Università di Catania

Global Environmental Indicators

Master's degree in Data Science for Management
Course: Data Base and Big Data Analytics
Module: Big Data Analytics

Professor: Orazio Tomarchio

Thamires de Souza Oliveira
1000023616

Contents

Introduction and Business Questions

This report is a critical and in-depth analysis of environmental indices covering the most diverse areas of this field, since this is an area that needs to gain priority in further studies from now on, due to the diverse effects that we can see in the world related to climate change,

After observing the available data that we will going to expose here soon, it was possible to see that, given the wide variety of indices, we can be capable to answer some questions related to the environment and sustainability, focusing on individualities from country to country.

Therefore, based on the capability to correlate a lot of data and find some good insights about it, our ultimate goal is to answer the following questions proposed below:

1. How is the emission of gas related to the propensity of climate disasters?
2. What are the gas most directly linked to climate disasters?
3. Is there a relationship between mineral extraction and the occurrence of geophysical disasters?
4. What kind of disasters are accentuated by decrease in forest area?
5. Are countries that have a high marine reserve area less prone to hydrological disasters?
6. Is harzadous waste generated related to any kind of natural disaster?

The Dataset

To answer the previous determined questions and develop the report we are using a dataset named **Global Environmental Indicators** that contains statistics content that can help us to understand and analyze the health of the planet.

The dataset contains 128 files and 1264 columns, and its divided in the following indicators:

- Air and Climate
- Biodiversity
- Energy and Minerals
- Forest
- Governance
- Inland Water Resources
- Land and Agriculture
- Marine and Coastal Areas
- Natural Disasters
- Waste

Since this is a very large dataset, the first chalenge of this report is to anaylise and filter what files and informations would be really usefull to answer the proposed business questions. Based on that, we can reach the following selection:

Air and Climate

It contains 14 files and we will use 6 of it.

CH4_emissions (190 unique values): it contains all the CH4 emissions divided by country from 1990 until 2018.

CO2_emissions (191 unique values): it contains all the CO2 emissions divided by country from 1990 until 2018.

GHG_emissions (192 unique values): it contains all the GHG emissions divided by country from 1990 until 2018.

N2O_emissions (189 unique values): it contains all the NO2 emissions divided by country from 1990 until 2018.

NOx_emissions (172 unique values): it contains all the NOx emissions divided by country from 1990 until 2018.

SO2_emissions (142 unique values):): it contains all the SO2 emissions divided by country from 1990 until 2018.

Biodiversity

It contains 2 files, but we will not use any of it for this analysis.

Energy and Minerals

It contains 12 files and we will use 1 of it.

Contribution of mining to value added (191 unique values): it contains the contribution of each country in data mining extraction activity.

Forest

It contains 2 files and we will use 1 of it.

Forest Area (237 unique values): it contains informations of forest areas divided by a couple of years in each country.

Governance

It contains 2 files, but we will not use any of it in this analysis.

Inland Water Resources

It contains 46 files, but we will not use any of it for this analysis.

Land and Agriculture

It contains 6 files, but we will not use any of it in this analysis.

Marine and Coastal Areas

It contains 2 files, and we will use one of it.

Marine protected areas (171 unique values): it contains the % of marine protected areas divided by each country in the year of 2018.

Natural Disasters

It contains 8 files and we will use 4 of it.

Climatological Disasters (153 unique values): It contains the number of all the climatological disasters that happened in each country from 1990 to 2019.

Metereological Disasters (185 unique values): It contains the number of all the metereological disasters that happened in each country from 1990 to 2019.

Geophysical Disasters (107 unique values): It contains the number of all the geophysical disasters that happened in each country from 1990 to 2019.

Hydrological Disasters (175 unique values): It contains the number of all the hydrological disasters that happened in each country from 1990 to 2019.

Waste

It contains 34 files and we will use 1 of it.

Harzadous waste generated (101 unique values): it contains the amount of harzadous waste generated by country from 1990 until 2018.

The whole dataset is available in this following link: https://www.kaggle.com/ruchi798/global-environmental-indicators

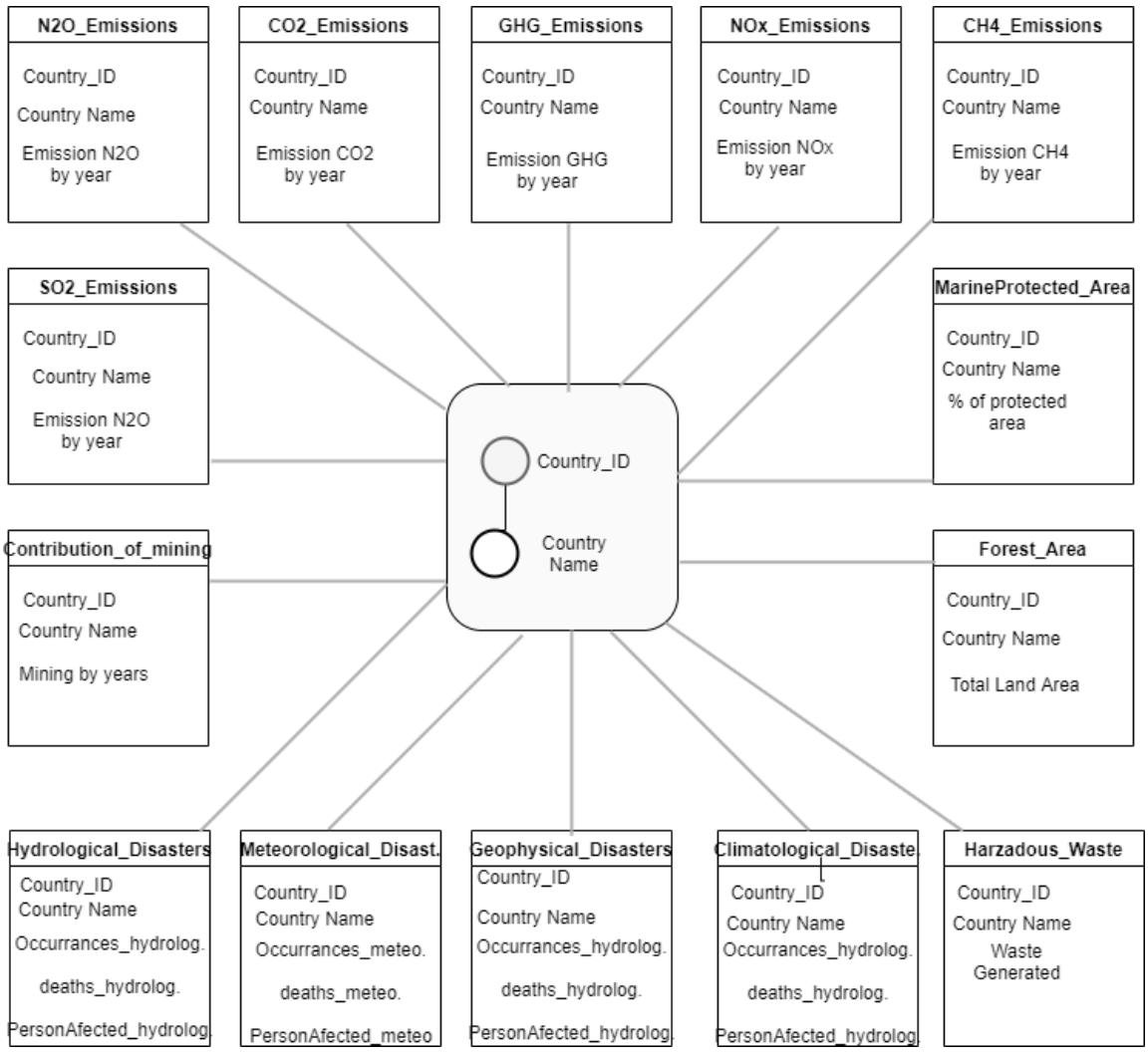
Dimensional Fact Model

The Dimensional Fact Model is a graphical formalism developed specifically to support the conceptual modeling phase of a Data Warehouse project. The two biggest goals of the DFM are: give effective support to the conceptual design and create an enviroment in which user queries can be formulated intuitively.

A **fact** is a relevant concept for decision-making processes. Typically, it models a set of events that occur. In this dataset we have 14 fact tables, that are: *CH4 emissions, GHG emissions, CO2 emissions, SO2 emissions, NOx emissions, N2O emissions, Meteorological disasters, Climatological disasters, geophysical disasters, hydrological disasters, forest area, contribution of mining, harzadous waste and marine protected areas.*

A **measure** is a numerical property of a fact and describes a quantitative attribute that is relevant for analysis. For example, the climatological disasters is measured by total persons affected, total occurance and total of deaths.

A **dimension** is a property, with finite domain, that describes a coordinate of the fact's analysis. In this graph is represented by cirles that are conected to the fact by straigh lines. The fact table of this dataset is Country and the dimensional attribute are *Country_name* and *Country_ID*.



ETL Process

In order to elaborate our analysis, all of these data must go through a processo of cleaning, and since all the questions we are trying to solve are about correlation of variables, we have to merge and conect a lot of tables. Almost all of this process was done using the software **Tableau Prep**, but our data had some issues related to title of columns and symbols to substitute that could be done fatest right through the csv file, although it could be done on Tableau Prep, thinking about optimize the time and the complexity of cleaning problem, it seemed are more smart idea to do this small part on csv before export to the software.

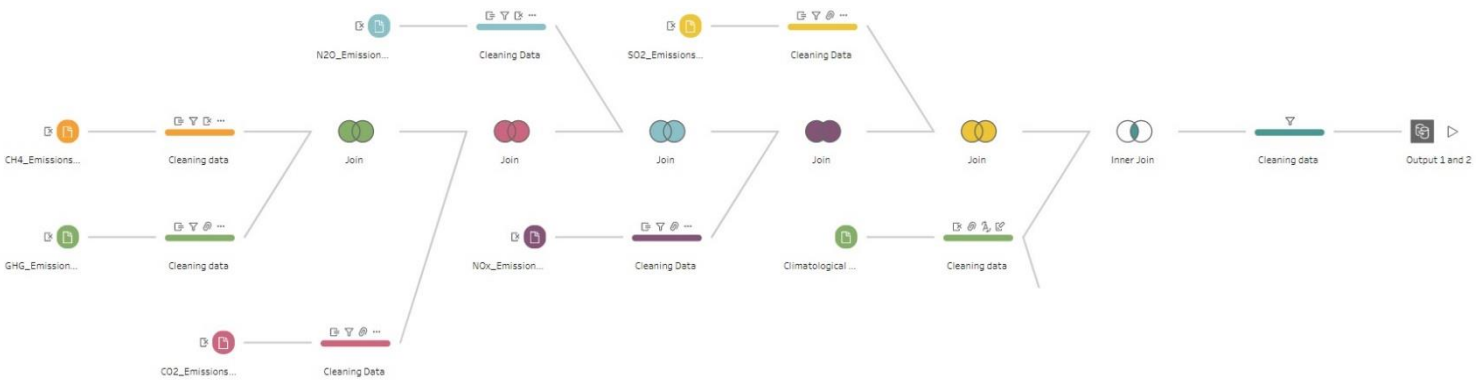
Basically what it was done directly on file was just an adjustment on the title of columns, cause the original data is divided in title and several subtitles, that could not be read by Tableau Prep in this way, so it was merged everything as only title. The other process that was done was the substitution of symbols, more specifically the dots [...] that means the number was zero. Since we had this in all of the columns and each sheet had and average of 35 columns, it was fast to do it on csv before exporting.

After this all the chosen spreadsheets were imported into Tableau Prep software and since all our questions are related to each other in a case of complexity, it was created a single clean and join scheme with 5 different outputs. Visually it looked like a complex scheme, as you can see from the full page right next, but it was the most optimized way to do this job.

To go deeper process-by-process in a visually cleaner way, we later highlighted on the paths that referred to each output and we will talk about them in more detail in the next few pages.


N2O_Emission...
Cleaning Data
SO2_Emissions...
Cleaning Data
CH4_Emissions...
Cleaning data
Join
Join
Join
Join
Join
Inner Join
Cleaning data
Output 1 and 2
GHG_Emission...
Cleaning data
NOx_Emission...
Cleaning Data
Climatological ...
Cleaning data
CO2_Emissions...
Cleaning Data
Meteorological...
Cleaning data
harzadous was...
Cleaning Data
Inner Join
Output 6
Hydrological di...
Cleaning data
Join
Join
Join
Inner Join
Cleaning Data
Output 4
Geophysical di...
Cleaning data
União (de colun...
Output 3
Contribution of...
Cleaning Data
União (de colun...
Forest Area_Fi...
Cleaning Data
Marine protect...
Cleaning Data
Output 5

Output 1 and 2: Climatological Disasters and Emission by Gas



To create an output of Climatological Disasters and Emission of Gas, we had top ut together 7 tables, 6 of it related to gas emission and 1 of it with the informations of climatological disasters. The tables and process in each one were:

CH4_Emissions: The country function has been changed from charactere to geographic region, null values have been filtered out, 3 calculated fields have been created that merged the years in 3 different decades, and some fields have been renamed for better understanding. In the end was made a join with the file *GHG_emissions*.

GHG_Emissions: The country function has been changed from charactere to geographic region, null values have been filtered out, 3 calculated fields have been created that merged the years in 3 different decades, and some fields have been renamed for better understanding. In the end was created a new join with *CO2_emissions* from the previous join with CH4 table.

CO2_Emissions: The country function has been changed from charactere to geographic region, null values have been filtered out, 3 calculated fields have been created that merged the years in 3 different decades, and some fields have been renamed for better understanding. In the end was created a new join with *N2O_emissions* from the previous join with GHG and CH4 table.

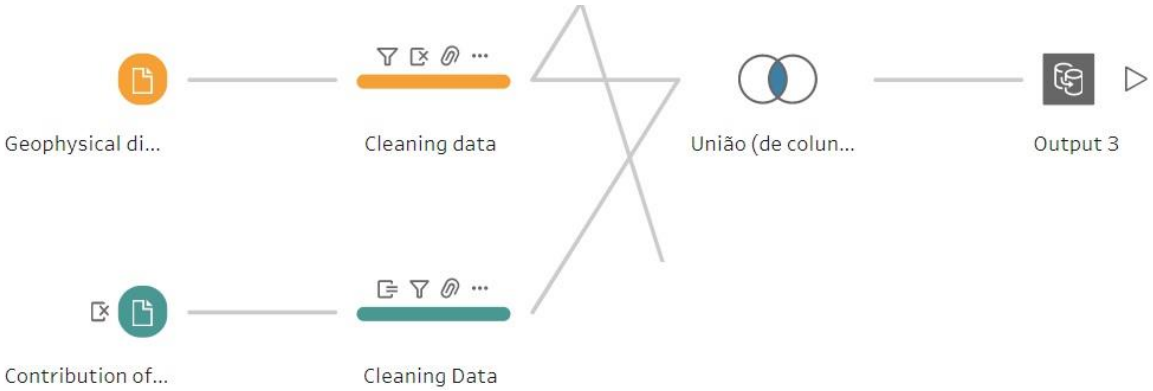
N2O_Emissions: The country function has been changed from charactere to geographic region, null values have been filtered out, 3 calculated fields have been created that merged the years in 3 different decades, and some fields have been renamed for better understanding. In the end was created a new join with *NOx_emissions* from the previous join with GHG, CH4 and CO2 table.

NOx_Emissions: The country function has been changed from charactere to geographic region, null values have been filtered out, 3 calculated fields have been created that merged the years in 3 different decades, and some fields have been renamed for better understanding. In the end was created a new join with *S2O_emissions* from the previous join with GHG, CH4, CO2 and N2O table.

SO2_Emissions: The country function has been changed from charactere to geographic region, null values have been filtered out, 3 calculated fields have been created that merged the years in 3 different decades, and some fields have been renamed for better understanding. In the end was created an inner join with *climatological disasters* from the previous join with GHG, CH4, CO2, N2O and NOx table.

Climatological Disasters: Some columns that were not usefull were removed, the country function has been changed from charactere to geographic region, null values have been filtered out, some null values have been filtered. After the inner join with all the other tables, the null values were filtered again and then we generated the output.

