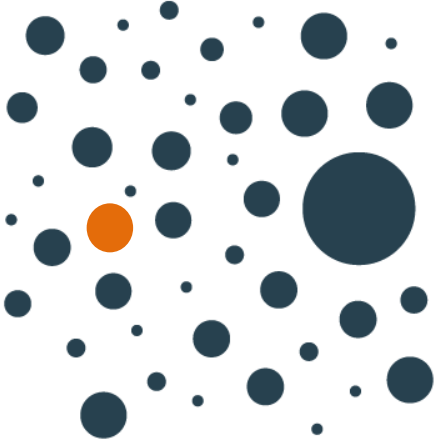
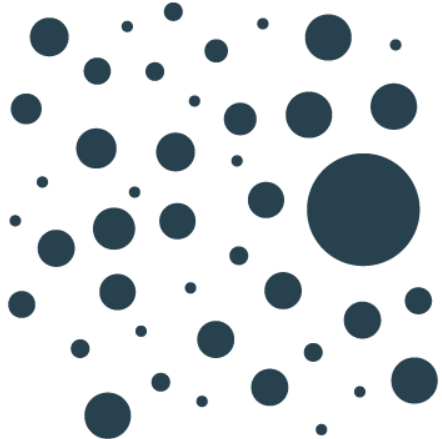
|        |             |                 |        |             |
|--------|-------------|-----------------|--------|-------------|
| RED    | PINK        | CHOOSE 2 COLORS | PURPLE | DEEP PURPLE |
| INDIGO | BLUE        | LIGHT BLUE      | CYAN   | TEAL        |
| GREEN  | LIGHT GREEN | LIME            | YELLOW | AMBER       |
|        |             |                 |        | BLUE GREY   |

Your Palette ^ [DOWNLOAD](#) [TWEET](#)

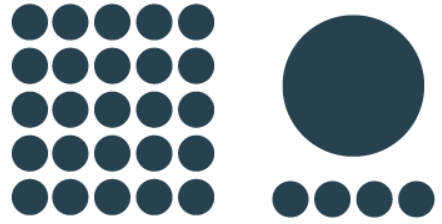
|                               |                                |                           |                          |
|-------------------------------|--------------------------------|---------------------------|--------------------------|
| #00796B<br>DARK PRIMARY COLOR | #B2DFDB<br>LIGHT PRIMARY COLOR | #009688<br>PRIMARY COLOR  | #FFFFFF<br>TEXT / ICONS  |
| #FFC107<br>ACCENT COLOR       | #212121<br>PRIMARY TEXT        | #757575<br>SECONDARY TEXT | #BDBDBD<br>DIVIDER COLOR |

# Your best friend, **visual hierarchy**

## Size



## Spacing



# Your best friend, **visual hierarchy**

Not all information should have the **same visual importance**. Readers should immediately know:

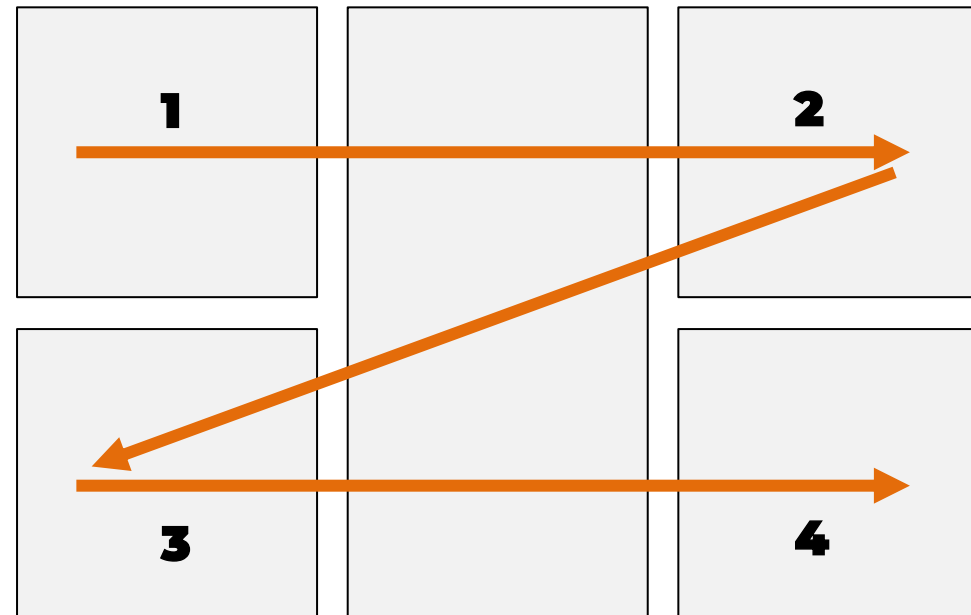
1. **Where** to look first
2. **What** matters most
3. **How** to navigate the poster

People scan posters following predictable **visual patterns**.

Good layouts work **with** natural reading behaviour, not against it.

## Z-Pattern

Works better when poster has **few major sections** there is a **relevant central figure**



# Your best friend, **visual hierarchy**

Not all information should have the **same visual importance**. Readers should immediately know:

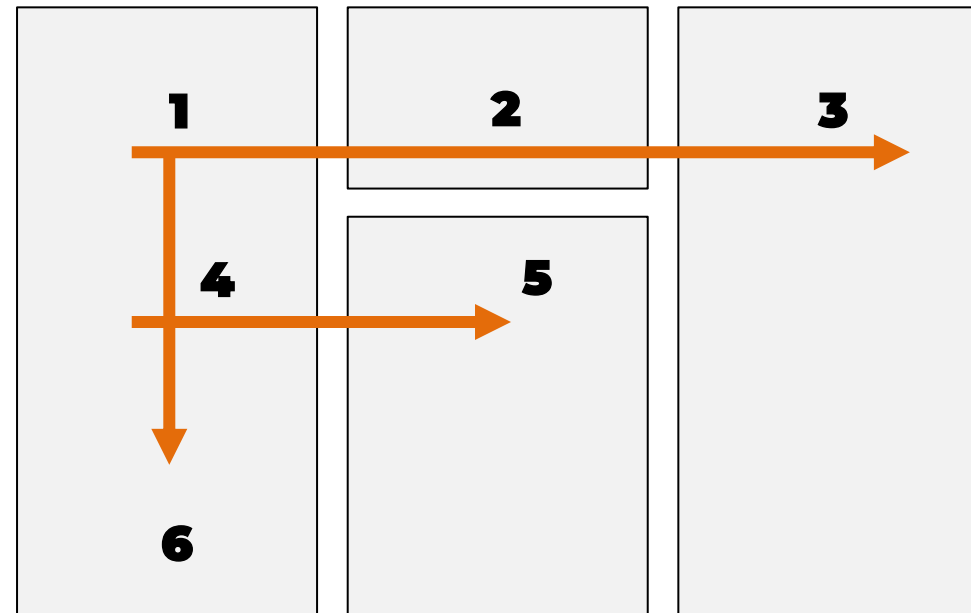
1. **Where** to look first
2. **What** matters most
3. **How** to navigate the poster

People scan posters following predictable **visual patterns**.

Good layouts work **with** natural reading behaviour, not against it.

## **F-Pattern**

Woks better when the poster is **organized into columns** and the readers are expected to **scan sections quickly**





## 1 Motivation

Lorem ipsum dolor sit amet, consectetur adipisci elit, sed eiusmod tempor incidunt ut **labore et dolore** magna aliqua. Ut enim ad minim veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur. Quis aute iure reprehenderit in **voluptate** velit esse cillum dolore eu fugiat nulla pariatur.

## 4 Motivation

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Figure 3

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## 2 Activity 2

Lorem ipsum dolor sit amet, consectetur adipisci elit, sed eiusmod tempor incidunt ut **labore et dolore** magna aliqua. Ut enim ad minim veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur. Quis aute iure reprehenderit in **voluptate** velit esse cillum dolore eu fugiat nulla pariatur.

- Lorem ipsum dolor sit amet, consectetur adipisci elit, sed eiusmod tempor incidunt ut **labore et dolore** magna aliqua.
- Ut enim ad minim veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur.



Figure 2



Figure 1

- Lorem ipsum dolor sit amet, consectetur adipisci elit, sed eiusmod tempor incidunt ut **labore et dolore** magna aliqua.
- Ut enim ad minim veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur.

## Activity 3

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Figure 3

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## Activity 3

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# A visual identity helps people remember your work



Be careful when asking AI!



# INTERACTIVE BLOCK 2

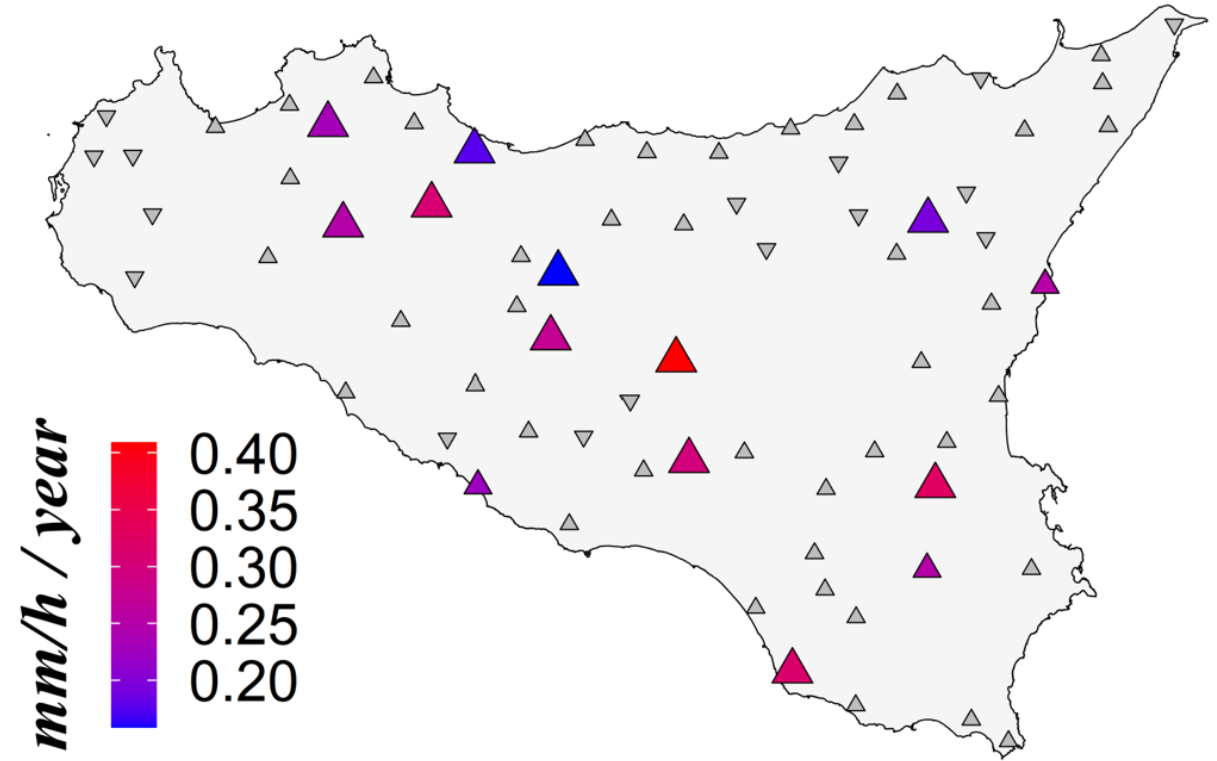
**Raise your hand  
if you agree with the statements/question.**



# Example 3

## What's your thoughts???

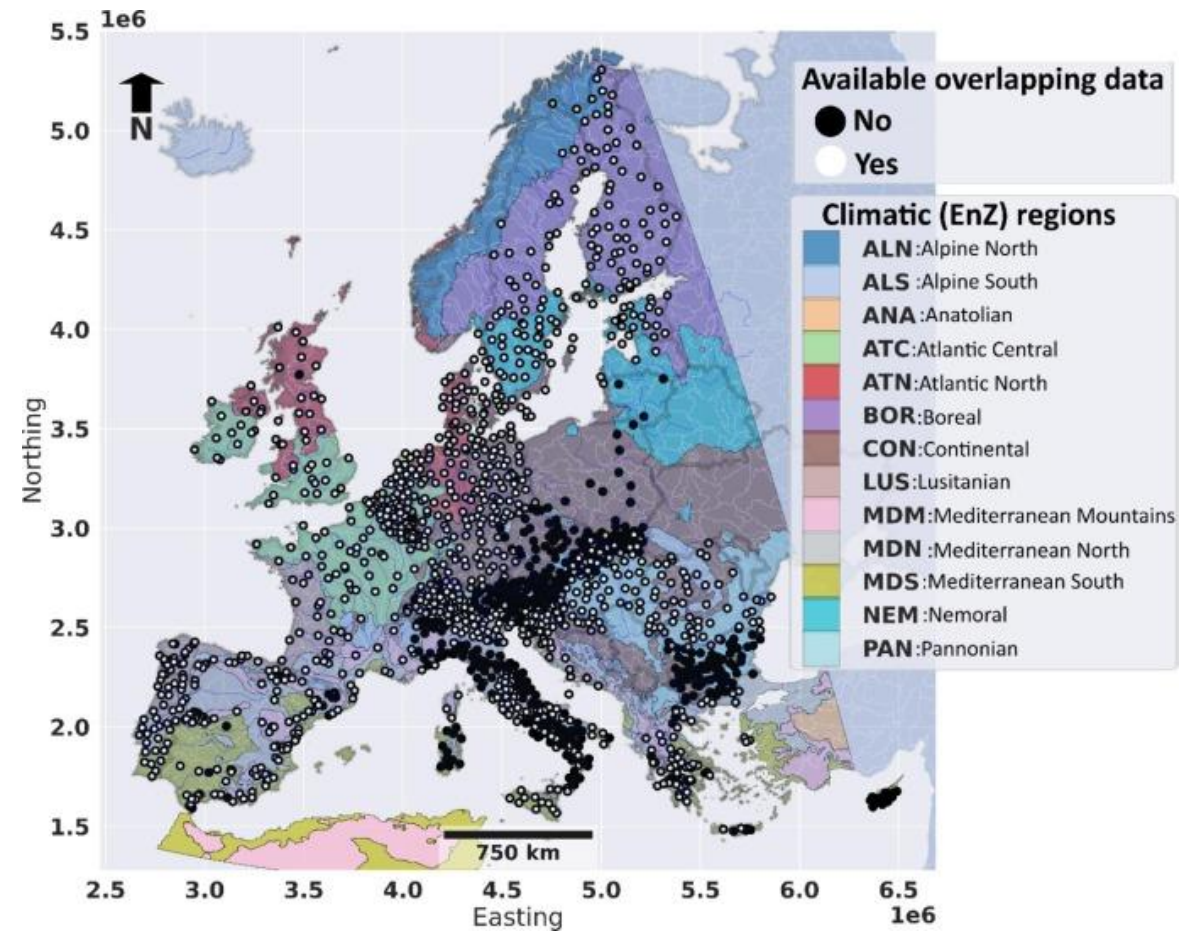
- Not self-explanatory legend
- Serif font stile
- Wrong use of diverging palette.



# Example 4

## What's your thoughts???

- Able to skim the information.
- Strategic use of colour and opacity.
- Legend self-explanatory.



Matthews et al., 2025,

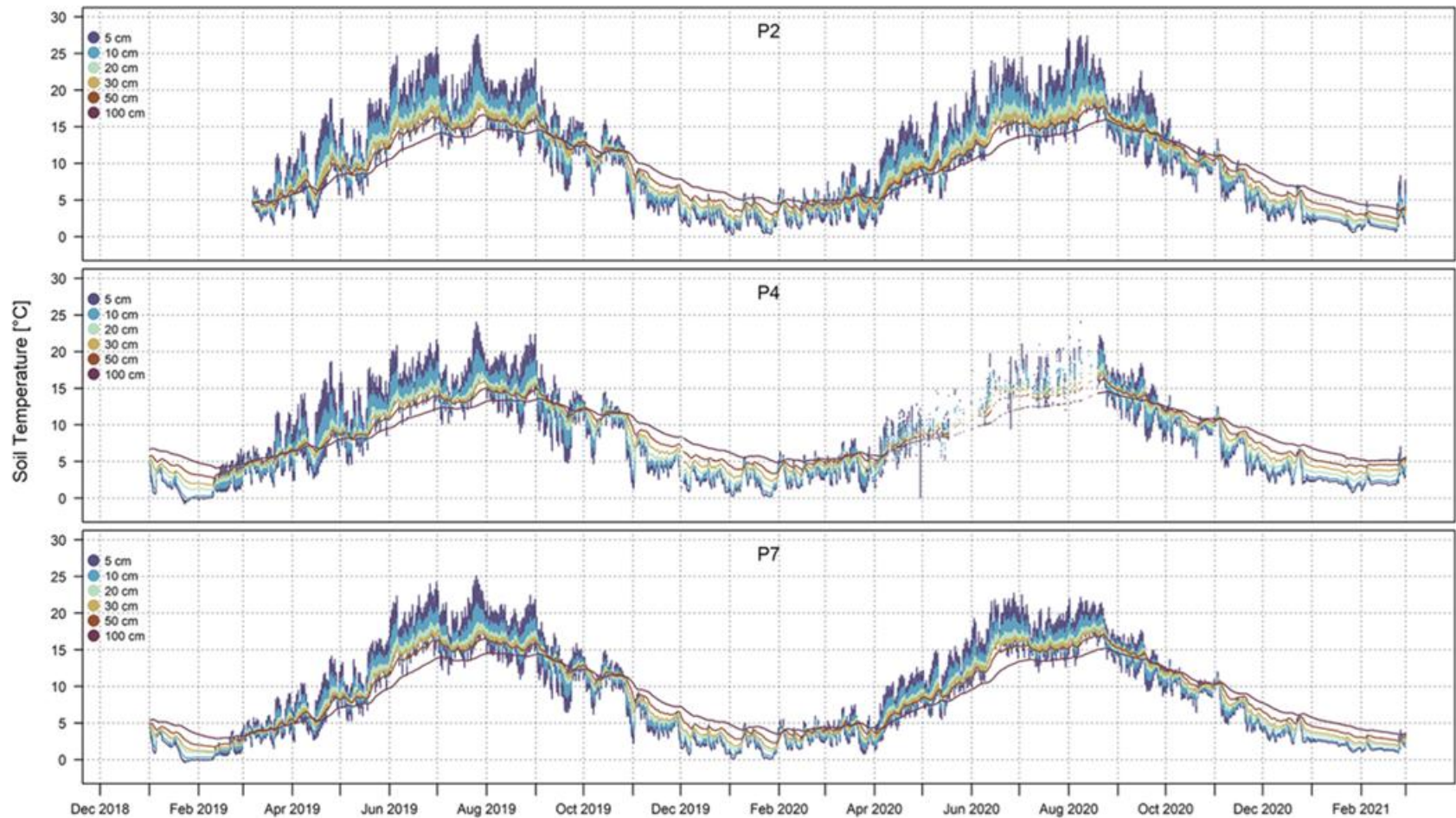
<https://doi.org/10.1016/j.jhydrol.2024.132460>

Fig. 1. An overview of the 1675 REDES gauge locations. Rainfall erosivity events were simulated at all locations (black and white points) in EMO of over the full EMO temporal extent (1990–2023), however only white points contain overlapping events between the REDES and EMO records (1990–2014). A further portion of locations (for example Austria) are not included in the REDES events database (REDESe) due to privacy restrictions on the event-scale data.

