

# Data Visualisation in user-tailored products

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**inDUST**

inDUST webinar  
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Building on the knowledge of **many BSC colleagues**: Marta Terrado, Dragana Bojovic, Diana Urquiza, Konstantina Chouta, Andria Nicodemou, Sara Octenjak, Jose Canovas, Miguel Segura, Marina Conde, Iliaria Vigo, Asun Lera St. Clair, Luz Calvo, Guillermo Marin, Fernando Cucchiatti

1990

SO, THIS CLIMATE CHANGE THING COULD BE A PROBLEM...



1995

CLIMATE CHANGE: DEFINITELY A PROBLEM.



2001

YEP, WE SHOULD REALLY BE GETTING ON WITH SORTING THIS OUT PRETTY SOON...



2007

LOOK, SORRY TO SOUND LIKE A BROKEN RECORD HERE...



2013

WE REALLY HAVE CHECKED AND WE'RE NOT MAKING THIS UP.



2019

IS THIS THING ON?



KOPKA  
28/9/13

A hand holds a rectangular piece of cardboard with the text "There is NO Planet B" written on it. The text is written in a thick, hand-painted style. "There is" is in black, "NO" is in black, "Planet" is in black, and "B" is in red. A red horizontal line is drawn under "Planet B". The background is a blurred crowd at a protest, with a large yellow balloon on the left and a building in the distance.

There is  
NO Planet B

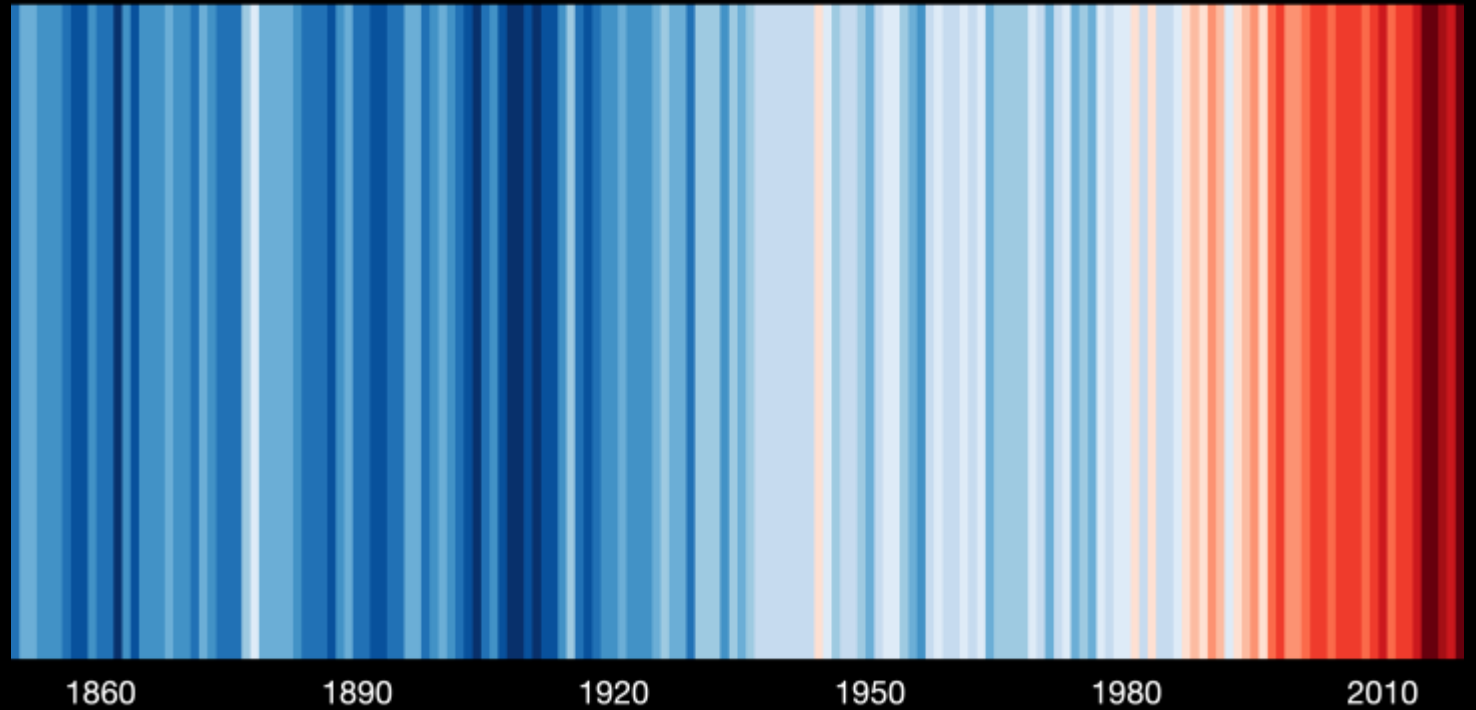


# NARRATIVES

# VISUALS

# #ShowYourStripes

Global temperature change (1850-2019)



Not only for  
broad audiences...

# Policy makers



# Industry



# Civil protection



... and many more

# USER-TAILORED PRODUCTS **PURPOSE**

Raise Awareness

Engagement

Storytelling from data

Knowledge transfer

support decision making

...Trigger action







1. Design
2. User-Centric design
3. Visual encoding
4. Color
5. Uncertainty
6. Interacting with information
7. Terminology
8. Language

Design is **ALL** around but we only realise when it **FAILS**



WOW factor... **Aesthetics also matter**

We all have  
**Unconscious biases**





[www.seasonalhurricanepredictions.org](http://www.seasonalhurricanepredictions.org)



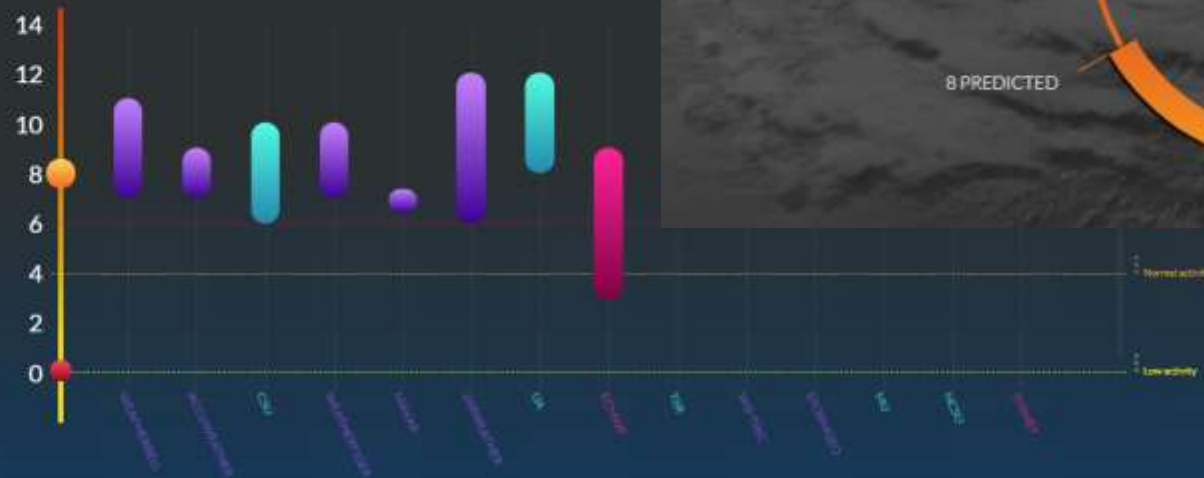
HOME SEASONAL INFORMATION

- LEGEND:
- UNIVERSITY
  - AVANCE CENTER
  - BARCELONA SUPERCOMPUTING CENTER
  - WIKIACAL PREDICTION

PLOT DESCRIPTION:  
Most recent tropical cyclone forecasts from each of the forecasting centers. Limits for the activity levels correspond to the ones defined by NOAA.

Download CSV

Download PDF



### FORECAST EXPLANATION

The Atlantic hurricane season begins on 1 June, and over one dozen groups have already issued seasonal hurricane forecasts for the 2020 season. To date, most groups have predicted an above-average season, with several forecasting an extremely active season (e.g., 9+ hurricanes). The spread in these early season predictions is somewhat less than we have seen in recent years. Several months

season historically ramp up in August, and consequently, significant alterations in seasonal forecasts are possible. For example, if the tropical Pacific were to anomalously warm and tropical Atlantic SSTs were to anomalously cool, seasonal forecasts would likely decrease. Alternatively, if La Niña appeared more likely and the tropical Atlantic remained warmer than normal, seasonal forecasts could be

