We are getting hotter!!

It’s not your imagination, world is getting warmer.

Juan Carlos Méndez
jc.mendez (at) uniandes.edu.co

http://jcmendez.gkudos.com/midterm/

Description

- Use visualization to get a better understanding of global temperature change.
- Dataset Title:
  - GISS Surface Temperature Analysis (GISTEMP)
  - Url https://data.giss.nasa.gov/gistemp/
  - Source: NASA
  - Files:
    - Global-mean monthly, seasonal, and annual means, 1880-present, updated through most recent month (GLB.Ts+dSST)
    - Zonal annual means, 1880-present, updated through most recent complete year (ZonAnn.Ts+dSST)

Main Datasets

- Dataset Name: GLB.Ts+dSST
- Dataset Type: Table, Temporal, Static
- Attributes:
  - *year*: quantitative, ordered, sequential
  - Months (Jan,Feb,Mar…*):* categorical, ordered, cyclic
  - temperature: quantitative, ordered, diverging

- Dataset Name: ZonAnn.Ts+dSST
- Dataset Type: Table, Temporal, Static
- Attributes:
  - *year*: quantitative, ordered, sequential
  - Zones (*64N-90N 44N-64N 24N-44N..):* categorical, ordered, diverging
  - temperature: quantitative, ordered, diverging

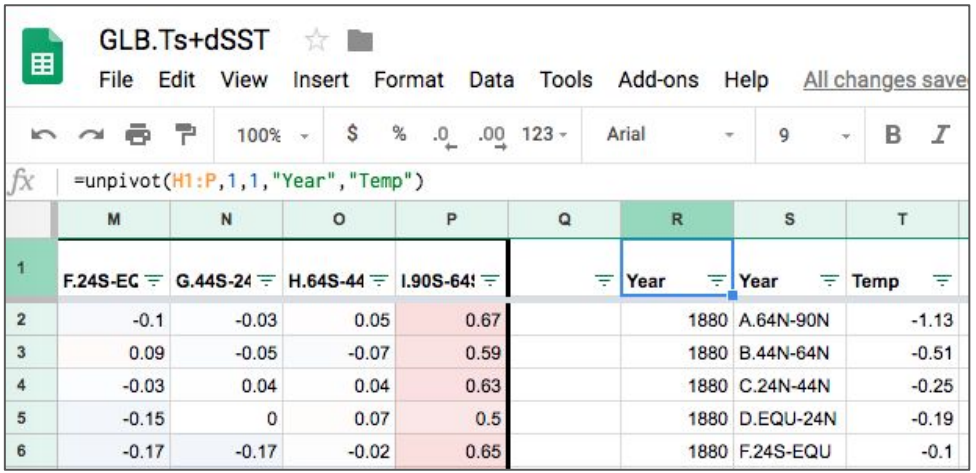
Derived Datasets

- Dataset Name: Moving Averages by Year / Month
- Dataset Type: Table, Temporal, Static
- Attributes:
  - year-month: date, ordered, sequential
  - temperature: quantitative, ordered, diverging
  - Temperature Moving averages (*6 months: tma_6, 60 months: tma_60, 11 years: tma_132*): quantitative, ordered, diverging
- Derivation: Moving average of temperaturer

```
SELECT month_temp AS "month",
     temp AS "temp",
     AVG(temp) OVER (ORDER BY month_temp ROWS
     BETWEEN 132 PRECEDING AND 0 FOLLOWING)::FLOAT AS "132-month Moving Average"
FROM kudosg.glb_ts_dsst_yearmonth_all
ORDER BY 1 DESC
```

Derived Datasets

- Dataset Name: Zones
- Dataset Type: Table, Temporal, Static
- Attributes:
  - year-month: date, ordered, sequential
  - zone: qualitative, ordered, diverging
  - Temperature: quantitative, ordered, diverging
- Derivation: “*unpivoting*” zones