Output 3: Relation of Mineral Extraction and Geophysical Disasters

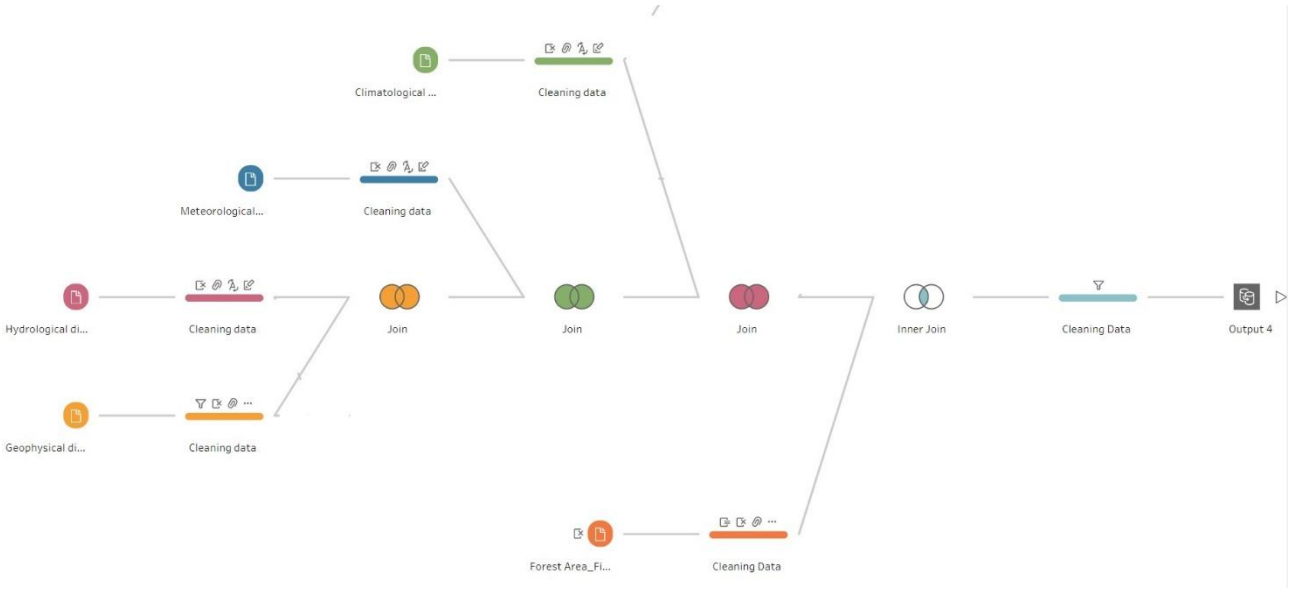


To create an output of Relation of Mineral Extraction and Geophysical Disasters, it was put together 2 tables, one related to geophysical disasters and other of Total Mining contribution. The process in each table were:

Geophysical disasters: Some columns were renamed for a better understanding, null values were filtered out, some types of columns were changed and some columns that were not usefull were removed. In the end it was made an inner join with *contribution of mining* file.

Contribution of mining: Some columns were renamed, 3 calculated fields were created to divided all the years in 3 different decades, null values were filtered, some countries names with wrong definition were re-labeled and the columns country and area was defined and geographic field. In the end, after the inner join with geophysical disasters file, the output was generated.

Output 4: Relation of decrease in forest and Natural Disasters



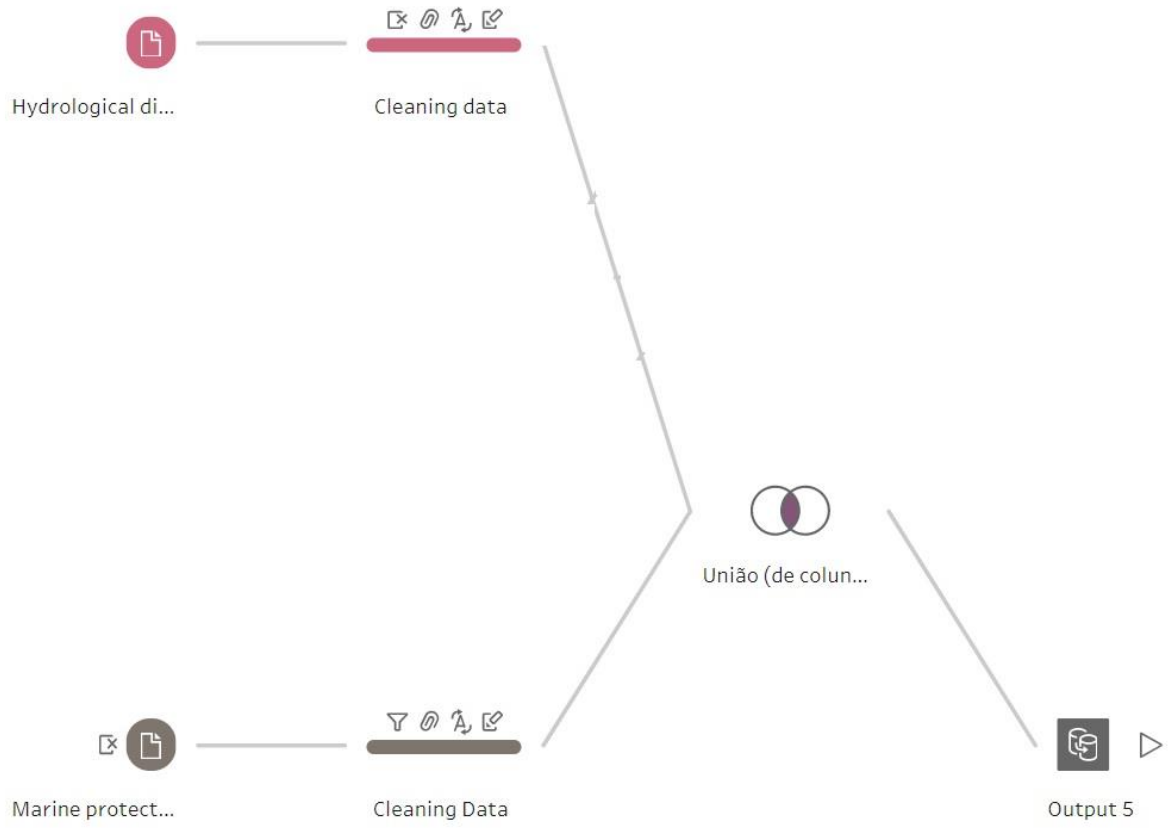
To create an output of Relation of Decrease in Forest and Natural it was put together 5 tables, one related to Forest Area disasters and the other related to Natural Disasters. The process of cleaning in each table, excluding the ones we are already talked about in the previous outputs, were:

Hydrological disasters: Some columns were renamed for a better understanding, some countries were re-labeled to fix it better in the geographic region function, null values were filtered and some columns that were not usefull were excluded. In the end was made a join with the table *geophysical disasters*.

Meteorological disasters: Some columns were renamed for a better understanding, some countries were re-labeled to fix it better in the geographic region function, null values were filtered and some columns that were not usefull were excluded. In the end was made a new join with the previous created join by *hydrological disasters* and *geophysical disasters* tables.

Forest Area: Null values were removed and the country column function was changed to geographic region. In the end was created na inner join with all the joins result by all the disasters tables. A new processo of cleaning were created to filter new null values and after that the output was generated.

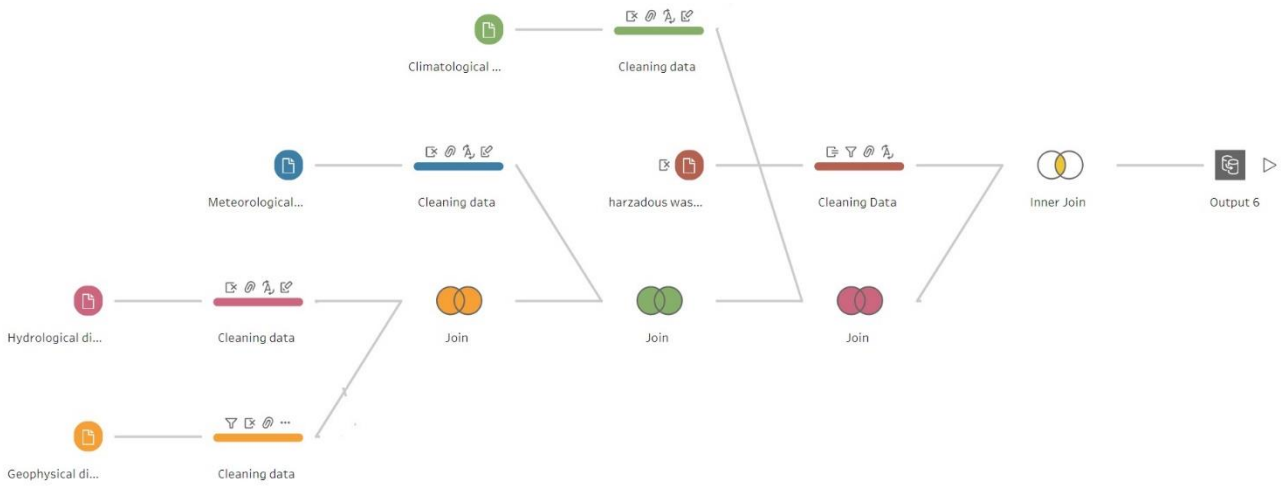
Output 5: Marine Protected Areas and Hydrological Disasters



To create an output of Marine Protected Area and Hydrological Disasters it was put together 2 tables, both related to these 2 subjects. The process of cleaning the table, excluding the one we are already talked about in the previous outputs, was:

Marine Protected Area: Rename some countries to a better fit with the geographic region function and null values were filtered out. In the end was made an inner join with *hydrological disasters* table and the output was generated.

Output 6: Harzadous Waste and Natural Disasters



To create an output of Harzadous Waste and Natural Disasters it was put together 5 tables, 4 of it related to natural disasters and one with the data of harzadous waste. The cleaning process of the tables of natural disasters was already described here in previous outputs, so lets just describe the harzadous waste table cleaning process:

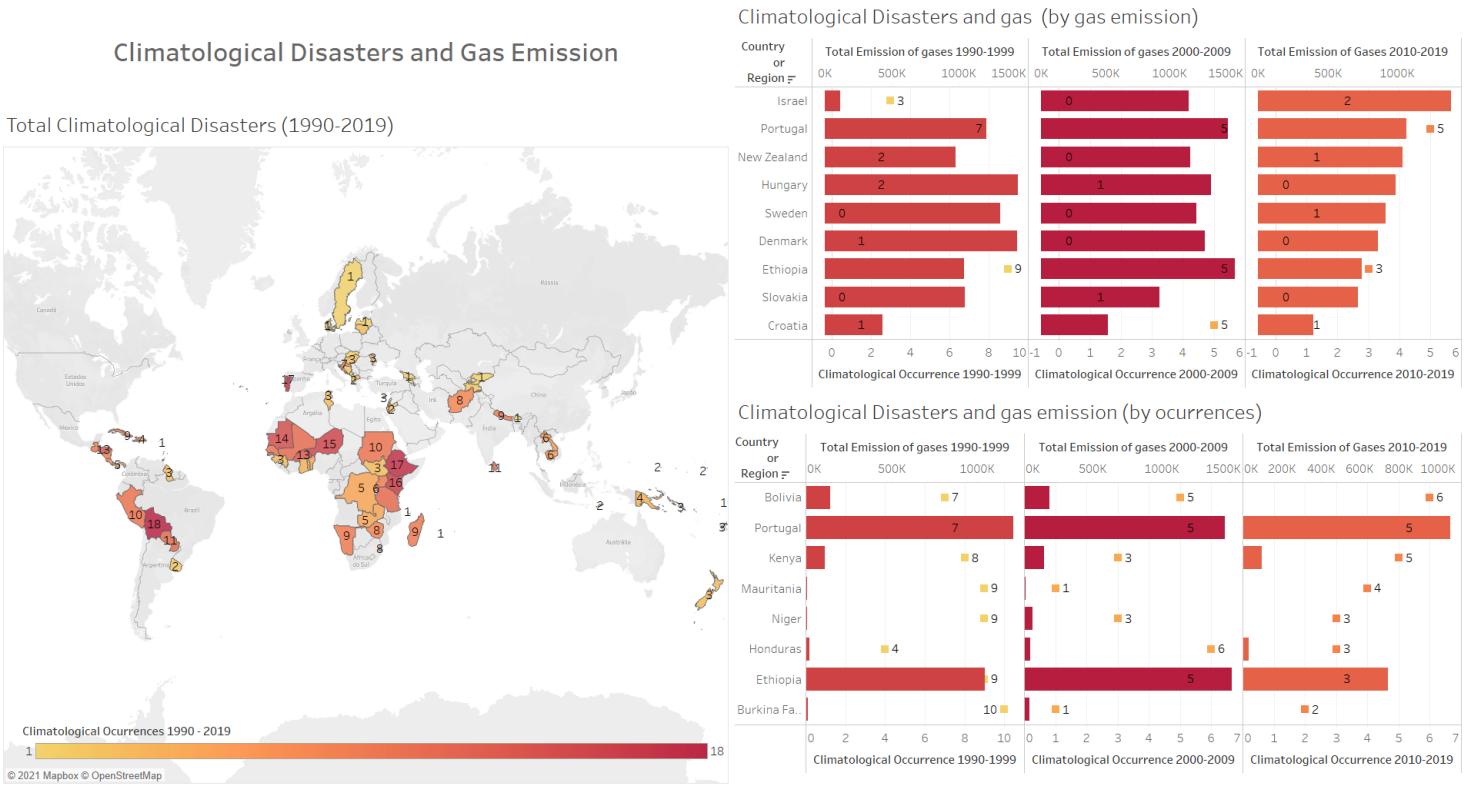
Harzadous waste: The country column was put as a geographic region function, 3 calculated fields were created to divide the years by 3 different decades and null values were filtered out. In the end was done an inner join with all disasters files previously joined together and the output was generated.

Dashboards

In order to simplify data analysis for the reader of this report, some dashboards were created to send a clear interpretation of the data and develop a line of reasoning that will lead to the elaboration and conclusion, negative or positive, of the answers to the questions at the beginning of this study.

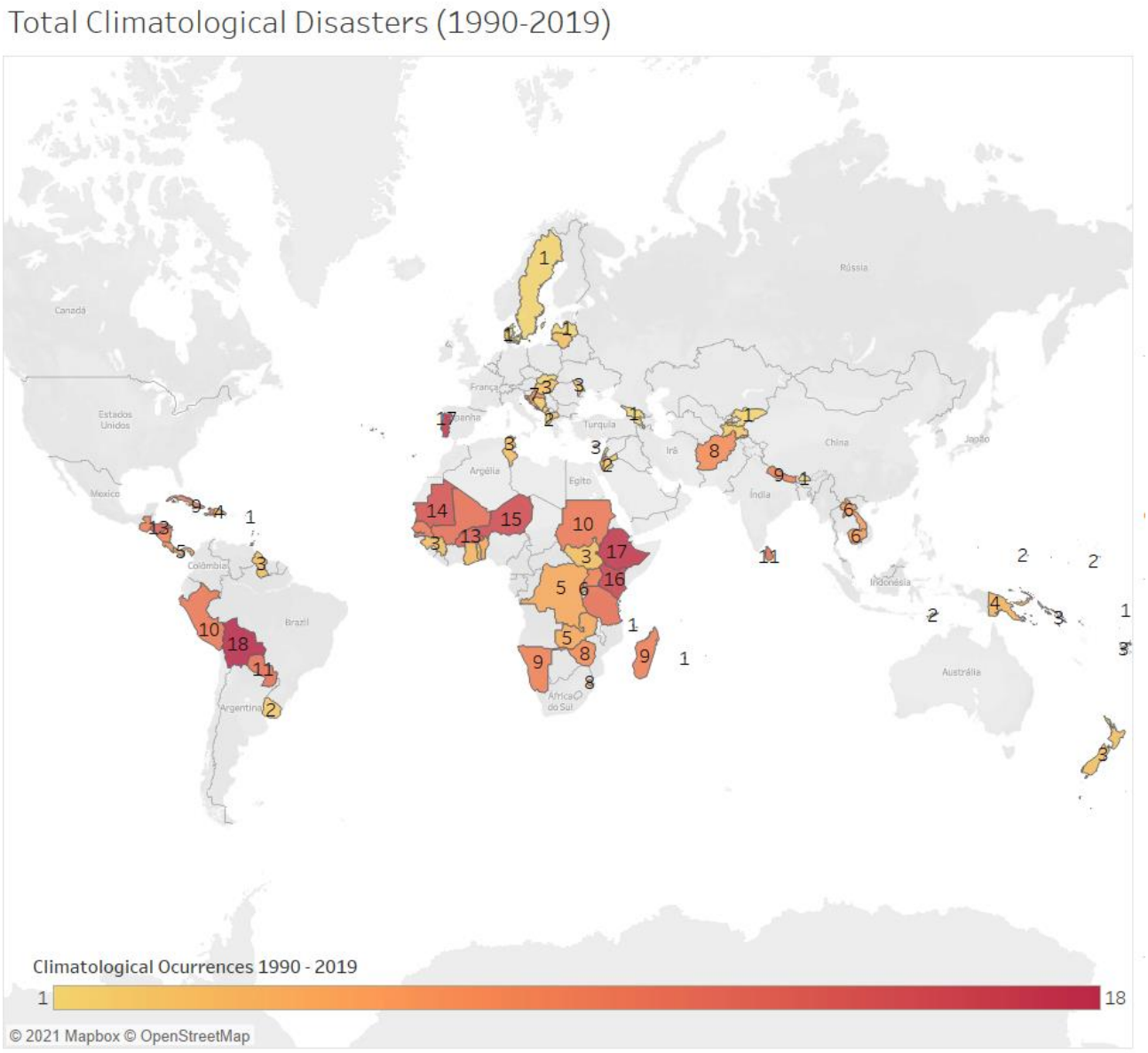
The dashboards are divided according to the questions asked, to facilitate understanding and the design was conceived thinking about the theme of the argument and ease of visualization.