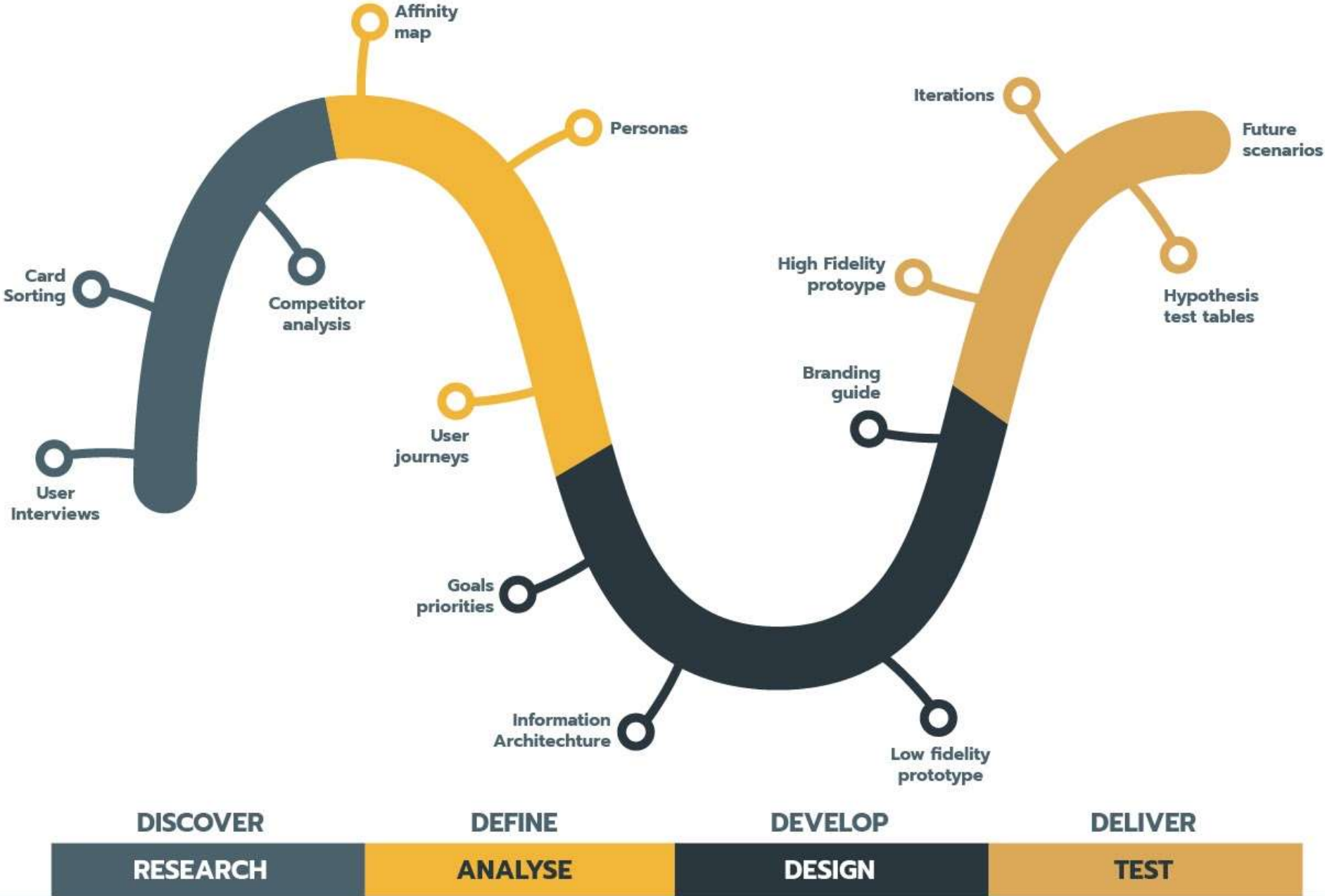
Sometimes the product is as simple as providing easy access to information in a well designed page





1. Design
2. **User-Centric design**
3. Visual encoding
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# UX PROCESS



# Interviews



# Affinity maps

## WHAT THEY ARE ASKING FOR

- "The dashboard is too slow, it takes too long to load. I want faster information please."
- "I can't see the data I need. It's all mixed up. I want it organized by department."
- "This is too long. I don't have time to read this. I want a summary."
- "I need more filters. I want to be able to filter by date, location, and category."
- "The data is not accurate. I want to be able to verify the numbers."
- "I need a way to share this data with my team. It's hard to explain."
- "The dashboard is too cluttered. I want a clean, simple interface."
- "I need a way to track my progress. I want to see how I'm doing over time."

## WHAT THEY LIKE

- "I like the way the dashboard is organized. It's easy to find what I need."
- "The charts are clear and easy to read. I like the way they are presented."
- "I like the way the dashboard is updated. I don't have to refresh the page every time."
- "I like the way the dashboard is designed. It's modern and professional."

## INTERESTING POINTS

- "I'm interested in the way the dashboard is designed. I want to know how it was created."
- "I'm interested in the way the dashboard is updated. I want to know how often it is updated."
- "I'm interested in the way the dashboard is organized. I want to know how it was designed."
- "I'm interested in the way the dashboard is presented. I want to know how it was designed."

## PAIN POINTS

- "There are too many reports. I don't have time to read them all. I want a summary of the most important ones."
- "I need a way to track my progress. I want to see how I'm doing over time."
- "The dashboard is too slow. It takes too long to load. I want faster information please."
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# Define user profiles (personas)



Maria
Persona 2



**Bio**

Maria is a 35-year-old Quality Manager working in the field of Quality. She has a Bachelor's degree in Business Administration and is currently working in Barcelona for the past 3 years.

**Goals - Interest**

- Expresses an interest in technology.
- Already interested in comparing her model to other models.
- Interested in learning about new models and how they work.
- Interested in learning about new models and how they work.

**Pain Points - Concerns**

- Does not know how to use the system. It is too complicated.
- Does not know how to use the system. It is too complicated.
- Does not know how to use the system. It is too complicated.

**Scenario**

Maria is interested in learning about new models and how they work. She is currently working in Barcelona for the past 3 years.

**Motivations**

Power & Prestige

Quality of life

Learning Curve

Technical aspects

Business

**Personality**

Extroverted

Optimistic

Creative

Curious

Logical

Active

**Brands**

M, Twitter, Python, LinkedIn, meteoblue, Jira, Fortna, Instagram

**Persona Summary:** Age: 35, Occupation: Air Quality Manager, Family: Single, Location: Barcelona. Personality: Friendly - Focused - Ambitious.



# User journey

**USER JOURNEY**


Maria

**Scenario**

Maria is interested in learning about new models and how they work. She is currently working in Barcelona for the past 3 years.

**Expectations**

- Maria needs to learn how to use the system.
- Maria needs to learn how to use the system.
- Maria needs to learn how to use the system.



The user journey map shows the following stages:

- Discover:** Maria discovers the system through a colleague's recommendation.
- Explore:** Maria explores the system and learns about its features.
- Evaluate:** Maria evaluates the system and compares it to other models.
- Purchase:** Maria purchases the system and sets it up.
- Post-purchase:** Maria uses the system and provides feedback.



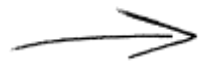
All this is used to build a  
**demand-driven** user-tailored product

Creating a

**GOOD / SUCCESSFUL / USEFUL / ...**

user-tailored product has many steps

Information architecture



Low fidelity prototypes



Branding guide



High fidelity prototype



Shadows



Colors



Icons



This is at the core of most  
private sector products...

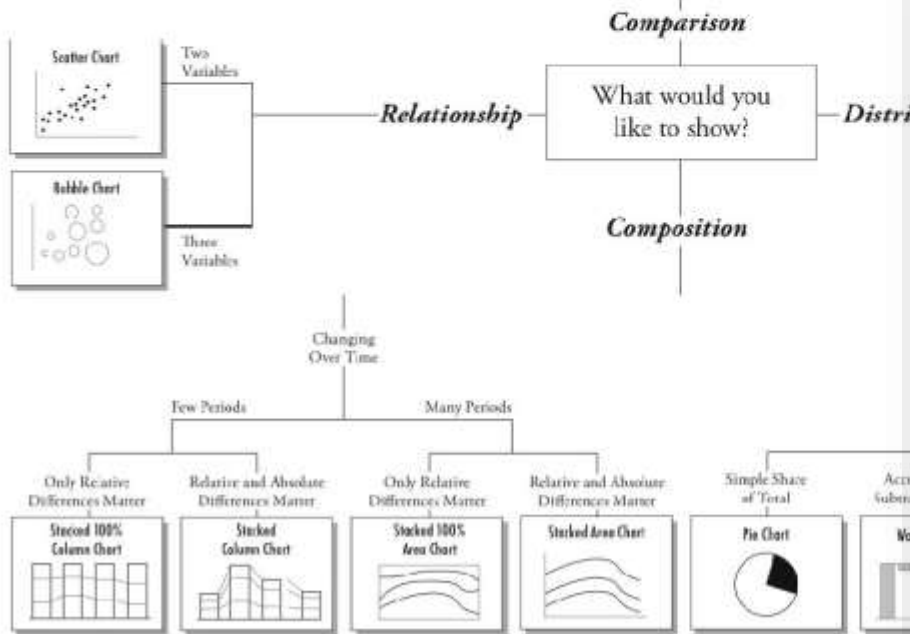
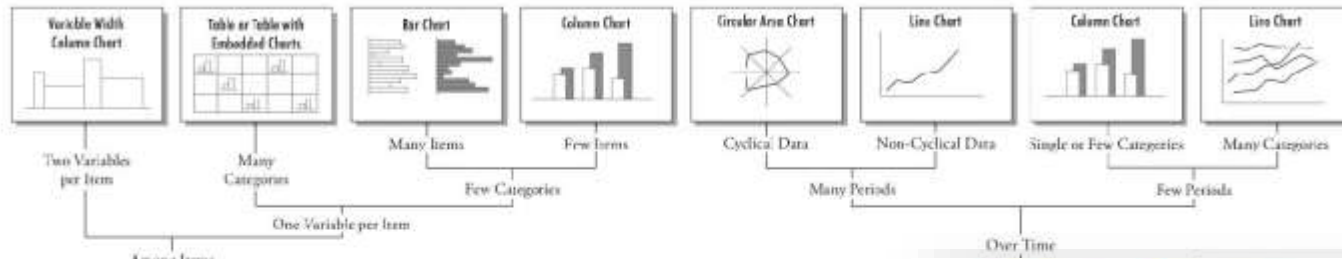
... and a needed step for any  
online product/interface



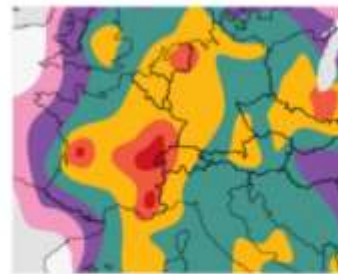


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2. User-Centric design
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## Chart Suggestions—A Thought-Starter



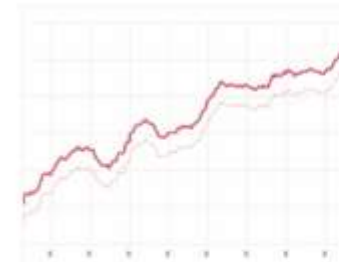
# Type of data and type of product



### Heatmap

Heatmaps are graphical representations of data where values are depicted by colours.