	M	N	O	P	Q	R	S	T
1	F.24S-EC	G.44S-24	H.64S-44	I.90S-64		Year	Year	Temp
2	-0.1	-0.03	0.05	0.67		1880	A.64N-90N	-1.13
3	0.09	-0.05	-0.07	0.59		1880	B.44N-64N	-0.51
4	-0.03	0.04	0.04	0.63		1880	C.24N-44N	-0.25
5	-0.15	0	0.07	0.5		1880	D.EQU-24N	-0.19
6	-0.17	-0.17	-0.02	0.65		1880	F.24S-EQU	-0.1

Derived Datasets

- Dataset Name: Decade
- Dataset Type: Table, Temporal, Static
- Attributes:
  - decade date, ordered, sequential
  - avg: quantitative, ordered, diverging
  - change: quantitative, ordered, diverging
- Derivation: average per decade, rate change from decade to decade

Tasks

Main Task:

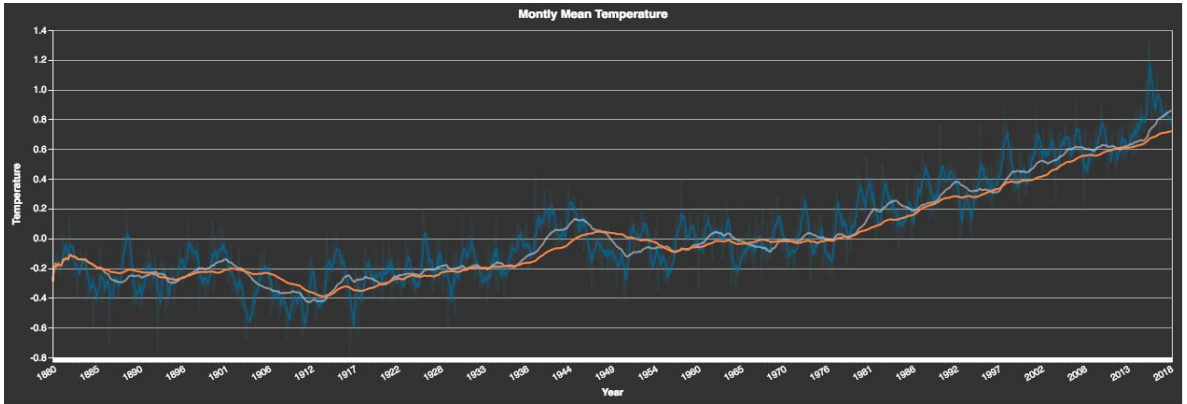
- **Discover Trends** in temperature change

Secondary Tasks:

- **Present Features** of temperature change by decade
- **Compare Trends** between year / months
- **Compare Trends** between zones
- **Derive Features** Temperature Moving Averages by Year / Month
- **Derive Features** Temperature by zones
- **Derive Features** Temperature by decade

Abstractions

- Idioms: Line Chart
  - Mark: line
    - Attributes:
      - Year / Month
      - Temperature, Avg temperature, moving average of temperature
    - Channels:
      - Position on a common scale, X position, Y Position,
      - Color hue (temperature, moving averages 6 / 60 / 132 months)
    - Encode -> arrange -> express