Dashboard: Climatological Disasters and Gas Emission



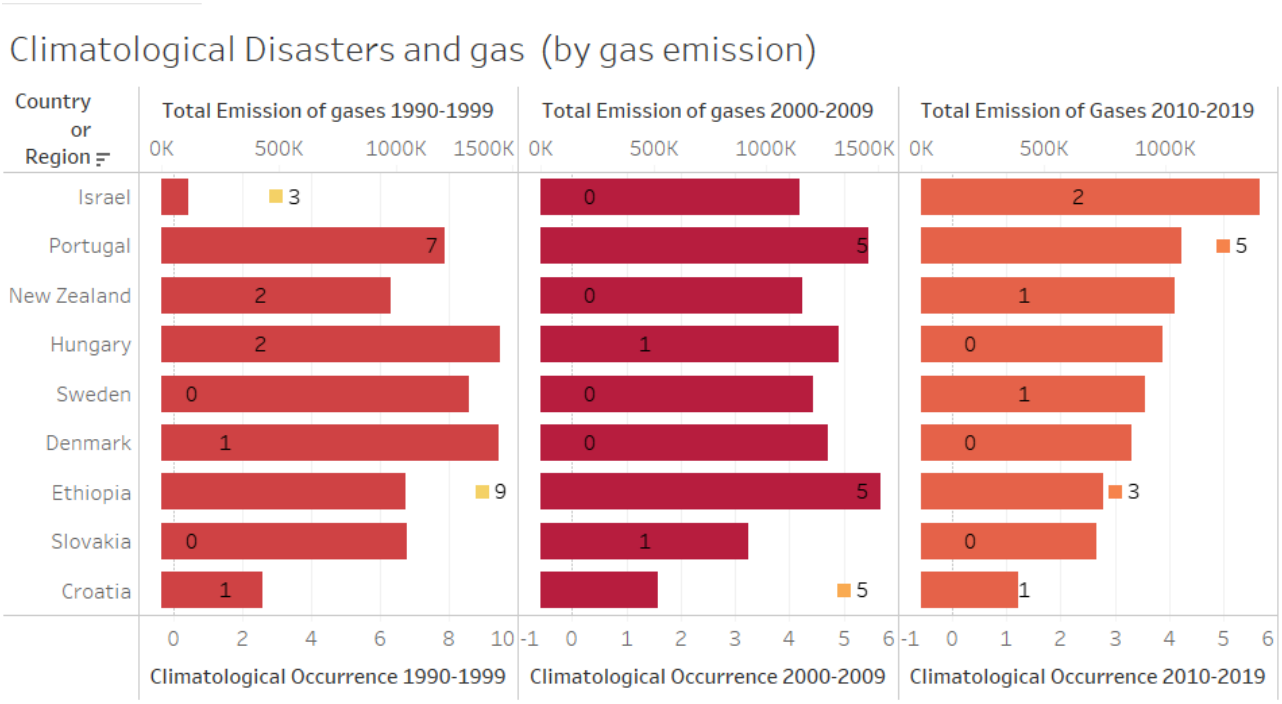
This dashboard has the goal to show some informations to answer our first question related to emission of gas around the world and climatological disasters. It contains 3 charts in total, divided by 1 map of frequency and 2 table charts analysing correlations between the variables climatological disasters and gas emission. In the following sections we will discuss each chart individually.

Total Climatological Disasters (1990-2019)



In this map chart we can see the amount of climatological disasters that happened all over the world between the years 1990-2019. Its possible to realize that mostly of this kind of disaster happened on the continente of Africa and that North America was not affected at all for this kind of disaster. Its a good way to visualize globally how it happens these ocurrences.

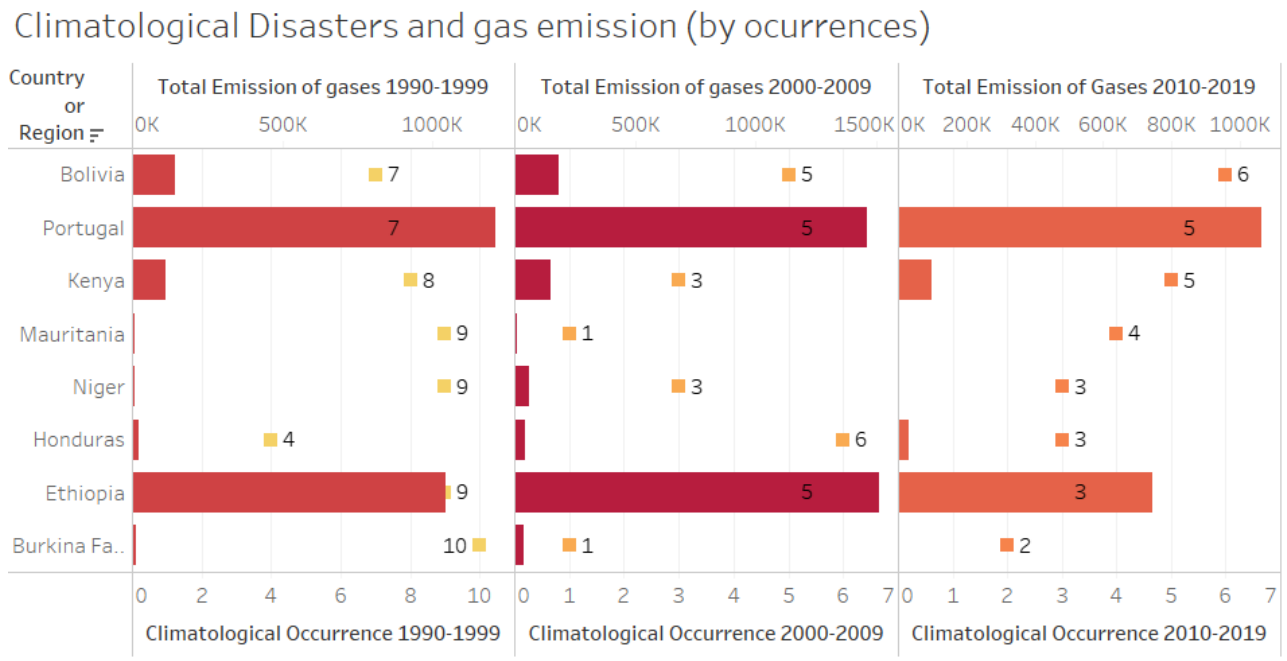
Climatological Disasters and Gas (by gas emission)



In this chart we have two variables correlation with each other: climatological ocurrence and total emission of gas, divided by 3 decades. The order and the amount of countries that are on the chart was based on gas emission, it was filtered the 9 countries with high value of gas emission in total, and with that we put the information of climatological disasters to check if there is any correlation.

In this case we could not prove a direct correlation globally, but we can check that Portugal is a country that has high levels of gas emission and also of Climatological disasters.

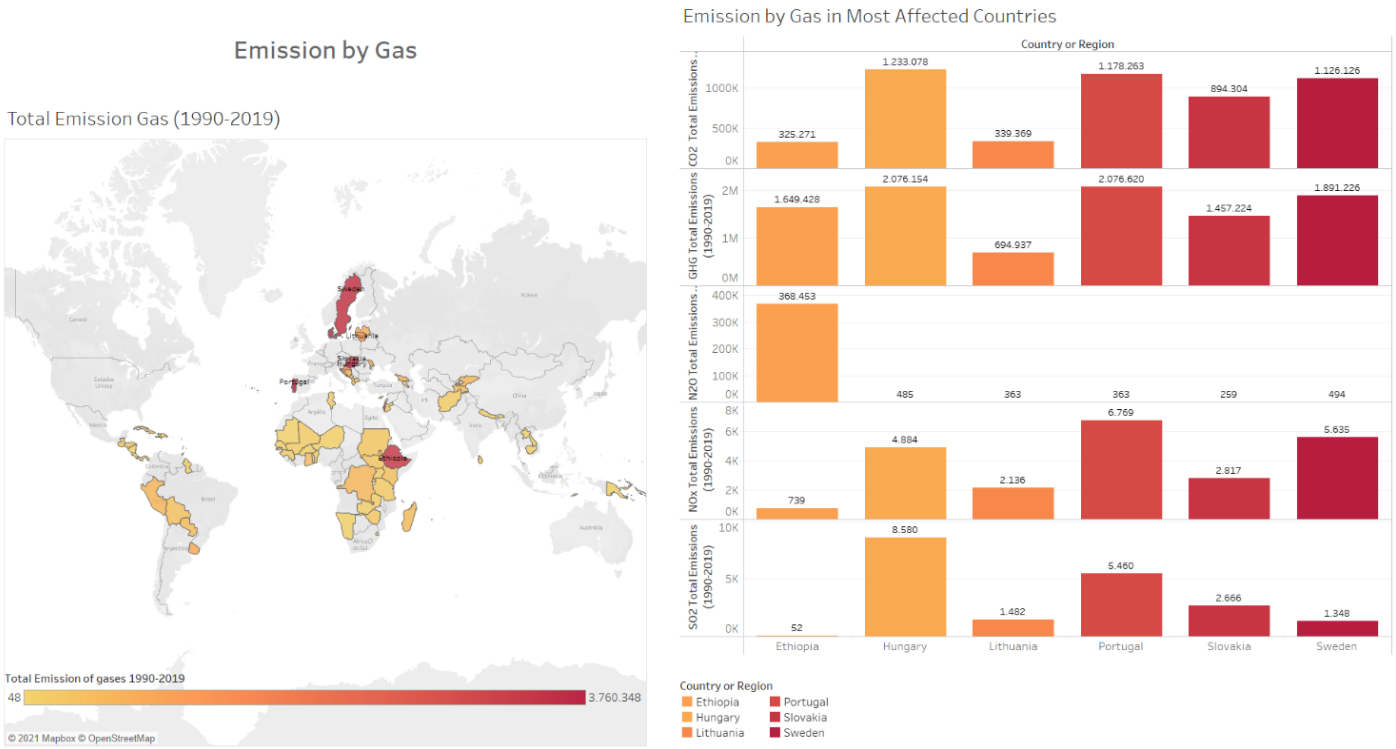
Climatological Disasters and Gas (by gas occurrence)



The climatological disaster and gas emission chart by ocurrence has two variables correlation with each other: climatological ocurrence and total emission of gas, divided by 3 decades. The order and the amount of countries that are on the chart was based on climatological disaster occurrance in this case, it has the 8 countries with high value of gas emission in total, and with that we put the information of climatological disasters to check if there is any correlation.

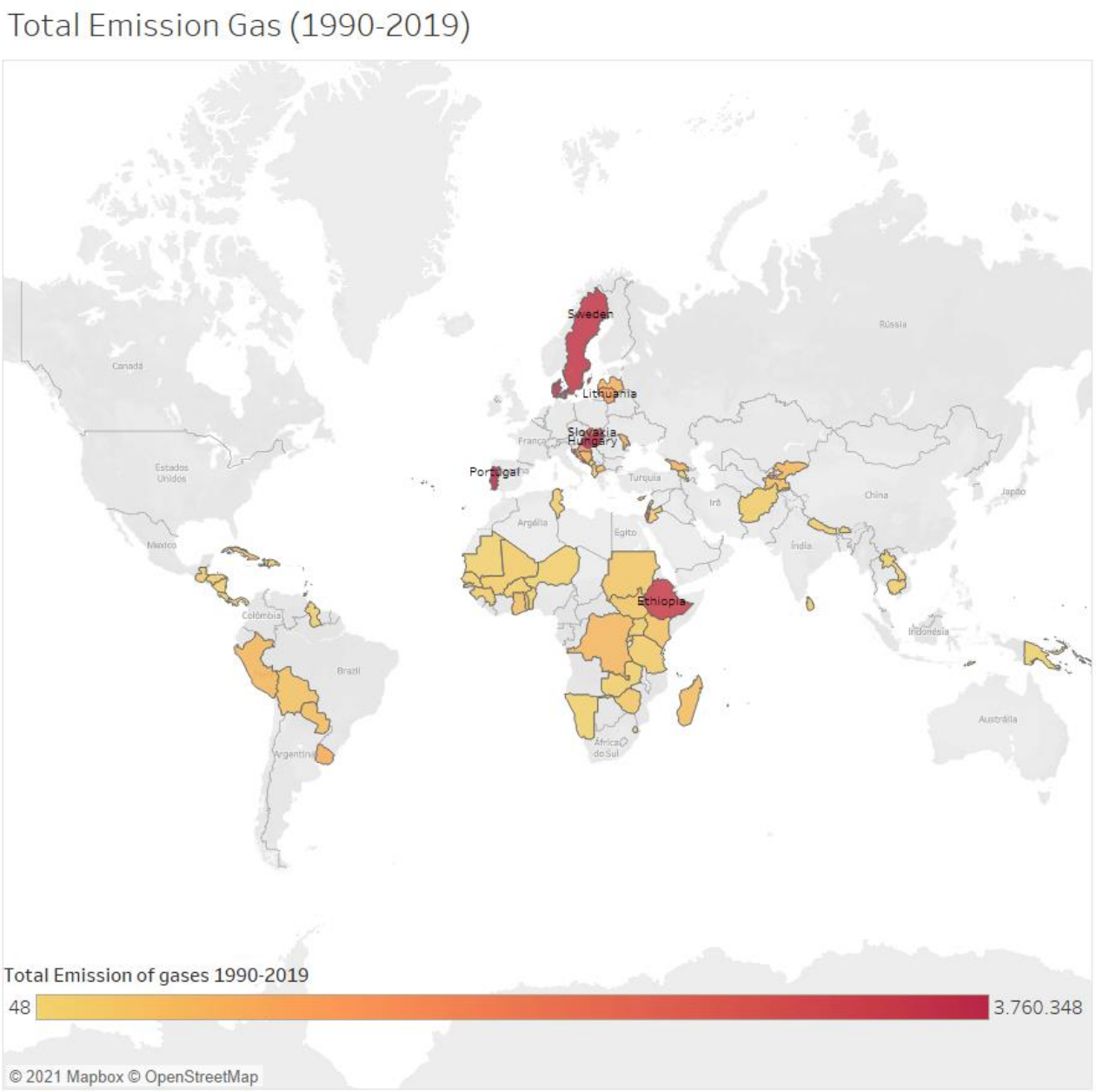
We can see that Portugal is number 2 in the ranking also in this chart, proving the correlation between these two variables in this country, and we can also check that in this chart Ethiopia also has a correlation.