# Example 5

What's your thoughts???

- Strategic use of colour.
- Information content is overloaded.



Martini et al., 2021, ESSD

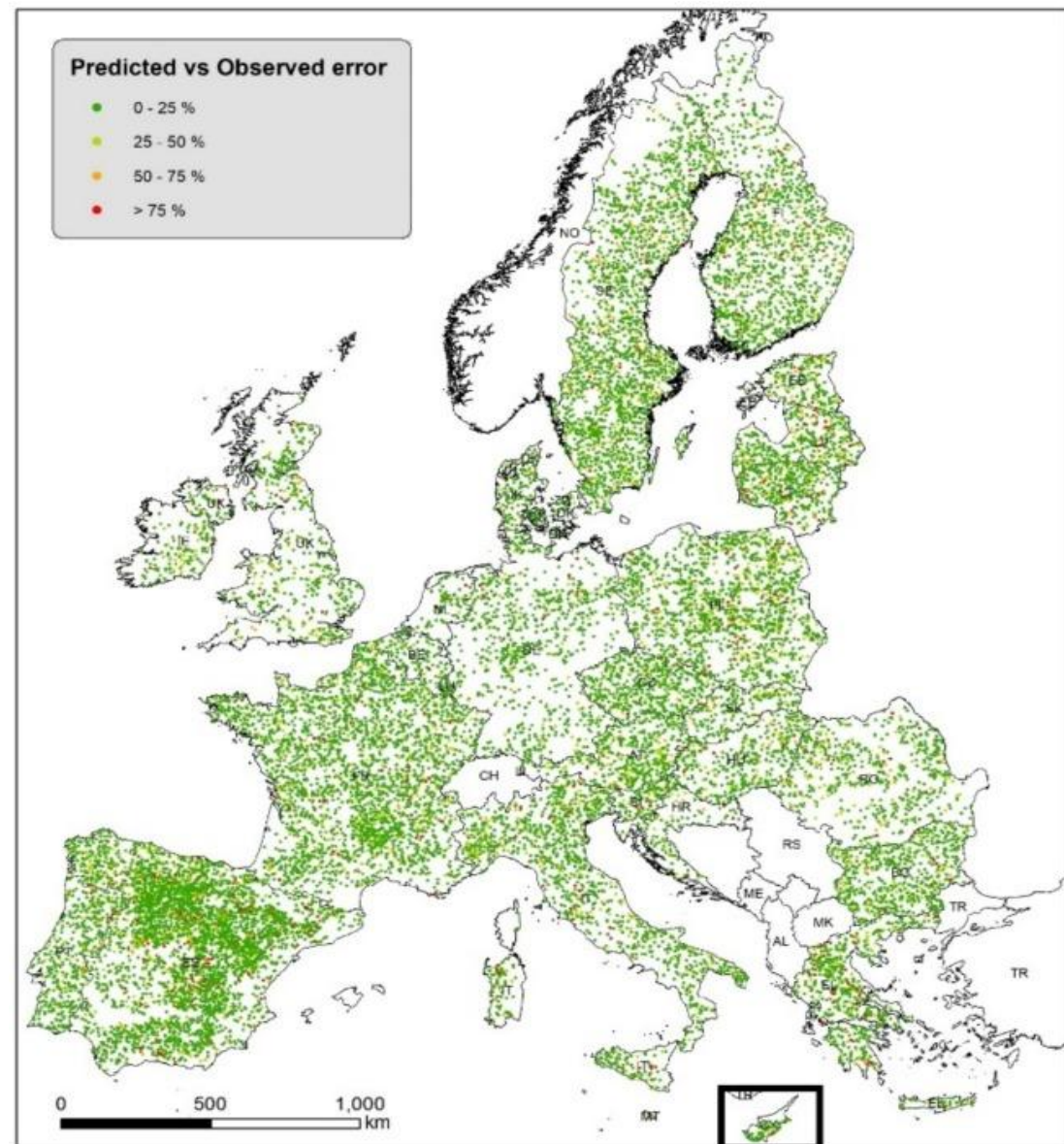
<https://essd.copernicus.org/articles/13/2529/2021/essd-13-2529-2021.html>

Fig. Time series of soil temperature data at different depth for three locations. The plots were made using the data set as it appears in the online archive. The data are plotted using a scientific colour scale from Crameri (2018) chosen according to the principles described in Crameri et al. (2020).

# Example 6

## What's your thoughts???

- Strategic use of colour and chart type.
- Able to visualise the information.
- Legend symbols should be changed.



Schillaci et al. (2025)

<https://doi.org/10.1016/j.geoderma.2025.117199>

Fig. 7. Spatial distribution of the prediction error.

**PANOPLY**

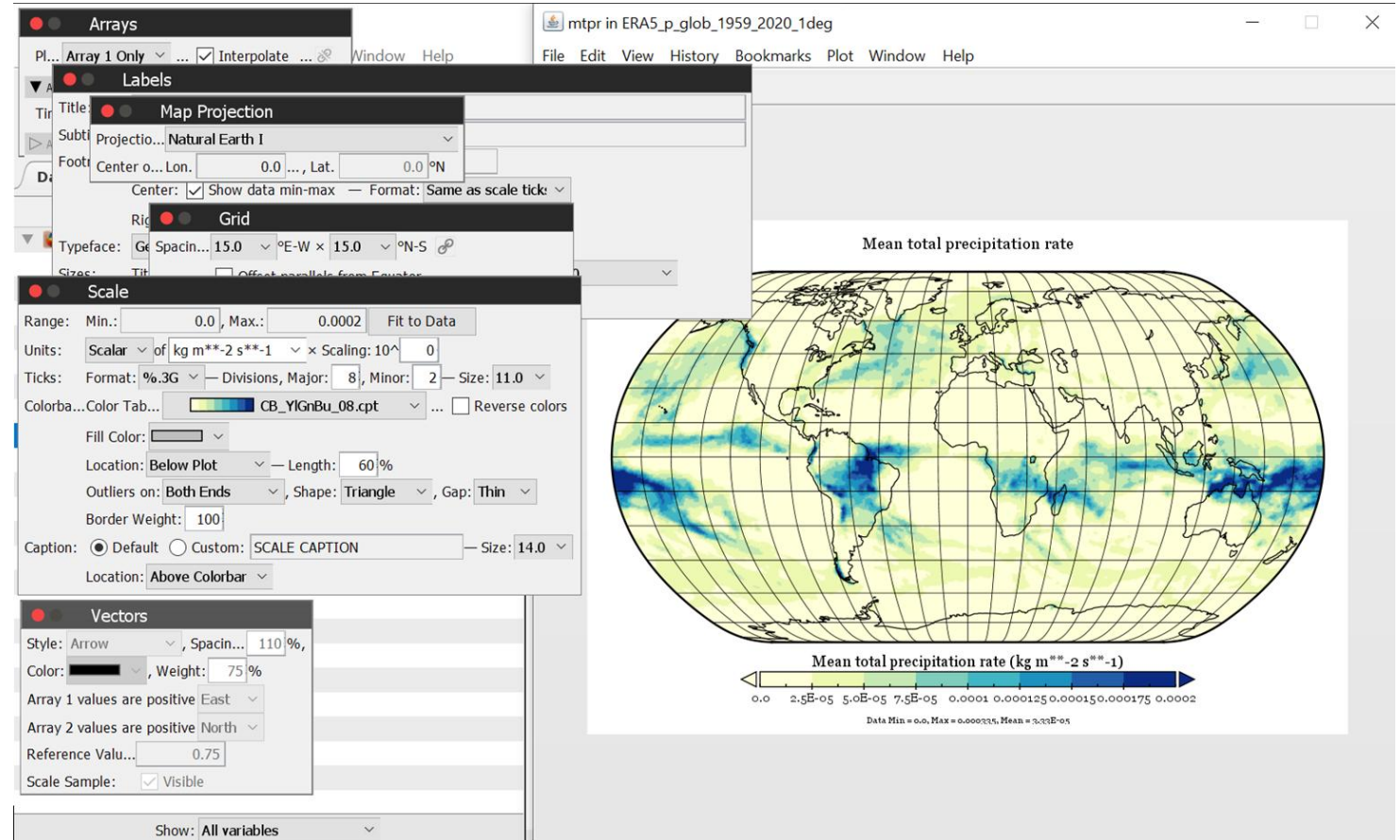
# Panoply netCDF, HDF and GRIB Data Viewer

*panoply* \PAN-uh-plee\, noun: 1. A splendid or impressive array. ...

Panoply plots georeferenced and other arrays from [netCDF](#), [HDF](#), [GRIB](#), etc.

Panoply is a cross-platform application; runs on Macintosh, Windows, Linux and other desktop computers.

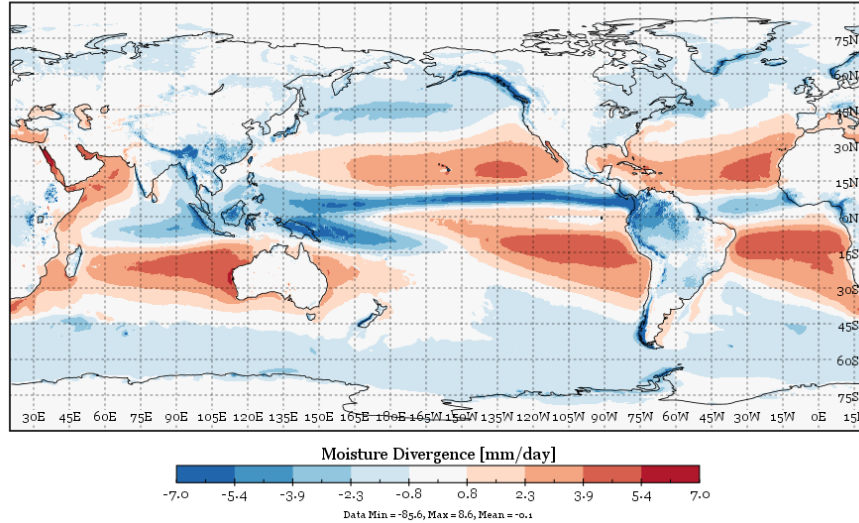
*Must have:* a compatible **Java 11** (or later version) JRE or JDK installed.



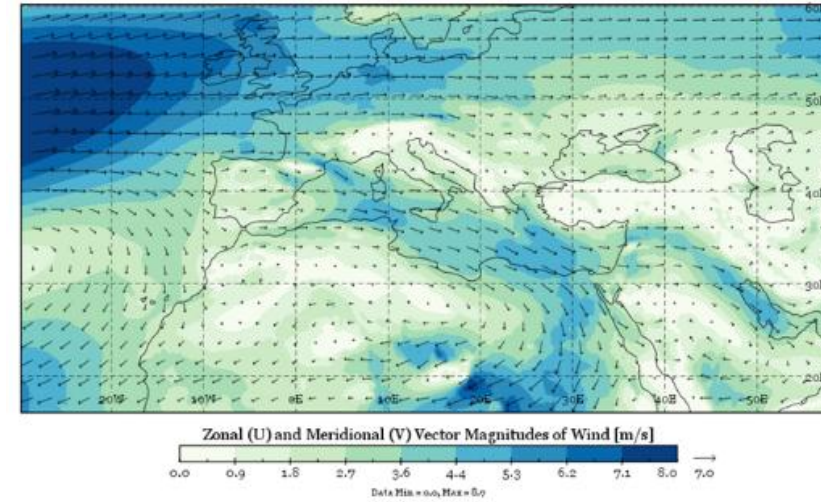
# Panoply netCDF, HDF and GRIB Data Viewer

What can you do with *Panoply 5*?

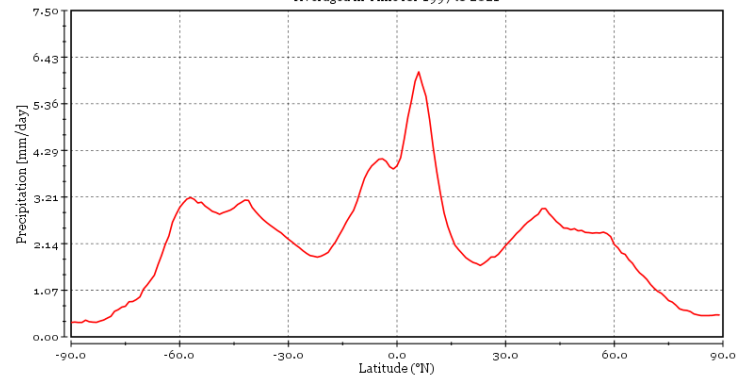
ERA5 "Moisture Divergence" Global Map  
Monthly Reanalysis Averaged for 1979 to 2021



ERA5 Monthly Wind Vectors (m/s) at 850 hpa  
Monthly Reanalysis Averaged for 1979 to 2021



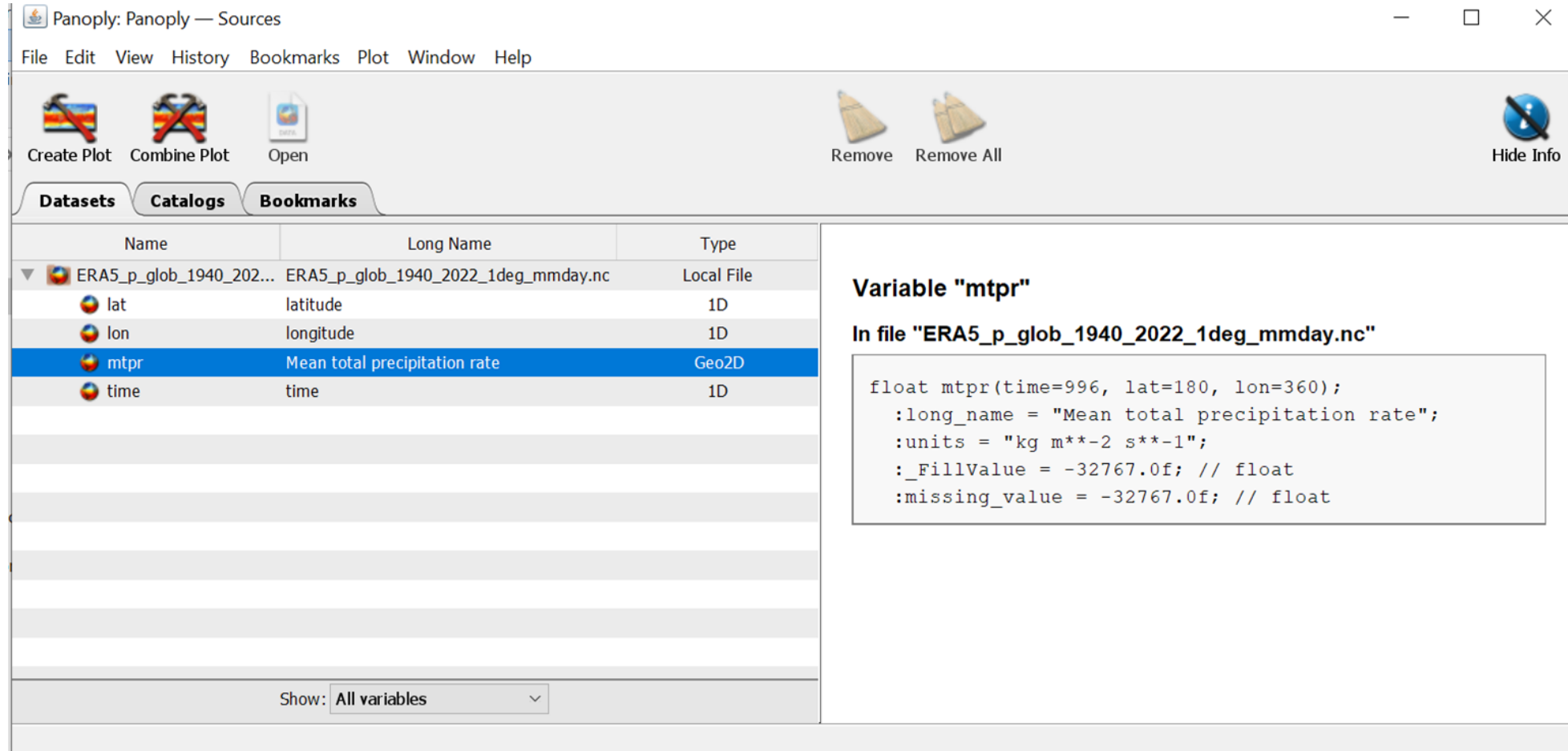
NOAA Climate Data Record (CDR) of Daily GPCP Precipitation (mm/day)  
Averaged in Time for 1997 to 2021