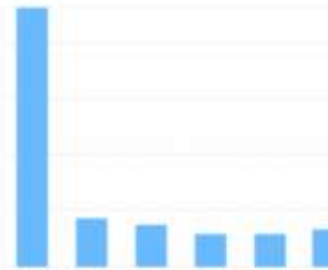
[EDIT & DOWNLOAD](#)



### Timeseries

Time series show how multiple dimensions compare over time, spot trends, and seasonal changes in data.

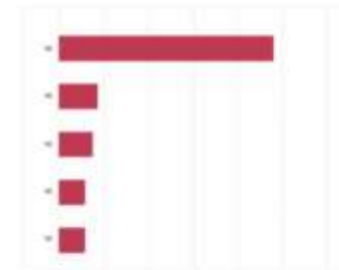
[EDIT & DOWNLOAD](#)



### Time Comparison

Time Comparison allows you to compare a selection of a period in a specific time scale.

[EDIT & DOWNLOAD](#)



### Ranking

Ranking charts are an effective way to show data ranked in an ascending or descending order.

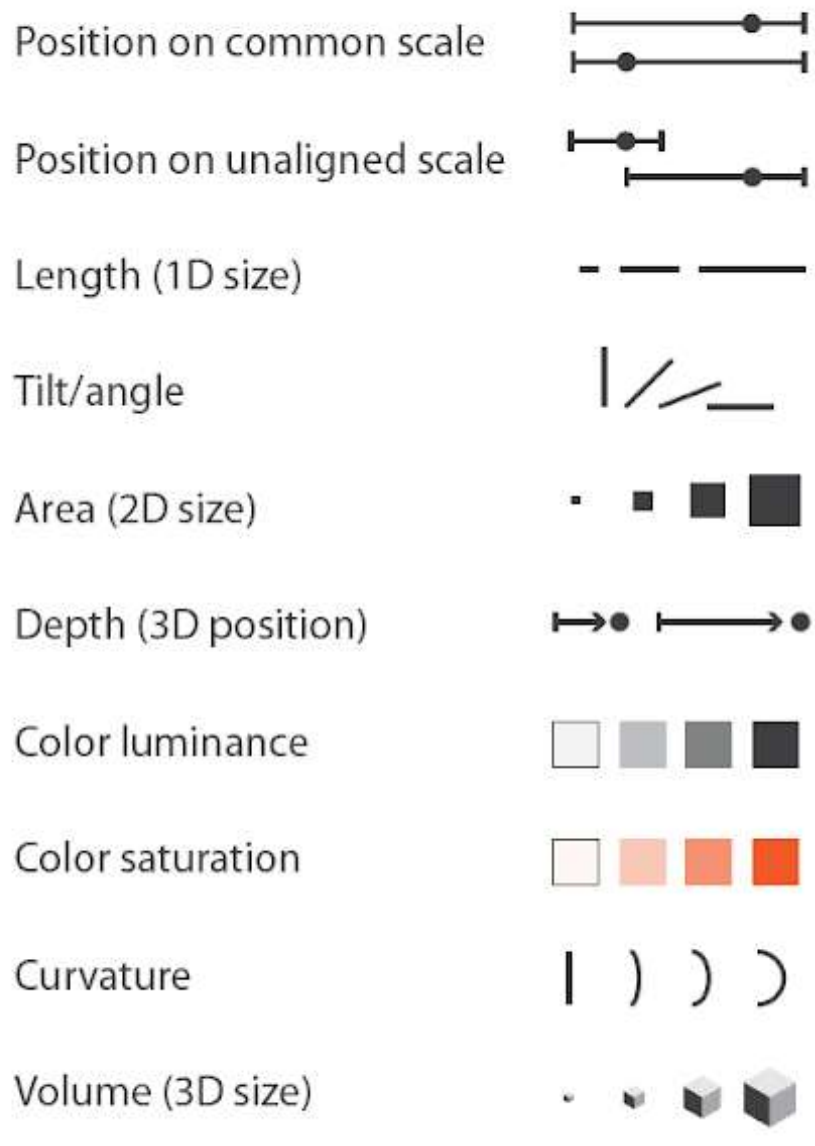
[EDIT & DOWNLOAD](#)



### Region Maps

Region maps display regions that are coloured, shaded or patterned in relation to a variable.

[EDIT & DOWNLOAD](#)



Same

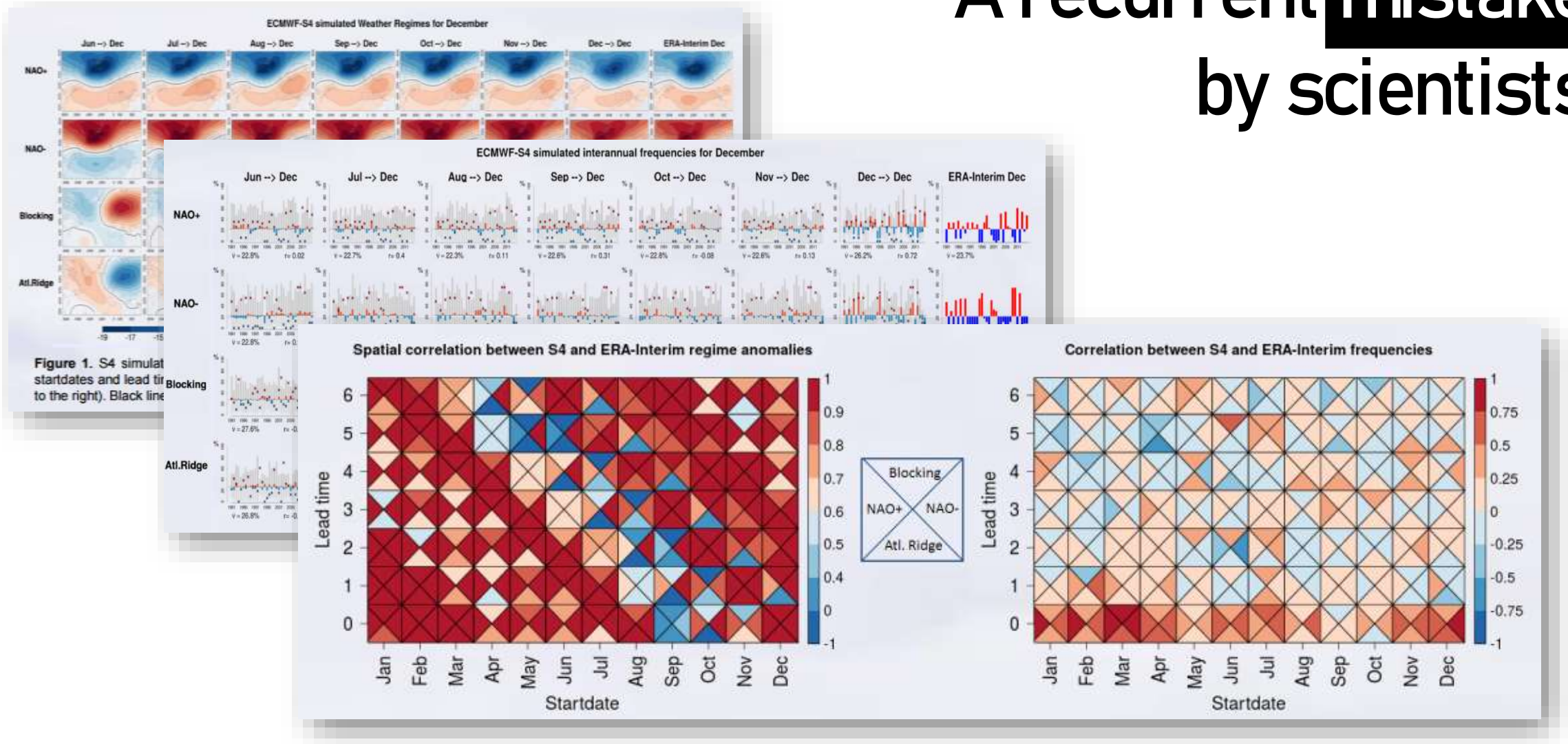
Same



# Not all encoding is equally good...



# A recurrent mistake by scientists

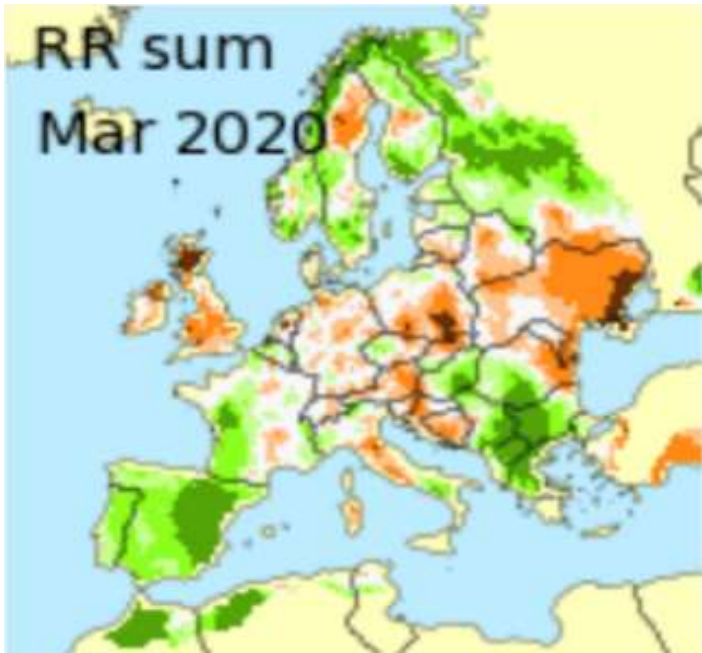




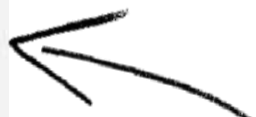
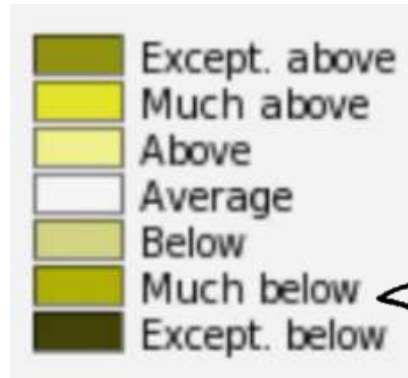
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Not all color scales are right:

Build **color-blind friendly** products

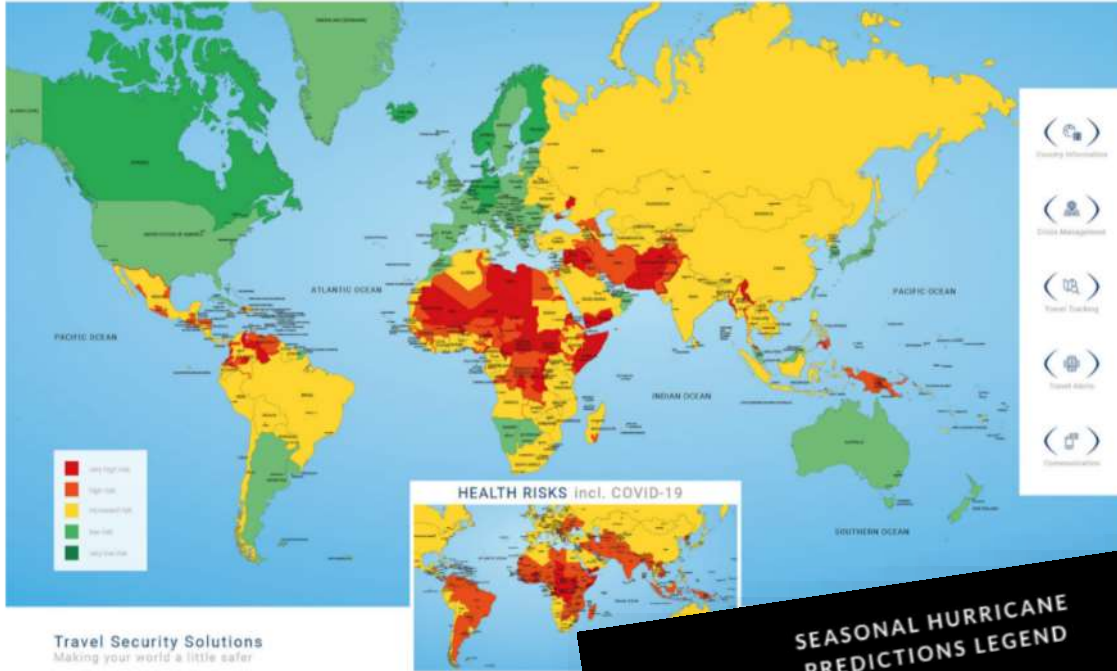


Usual color scale  
for precipitation



Color-blind  
simulation





**Normal practice  
does not mean  
good practice**

Not all color scales are right:

Build color-blind friendly products

Mind human **perception**

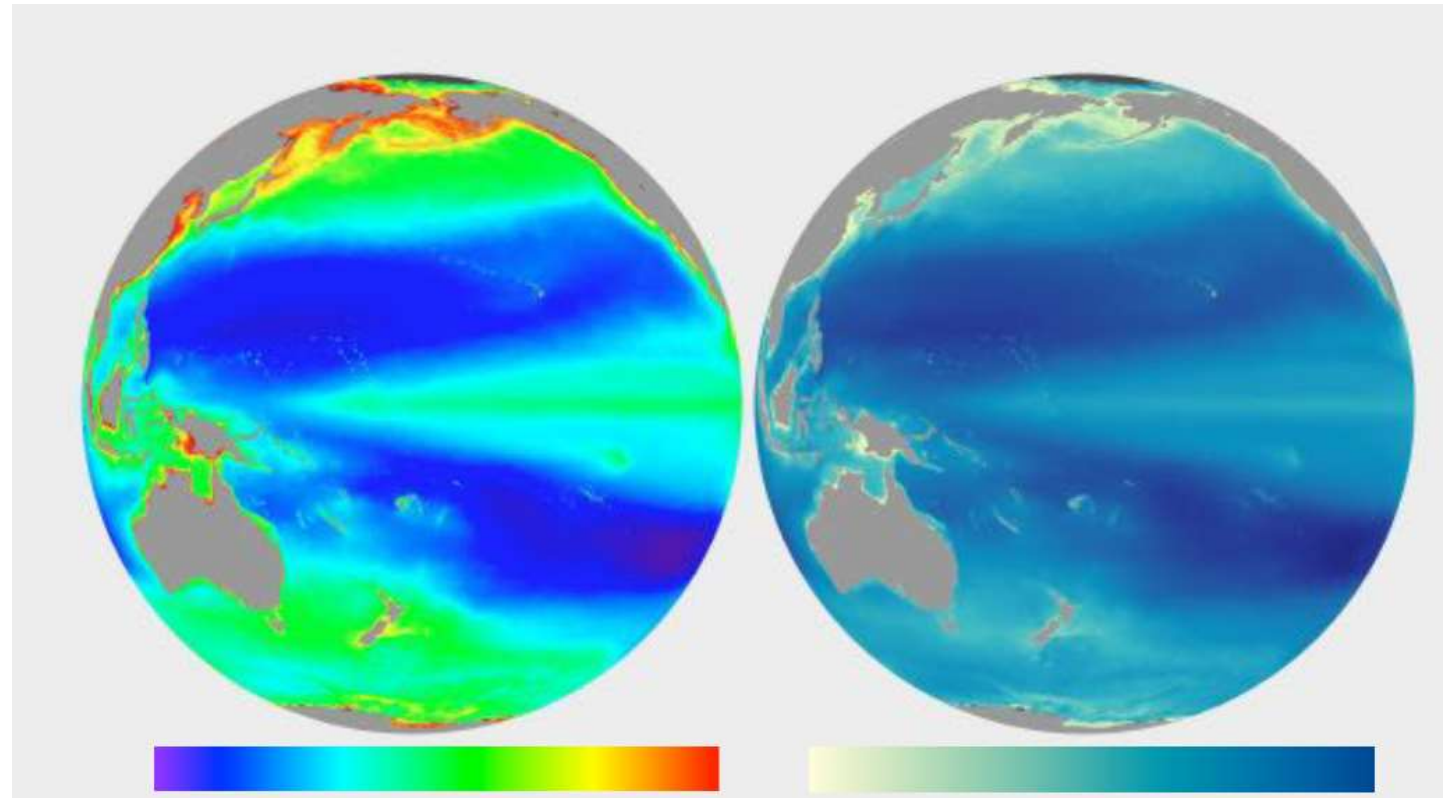
# The Rainbow color scale

- Some colors brighter than others
- Interpolation is not perceptually linear
- No continuous variation in lightness
- No inherent meaning for color breaks

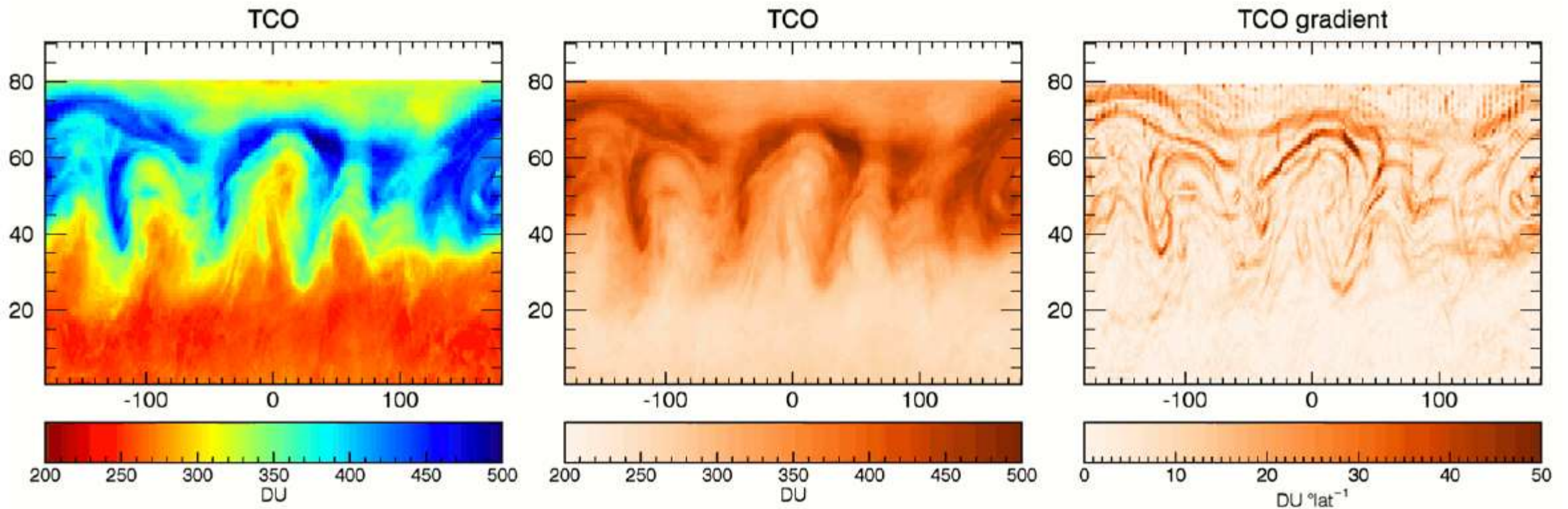
(please)