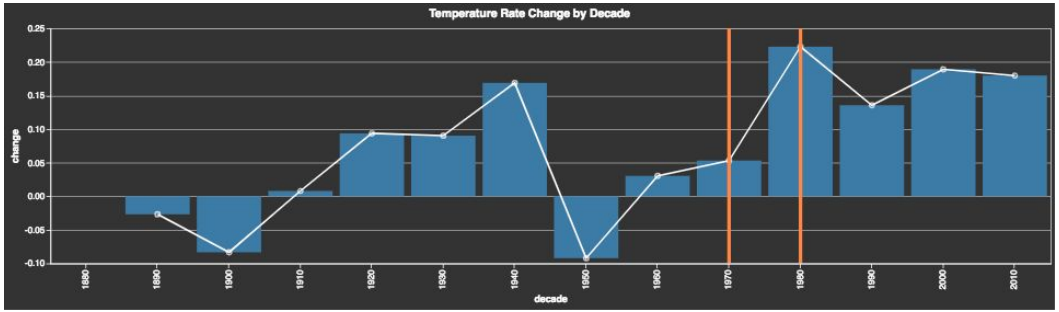


Abstractions

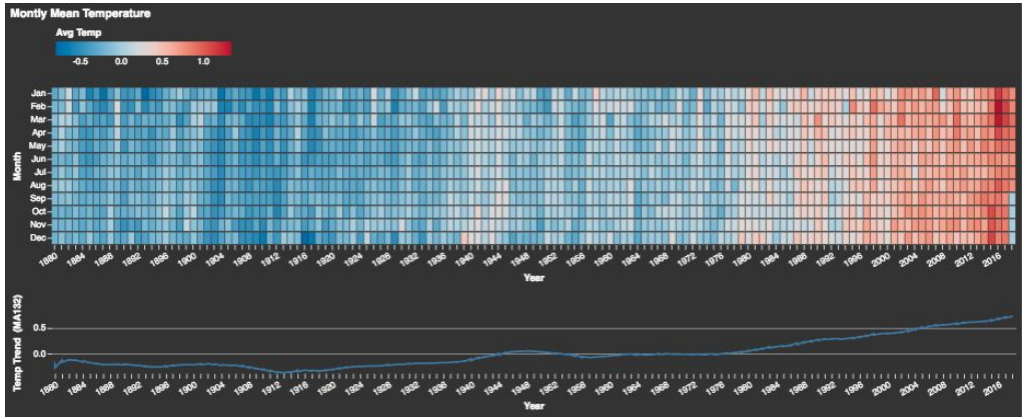
Idioms: Bar Chart

- Mark: Area
  - Attributes:
    - Decade
    - Avg temperature
  - Channels:
    - Position on a common scale, X position, Y Position
  - Encode -> Arrange, separate, arrange, align

- Mark: Line
  - Attributes:
    - Decade
  - Channels:
    - Position on a common scale, X position
    - Color: orange for “popup”
  - Encode -> Arrange, separate