Data Min = 0.33, Max = 6.09

# Panoply netCDF, HDF and GRIB Data Viewer

## A [Very] Short Tutorial



The screenshot shows the Panoply software interface. The window title is "Panoply: Panoply — Sources". The menu bar includes File, Edit, View, History, Bookmarks, Plot, Window, and Help. The toolbar contains icons for Create Plot, Combine Plot, Open, Remove, Remove All, and Hide Info. Below the toolbar are tabs for Datasets, Catalogs, and Bookmarks. The main area displays a table of datasets and variables.

| Name                    | Long Name                            | Type         |
|-------------------------|--------------------------------------|--------------|
| ERA5_p_glob_1940_202... | ERA5_p_glob_1940_2022_1deg_mmday.nc  | Local File   |
| lat                     | latitude                             | 1D           |
| lon                     | longitude                            | 1D           |
| <b>mtp_r</b>            | <b>Mean total precipitation rate</b> | <b>Geo2D</b> |
| time                    | time                                 | 1D           |

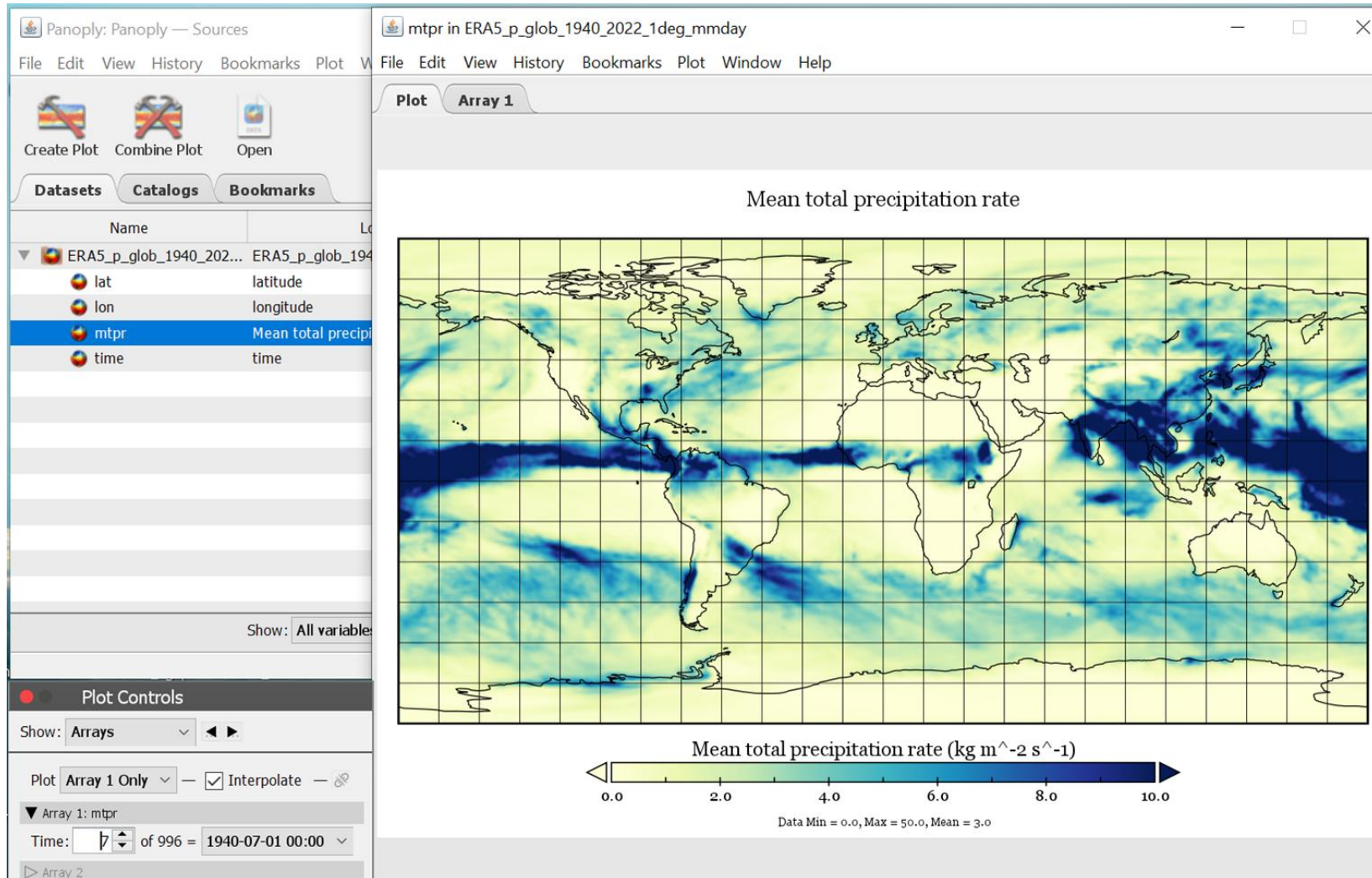
At the bottom of the table, there is a "Show:" dropdown menu set to "All variables".

**Variable "mtp\_r"**  
In file "ERA5\_p\_glob\_1940\_2022\_1deg\_mmday.nc"

```
float mtp_r(time=996, lat=180, lon=360);
:long_name = "Mean total precipitation rate";
:units = "kg m**-2 s**-1";
:_FillValue = -32767.0f; // float
:missing_value = -32767.0f; // float
```

# Panoply netCDF, HDF and GRIB Data Viewer

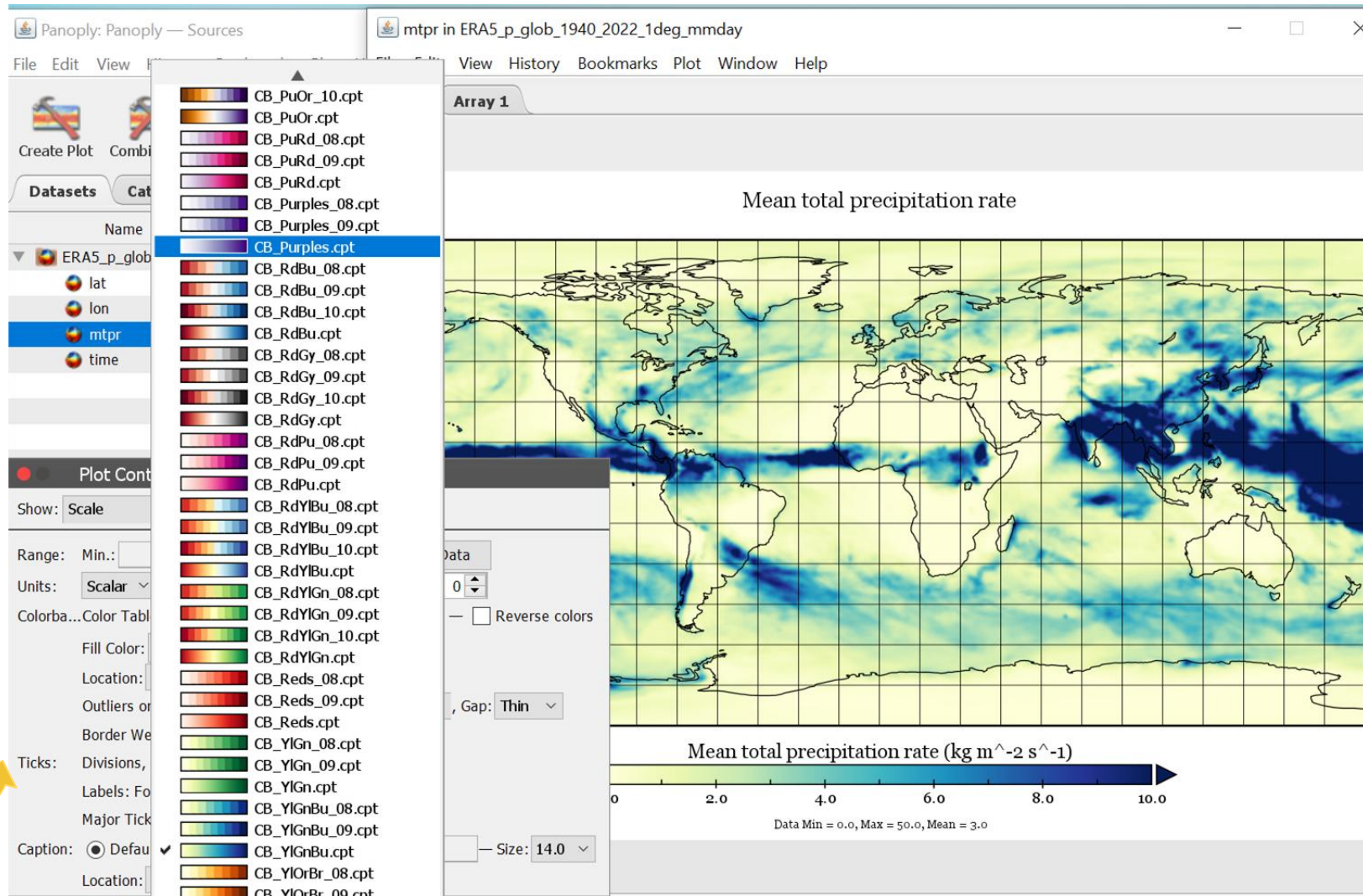
## A [Very] Short Tutorial



# Panoply netCDF, HDF and GRIB Data Viewer

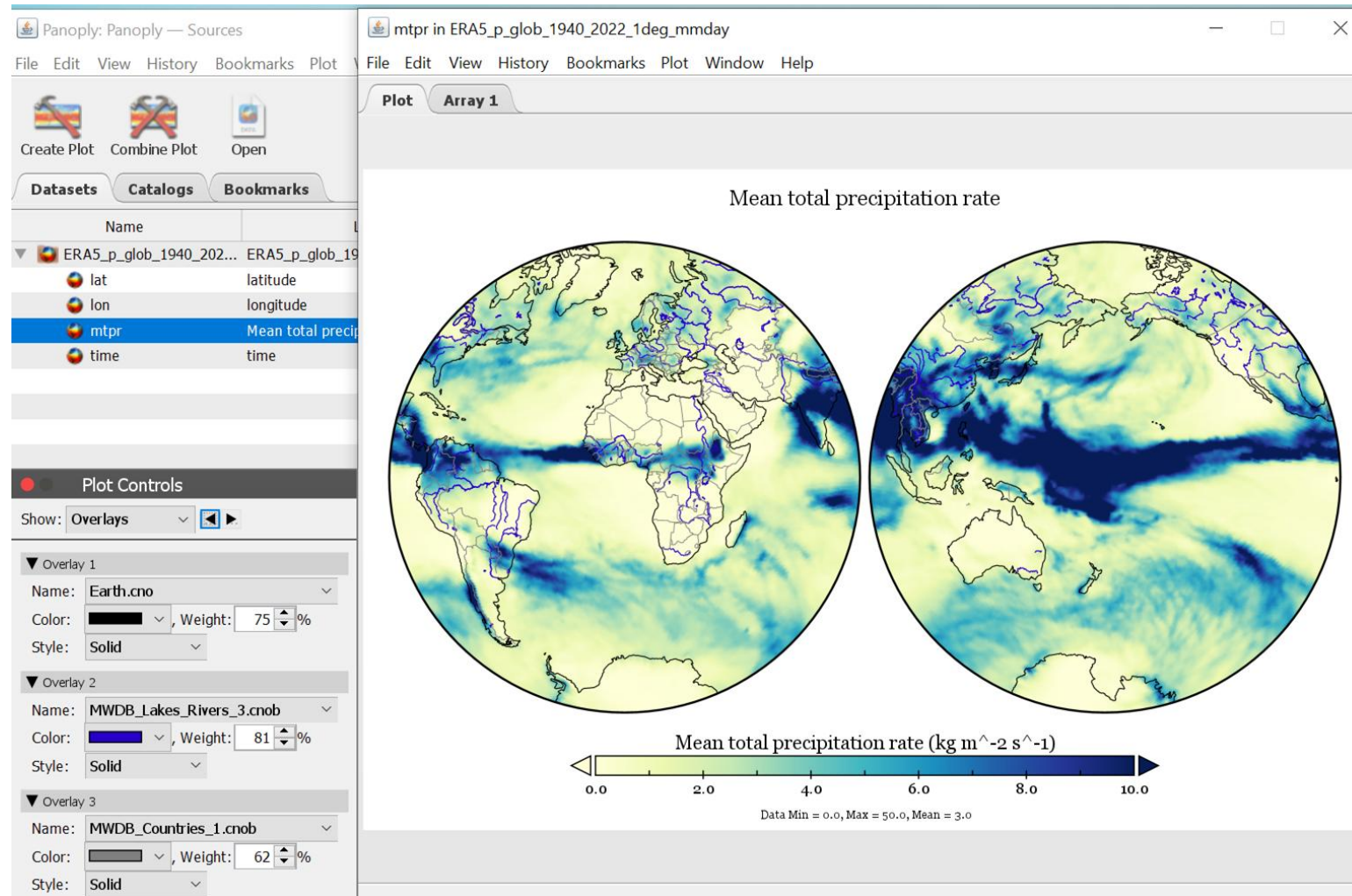
## A [Very] Short Tutorial

Numerous  
colour tables



# Panoply netCDF, HDF and GRIB Data Viewer

## A [Very] Short Tutorial



Overlay rivers,  
lakes,  
boundaries



> 200 map  
projections



# Panoply netCDF, HDF and GRIB Data Viewer

A summary of the things *Panoply 5* offers:

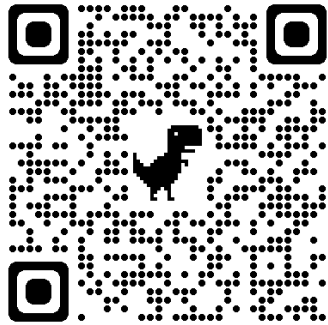
- Create color contour plots of geo-referenced lat-lon, lat-vertical, lon-vertical, time-lat or time-vertical arrays from 2D or larger multi-D variables.
- Create line plots of data from 1D or larger multi-D variables.
- Combine two geo-referenced arrays in one plot by subtracting, summing, averaging, merging, etc.
- Plot global or regional maps using over 200 map projections or make a zonal average line plot.
- Use numerous color tables for the scale colorbar, or apply your own custom RGB color table (e.g., use colorbrewer).
- Export animations as MP4 video, or collection of individual frames.

# Panoply netCDF, HDF and GRIB Data Viewer

Where and how??

Google: Panoply data viewer

<https://www.giss.nasa.gov/tools/panoply/>



Scroll down and find the [Download Panoply](#) option.

The screenshot displays the Panoply web interface. At the top, there is a NASA logo and the text "National Aeronautics and Space Administration" and "Goddard Institute for Space Studies". On the right, it says "Goddard Space Flight Center Sciences and Exploration Directorate Earth Sciences Division". A navigation menu on the left includes "GISS Home", "News & Features", "Projects & Groups", "Datasets", "Publications", "Software", "Education", "Events", and "About GISS". The main content area is titled "Panoply netCDF, HDF and GRIB Data Viewer" and includes a definition: "panoply [PAN-uh-plee], noun: 1. A splendid or impressive array, ...". Below this is a screenshot of the Panoply application window. The window shows a map titled "November Mean Temperature" with a color scale from 225.0 to 325.0. The map is centered on North America. The application window has several panels: "Datasets" on the left, "Map Projection" on the right, and "Scale" at the bottom. The "Scale" panel shows a range from 225 to 325, with a color bar below it. The "Map Projection" panel shows "Orthographic" projection with center coordinates (-76.21515, 40.112) and an edge angle of 60.0. The "Datasets" panel shows a list of datasets including "1999-2019", "latitude", "longitude", "month", and "temp\_mo".

Panoply plots geo-referenced and other arrays from netCDF, HDF, GRIB, and other datasets.

Panoply is a cross-platform application that runs on Macintosh, Windows, Linux and other desktop computers. Panoply requires that your computer has have had a compatible **Java 11** (or later version) JRE or JDK installed.

The current version of Panoply is 5.2.4, released 2023-02-28.

**Inkscape**

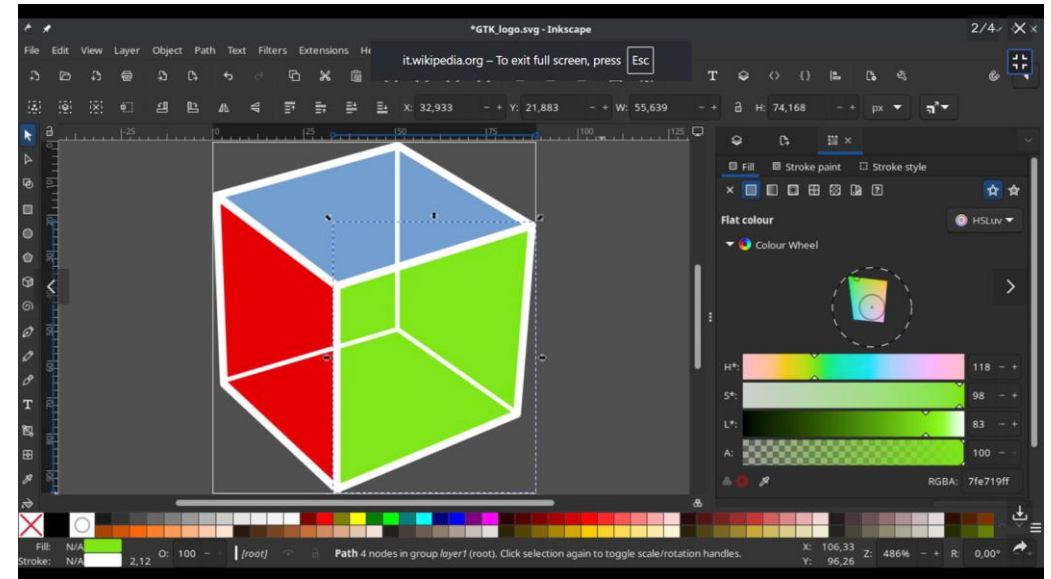
# Inkscape

Inkscape is a free powerful **graphic and design** editor that can be used for personal and professional purposes.