Dashboard: Emission by gas



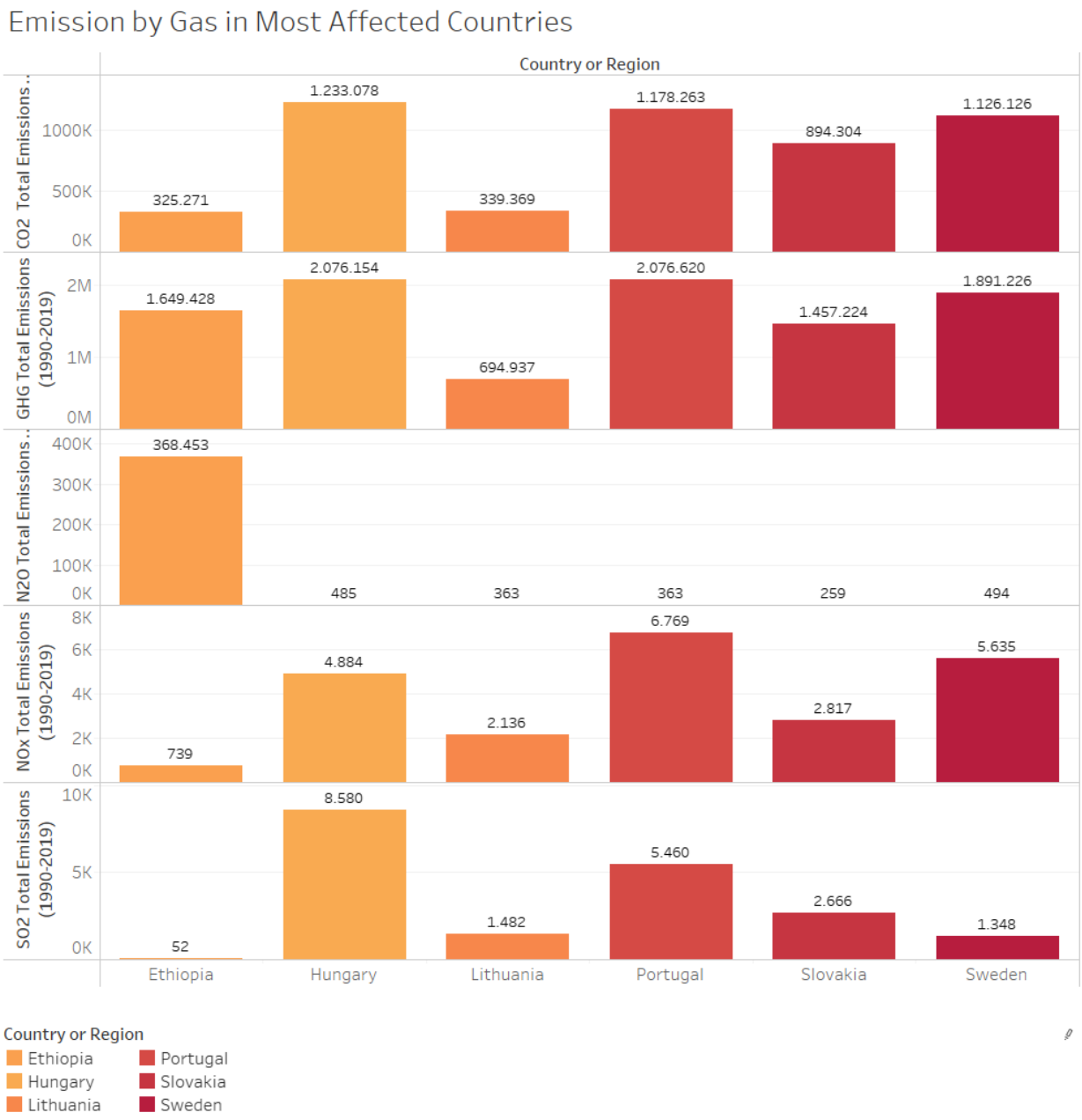
This dashboard has the goal of trying to answer the question related to what kind of gas are responsible for increasing the correlation between gas emission and climatological ocurrence. It contains 3 charts divided by 1 map e 1 bar chart. The map shows the countries that has more high levels of gas emission and the bar chart explore how is divided the emission of gas in each of these countries affected. In the following sections we will discuss each one of it individually.

Total Emission Gas (1990-2019)



The first chart that we need to analyse into this dashboard is the map showing a color increase pontiality into countries that are more responsible for gas emission. The information that we can took with that is that we have some countries that stand out between the other ones: Sweden, Lithuania, Slovakia, Hungary, Portugal and Ethiopia.

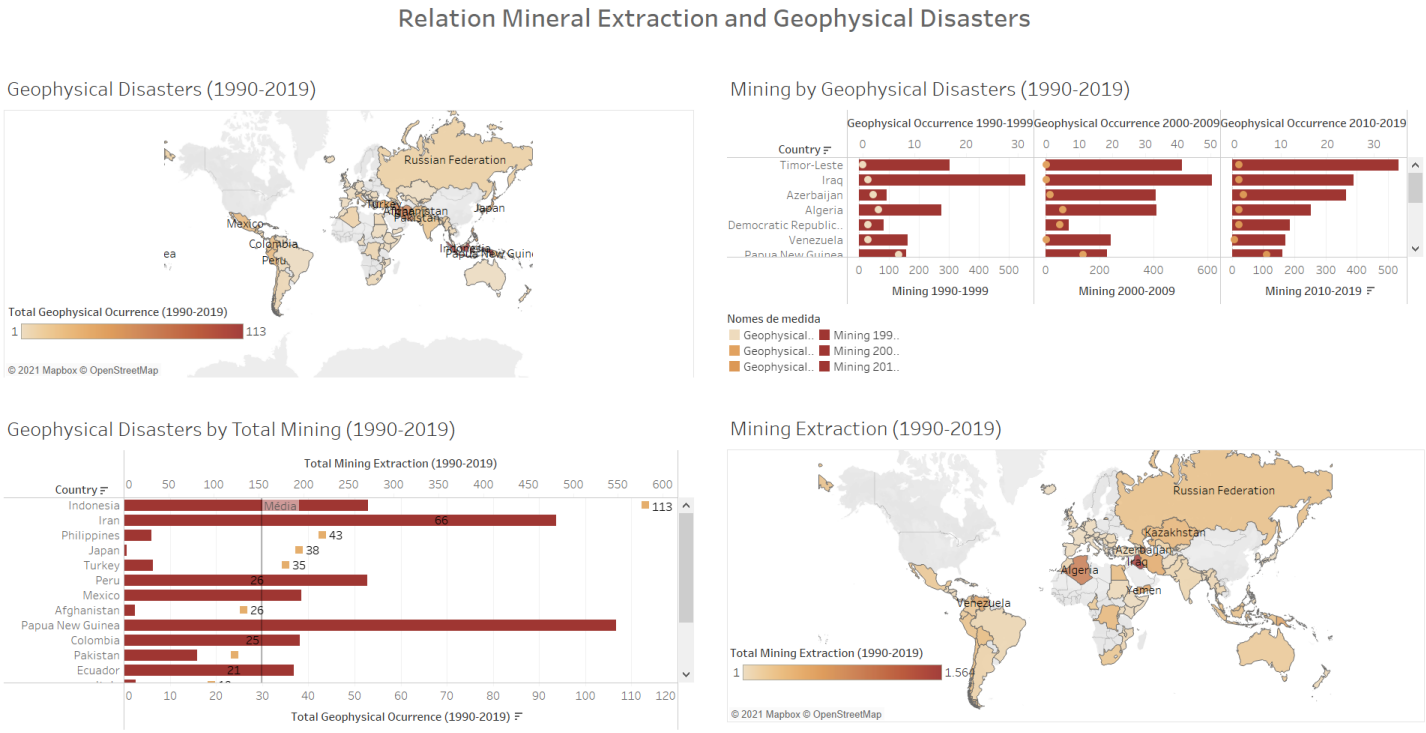
Emission by Gas in Most Affected Countries



In this second chart we filtered all the countries that stood out and divided how is the gas emission divided by each harmfull gas: CO2, GHG, N2O, NOx and SO2. The bar chart looked like the best visual contente to help us to find some pattern between each country. It is possible to take it back the filter in this case if we want to analyse the gas emition of any other country in the world.

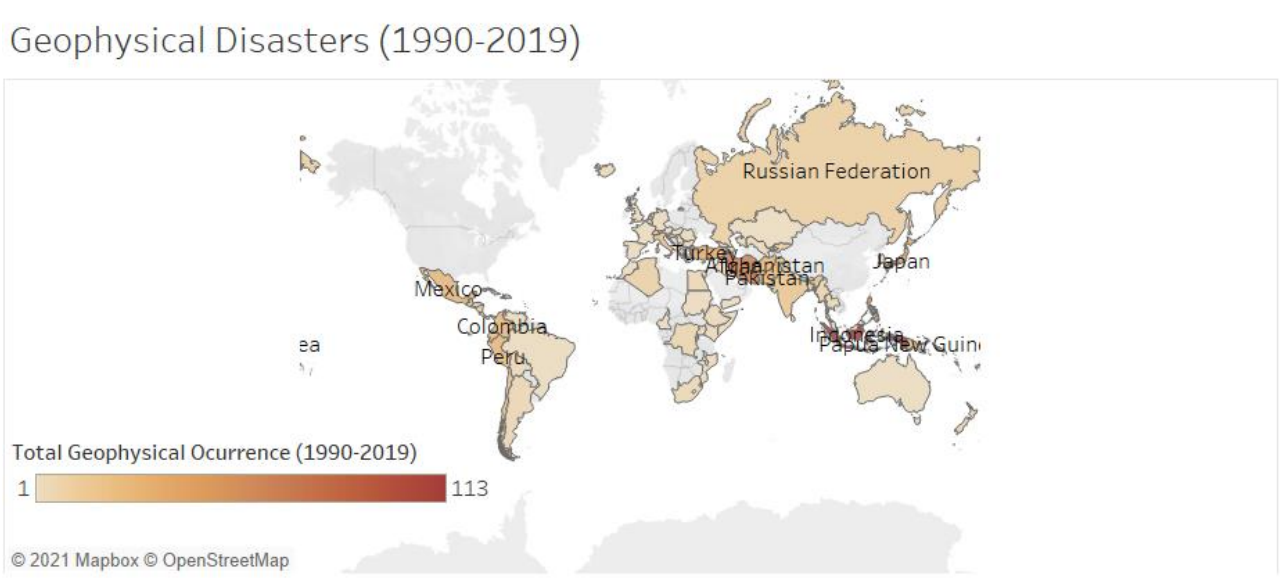
With this we realize that Lithuania is not so harmfull in gas emission when compared to the others, that NO2 is for sure not one of the gas related to the increase of high gas values into atmosphere and that Portugal has high levels of emissions of almost every harmfull gas. We can also try to correlate Portugal and Ethiopia, based on the information we realized on the first chart and realize that both of them has only in common high level of emission of GHG, and that probably that is the gas responsible for the correlation of gas emission and climatological disasters.

Dashboard: Relation of Mineral Extraction and Geophysical Disasters



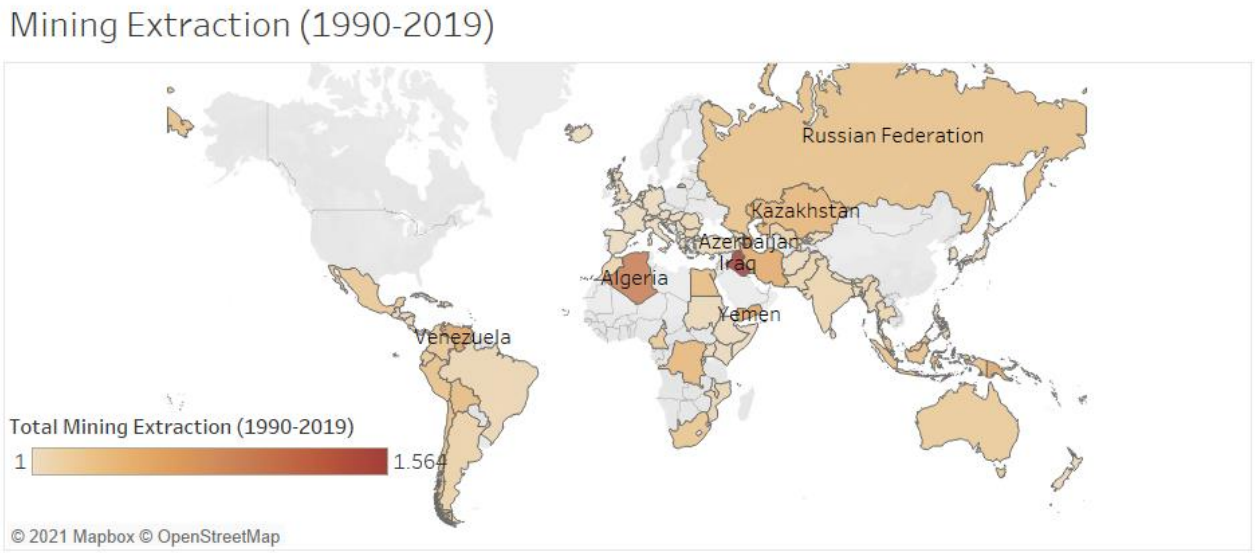
The goal of this dashboard is to show all the informations related to geophysical disasters and mining extraction and try to find any correlation between these two variables, if it exists. We can see in this dashboard 4 different charts, 2 in formato of maps that explain the numbers of geophysical disasters and mining extraction globally between 1990 and 2019 and other 2 bar charts correlation between these two occurrences. Lets analyse all the charts deeply in the following sections.

Geophysical Disasters (1990-2019)



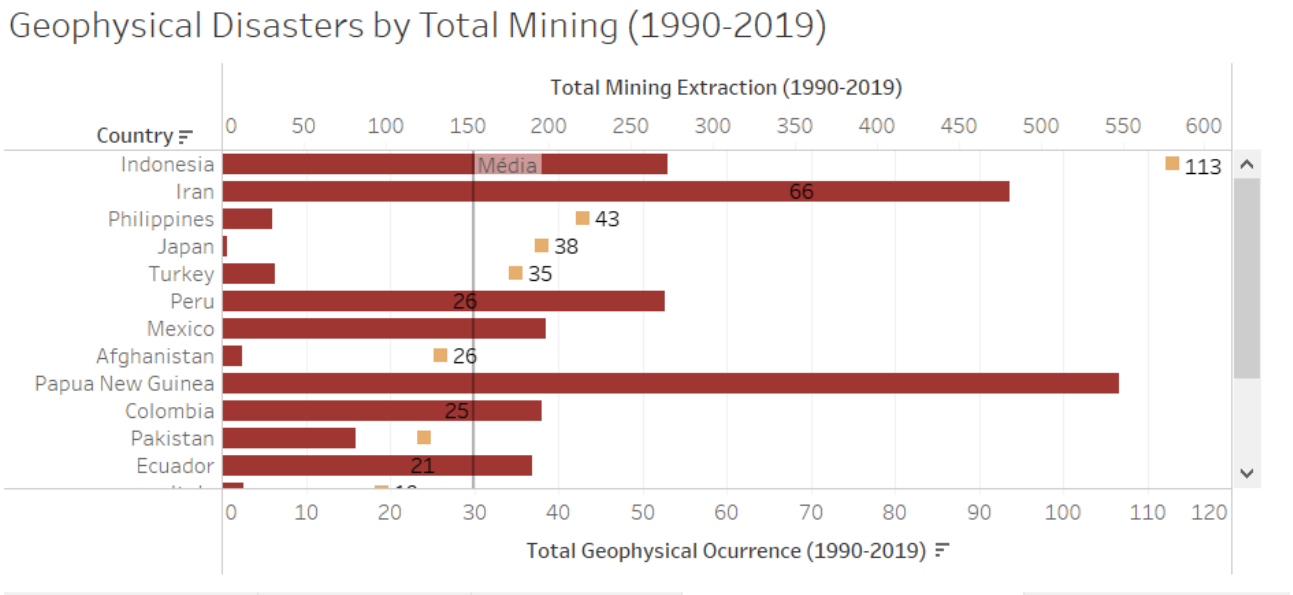
In this chart we can see the distribution of occurrences of geophysical disasters around the world. We can check that the biggest concetration of occurrences are in middle east, Oceania and latin america. Since geophysical disasters are commonly caused by human actions, besides naturally effects, we will check if the mining extraction can be one of the reasons for it happens into these regions.

Mining Extraction (1990-2019)



In the second map of this dashboard, we can see all the distribution of mining extraction into the world. We can see the presence of this type of activity mantaning the same frequency as the geophysical disasters map, they look like very similar, which can means that both effects can be correlated.