**Don't use it**

Source slide by  
Guillermo Marin



# Wrong color scale can show effects not present in data



Learn more at: <https://www.climate-lab-book.ac.uk/2014/end-of-the-rainbow/>

Sean Davis, NOAA

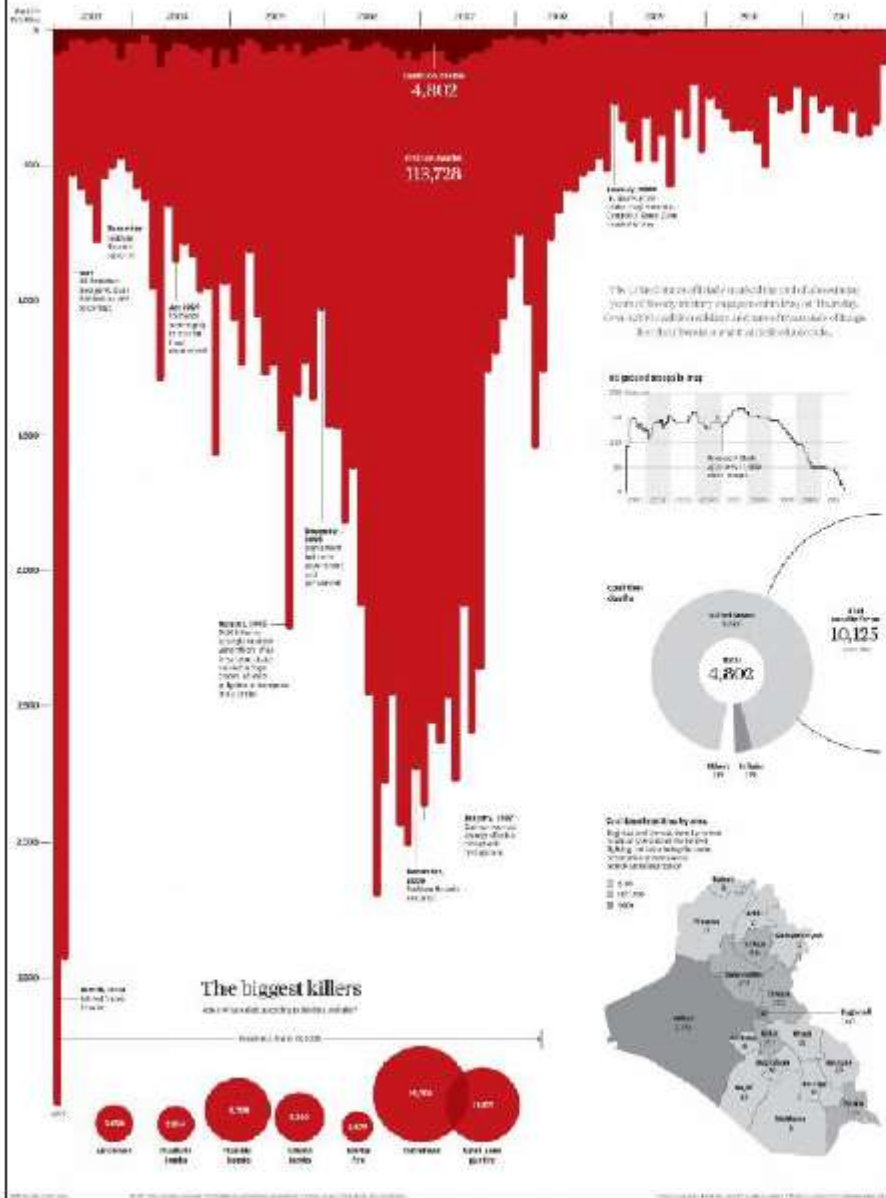
Not all color scales are right:

Build color-blind friendly products

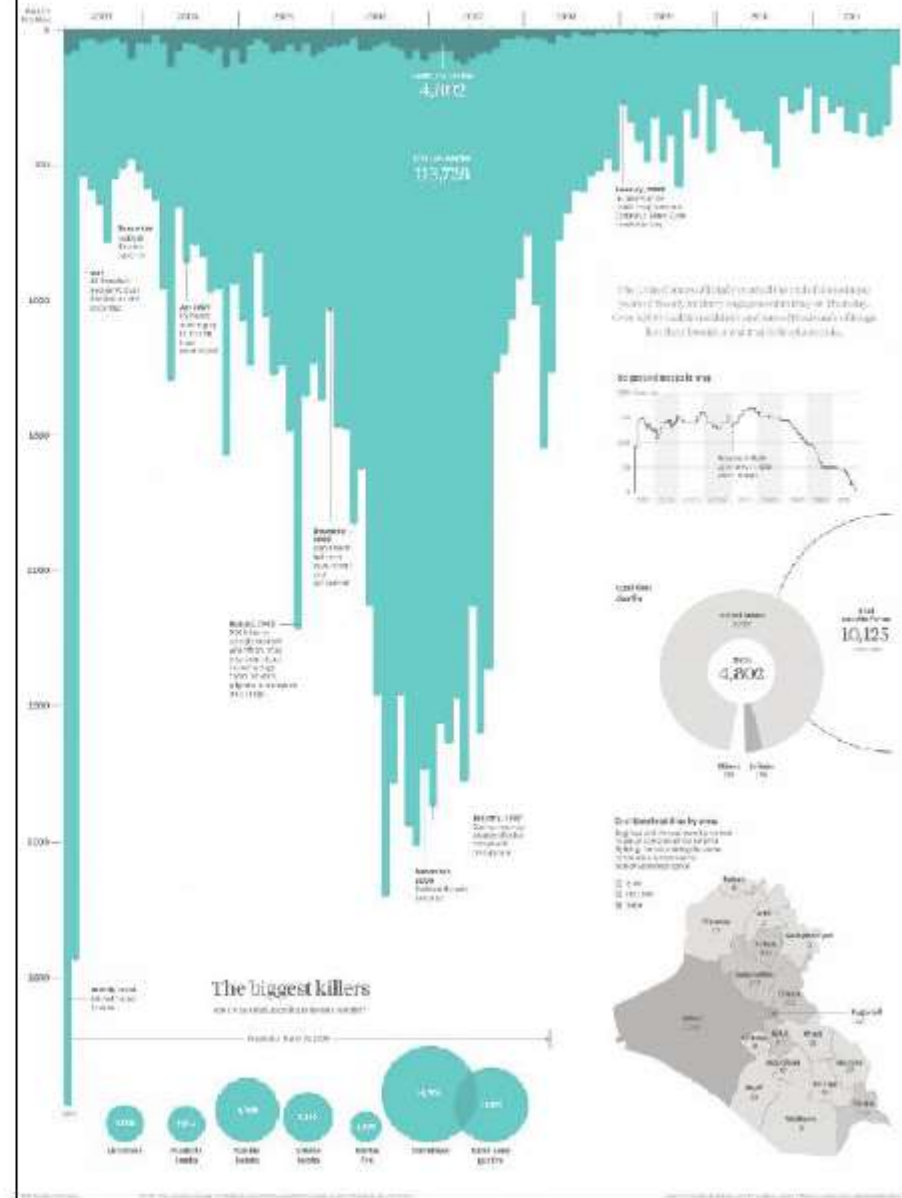
Mind human perception

Semantics of color matter

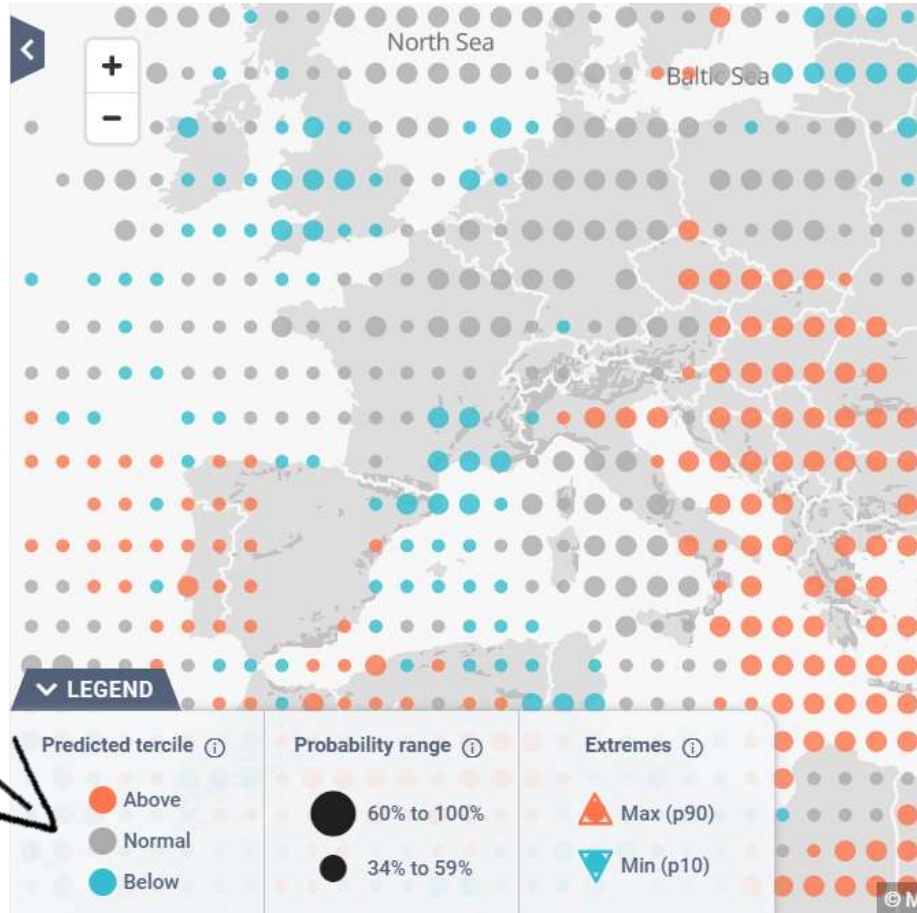
# Iraq's bloody toll



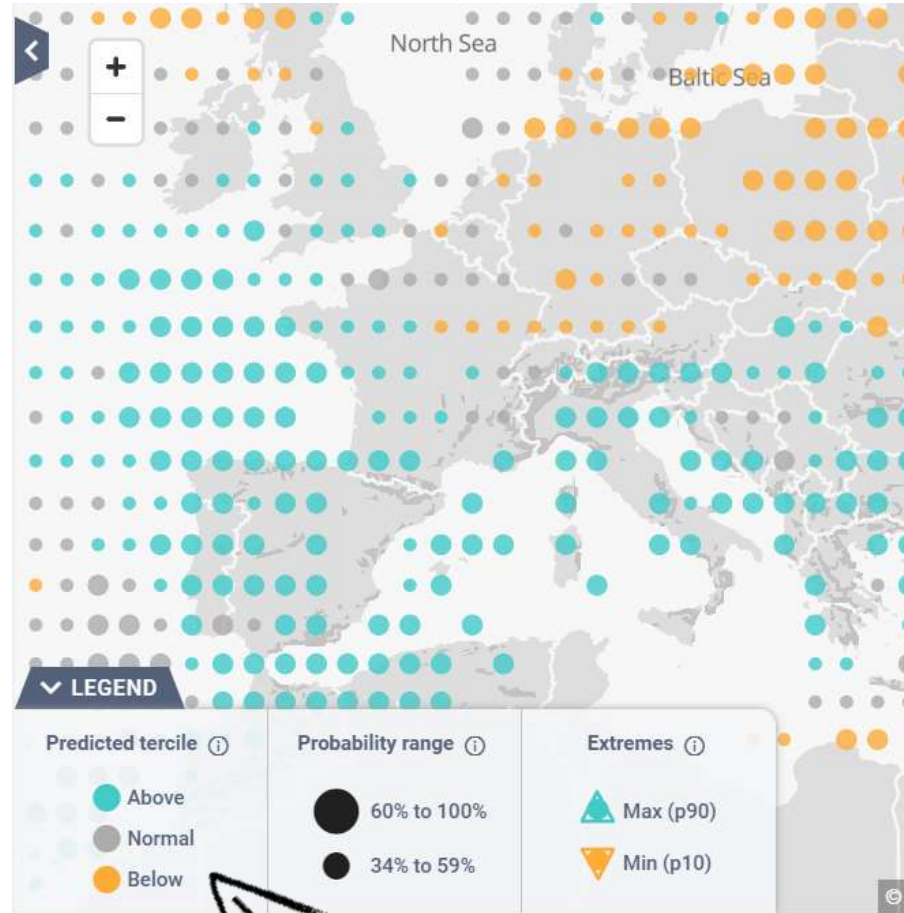
# Iraq's bloody toll



# Temperature



# Precipitation





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**Uncertainty** visualisation is a key challenge  
for Data visualisation and Science

First order uncertainty:  
e.g. **probabilities**

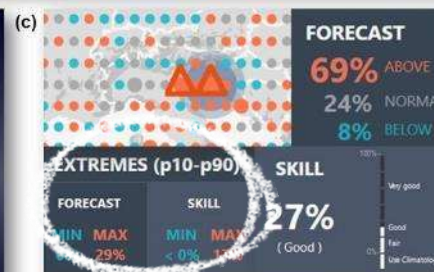
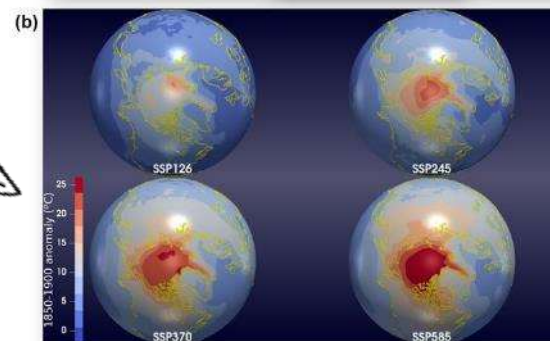
anomalies

terciles

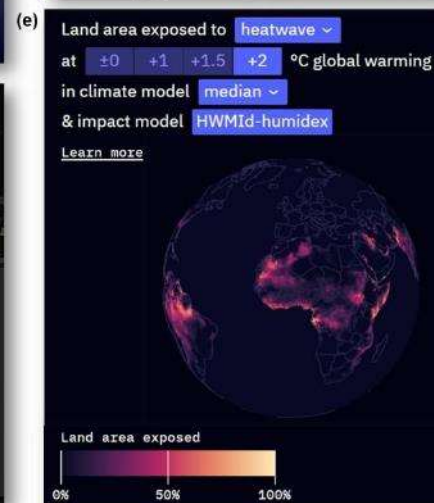
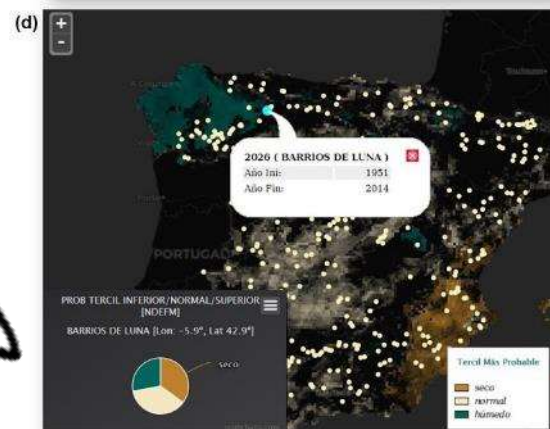
Terrado, M. et al.  
[www.climateurope.eu](http://www.climateurope.eu)



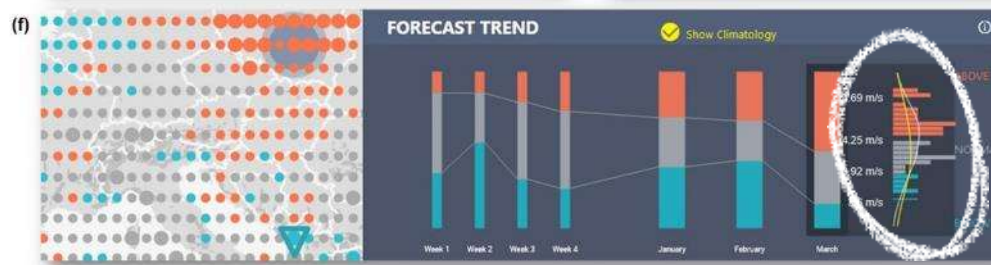
average and possible range



extreme events probabilities (e.g. p10 and p90)



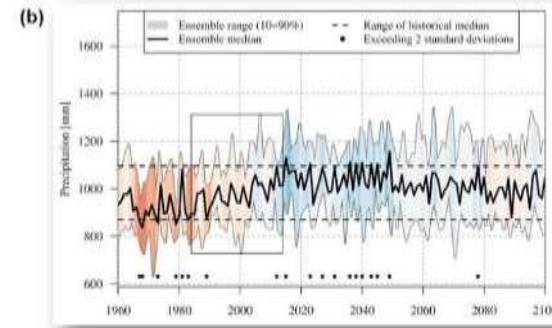
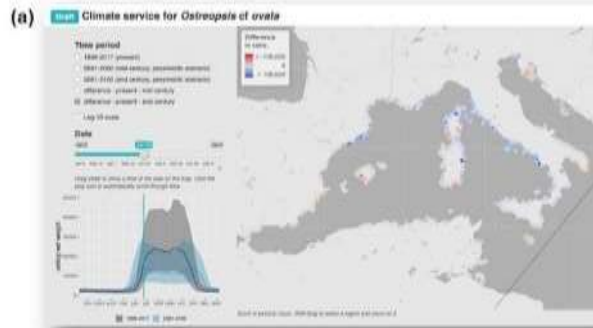
scenarios



whole probability distribution function

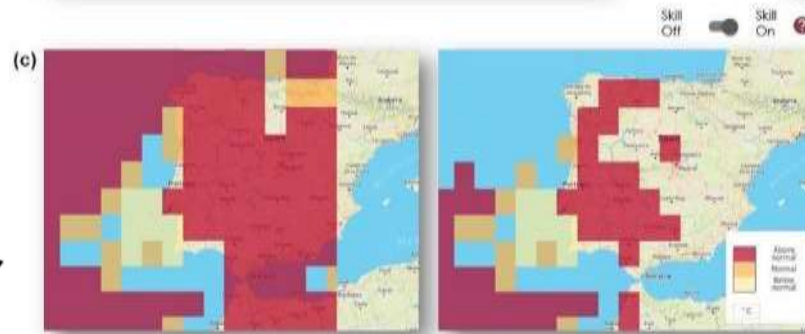
# Second order uncertainty: e.g. skill, reliability

uncertainty  
not shown

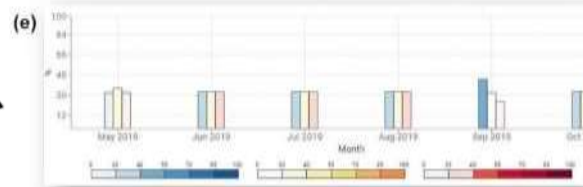


show ensemble  
range

mask areas with  
high uncertainty



use visual  
encoding (e.g.  
transparency)



replace predictions with high uncertainty by the  
climatology (i.e. average conditions of the past years)

use interactive options (e.g. slider)