The program has a complete set of design tools that allow you to work with **vector graphics** files (**SVG**) and rasterized images (**bitmaps**).

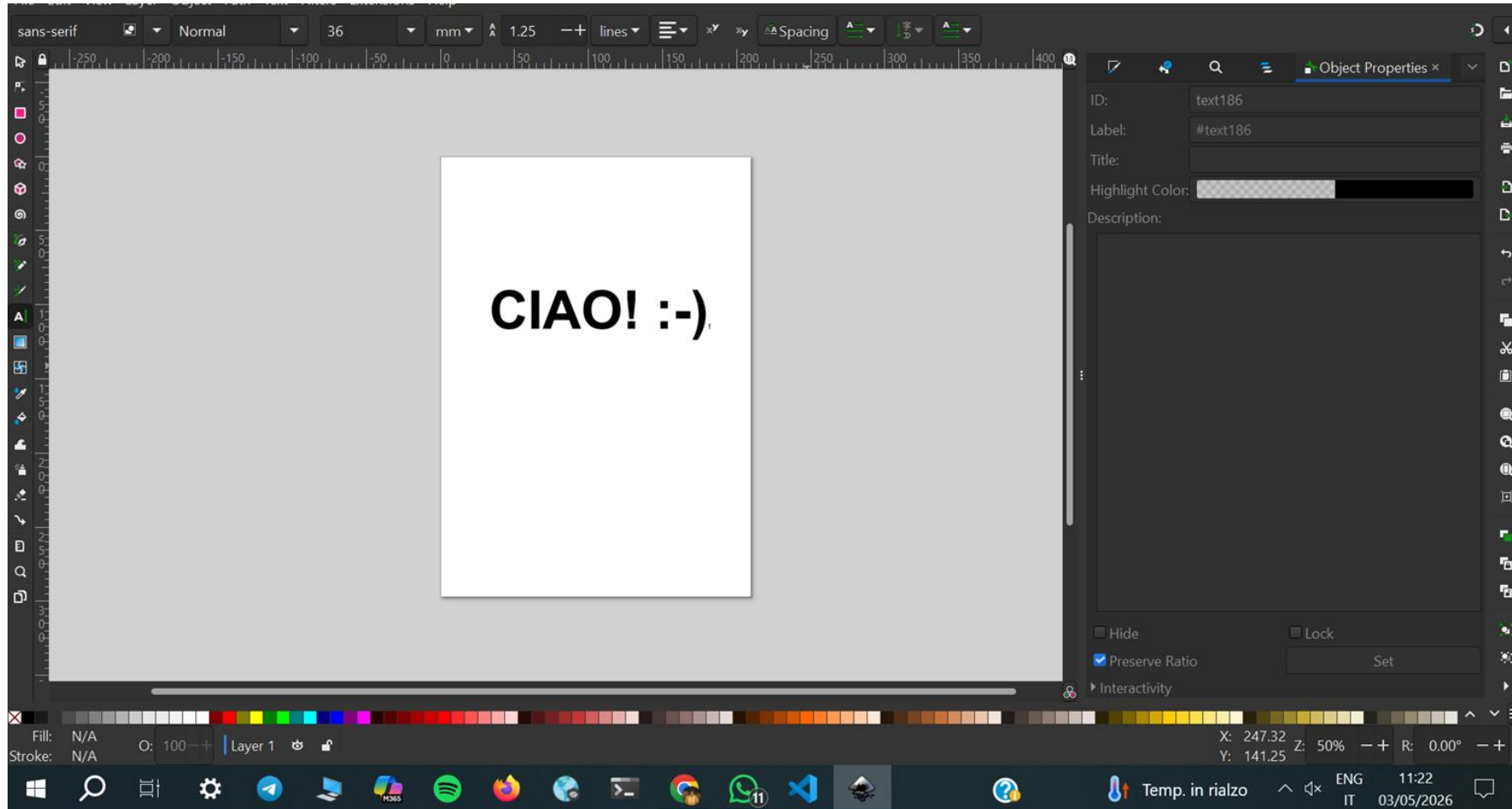
## *What can you do with Inkscape?*

Logo design, poster design, repare figures for articles/theses, anything design-related, really!



# Inkscape

## A [Very] Short Tutorial

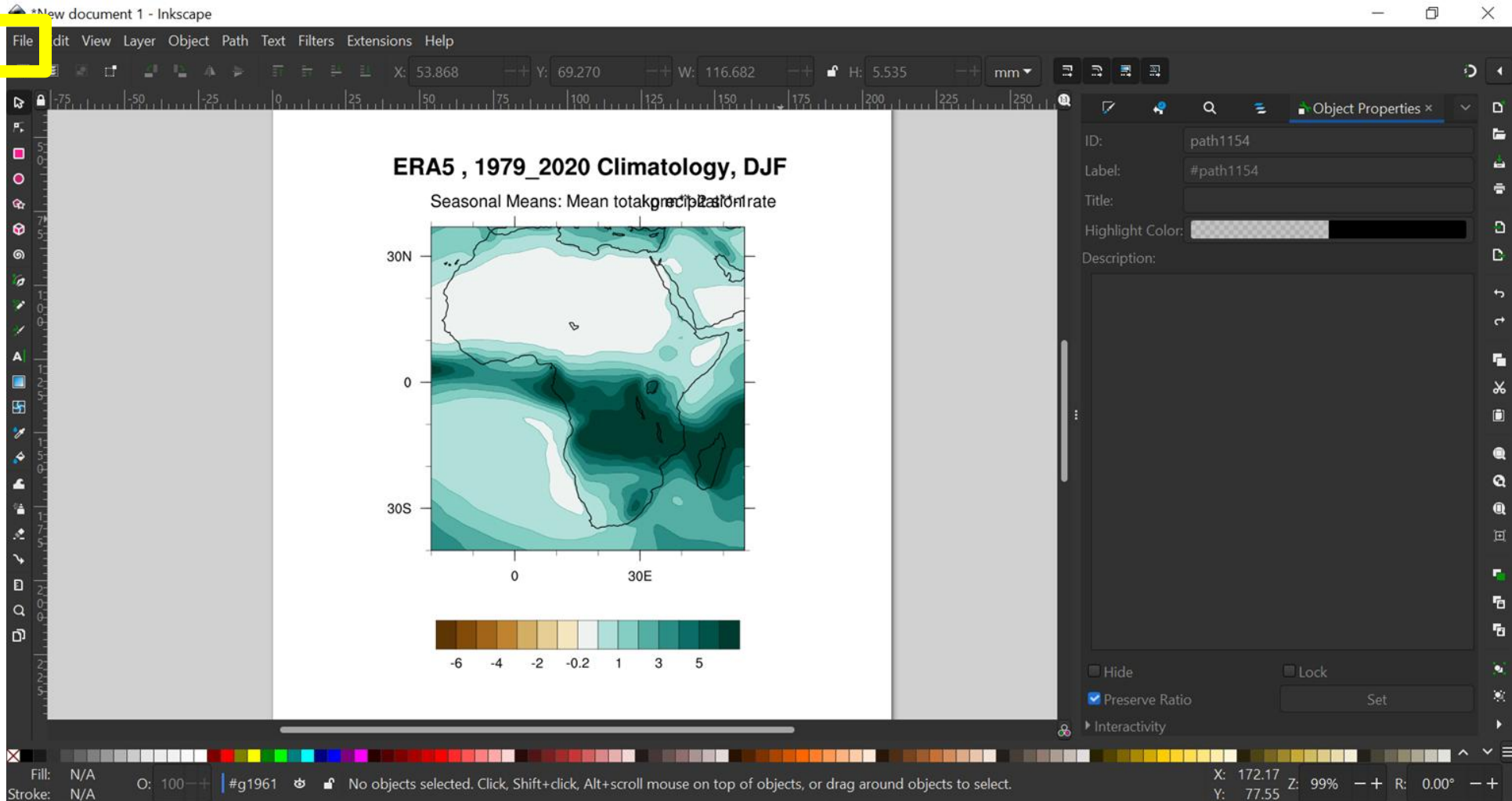


It is free and open-source (unlike Adobe Photoshop)

# Inkscape

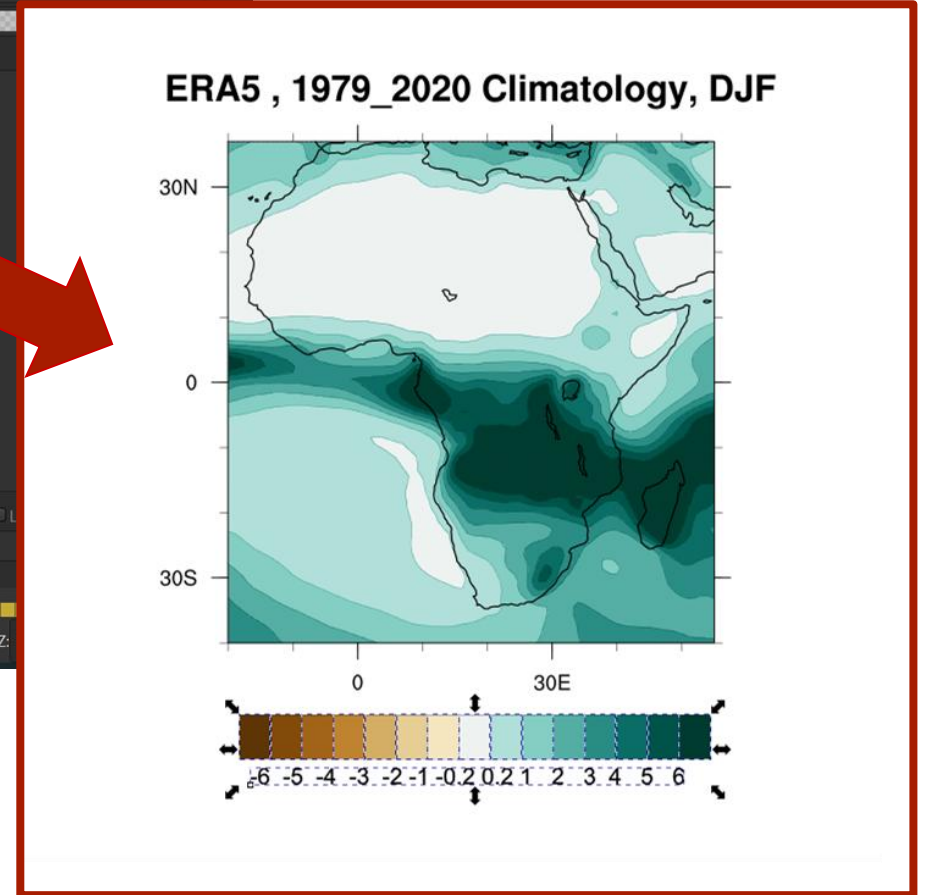
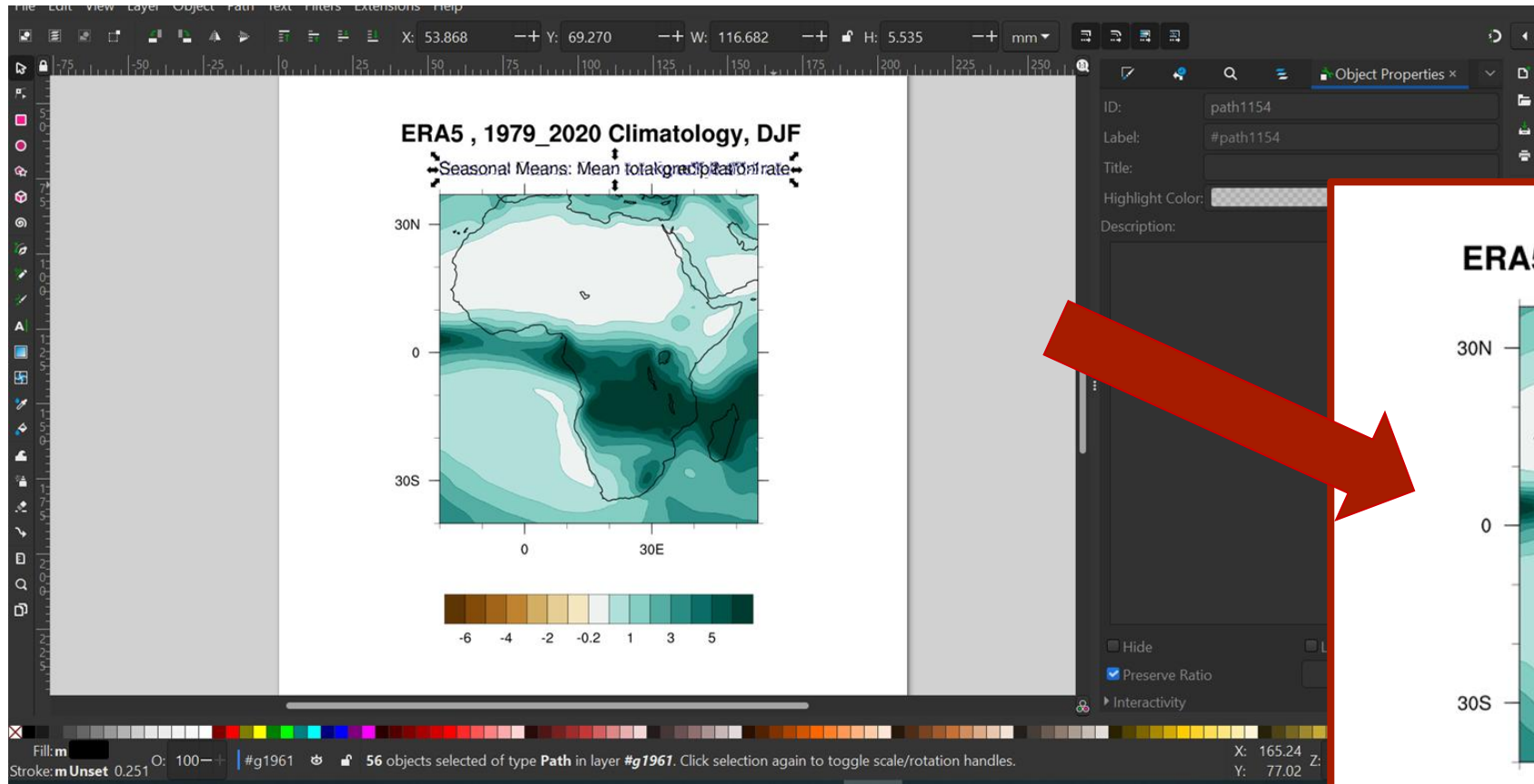
## A [Very] Short Tutorial

Import file



# Inkscape

## A [Very] Short Tutorial



# Inkscape

## A [Very] Short Tutorial

You can insert color-blind safe RGB codes

The screenshot displays the Inkscape interface with a plot and the Fill and Stroke panel. The plot shows Latitude (30N to 50N) on the y-axis and mm/day (-2.0 to 2.0) on the x-axis. The legend includes:

- $\{ \bar{P} \} - \{ \bar{E} \}$  (black solid line)
- $-\{ \nabla \cdot \langle \bar{u} | \bar{q} \rangle \}$  (yellow solid line)
- $-\{ \nabla \cdot \langle \bar{u}' | \bar{q}' \rangle \}$  (green solid line)
- $-\{ \nabla \cdot \langle \bar{u}^* | \bar{q}^* \rangle \}$  (red dashed line)
- $-\{ \nabla \cdot \langle \bar{u}^* | \bar{q} \rangle \}$  (red dashed line)
- $-\{ \nabla \cdot \langle \bar{u} | \bar{q}^* \rangle \}$  (red dashed line)

The Fill and Stroke panel on the right shows the Flat colour section with RGB values: R: 46, G: 139, B: 87. A yellow circle highlights this section, and a yellow arrow points from it to the plot area.

At the bottom of the interface, the status bar shows: Fill: None, Stroke: 0.627, #g3287, Path 20 node in layer #g3287. Click selection again to toggle scale/rotation handles. Coordinates: X: 231.61, Y: 97.24, Z: 140%, R: 0.00°.

# **AI TOOLS FOR DATAVIZ**

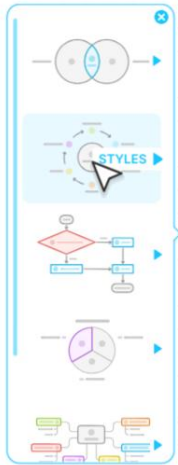
# Some AI friends for researchers

1. Supports overall Learning: **Notebook LM, Perplexity and ChatGPT deep research**
2. Code development: **Claude**
3. Research workflows: **n8n, Claude co-work**
4. Building apps- **Replit**
5. Illustrations, Presentation and posters design: **Napkin AI, DEXdata, Gamma, Nano Banana pro, Kimi Slides**
6. Data Visualisation Tools: **Julius AI, Datawrapper, Flourish, Polymer**



## Get visuals from your text

Napkin turns your text into visuals so sharing your ideas is quick and effective.



<https://www.napkin.ai/>

## Example:

### Scaling and intermittency in time of urban precipitation in Warsaw, Poland



- Multifractal analysis of Warsaw's 1-minute precipitation data.
- Estimation of parameters  $\alpha$ ,  $C1$  and  $H$  by applying 5 multifractal geometry methods.
- Majority of Warsaw rain gauges have distinct similarity of multifractal properties.
- Cascade generators could be used in generating high resolution precipitation.
- Practical parameterization of the cascade generator with only two multifractal parameters.