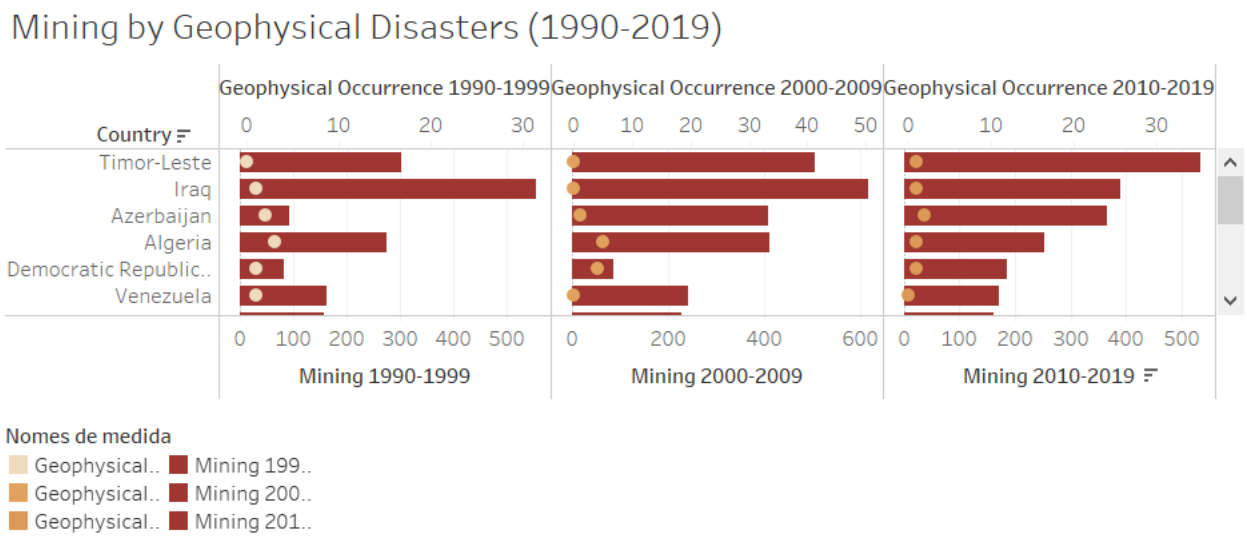
Geophysical Disasters by Total Mining (1990-2019)



This bar graph with scroll shows the first correlation between geophysical disasters and mining extraction, but based on total mining. The countries were filtered based on mining extraction and the order is based on geophysical disasters, in this case we can see that some countries like Indonesia, Iran, Peru, Mexico and others has high number of geophysical disasters and we also added an average line to observe that these countries has a mining extraction activity higher than the average.

But some other countries like Philipines, Japan and Turkey has low level of mining extraction but a lot of geophysical disasters. Thats the type of country that probably has these kind of occurrence not because of human activity, but mostly because of natural reasons, like geographic position.

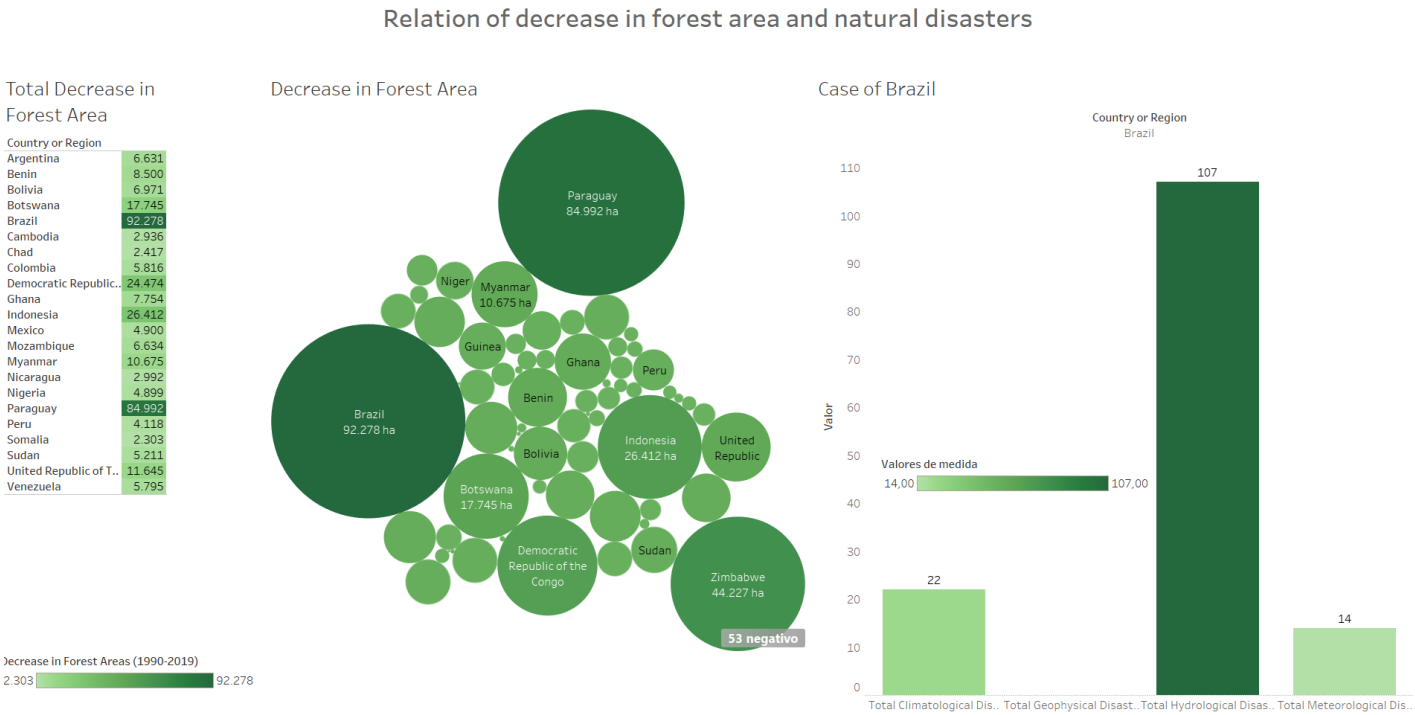
Total Mining by Geophysical Disasters (1990-2019)



This graph with scroll shows the second correlation between geophysical disasters and mining extraction, but based on geophysical disasters. The countries are filtered based on geophysical disasters occurrences and the order is based on total mining, but it also was divided by decade, to see if we can find a even better relation.

Different of the first graph, almost all the first countries positioned in ranking, like Timor-lest, Iraq and Azerbaijan for example, has high levels of mining extraction, but almost none geophysical disaster. This graph show us that mining not always causes geophysical issues, but when geophysical issues happens it mostly because of mining, instead of countries that already has natural tendency into this kind of occurrence.

Dashboard: Relation of Decrease in Forest Area and Natural Disasters

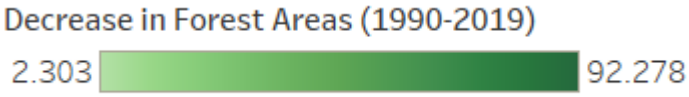


This dashboard has the goal to demonstrate the most important informations related to Forest Area and some natural disasters. It has 3 charts, the first of it its a highlight table, the second one is a bubble chart, spotlighting the countries that had the most impactant decrease in forest areas and the second one is a simple bar chart to explain the particular case of Brazil. In the following sections, we will analyse it deeply.

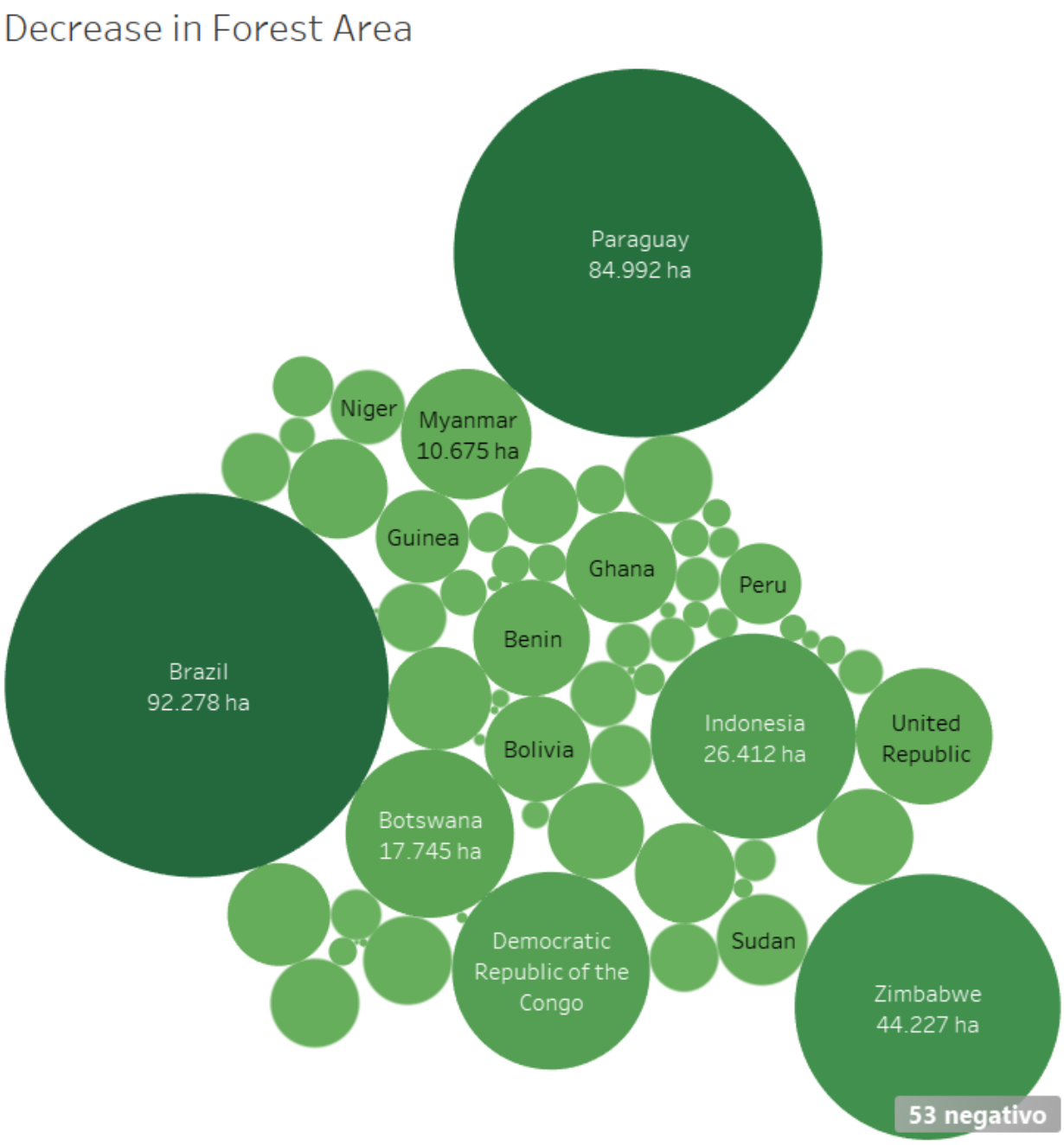
Total Decrease in Forest Area

Total Decrease in Forest Area

Country or Region	
Argentina	6.631
Benin	8.500
Bolivia	6.971
Botswana	17.745
Brazil	92.278
Cambodia	2.936
Chad	2.417
Colombia	5.816
Democratic Republic..	24.474
Ghana	7.754
Indonesia	26.412
Mexico	4.900
Mozambique	6.634
Myanmar	10.675
Nicaragua	2.992
Nigeria	4.899
Paraguay	84.992
Peru	4.118
Somalia	2.303
Sudan	5.211
United Republic of T..	11.645
Venezuela	5.795

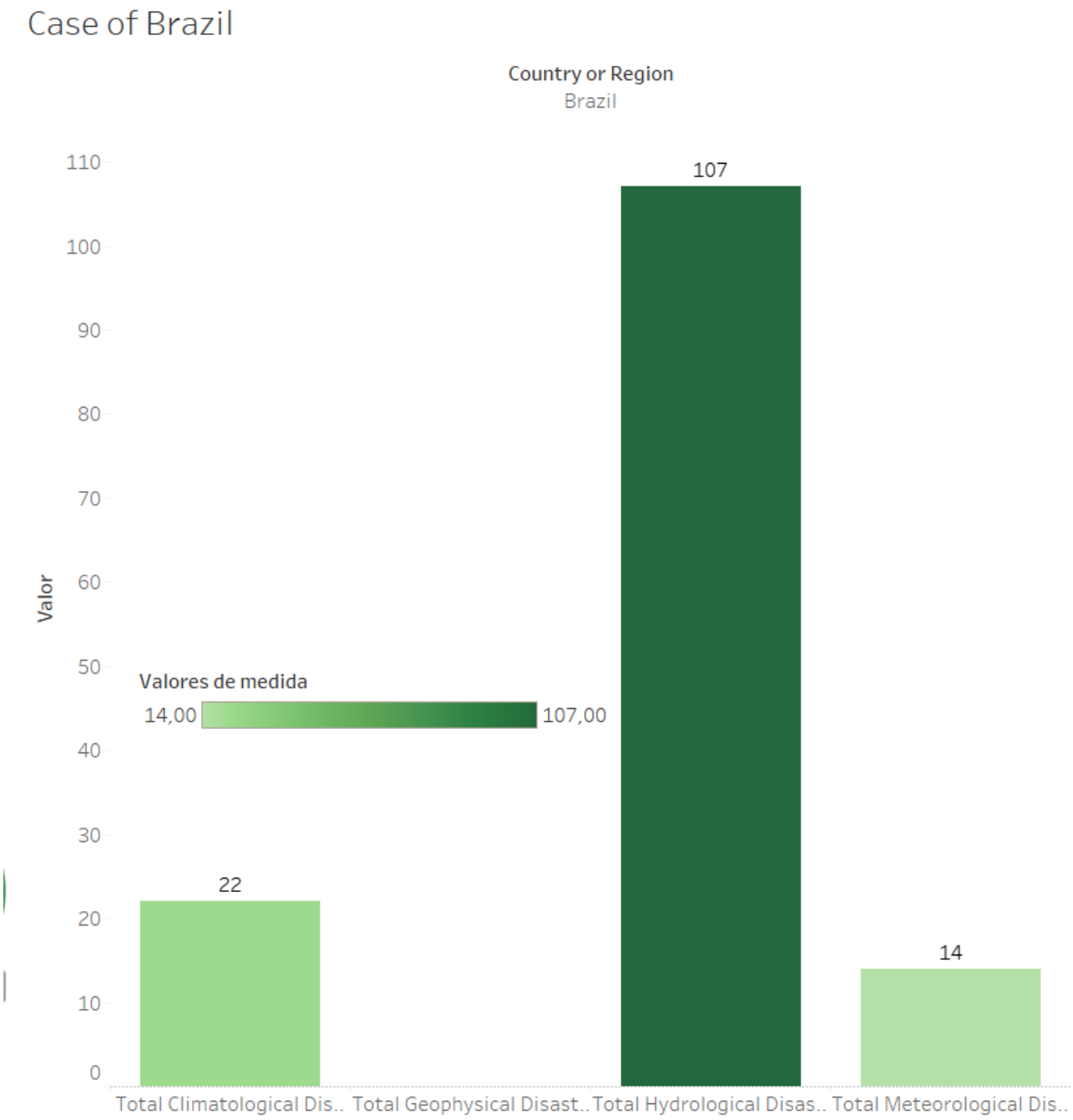


In this table we have a relation of the most important countries in the situation of high dicrease in forest area in the last years, this table is already filtered to show only the countries that had a dicrease over the average. We can see that Brazil and Paraguay had a really high decrease into this case.



Since the table is not the most eficiente way to show the difference of importance of each country about decrease in forest area, the bubble chart its an other way to show in a most visual way how Brazil and Paraguay had a really impactant decrease in area when it comes to forest.