1. Design
2. User-Centric design
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4. Color
5. Uncertainty
- 6. Interacting with information**
7. Terminology
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Two key concepts



Progressive Disclosure  
Of information

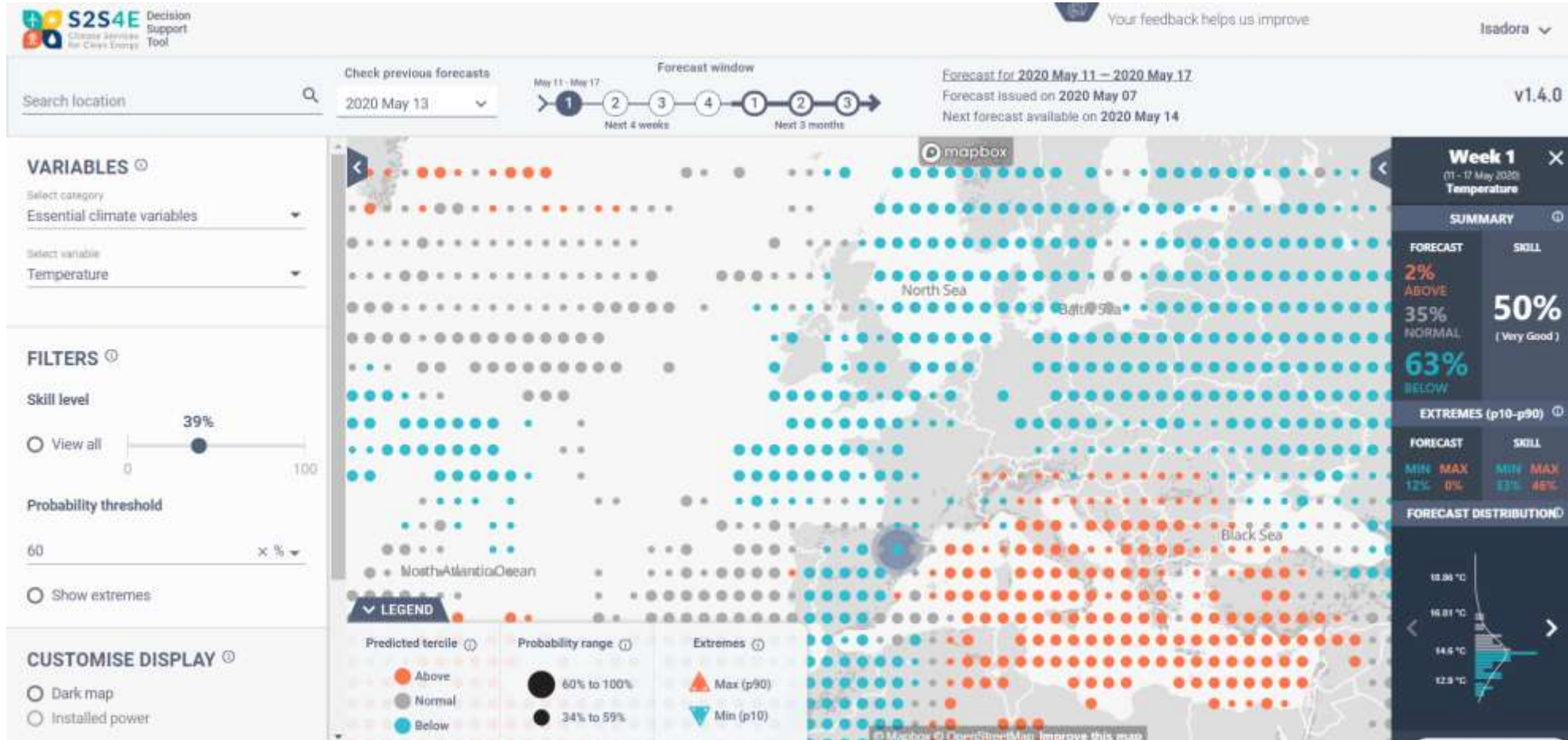


# S2S4E

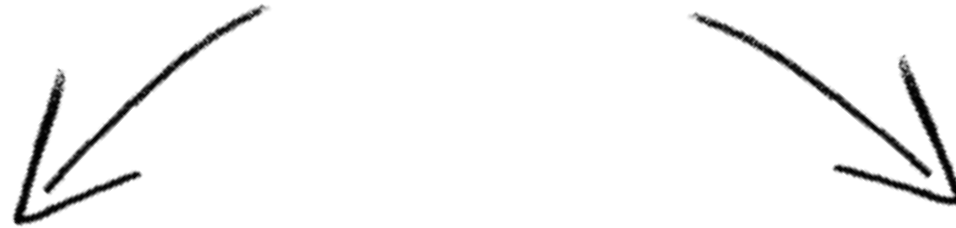
Climate Services  
for Clean Energy

 @S2S4E

[www.s2s4e.eu/dst](http://www.s2s4e.eu/dst)



# Two key concepts



**Progressive Disclosure  
Of information**

**Interactive  
Design**

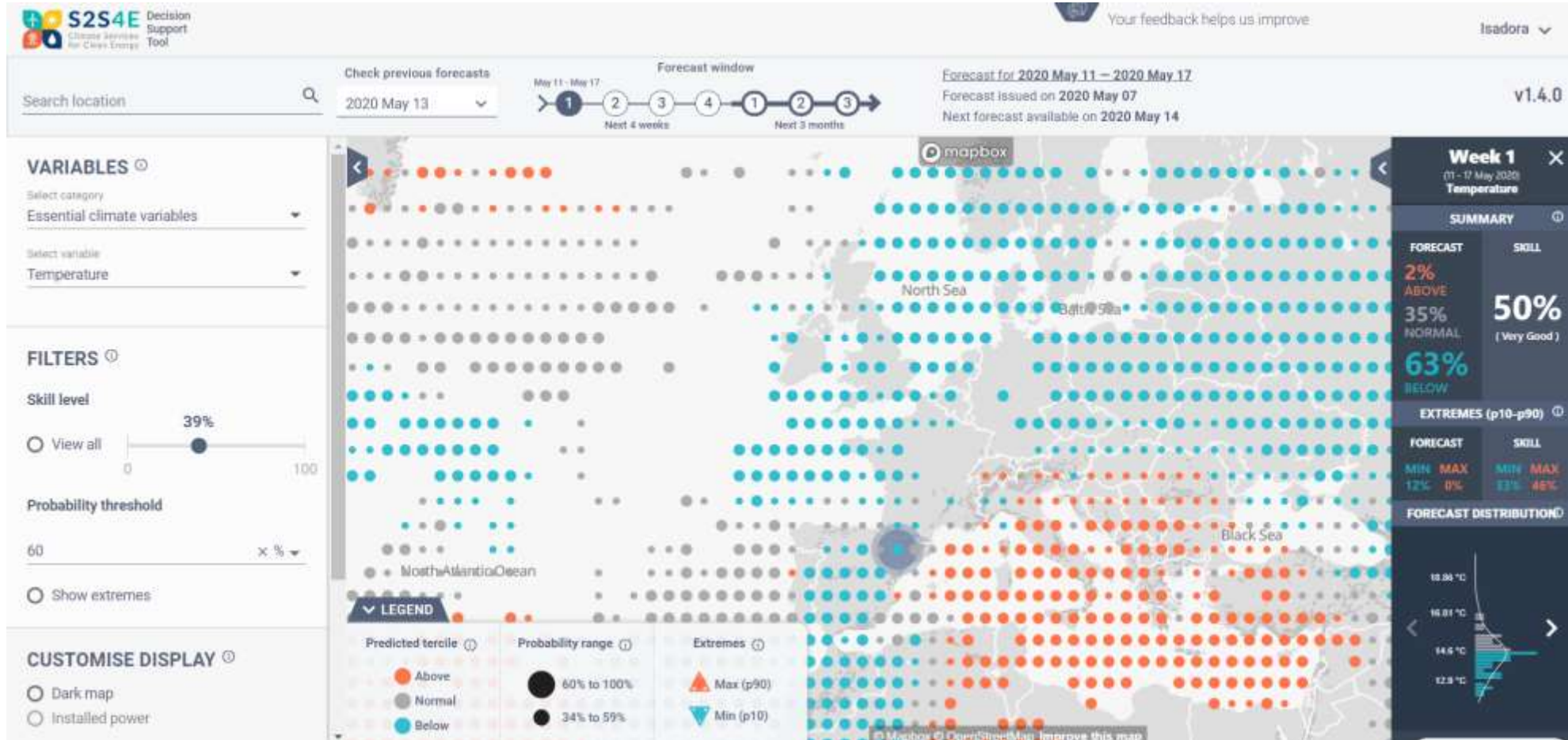


# S2S4E

Climate Services  
for Clean Energy

 @S2S4E

[www.s2s4e.eu/dst](http://www.s2s4e.eu/dst)







1. Design
2. User-Centric design
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And once you finish with all  
visual stuff....