Dzugaj et al. (2023)  
(<https://doi.org/10.1016/j.ejrh.2023.101440>)

# Napkin.ai

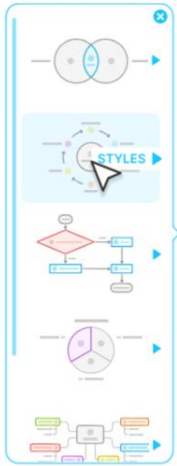
## Generate Visuals:

[Home](#) [Pricing](#) [About us](#)

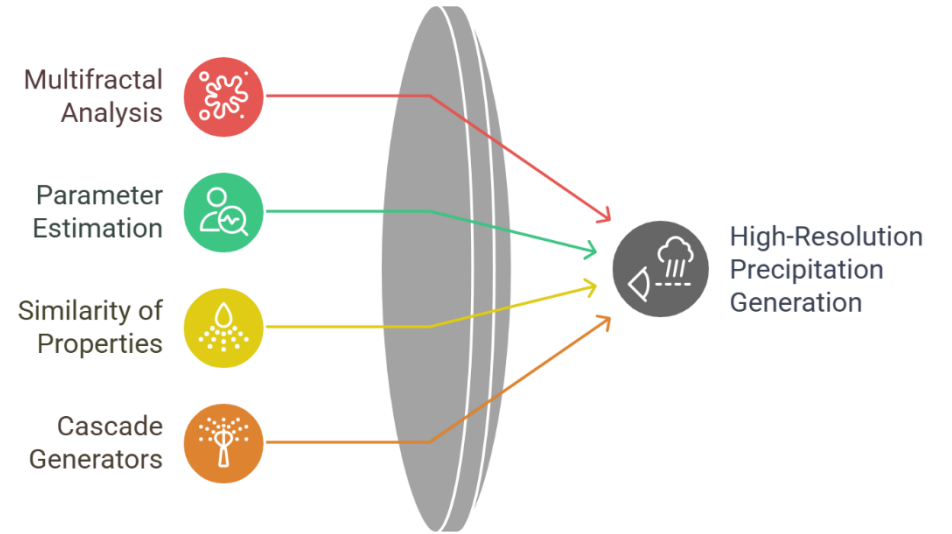


### Get visuals from your text

Napkin turns your text into visuals so sharing your ideas is quick and effective.

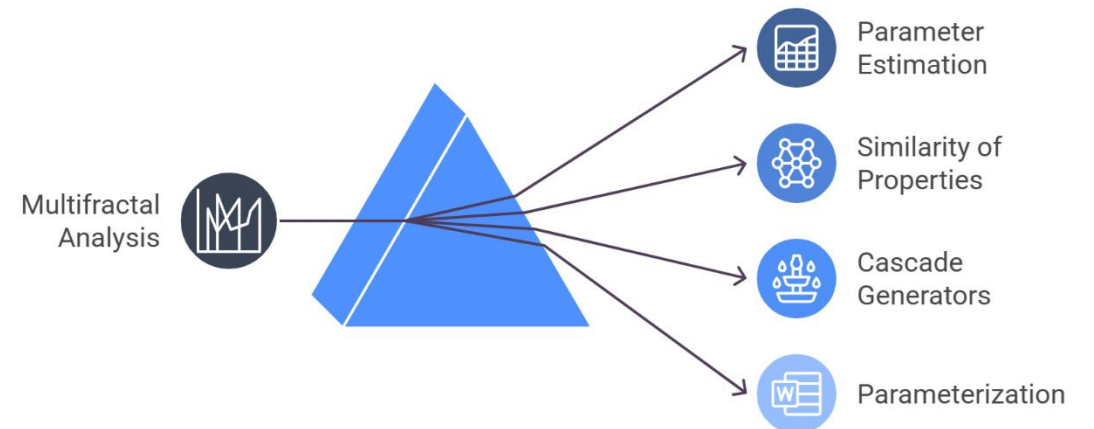


## Unifying Multifractal Insights

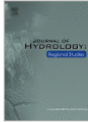


Made with Napkin

## Unveiling Warsaw's Precipitation Dynamics



Made with Napkin



## Scaling and intermittency in time of urban precipitation in Warsaw, Poland

Dagmara Dżugaj <sup>a, b</sup>, Epari Ritesh Patro <sup>c</sup>, Carlo De Michele <sup>d</sup> , Paweł Licznar <sup>e</sup>

Show more ▾

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<https://doi.org/10.1016/j.ejrh.2023.101440>

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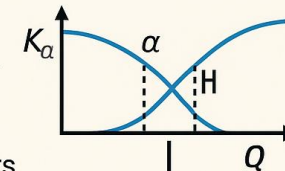
### Highlights

- Multifractal analysis of Warsaw's 1-minute precipitation data.
- Estimation of parameters  $\alpha$ ,  $C_1$  and  $H$  by applying 5 multifractal geometry methods.

## Scaling and intermittency in time of urban precipitation in Warsaw, Poland



Multifractal analysis of Warsaw's 1-minute precipitation data

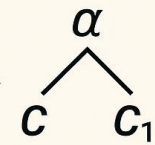
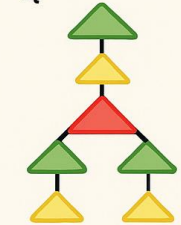


Estimation of parameters  $\alpha$ ,  $C_1$  and  $H$  by applying 5 multifractal geometry



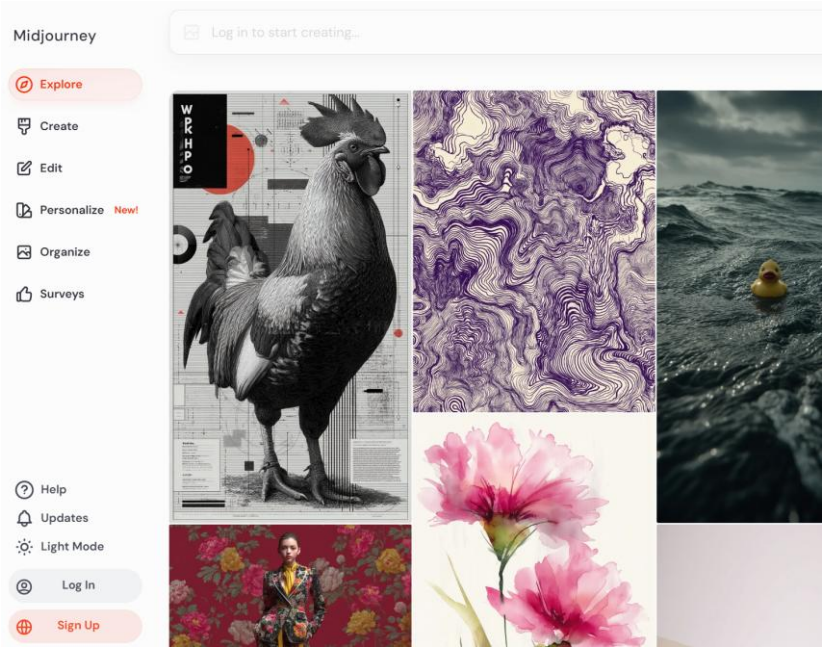
Practical parameterization of the cascade generator with only two multifractal parameters

Cascade generators could be used in generating high resolution precipitation



# Other Tools:

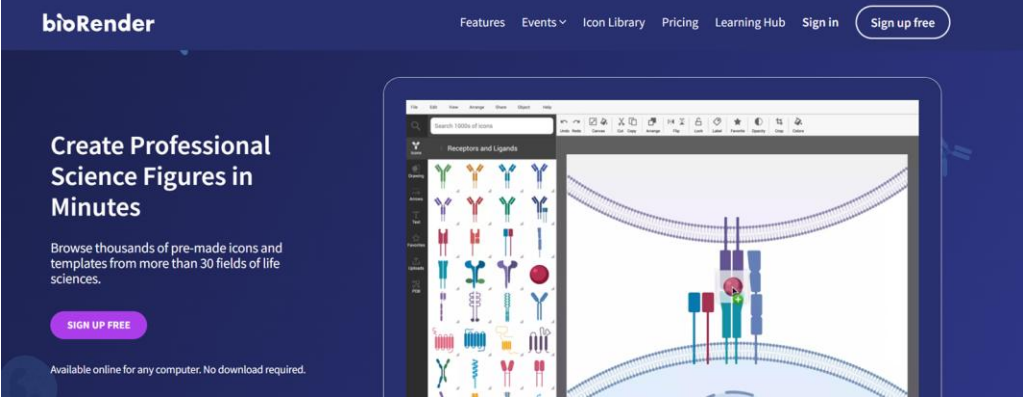
- There are a lot but here are few.....



Midjourney

## Leave it to Manus

Manus is a general AI agent that bridges minds and actions: it doesn't just think, it delivers results. Manus excels at various tasks in work and life, getting everything done while you rest.



bioRender

# This is just one example:



You

Download\_2025-04-11\_173...  
spreadsheet - 18.81 KB

I uploaded the file: `Download_2025-04-11_173627.xlsx`  
is there a correlation between the number of pages and the price?

✎ 📌 📄

Julius

</> Loaded all sheets from an Excel file

Python

Rerun code

Edit code

📄

```
1 # load all sheets and print names and keys
2 import pandas as pd
3 # loading file
4 FILEPATH = 'Download_2025-
5 dataframes = read_all_sheets
6 # print sheet names
7 df_keys = list(dataframes.
8 print('Sheet names:')
9 print(df_keys)
10 # print head of each sheet
```

```
19 plt.ylabel('Price')
20 plt.show()
21
```

### Code Explanation

This code snippet calculates the correlation between the number of pages and the price of books, and visualizes this relationship using a scatter plot.



Text  
Click to view



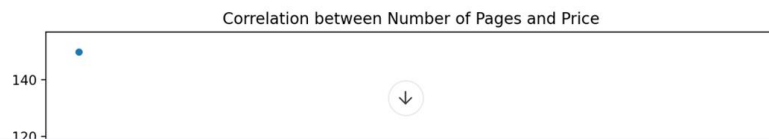
Image  
Click to view

I loaded the "Titelliste" sheet, coerced Seitenzahl and Preis to numeric, computed their Pearson correlation and plotted a scatter to visualize it.

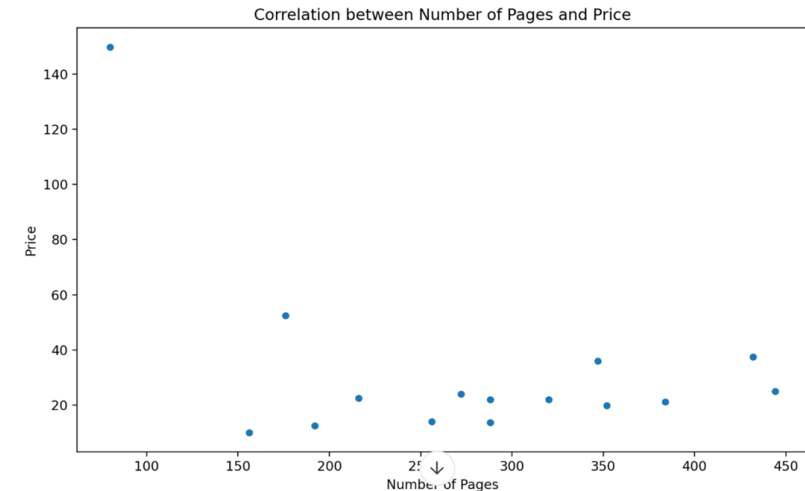
Correlation coefficient between number of pages and price:

-0.45660952317594

Scatter plot of pages vs. price:



Scatter plot of pages vs. price:



Default

Tools

No Theme

Advanced Reasoning

Saved Prompts

13 Free messages remaini

Default

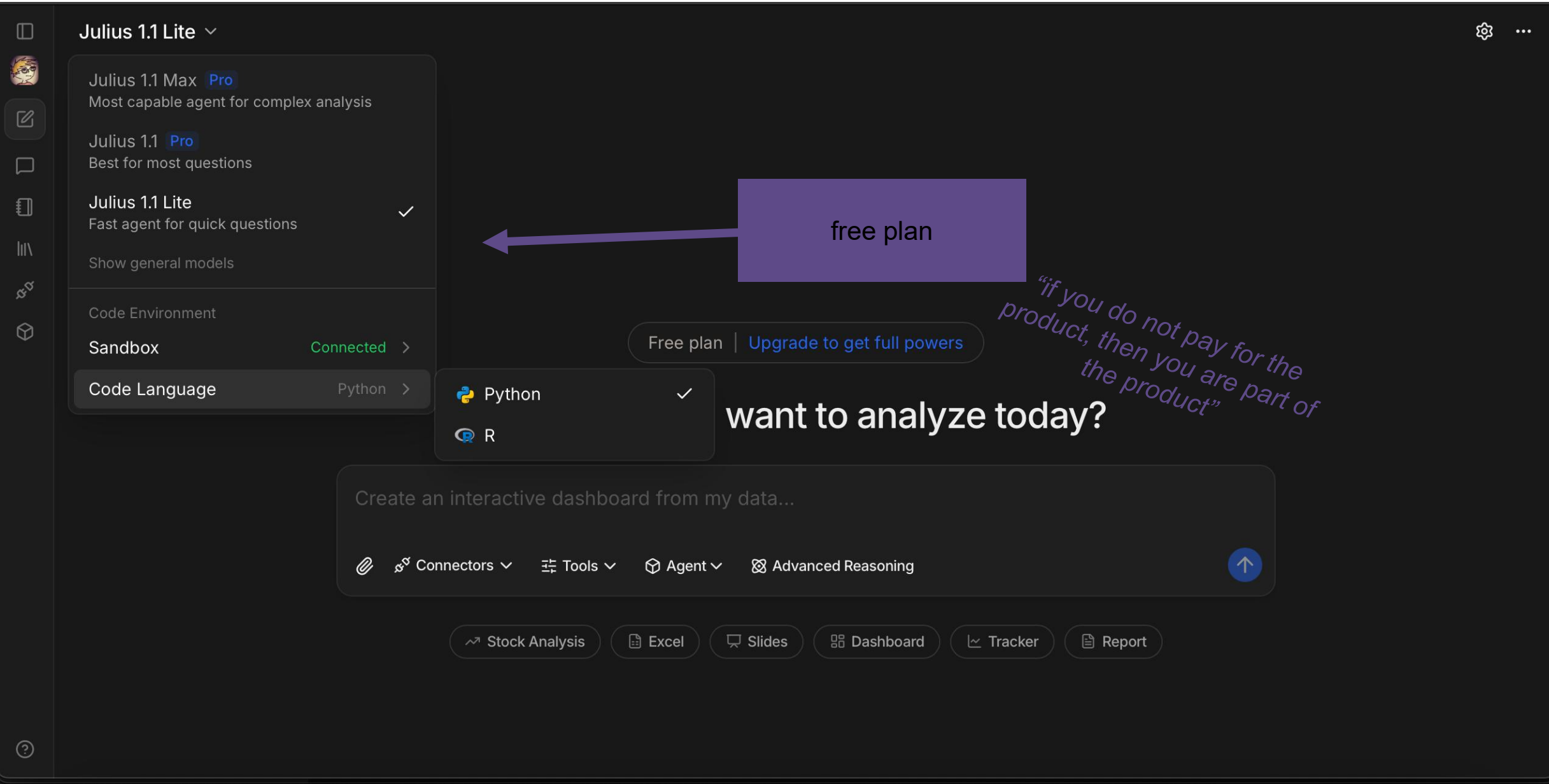
Tools

No Theme

Advanced Reasoning

Saved Prompts

13 Free messages remaining



Julius 1.1 Lite

Julius 1.1 Max Pro  
Most capable agent for complex analysis

Julius 1.1 Pro  
Best for most questions

Julius 1.1 Lite  
Fast agent for quick questions

Show general models

Code Environment

Sandbox Connected

Code Language Python

Free plan | Upgrade to get full powers

Python

R

free plan

want to analyze today?

*"if you do not pay for the product, then you are part of the product"*

Create an interactive dashboard from my data...

Connectors Tools Agent Advanced Reasoning

Stock Analysis

Excel

Slides

Dashboard

Tracker

Report



Free plan | [Upgrade to get full powers](#)

## What do you want to analyze today?

At the Annual Conference of the European Geoscience Union (EGU) in Vienna, Austria, an engaging workshop on Data Visualization is being held. One hundred geoscientists from around the world participate. Create a synthetic but realistic dataset that reports:

- the university of origin of the participants;
- their career stage (BSc, MSc, PhD students; early-career or established scientists);
- their feedback on the workshop (rated from 1 to 5 stars);
- whether they plan to use a rainbow color scale in their future visualizations.

Then, visualize the data in a clear and informative way.



Connectors ▾

Tools ▾

Agent ▾

Advanced Reasoning



Stock Analysis

Excel

Slides

Dashboard

Tracker

Report



## Synthetic workshop dataset

I created a realistic synthetic dataset for **100 geoscientists** attending the EGU workshop in Vienna. It includes:

- `participant_id`
- `university_of_origin`
- `career_stage`
- `workshop_feedback_stars` from **1 to 5**
- `plan_to_use_rainbow_scale` as **Yes/No**

The sample looks good and the generated distribution is plausible for a workshop audience, with many **PhD students** and mostly positive feedback.

### Main takeaways from the synthetic data

The workshop was rated quite well overall, and only a **small minority** said they plan to use a rainbow color scale in future visualizations.

Send a message...



Connectors ▾

Tools ▾

Agent ▾

Advanced Reasoning



Data Explorer

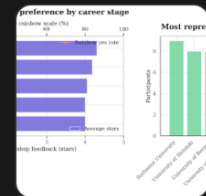
Report



Create report

Capture insights as a d...

Charts & Images



### Main takeaways from the synthetic data

The workshop was rated quite well overall, and only a **small minority** said they plan to use a rainbow color scale in future visualizations.

The most common career stage in the synthetic group was **PhD student**, followed by **MSc student** and **early-career scientist**.

### Visualization

I also generated a two-panel chart showing:

- Average workshop feedback by career stage
- Share planning to use a rainbow scale by career stage
- Top represented universities

If you want, I can next turn this into:



... a CSV file

Send a message...