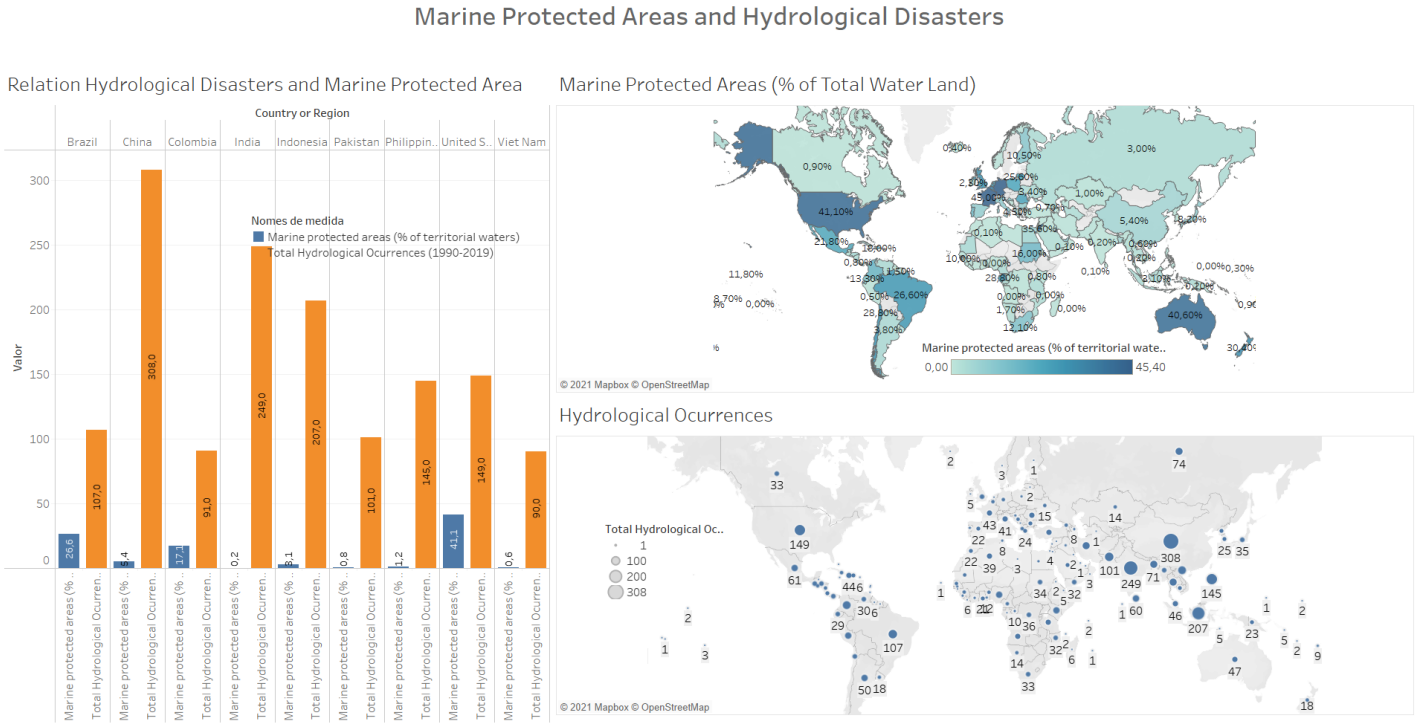
Case of Brazil



Based on the last informations of first 2 charts of this dashboard, this barplot shows in a most specific way how dicreasing in forest area can affect a country when it comes to natural disasters. Brazil was the choice because of the decrease in forest areas and mostly because naturally it doesnt have the tendency to have any kind of natural disaster. In this way, we can check the effects of changing in forest area in a most clean way.

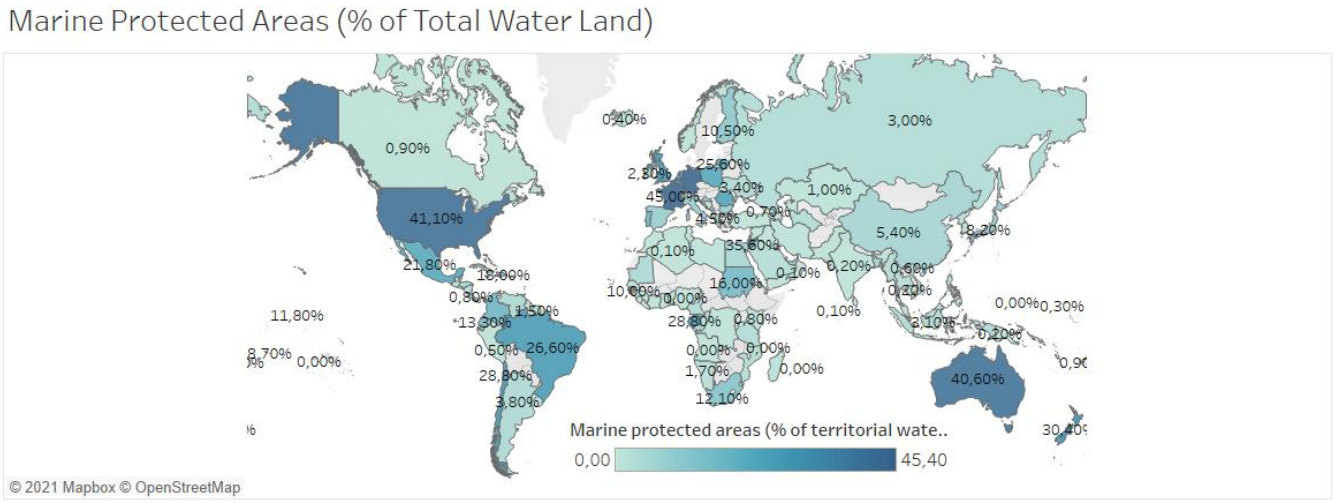
With this, we can see that the disaster probably more affected by this factor is related to hydrological occurrences.

Dashboard: Marine Protected Areas and Hydrological Disasters



This dashboard has the goal to demonstrate the most important informations related to Forest Area and some natural disasters. It has 3 charts, the first of it its a highlight table, the second one is a bubble chart, spotlighting the countries that had the most impactant decrease in forest areas and the second one is a simple bar chart to explain the particular case of Brazil. In the following sections, we will analyse it deeply.

Marine Protected Area (% of Total Water Land)

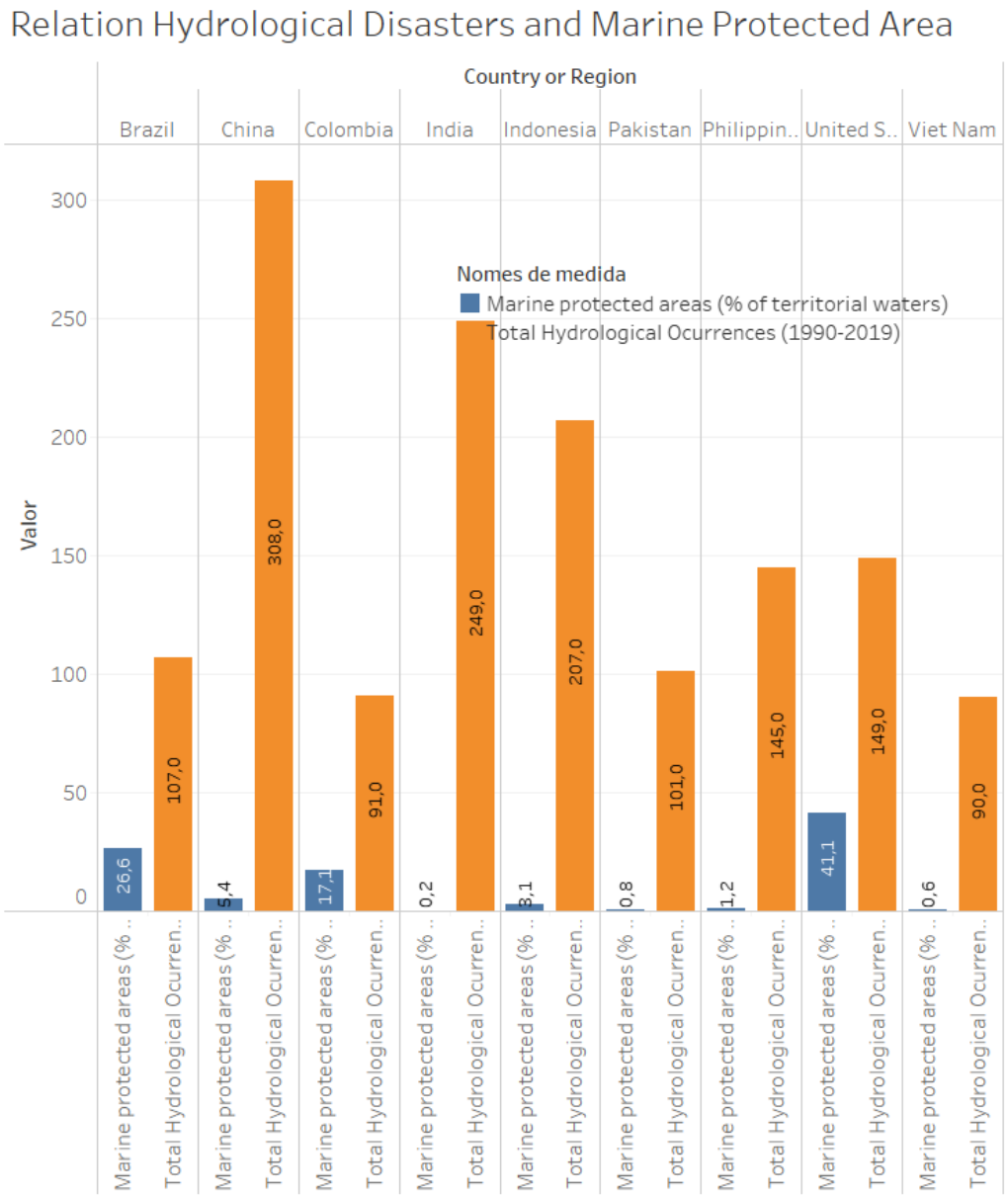


This map shows the porcentage of marine protected area based on the total water land of each country. We can see some countries like United States, Australia and France has almost half of the water land protected. The aim of it is to see if that impact in a positive way any kind of hydrological disaster.

Hydrological Occurrences

This symbol map indicates on the globe which countries had more hydrological disasters in the last years, with this we can see that China and Indonesia are the leading one in these type of natural disasters, and when we come back to the first map, we realize that these two countries has only 5% and 3% of marine respectively.

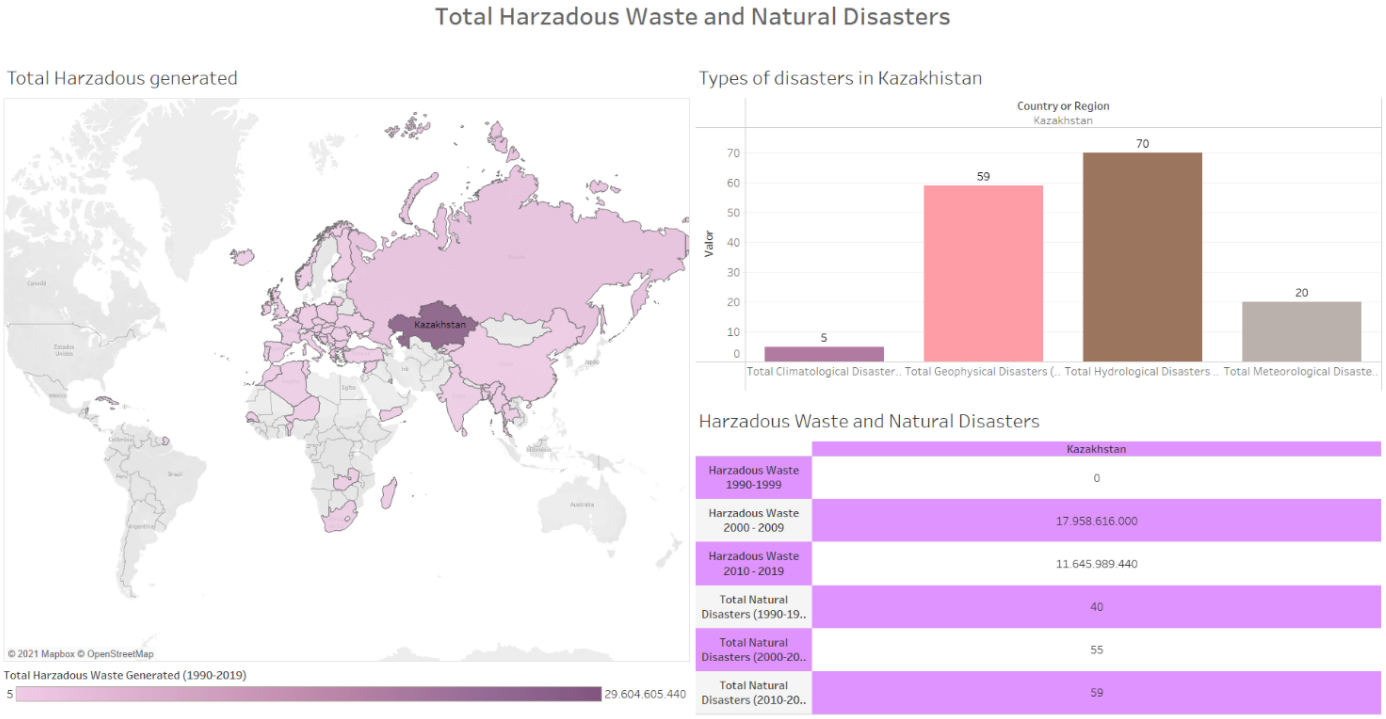
Relation Hydrological Disasters and Marine Protected Area



This chart aims to show any kind of direct relation between the two variables that we just analysed individually on the previous maps. We combine 2 graphs in once and it shows the porcentage of marine protected area and hydrological disasters of the top 9 countries in the ranking of hydrological disasters.

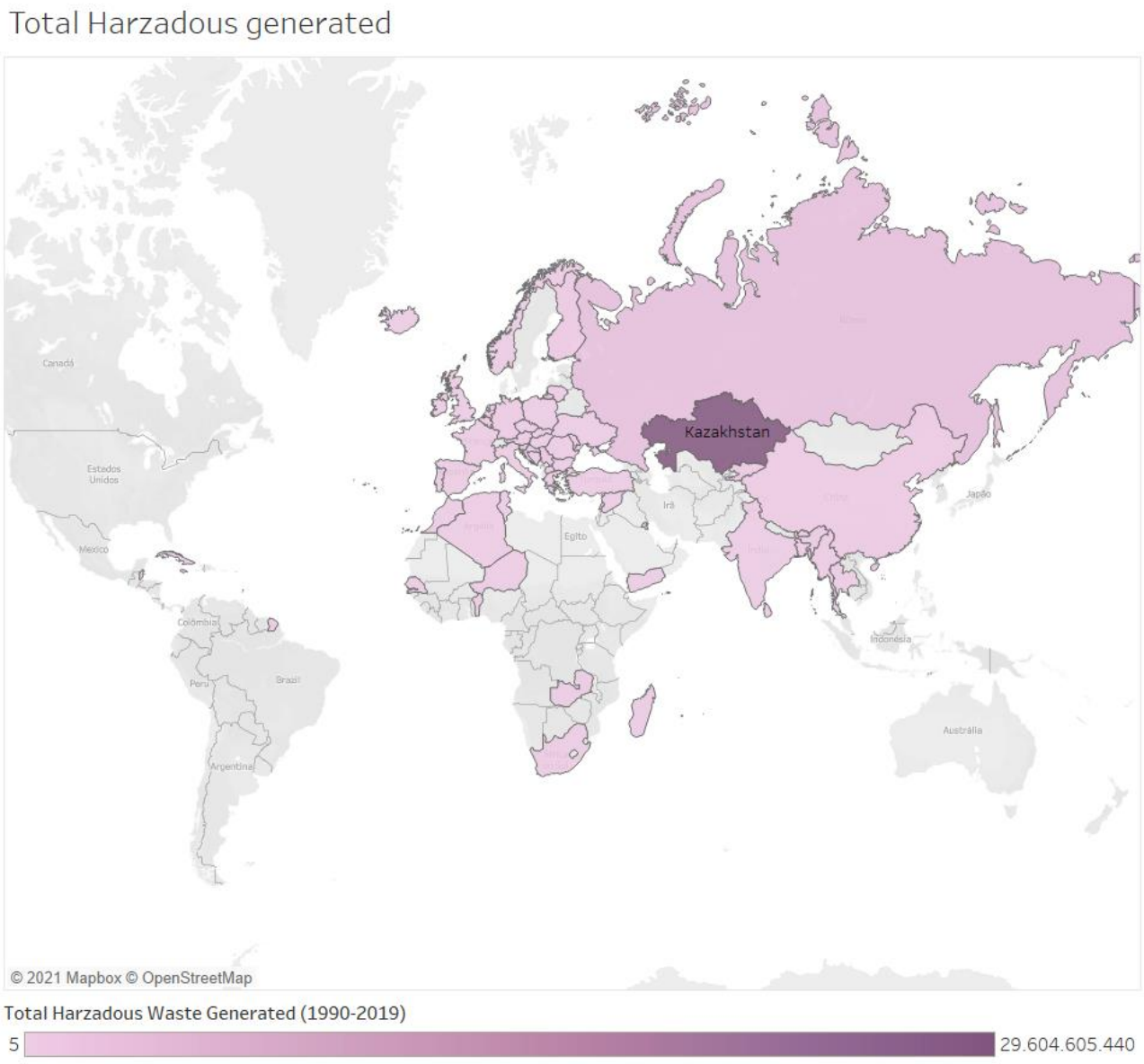
We can see that most of the countries into this ranking has less than 30% of marine protected area, the only exeption is United States. Actually five of the nine countries have less than 5% of marine protected area, what lead us to a high correlation between this and the occurrence of hydrological disasters.