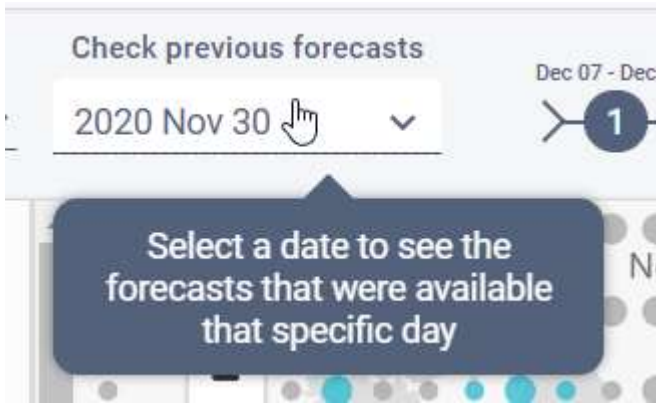
... you still have to deal with  
all **TEXT** in the product

# All “copy” in the visualisation product

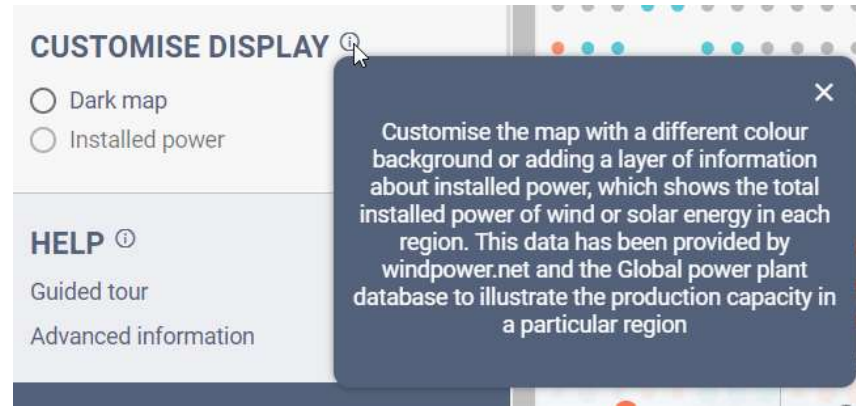


# Guiding the User

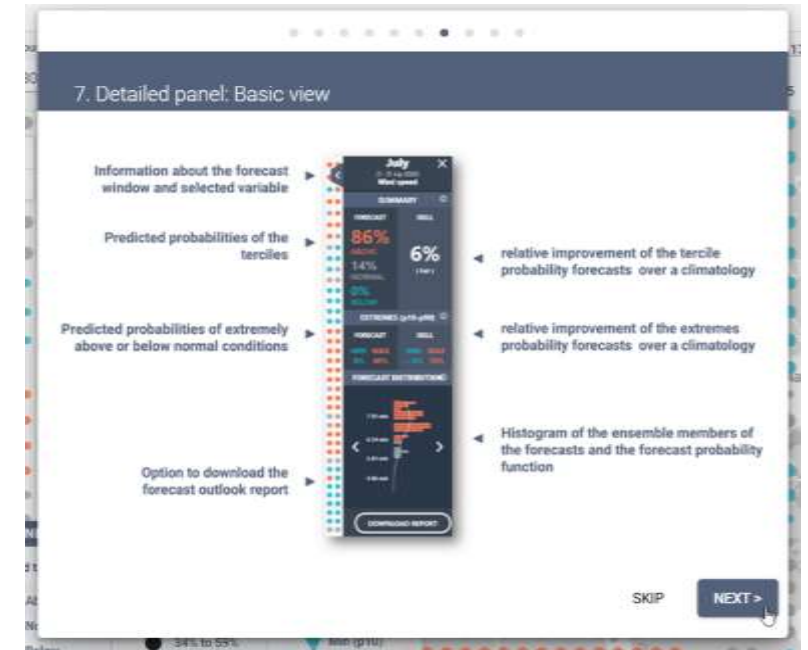
## Mouse hover text



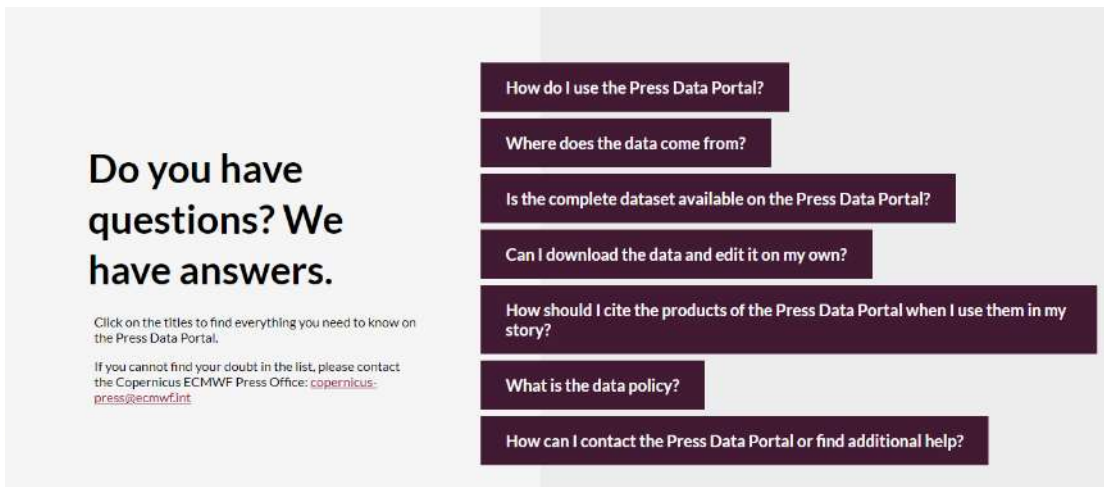
## Tooltips



## Guided tours



## FAQ



## Advanced help and documentation



# Background and context information about the product

## Factsheets

**CLIMATE SERVICES FOR THE OLIVE AND OLIVE OIL SECTOR**

*"Good agricultural practices based on climate services could increase the resilience of olive crops" (Jover et al., 2020)*

Olive and olive oil production is heavily affected by weather and climate, and is thereby highly vulnerable to climate change. MED-GOLD will use a range of tools to support decision making in the olive and olive oil sector over a range of timescales, from months to decades. These tools will include climate values, numerical models, and agroecosystem analyses to turn climate and other data into customized products. The process of turning climate-related information into products with added value for decision-making is called climate service. Climate information underlying the services will be provided at higher spatial resolution and with less bias than currently available.

Olive and olive oil producers face a variety of climate-related challenges in the long, medium and short term that need to be tackled by climate-informed decision making. Some of the main challenges are presented below, with an indication of how the related decisions can be optimized using appropriate climate services tools that support a long-term strategy as well as shorter-term agricultural and commercial management.

Time scale	Decision type	Challenges	MED-GOLD climate services tools	Benefits
Short term (up to 10 days)	Agri-management	Optimize water management	Temperature	Reduce peak damage while protecting the environment
	Quality management	Better estimation of olive yield and final damage	Precipitation	Optimization of use of water resources
Mid term (10 days to 1 year)	Agri-management	Optimize fertilization planning	Temperature	Sustainability
	Harvest management	Better estimation of olive production	Precipitation	Optimization of the use of facilities
Long term (10 years)	Long term strategy	Optimal production system	Temperature and precipitation patterns	Reduce vulnerability per geographical area
		Optimal water planning, varieties, etc.	Numerical modeling of present and productivity	Resilient recommendations for improved crop management strategies

## Case studies

**APPLICATE.eu**  
Advanced applications for water regions and beyond

**ENERGY CASE STUDY**

### HOW DOES ARCTIC SEA ICE AFFECT ENERGY PRODUCTION IN MID-LATITUDES?

**CHAIN OF EVENTS**

1. Abnormal low sea ice concentration in the Barents and Kara (BK) seas

During November and December 2016, extreme warm temperatures were observed in the Arctic. As a result, the total Arctic sea ice extent experienced a historical low value, with negative anomalies<sup>1</sup> in most of the Arctic, but especially strong in the BK seas (Accosta-Manzano et al., 2018). According to existing results, a breakdown in sea ice loss (i.e., an accelerated decline) over the BK seas took place in the early 2000 (Clausen et al., 2015). In the last decade several studies have found causal links between low Arctic sea ice cover in the late autumn and extreme climate anomalies in the following winter in mid-latitudes (Clausen et al., 2014; Screen et al., 2018). In the framework of the APPLICATE project, retrospective forecasts<sup>2</sup> with the EC-Earth3 climate model (Stocker-Royes et al., 2013) were performed to attribute the role of extremely reduced Arctic sea ice conditions (mainly over BK) with regard to the extremely low precipitation event in Europe in winter 2016-2017 (Accosta-Manzano et al., 2018, see Fig. 1).

**GLOSSARY**

<sup>1</sup> Anomaly difference (or bias) the mean value, area- or concentration of a given time and the long-term average. When it is negative, it usually indicates there is less ice than average for a given month.

<sup>2</sup> Retrospective forecast refers to forecast made in the context of the past using only information available before the beginning of the forecast.

## Glossaries

**MED-GOLD**

PROJECT | DOCUMENTS | CLIMATE SERVICES | CASE STUDIES | MEDIA | EVENTS & NEWS | INTERNAL AREA | JOIN MED-GOLD

# Glossary

A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z



1. Design
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Regional products  
vs  
International products



Relevant products  
only in English  
is a **non-inclusive practice**

# THANK YOU

# inDust



**Barcelona  
Supercomputing  
Center**  
Centro Nacional de Supercomputación



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