Connectors

Tools

Agent

Advanced Reasoning

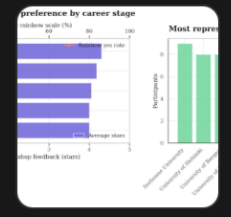


you are a good audience :)

Data Explorer

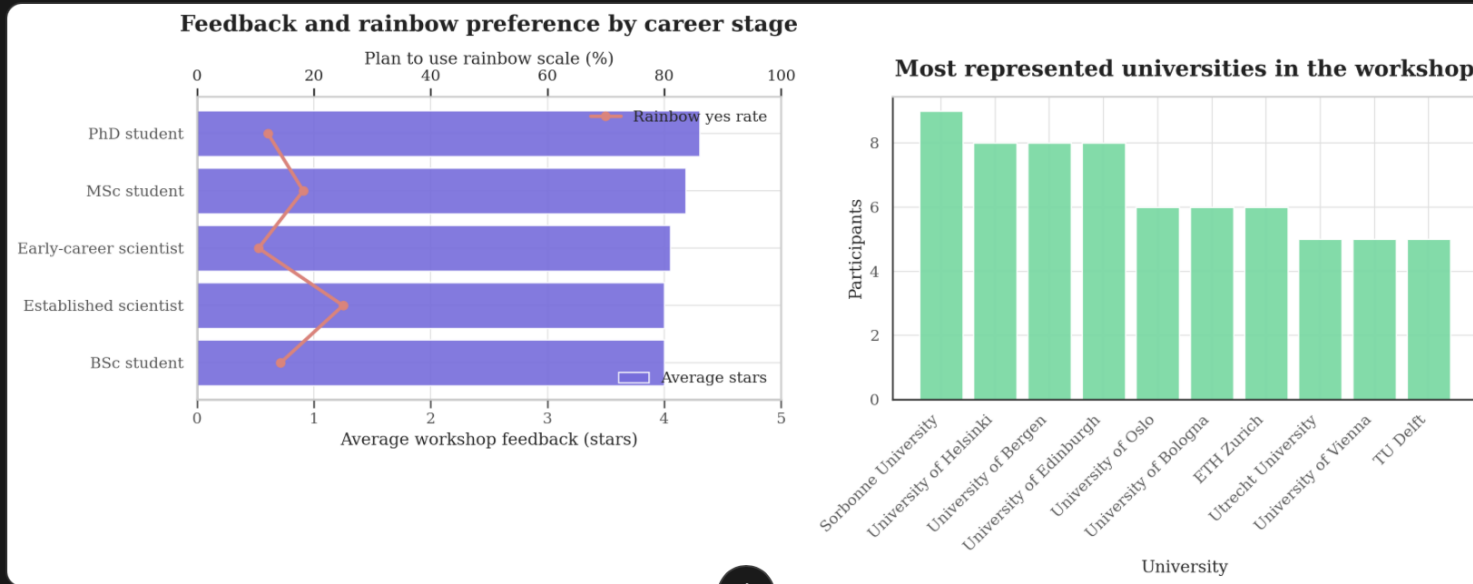
Report

Charts & Images



- a publication-style figure
- or a more complex analysis such as whether feedback differs by career stage or university.

Download



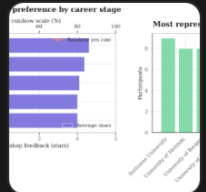
Data Explorer

Report

Create report

Capture insights as a d...

Charts & Images



Send a message...



Connectors



Tools

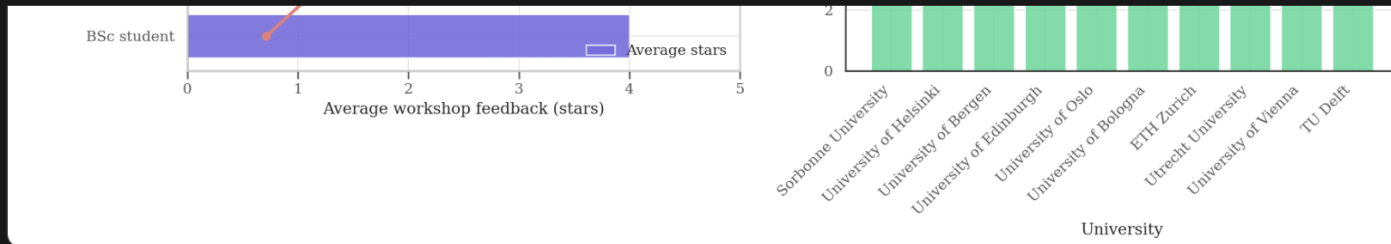


Agent



Advanced Reasoning





Was this analysis helpful?

I would like to see the data visualized using a variety of plots to explore different aspects of the dataset. Please include a visualization of the distribution of career stages, clearly showing the proportion of BSc, MSc, PhD students, and early-career or established scientists. In addition, generate one or more complex visualizations that reveal meaningful relationships—such as the connection between career stage and workshop feedback, or the relationship between institutional origin and the use of rainbow color scales. When using color, adhere to the golden rules of data visualization: ensure colors are perceptually uniform, colorblind-friendly, and used purposefully to convey meaning—not decoration. Avoid rainbow color schemes unless explicitly justified. The visualizations should be clear, well-labeled, and suitable for inclusion in a scientific or educational context.

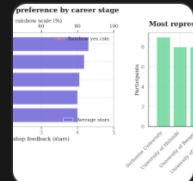


Data Explorer

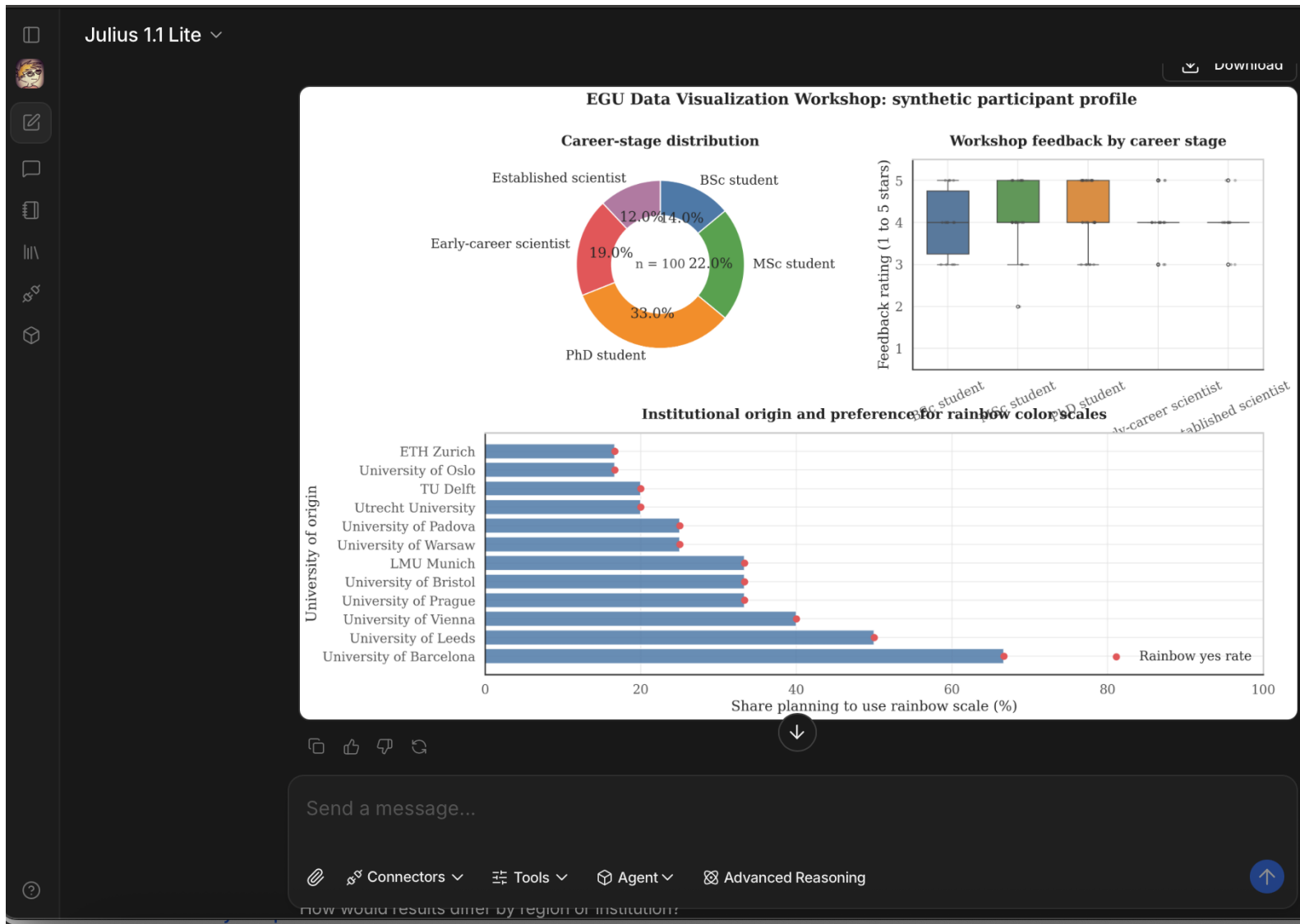
Report

**Create report**  
Capture insights as a d...

Charts & Images



- we can definitely do better



Report

Create report  
Capture insights as a d...

Charts & Images

• we are saying: Julius, I appreciate your effort but retry

Julius 1.1 Lite

The dashboard contains three main charts:

- Donut Chart: Career Stage Distribution**  
n = 100  
- Early-career scientist: 19.0% (red)  
- PhD student: 33.0% (orange)  
- MSc student: 22.0% (green)  
- Established scientist: 14.0% (blue)  
- Unlabeled: 12.0% (purple)
- Box Plot: Feedback Rating (1 to 5)**  
The plot shows the distribution of feedback ratings for each career stage. The y-axis ranges from 1 to 5. The x-axis categories are Early-career scientist, PhD student, MSc student, and Established scientist.
- Horizontal Bar Chart: Institutional origin and preference for rainbow color scales**  
The chart shows the percentage of respondents from various universities planning to use a rainbow scale. The x-axis is 'Share planning to use rainbow scale (%)' from 0 to 100. The y-axis lists universities. A red dot on each bar indicates the 'Rainbow yes rate'.

University of origin

| University of origin    | Share planning to use rainbow scale (%) |
|-------------------------|---|
| ETH Zurich              | ~18                                     |
| University of Oslo      | ~18                                     |
| TU Delft                | ~20                                     |
| Utrecht University      | ~20                                     |
| University of Padova    | ~25                                     |
| University of Warsaw    | ~25                                     |
| LMU Munich              | ~35                                     |
| University of Bristol   | ~35                                     |
| University of Prague    | ~35                                     |
| University of Vienna    | ~40                                     |
| University of Leeds     | ~50                                     |
| University of Barcelona | ~65                                     |

Share planning to use rainbow scale (%)

• Rainbow yes rate

Please revise all elements of the visualization: axis, labels, etc. The charts should be well readable! Please check again the colors for accessibility.

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How would results differ by region or institution?

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## Updated, more readable visualizations

I revised the charts to improve **legibility**, **axis readability**, and **accessibility**.

The main changes were:

- larger font sizes for titles, axis labels, and tick labels
- clearer axis limits and tick spacing
- stronger separation between marks and background
- an **accessible, colorblind-friendly palette** based on the Okabe-Ito style rather than decorative colors
- a cleaner stacked comparison for the university vs rainbow-scale view

### What the plots now emphasize

The **career-stage distribution** is shown as a bar chart with percentages labeled directly above each bar, so the proportions are easy to read immediately.

The **feedback-by-career-stage** plot now uses a boxplot plus jittered points, which makes both the overall

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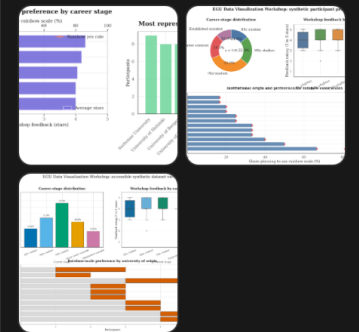
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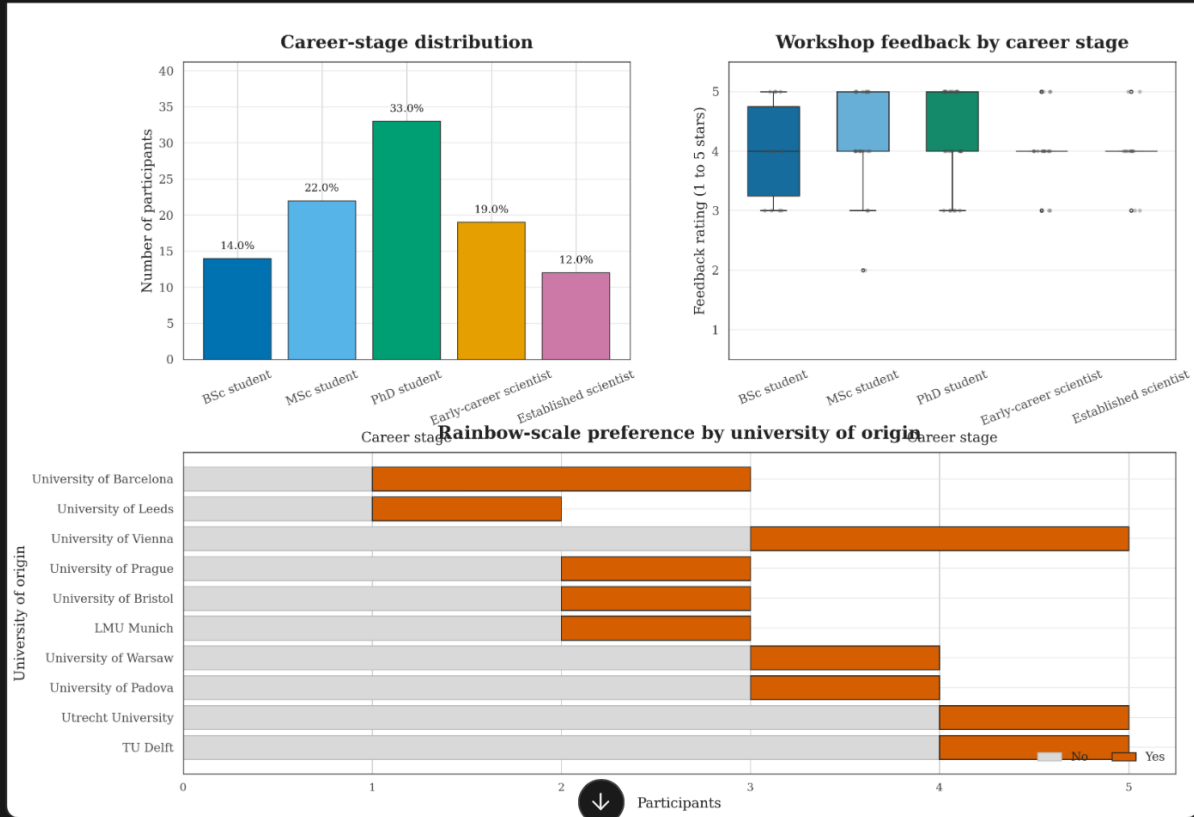
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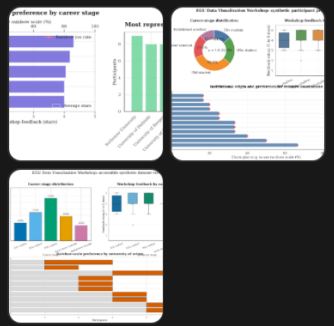


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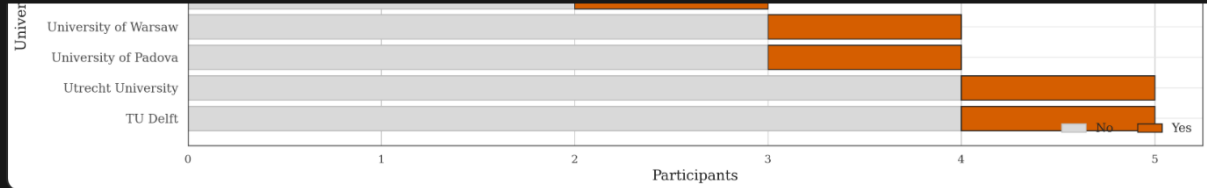
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Good job, thanks! Now please show me the same data but with different plot types. I would like to get an inspiration about the most appropriate plot type

Running 1 step

Generating Code

```
ax4_t.set_ylim(0, 100)
ax4_t.set_ylabel('Rainbow-scale use (%)')
ax4.set_title('Two metrics by career stage: line chart comparison', fontsize=18, pad=12)
ax4.tick_params(axis='x', rotation=22)

for
```

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### Alternative plot types for inspiration

I kept the same synthetic dataset and re-plotted it with **different chart forms** so you can compare which type fits which question best.

The new figure includes:

- a **lollipop chart** for the **career-stage distribution**
- a **heatmap** for **university of origin vs career stage**
- a **scatter plot** for **feedback vs career stage**, colored by **rainbow-scale preference**
- a **dual-line chart** comparing **average feedback** and **rainbow-scale use** by career stage

### Why these work well

The **lollipop chart** is a nice alternative to bars when you want a clean, compact frequency display.

The **heatmap** is useful for seeing how universities and career stages overlap, especially when you care about structure across two categorical variables.

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### Why these work well

The **lollipop chart** is a nice alternative to bars when you want a clean, compact frequency display.

The **heatmap** is useful for seeing how universities and career stages overlap, especially when you care about structure across two categorical variables.

The **scatter plot** is helpful for showing individual responses and how feedback differs across groups, while still encoding the rainbow preference in color.

The **dual-line chart** is a compact way to compare two aggregated measures across the same ordering of career stages.

### From an interpretation perspective

For this dataset, the most suitable plot type depends on the question.