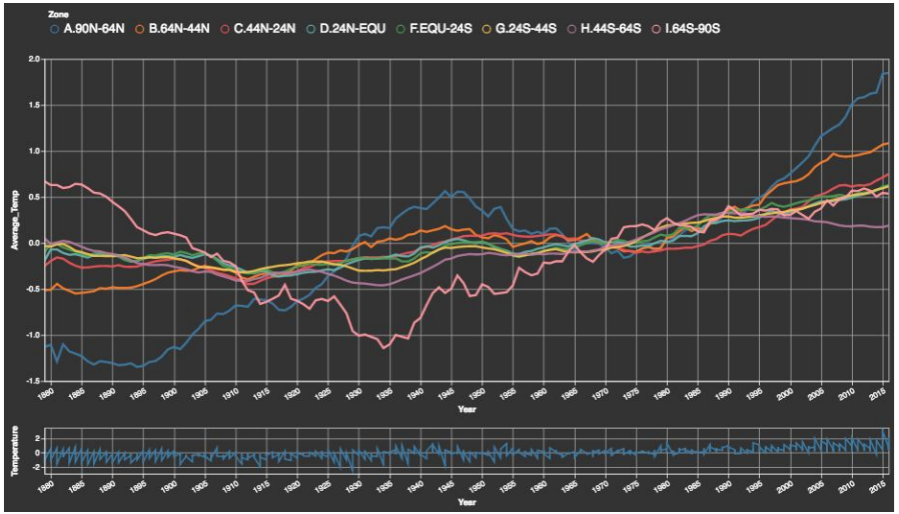


Abstractions

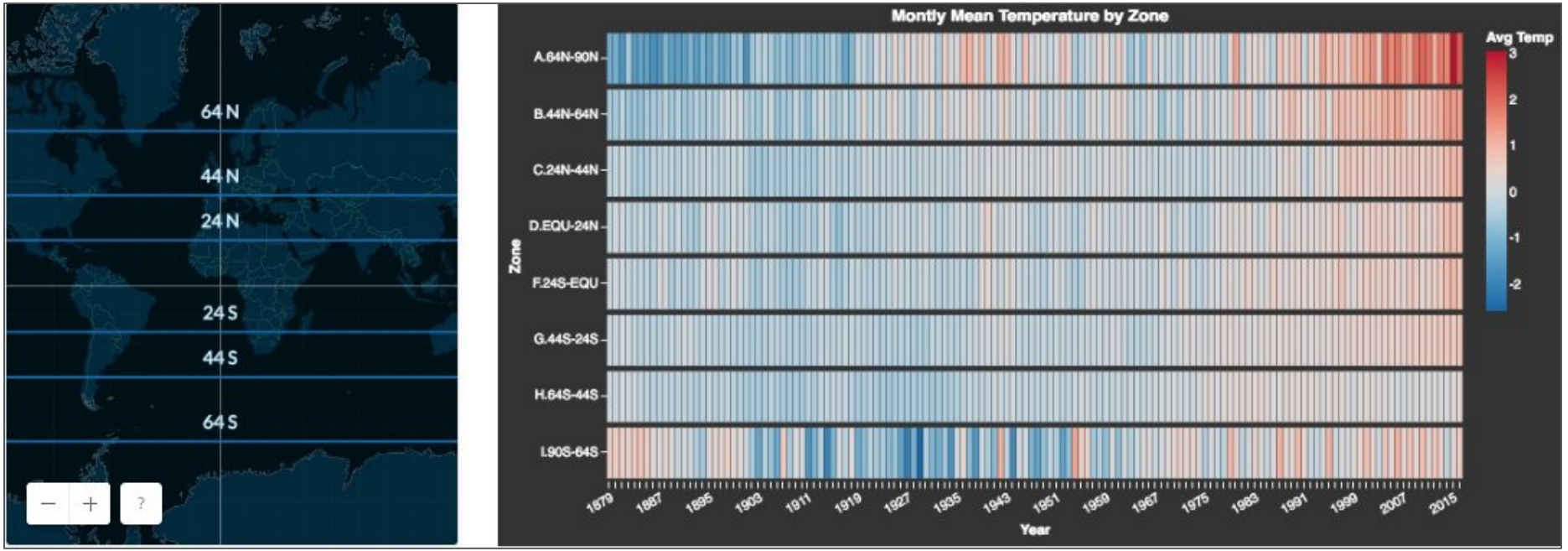


- Idioms: Heatmap
  - Mark: Area
    - Attributes:
      - Year / Month
      - Avg temperature
      - Month
    - Channels:
      - Position on a common scale, X position, Y Position, spatial region, color saturation
    - Encode -> arrange, express
    - Reduce -> filter

Abstractions



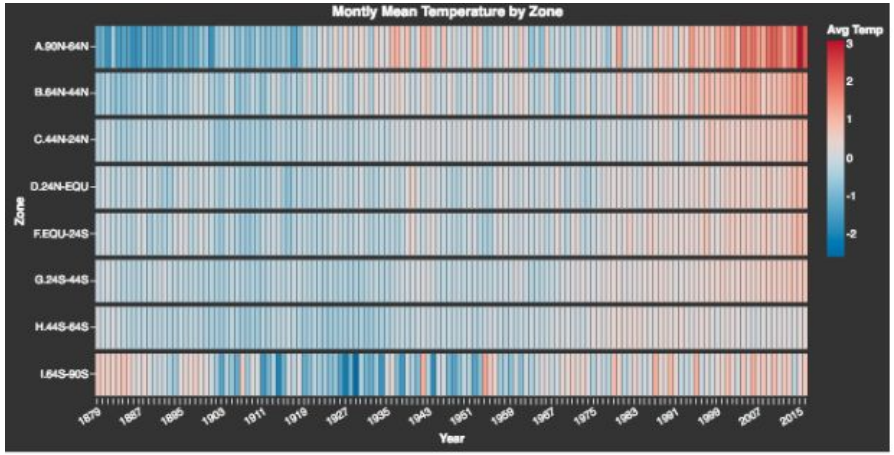
- Idioms: Line Chart
  - Mark: Line
    - Attributes:
      - Year / Month
      - Avg temperature
      - Zone
    - Channels:
      - Year/Month - Avt Temp : Position on a common scale, X position, Y Position
      - Zone: color saturation
    - Encode -> arrange, express
    - Reduce -> filter