Dashboard: Total Harzadous Waste and Natural Disasters



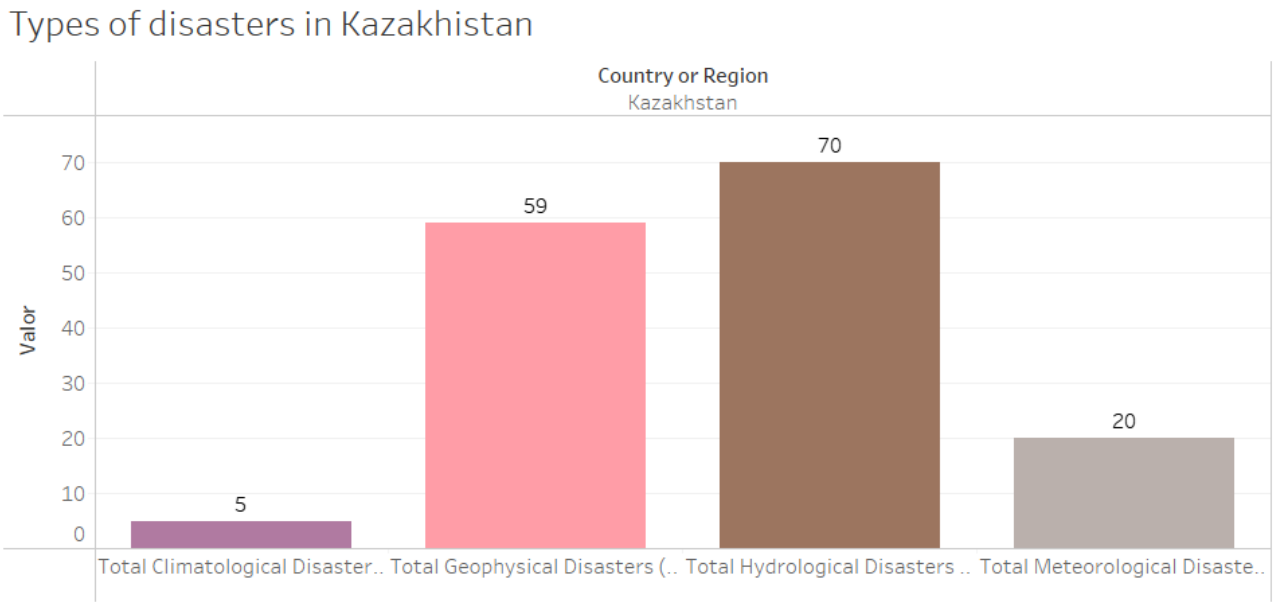
The last dashboard of this whole analysis has the goal to try to demonstrate if harzadous waste generated for all over the world has some correlation with any kind of natural disaster. This dashboard only contains 3 charts: one map, one bar chart ando ne numerical table. We will explain each one of it next.

Total Harzadous Generated



This first chart is a map with all the datas from harzadous waste generated, highlighting the countries that has the most expressive numbers. In this case we have only one country with a very dark color globally, that is kazakhistan, what means that he is the one who generate not only more harzadous waste, but also in a very different levels than the other ones.

Types of Disasters in Kazhakistan



The second chart was decided based on the result of the map frequency, since Kazakhistan is the lead in harzadous waste, its is good to analyse its characteristics more deepy, in this case we demonstrate de amount of natural disasters of the country and realize that hydrological disasters followed by geophysical disasters are the most present.

Harzadous Waste and Natural Disasters

Harzadous Waste and Natural Disasters

	Kazakhstan
Harzadous Waste 1990-1999	0
Harzadous Waste 2000 - 2009	17.958.616.000
Harzadous Waste 2010 - 2019	11.645.989.440
Total Natural Disasters (1990-19..	40
Total Natural Disasters (2000-20..	55
Total Natural Disasters (2010-20..	59

This simple table is only to summarize all the natural disasters of Kazakhistan and harzadous waste generated divided by decade, to realize if we can visualize any direct correlation between it. But the frequency of natural disasters remains almost the same thing even with the increase of dicrease of harzadous waste, so we cannot get to this conclusion.

Conclusions

The goal of this report is to analyse some enviromental indicators and the relation between it. As the analysis was carried out, it was possible to develop the answers of our initital business questions. We can check the final analysis of it below:

1. *How is the emission of gases related to the propensity of climate disasters?*

Based on the data that we analysed together, its not possible to say that elevate taxed of gases emissions in general is directly connected to climate disasters when it comes to all countries. But in two countries, Portugal and Ethiopia, it seems to have a high correlation between these two facts, what can be an interesting factor in further studies into this case, using maybe economics factors as correlate events.

2. *What are the gas most directly linked to climate disasters?*

Based on the cases of Portugal and Ethiopia, we can say that GHG gas (Greenhouse gas) must be the one that leads in a high correlation between gas emission and climate disasters.

3. *Is there a relationship between mineral extraction and the occurrence of geophysical disasters?*

Since a lot of geophysical disasters happens by human actions, by the indicators we analysed, we can say there is a correlation between these two factors, this just not happens when the country has already natural tendency to have geophysical disasters.

4. *What kind of disasters are accentuated by decrease in forest area?*

Based on the case of Brazil, that has the most decreasing forest area through the years, we can say that this type of factor can lead to hydrological disasters.

5. *Are countries that have a high marine reserve area less prone to hydrological disasters?*

Since five of the nine countries that have high occurrances of hydrological disasters have less than 5% marine protected area and other 3 have only 30%, we can say that the lack of marine protected area can increase the tendecy to hydrological disasters.

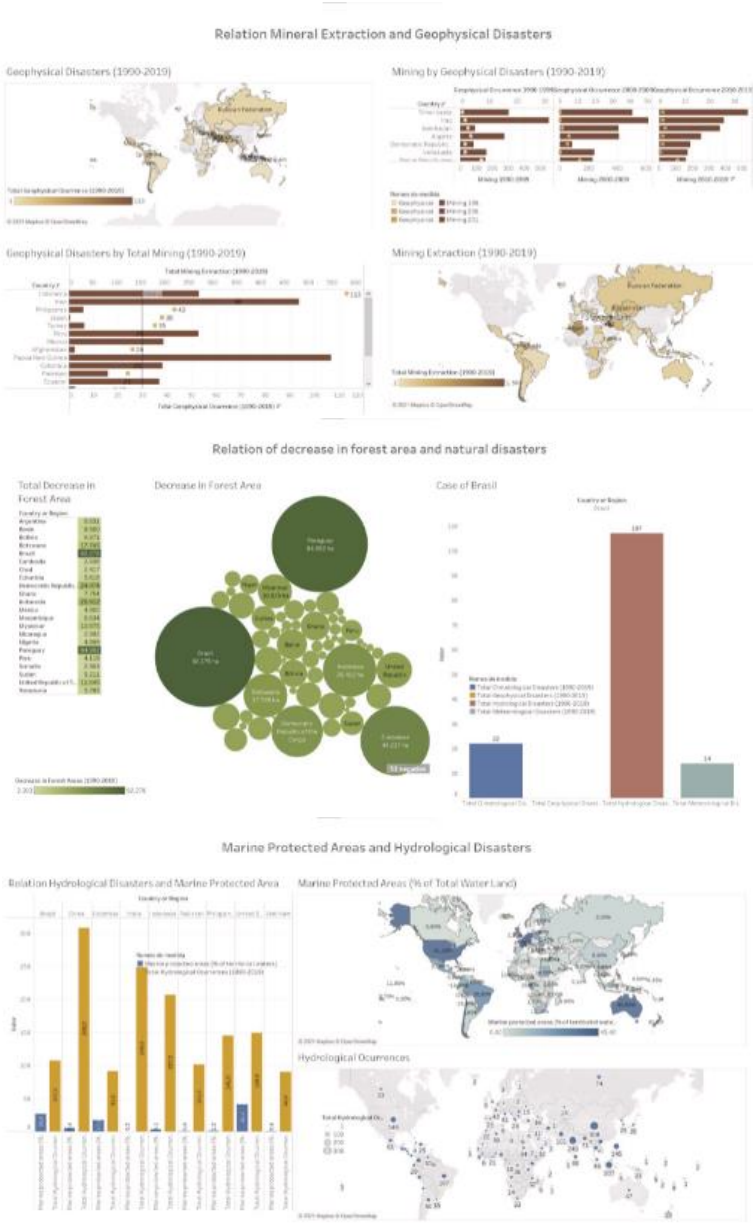
6. *Is harzadous waste generated related to any kind of natural disaster?*

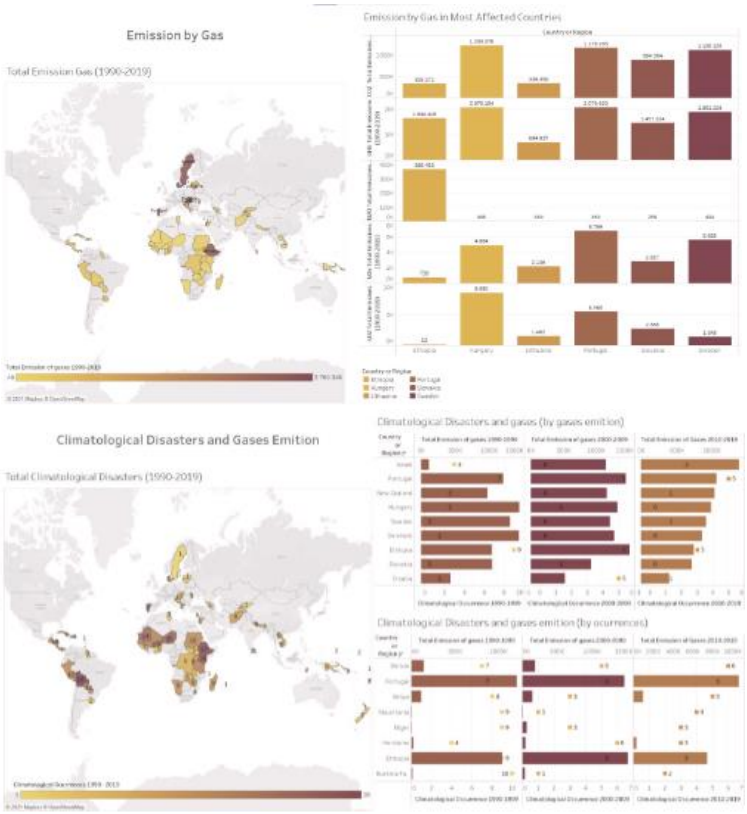
Based on the case of Kazhakistan, that generates more harzadous waste than any other country, we could not find a direct correlation between harzadous waste and any kind of natural disaster.

Color Blindness Test

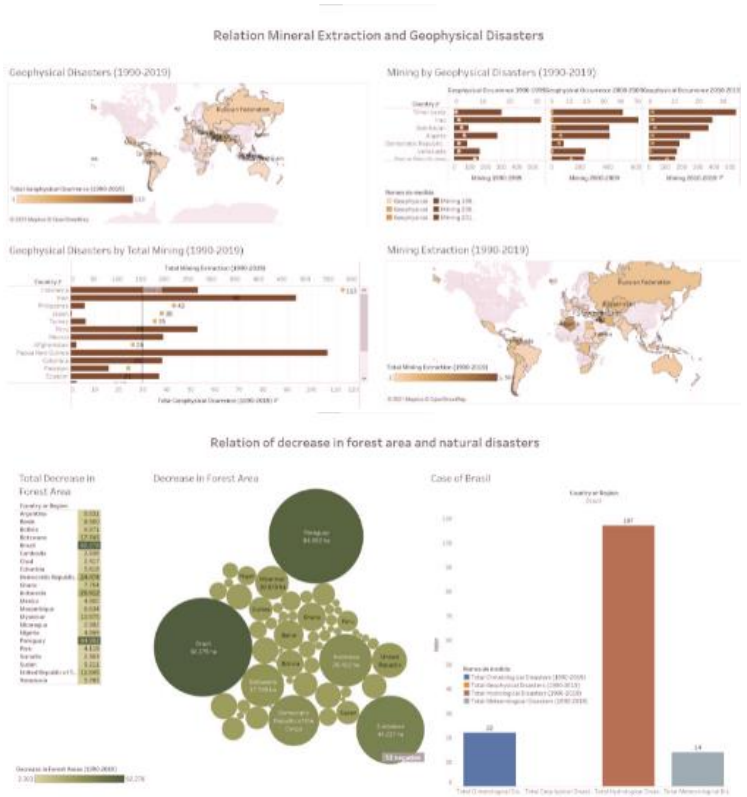
For each dashboard, the color blindness test is carried out, in order to evaluate whether the dashboards achieved can be easily analyzed by people who have anomalies in the perception of colors.

Protanomaly- Red weak



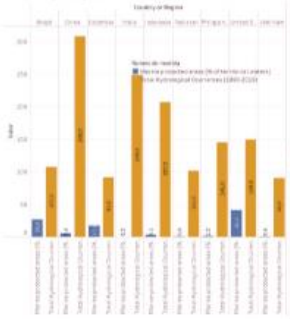


Deuteranomaly- Green weak



Marine Protected Areas and Hydrological Disasters

Relation Hydrological Disasters and Marine Protected Area

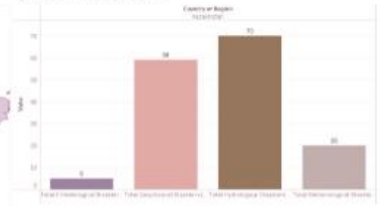


Marine Protected Areas (% of Total Water Land)

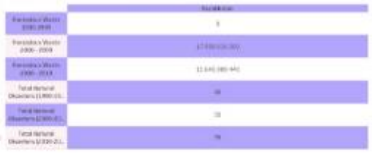
Hydrological Ocurrences

Total Harzadous generated

Types of disasters in Kazakhstan

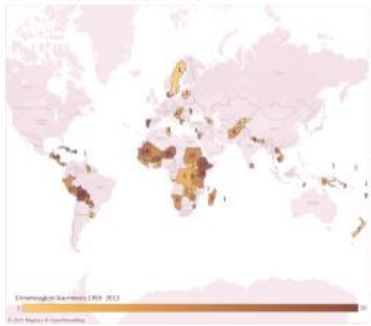


Harzadous Waste and Natural Disasters

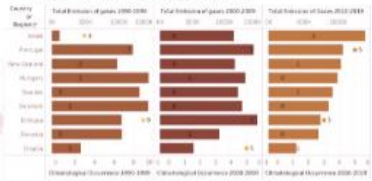


Climatological Disasters and Gases Emition

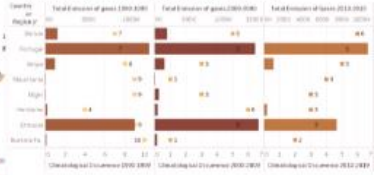
Total Climatological Disasters (1990-2019)



Climatological Disasters and gases (by gases emition)

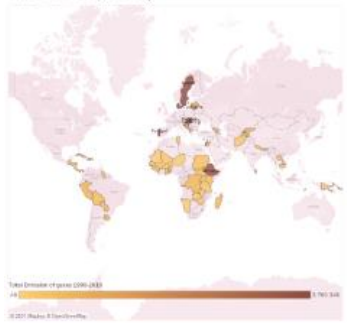


Climatological Disasters and gases emition (by ocurrences)

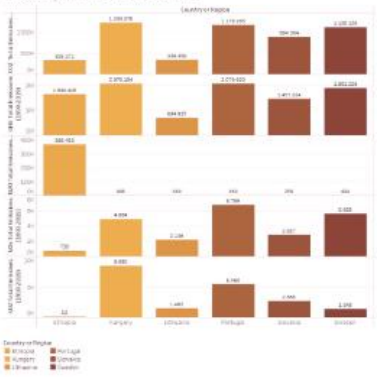


Emission by Gas

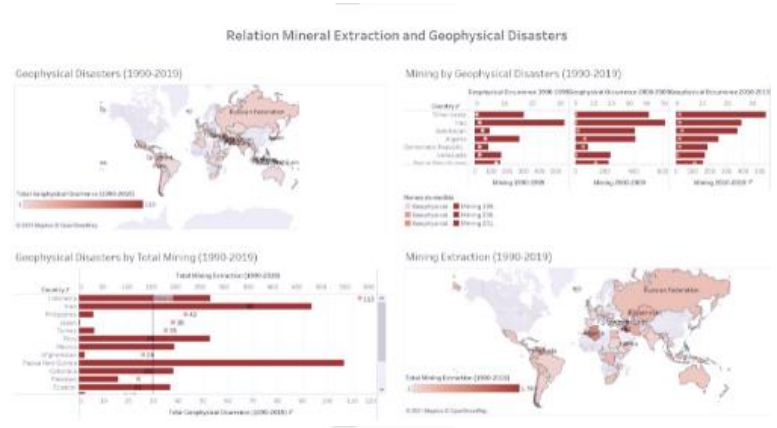
Total Emission Gas (1990-2019)