- **career-stage proportions** → bar chart or lollipop chart
- **career stage vs feedback** → boxplot or violin plot

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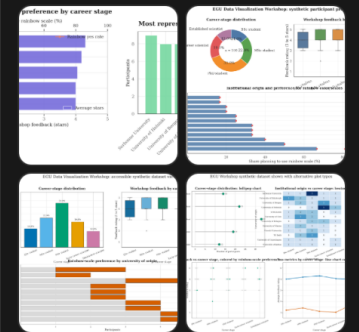
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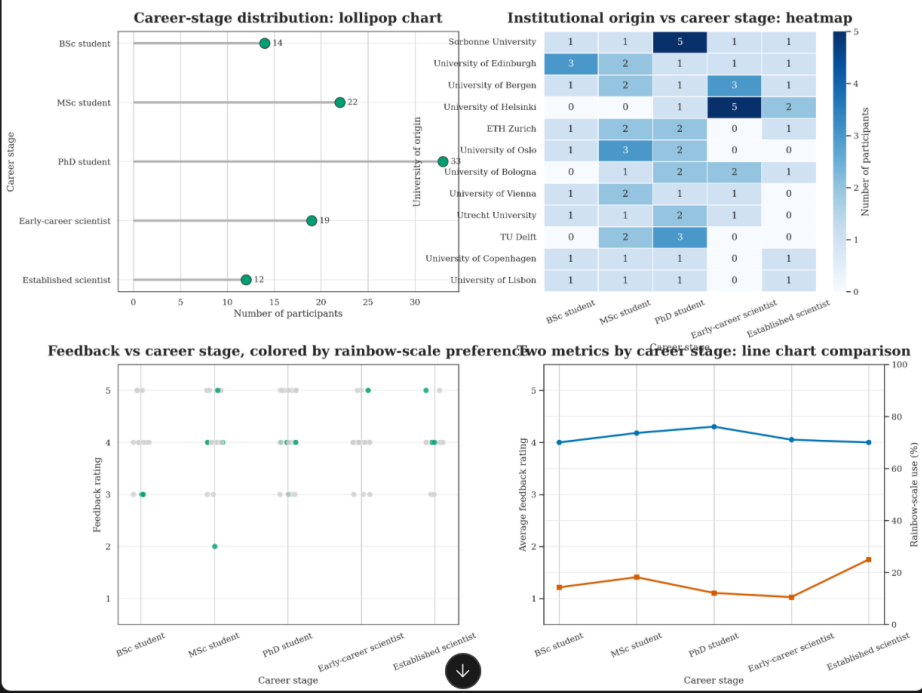
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### EGU Workshop synthetic dataset shown with alternative plot types



Data Explorer

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- Julius is a gentleman, this offer is very nice

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career stages.

### From an interpretation perspective

For this dataset, the most suitable plot type depends on the question:

- **career-stage proportions** → bar chart or lollipop chart
- **career stage vs feedback** → boxplot or violin plot
- **university vs career stage** → heatmap
- **rainbow preference by category** → stacked bars or grouped bars
- **combined summary of two metrics** → line chart or small multiples

If you want, I can now make a **side-by-side comparison sheet** showing the *same variable* in several plot types so it becomes even easier to decide which one is most appropriate.

Download

EGU Workshop synthetic data shown with alternative plot types

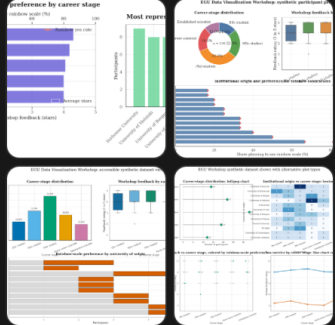
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Yes, please make a side-by-side comparison sheet, thanks!

```
fig = plt.figure(figsize=(20, 16))
gs = GridSpec(3, 2, figure=fig, hspace=0.32, wspace=0.22)

# 1. Bar chart for career-stage distribution.
ax1 = fig.add_subplot(gs[0, 0])
colors_stage = ['#0072B2',
```

Running 1 step

<> Generating Code

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### Side-by-side comparison sheet

Done — I created a **single comparison sheet** that shows the same synthetic workshop dataset with several different plot types side by side, so you can judge which one works best for each question.

The sheet includes:

#### Career-stage distribution

- Bar chart
- Donut chart

#### Career stage vs workshop feedback

- Boxplot + jittered points
- Violin plot

#### Institutional origin vs career stage

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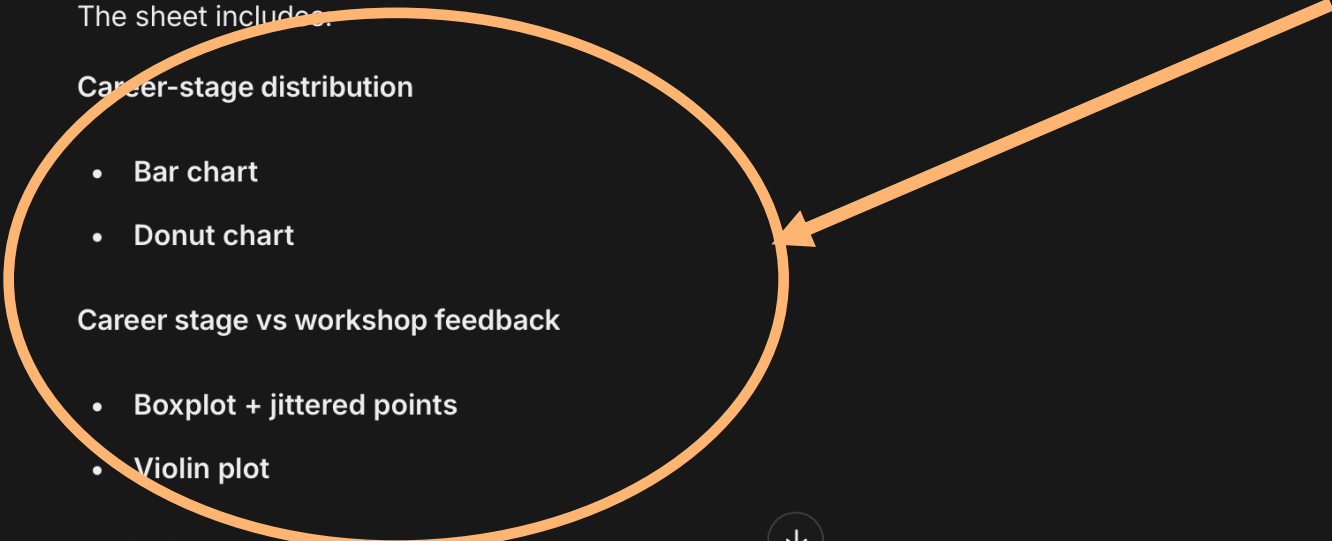
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- Violin plot
- Institutional origin vs career stage
- Heatmap
- Rainbow-scale preference
- Stacked horizontal bar chart

### What this helps you see

The **bar chart** is probably the clearest choice for the career-stage proportions, while the **donut chart** is a nice alternative if you want a compact overview.

For **feedback by career stage**, the **boxplot** is usually the best scientific choice because it shows spread, medians, and outliers clearly. The **violin plot** adds density information, which can be useful but is a bit less immediately interpretable for small samples.

For **university of origin vs career stage**, the **heatmap** works well because it summarizes a two-way

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### What this helps you see

The **bar chart** is probably the clearest choice for the career-stage proportions, while the **donut chart** is a nice alternative if you want a compact overview.

For **feedback by career stage**, the **boxplot** is usually the best scientific choice because it shows spread, medians, and outliers clearly. The **violin plot** adds density information, which can be useful but is a bit less immediately interpretable for small samples.

For **university of origin vs career stage**, the **heatmap** works well because it summarizes a two-way categorical relationship compactly.

For **rainbow-scale preference**, the **stacked bar chart** is a good fit because it makes the yes/no split easy to compare across groups.

If you'd like, I can next make a **recommendation sheet** that labels each plot as *best*, *acceptable*, or *not ideal* for this dataset.

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30

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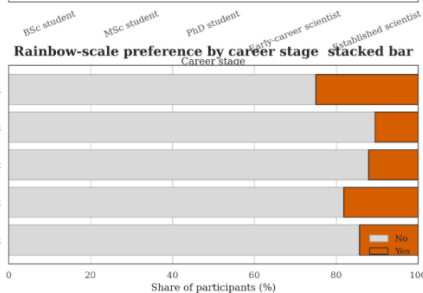
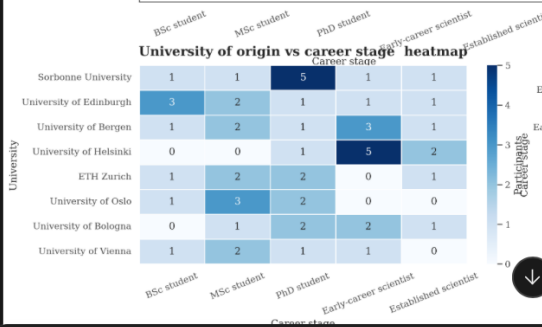
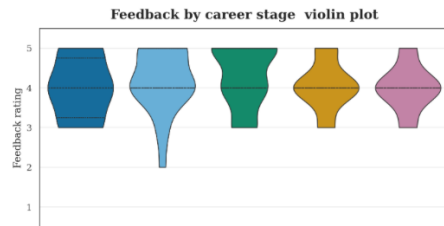
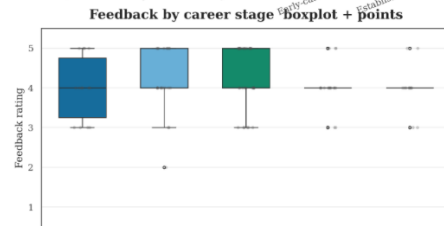
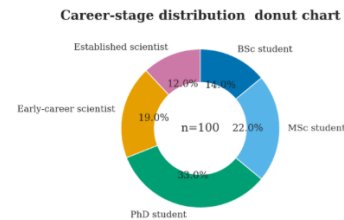
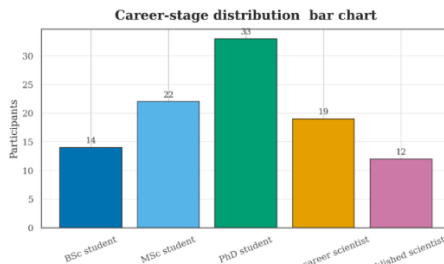
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### EGU workshop synthetic data side-by-side comparison of plot types



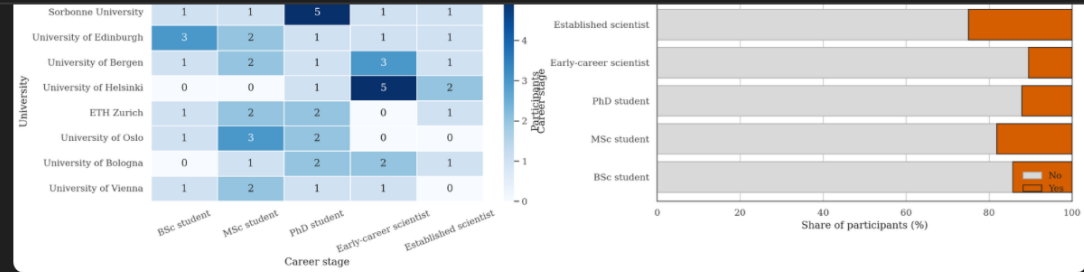
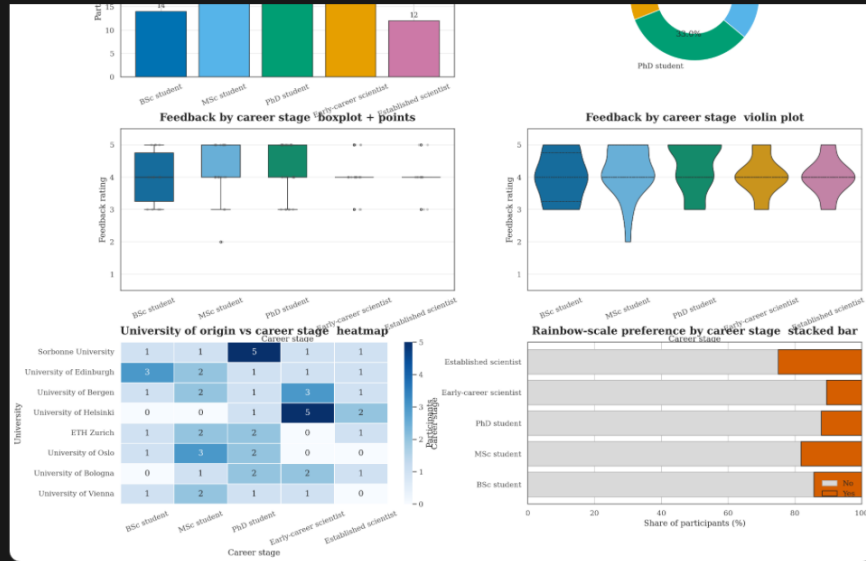
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- **Proportions** (career-stage counts) — the bar chart wins for precision; the donut chart works for a quick visual summary.
- **Distribution comparisons** (feedback by career stage) — the boxplot with jittered points is the strongest scientific choice; the violin plot adds density but sacrifices simplicity.
- **Two-way categorical relationships** (university × career stage) — the heatmap compactly encodes structure across many categories.
- **Binary preference splits** (rainbow-scale use) — the stacked horizontal bar chart makes yes/no proportions immediately comparable.

All visualizations used an Okabe-Ito-inspired, colorblind-friendly palette with perceptually uniform steps — no rainbow schemes in sight, which is fitting for a workshop dedicated to better data visualization practices.

### Key Takeaways

The synthetic EGU workshop audience skews toward PhD and MSc students, feedback is overwhelmingly positive across all career stages, and the vast majority of participants intend to leave rainbow color scales behind. When it comes to presenting these findings, the most readable chart is usually the simplest one: bar charts for counts, boxplots for distributions, heatmaps for cross-tabulations, and stacked bars for binary splits.

Thank you for your attention and for the “overwhelmingly positive” feedback!

- Suggestions
- What is the dataset?
  - How would you compare p...
  - What else can we reveal a...

Send a message...

# Are AI tools perfect !!



Absolutely Not.



But Makes thing easier



Check Always and Test with your Prompts



Of course, better results with paid versions



Transforming the Way, We Create Research Visuals

# INTERACTIVE BLOCK 3

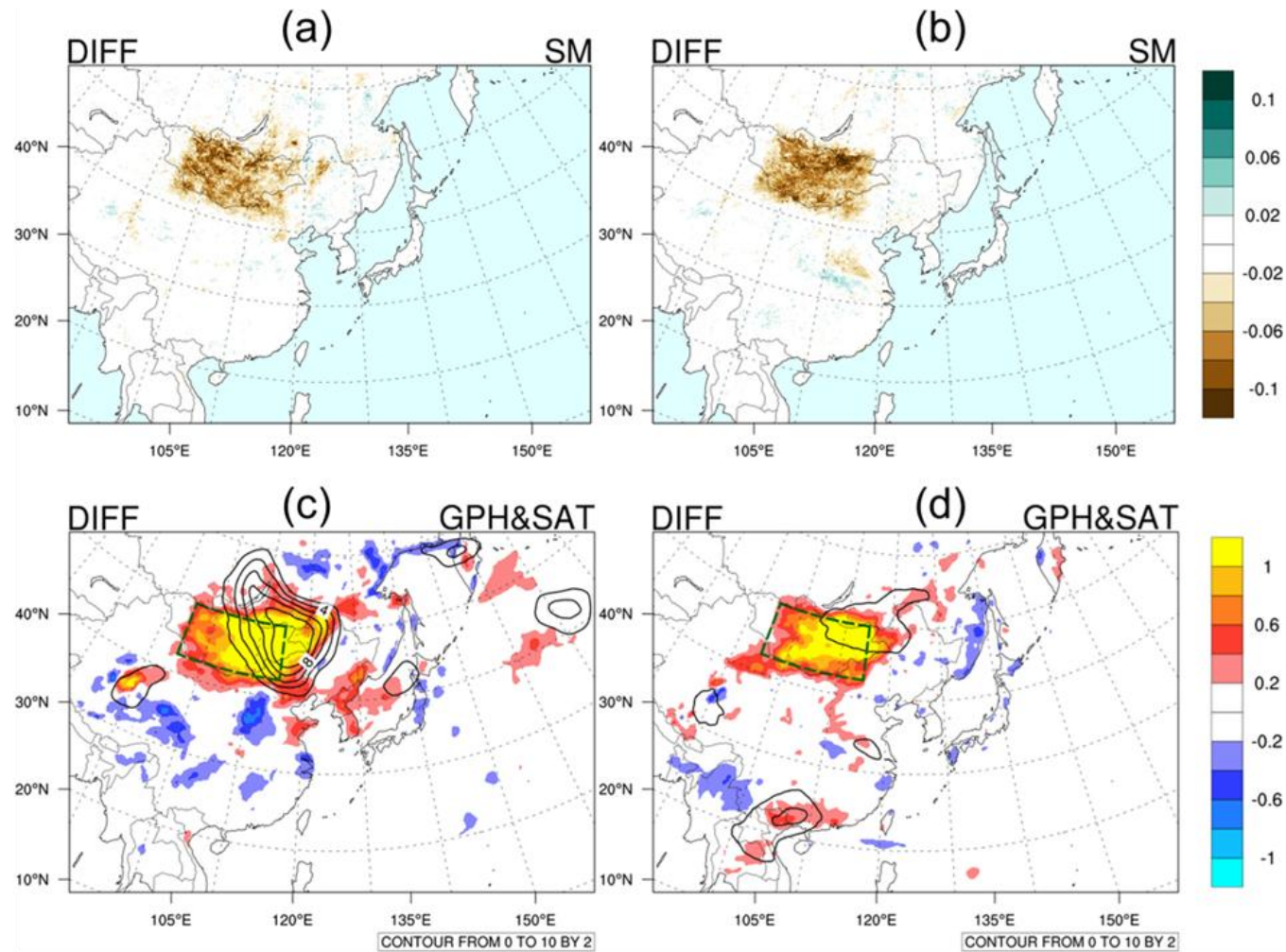
**Raise your hand  
if you agree with the statements/question.**



# Example 6

## What's your thoughts???

- Easy to compare values looking at Geospatial data.
- Color scale and amplitude are optimal.