Map: helps user to associate categorical zones to geography

Abstractions

- Idioms: Heatmap
  - Mark: Area
    - Attributes:
      - Year / Month
      - Avg temperature
      - Zone
    - Channels:
      - Position on a common scale, X position, Y Position, spatial region, color saturation
    - Encode -> arrange, express



Abstractions

- Idioms: Map
  - Mark: Line
    - Attributes:
      - Zone
    - Channels:
      - Position on a common scale, Y Position

Demo

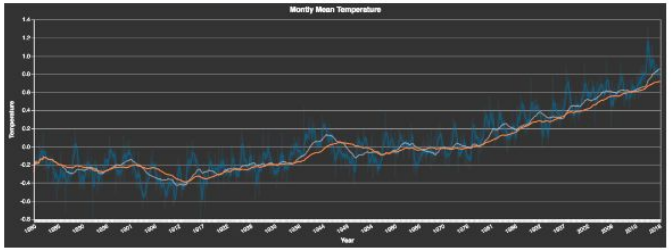
We are getting hotter!!

We are getting hotter!!

It's not your imagination, world is getting warmer.

Scientists have measured global temperatures for over a hundred years and see that the Earth is getting hotter. The trend can be best visualized by comparing each year's average temperature with the long-term average.

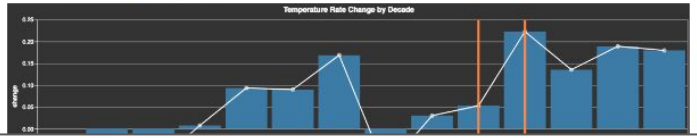
The orange line in the following graphic shows the trend of Earth's heating up using a moving average of 11 years for temperature value.



Looks like between 70's and 80's we not only got a *Saturday Night Fever* ...

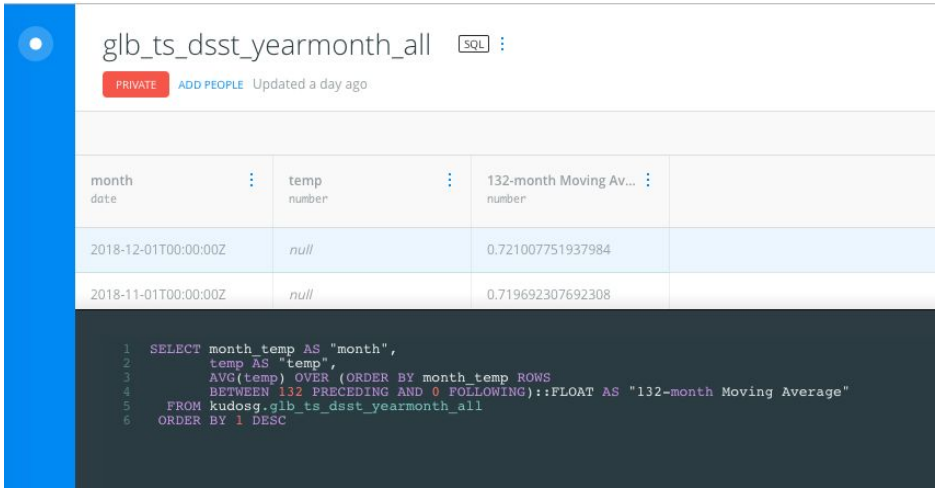
According to an ongoing temperature analysis conducted by scientists at NASA's Goddard Institute for Space Studies (GISS)...the average global temperature on Earth has increased by about 0.8°Celsius (1.4°Fahrenheit) since 1880. Two-thirds of the warming has occurred since 1975, at a rate of roughly 0.15-0.20°C per decade.