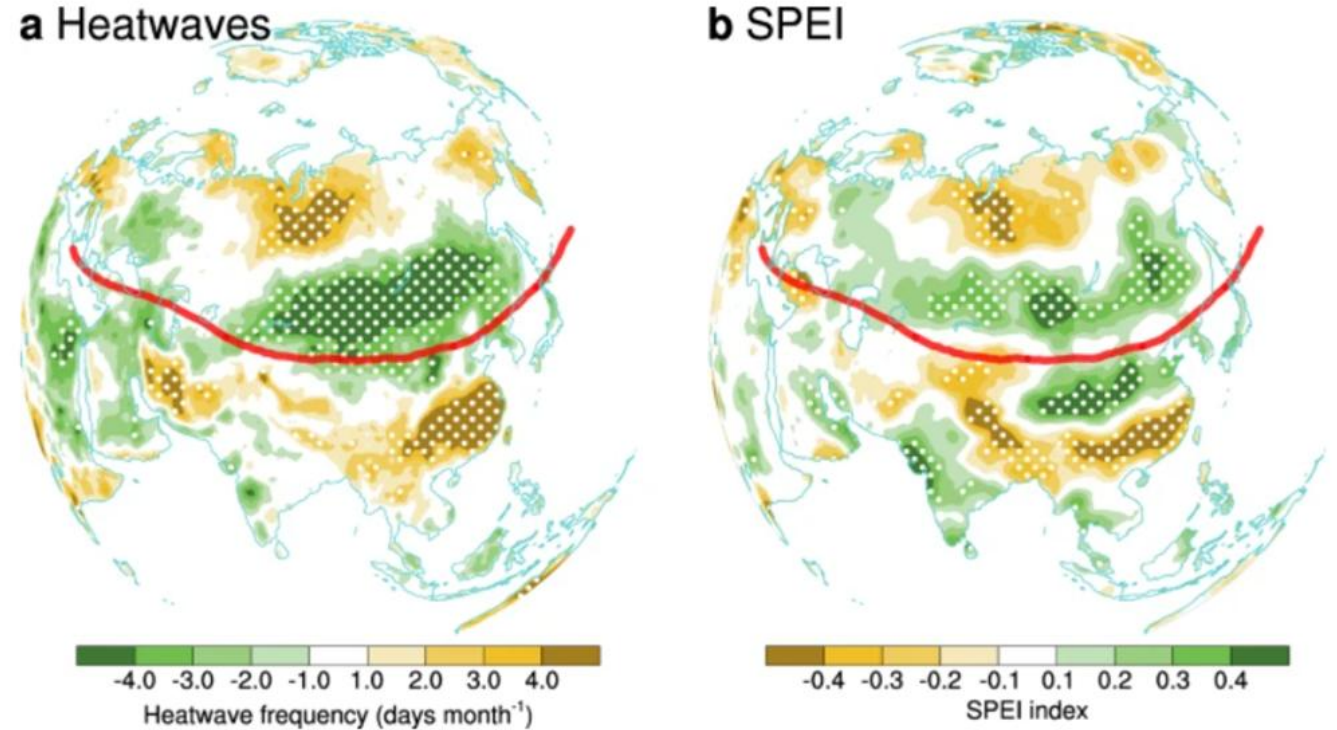
Yoon et al. (2023) <https://doi.org/10.1029/2022JD037718>

Fig. Differences in the (a and b) surface soil moisture content (m<sup>3</sup> m<sup>-3</sup>), and (c and d) SAT50 (°C) (shading) with 500 GPH50 (gpm) (contour) between the LIS50 and Land Information System experiments during the simulation period of 2016 (left column) and 2018 (right column).

# Example 8

## What's your thoughts???

- Easy to understand aggregated overlapping data.
- Correct scale and resolution.



Lin et al., 2024, (<https://doi.org/10.1038/s41467-024-46543-x>)

Fig. a Regression map of heatwave frequency anomalies (days month<sup>-1</sup>) against the normalized EAJ index during the post-1999 period. b Same as (a), except for the standardized precipitation evapotranspiration index (SPEI). Red dash line represents the jet axis in 200 hPa in high summer. Dotted areas are statistically significant at the 0.05 level.

# **ADDITIONAL RESOURCES**

# DataViz with R

The screenshot shows a web browser window displaying the Rpubs website. The URL in the address bar is [rpubs.com/Vinit\\_Sehgal/lgar23](https://rpubs.com/Vinit_Sehgal/lgar23). The page title is "Data Visualization and Geospatial Analysis With R". The main content area features three visualizations: a circular map with horizontal bands of color (purple, blue, green, yellow), a 3D scatter plot with axes labeled x, y, and z, and a circular world map with a color gradient. Below these is the title "Large-scale Geospatial Analysis (2023)" and a paragraph of text: "Taking examples from global satellite data in `gridded/raster format`, we will demonstrate several common geospatial operations like `projections`, `resampling`, `cropping`, `masking`, `spatial extraction` etc. using rasters." The left sidebar contains a navigation menu with the following items: "Data Visualization and Geospatial Analysis With R", "Large-scale Geospatial Analysis (2023)", "CHAPTER 0. Import libraries and sample dataset", "CHAPTER 1. Raster and shapefile visualization", "1.1. Plotting raster data", "1.2. Customizing `terra` plot options", "1.3. Plotting raster data using `tidyterra`", "1.4. Plotting vector data", "1.5. Reprojection of rasters using `terra::project`", "CHAPTER 2. Geospatial operations on raster/vector data", "2.1. Raster resampling", "2.2. Raster summary statistics". At the bottom of the sidebar, the author information is listed: "Vinit Sehgal (Louisiana State University) & Debasish Mishra (Texas A&M University)" and the date "October/2023".

Website:

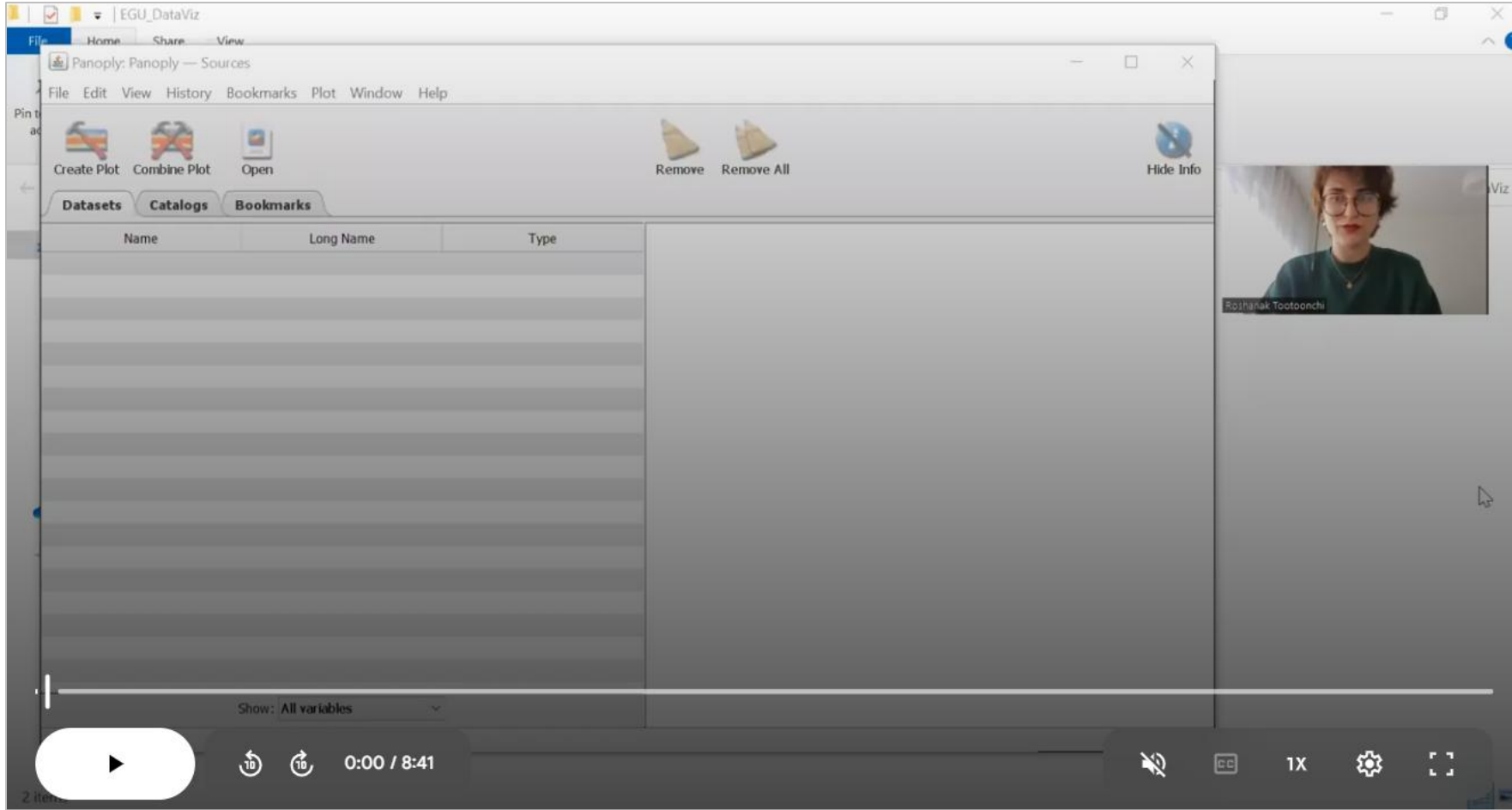
[https://rpubs.com/Vinit\\_Sehgal/lgar23](https://rpubs.com/Vinit_Sehgal/lgar23)

Video:

[https://drive.google.com/file/d/10ZQ5l8f\\_JzzUk6hUCU60LgtyZMCbAq1B/view](https://drive.google.com/file/d/10ZQ5l8f_JzzUk6hUCU60LgtyZMCbAq1B/view)

Contact Details:  
[debmishra@tamu.edu](mailto:debmishra@tamu.edu)

# Panoply



Video:  
<https://drive.google.com/file/d/1FMbxLGiJssgKlrigJCjiSs6fXGjRPKt7/view>

# NCAR Command Language (NCL)

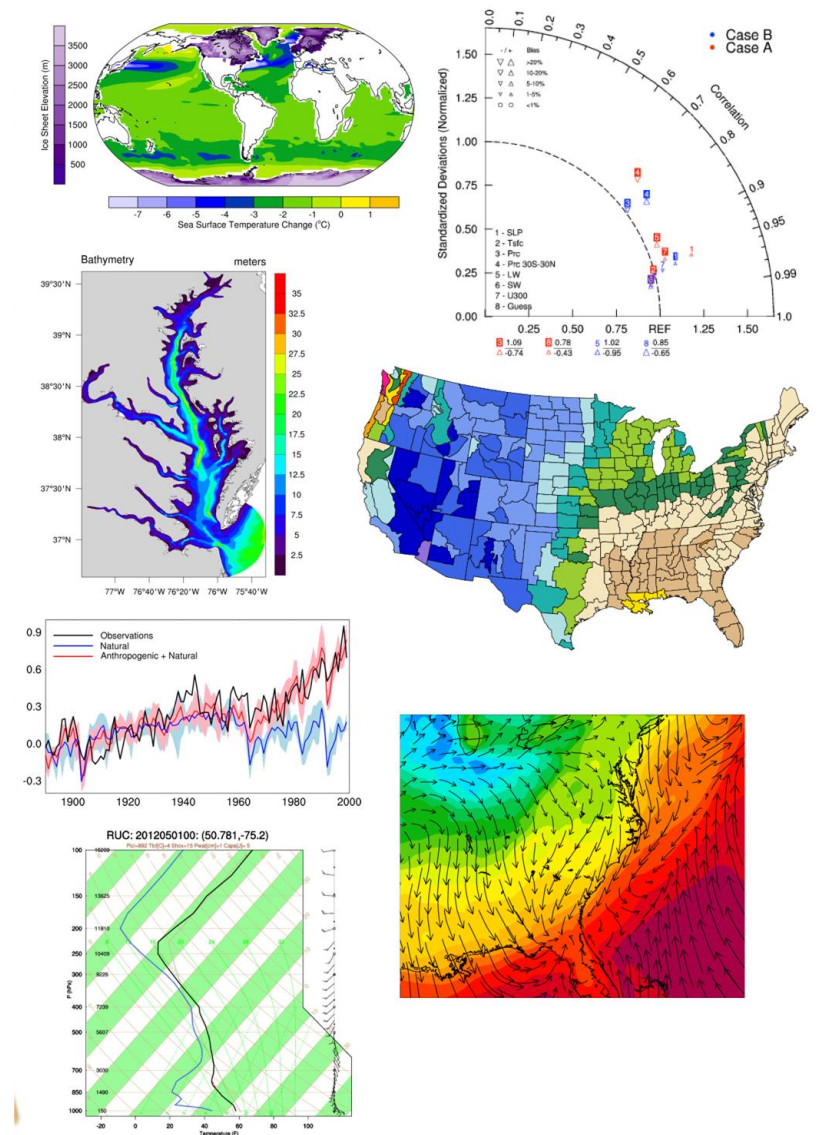
NCL is an interpreted language designed for data analysis and visualization.

NCL is open source! It is available for MacOS, Linux, and Windows systems running the Windows 10 Linux subsystem.

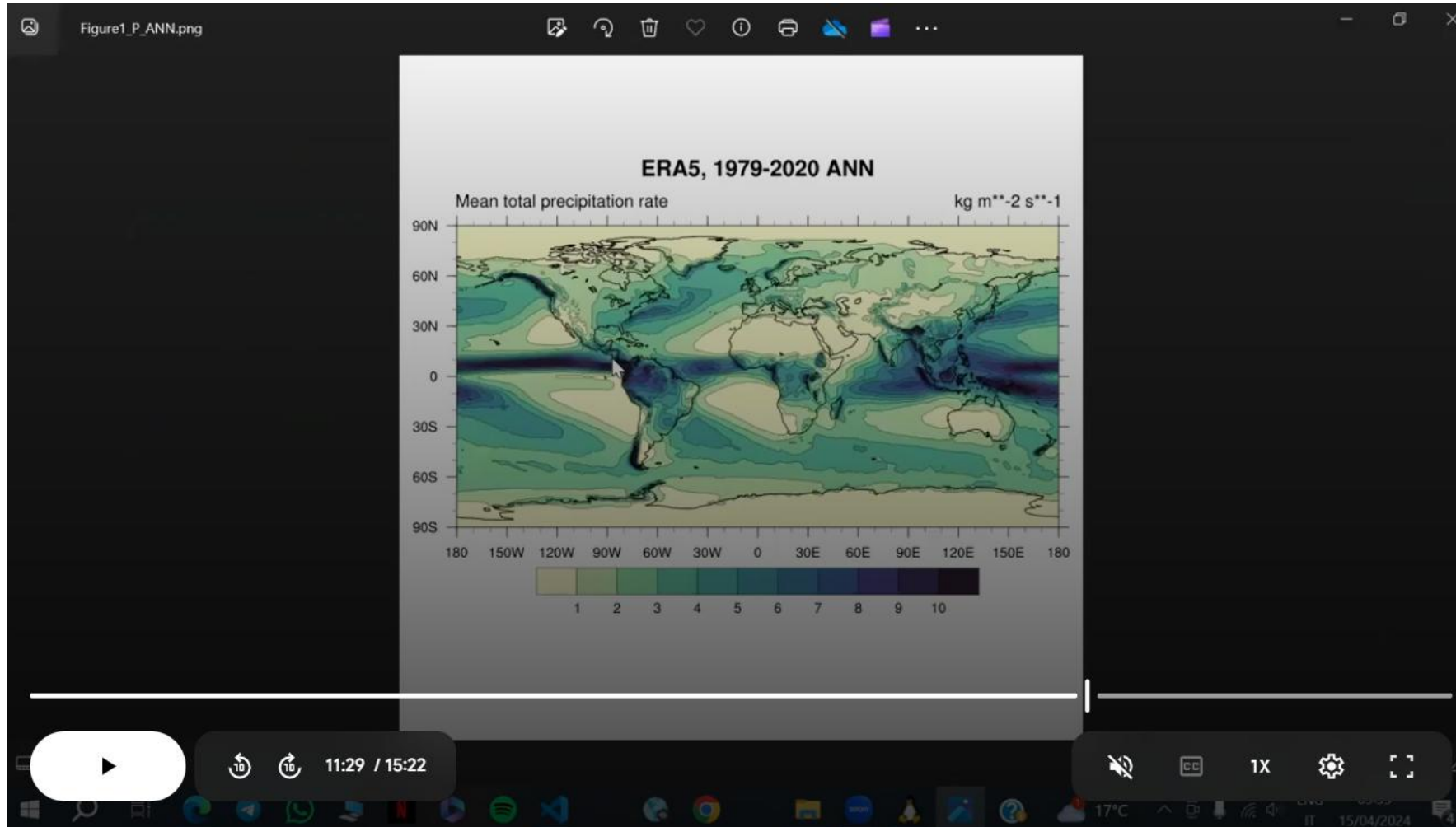
It supports NetCDF, GRIB, Shapefile, etc.

There are a lot of useful built-in functions.

It's got many graphic resources, and high-quality graphics can be created.



# NCAR Command Language (NCL)



Applications and examples:  
<https://www.ncl.ucar.edu/Applications/>

Video:  
<https://drive.google.com/file/d/1ktjxWxq4TuL9mTpcjPkm6hHuTezvMxl9/view>

**Q&A**

# Thank you for your attention!

**Conveners:**

**Epari Ritesh Patro** (University of Oulu, Finland)

**Paola Mazzoglio** (Politecnico di Torino, Italy)

**Edoardo Martini** (University of Leipzig, Germany)

**Roshanak Tootoonchi** (Euro-Mediterranean Center on Climate Change, Italy)

**Xinyang Fan** (University of Erlangen-Nuremberg, Germany)

**Invited speaker:**

**Dario Treppiedi** (University of Palermo, Italy)