Source: NASA Earth Observatory



Technologies

- Derivation:
  - Google Sheets, Postgresql (Carto SaaS)



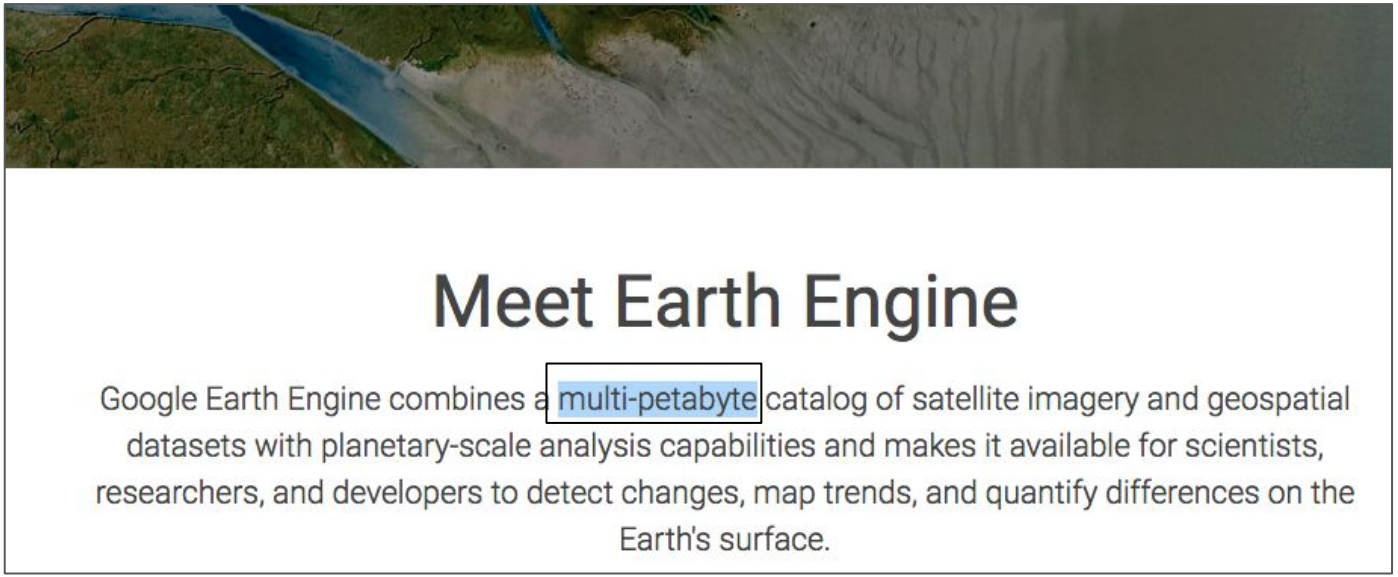
- Client:
  - D3 v5.7.0 (vl.json loading)
  - Vega Lite
  - Carto (Map)
  - Gulp
  - Bootstrap
  - CSS

Insights

- Long term averages show how temperature is increasing
- There was a dramatic change in temperature between 70’s and 80’s
- Top and bottom (artic / antartic) zones are changing faster
- January to March of 2016 was the hottest period on history until now

Difficulties

- Few expertise in time series analysis
- netCdf files are hard (raster data is hard….) it wasn’t possible to extract data to show data by continent / country.



Achievements

- Learn a new technology (Vega Lite)
- Build a *useful* visualization in a *few* time