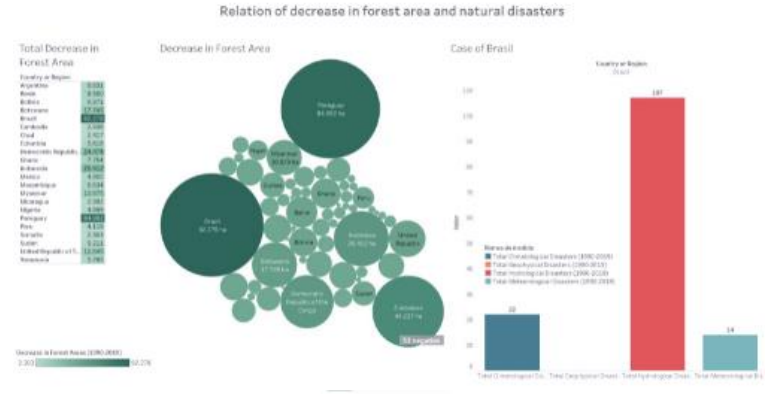


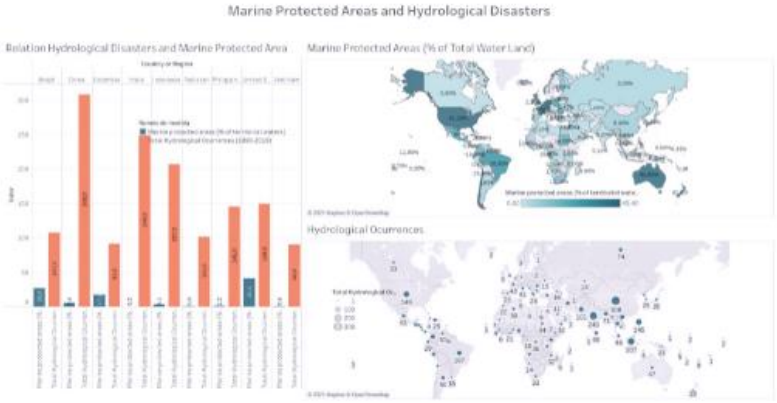
Emission by Gas in Most Affected Countries

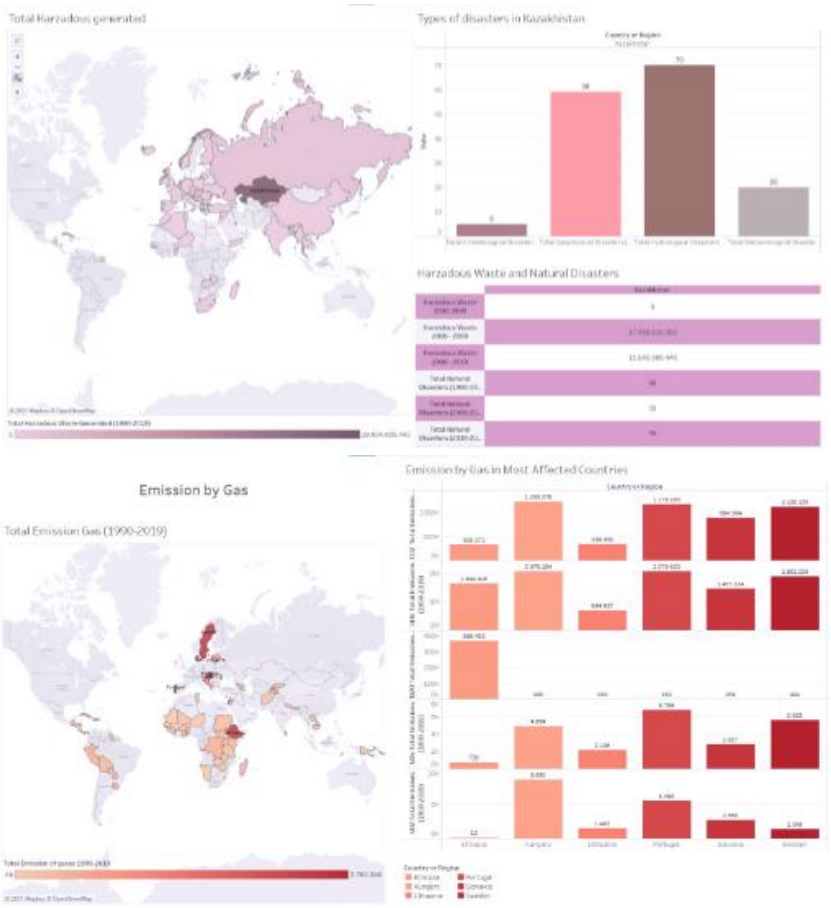


Tritanomaly- Blue weak

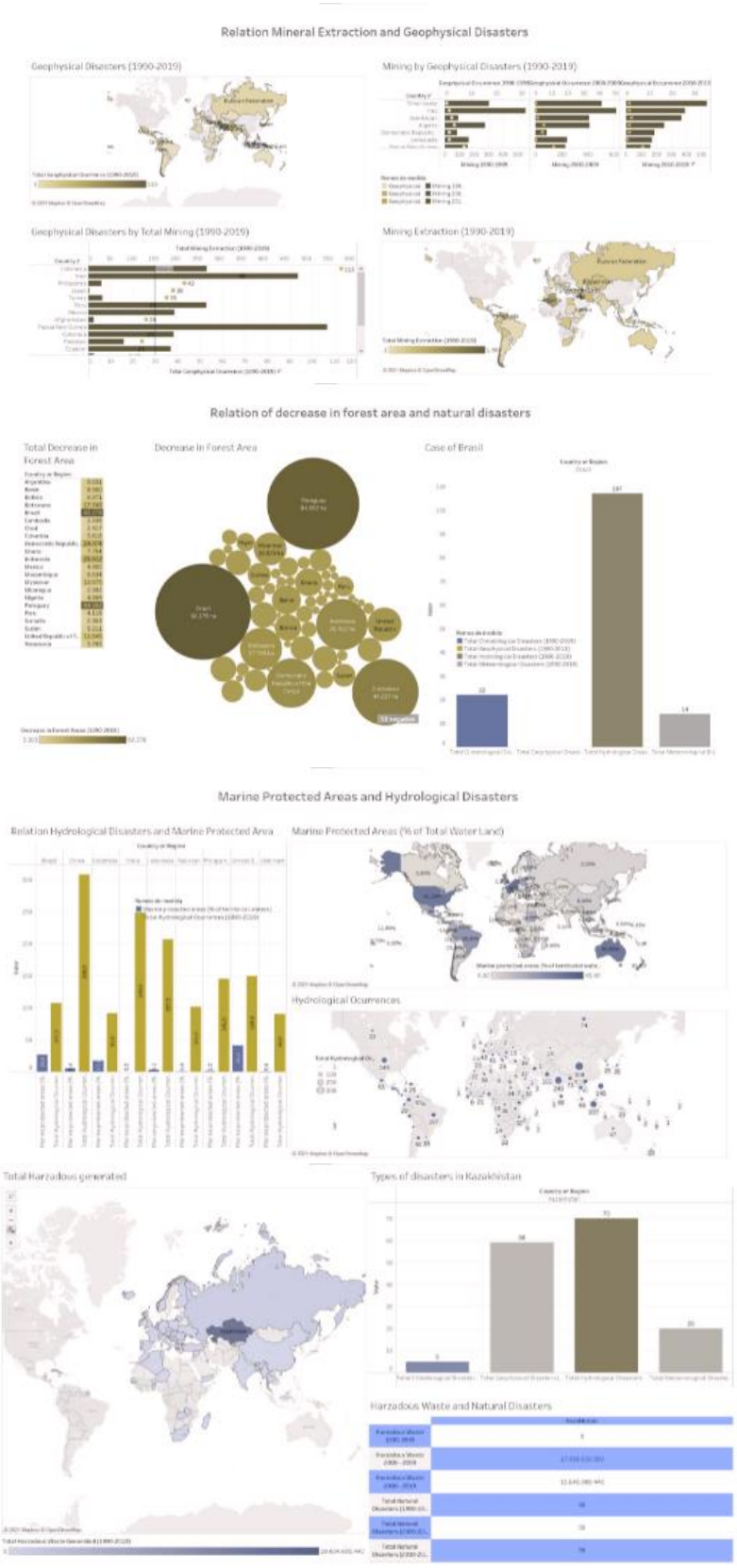


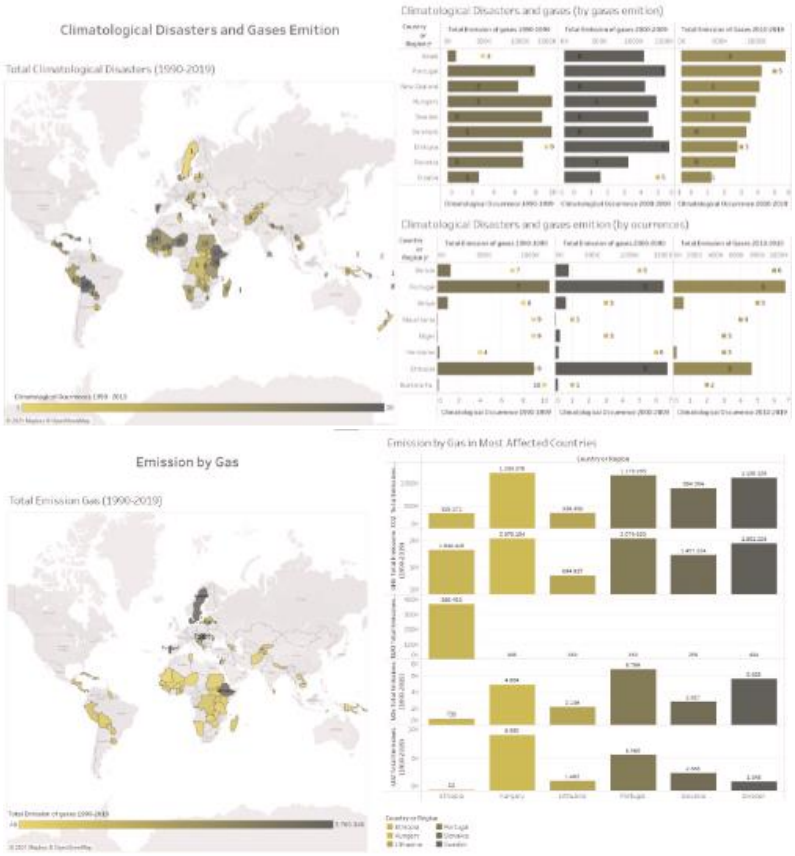




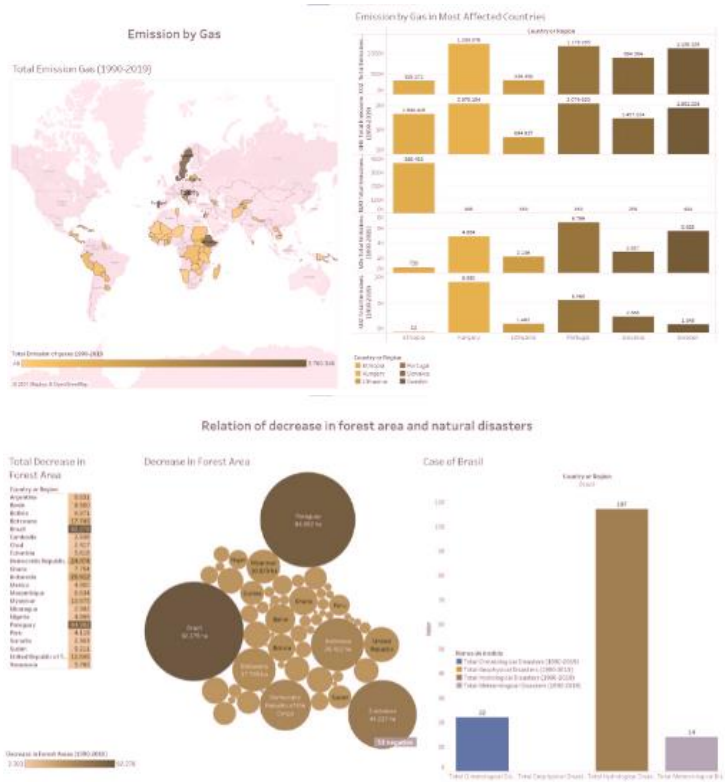

Total Hazardous generated
Types of disasters in Kazakhstan
Harzadous Waste and Natural Disasters
Emission by Gas
Total Emission Gas (1990-2019)
Emission by Gas in Most Affected Countries

Protanopia- red blind

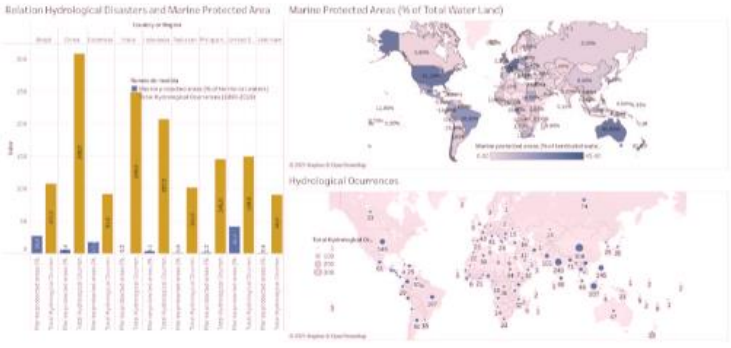


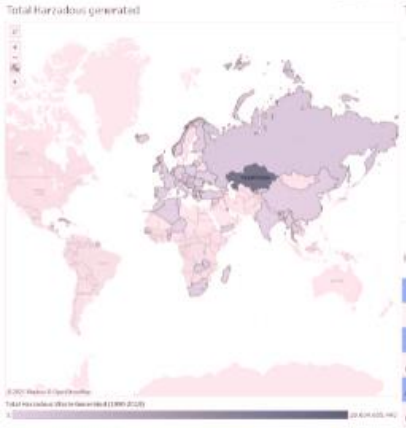


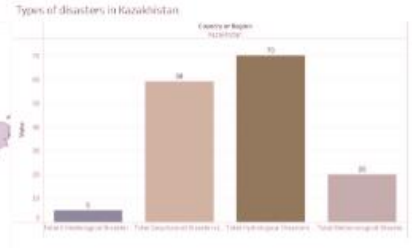
Deuteranopia - Green blind

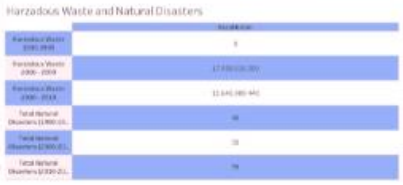


Marine Protected Areas and Hydrological Disasters

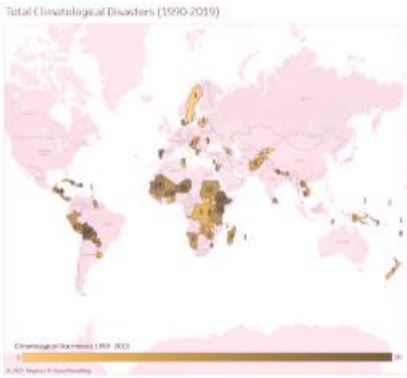


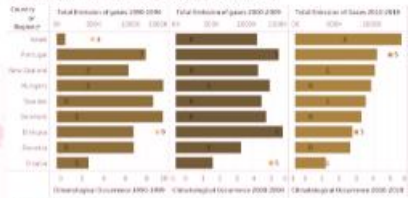


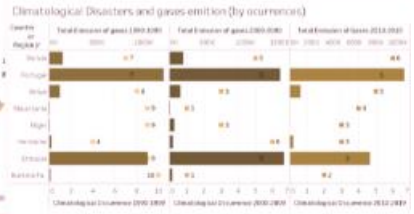




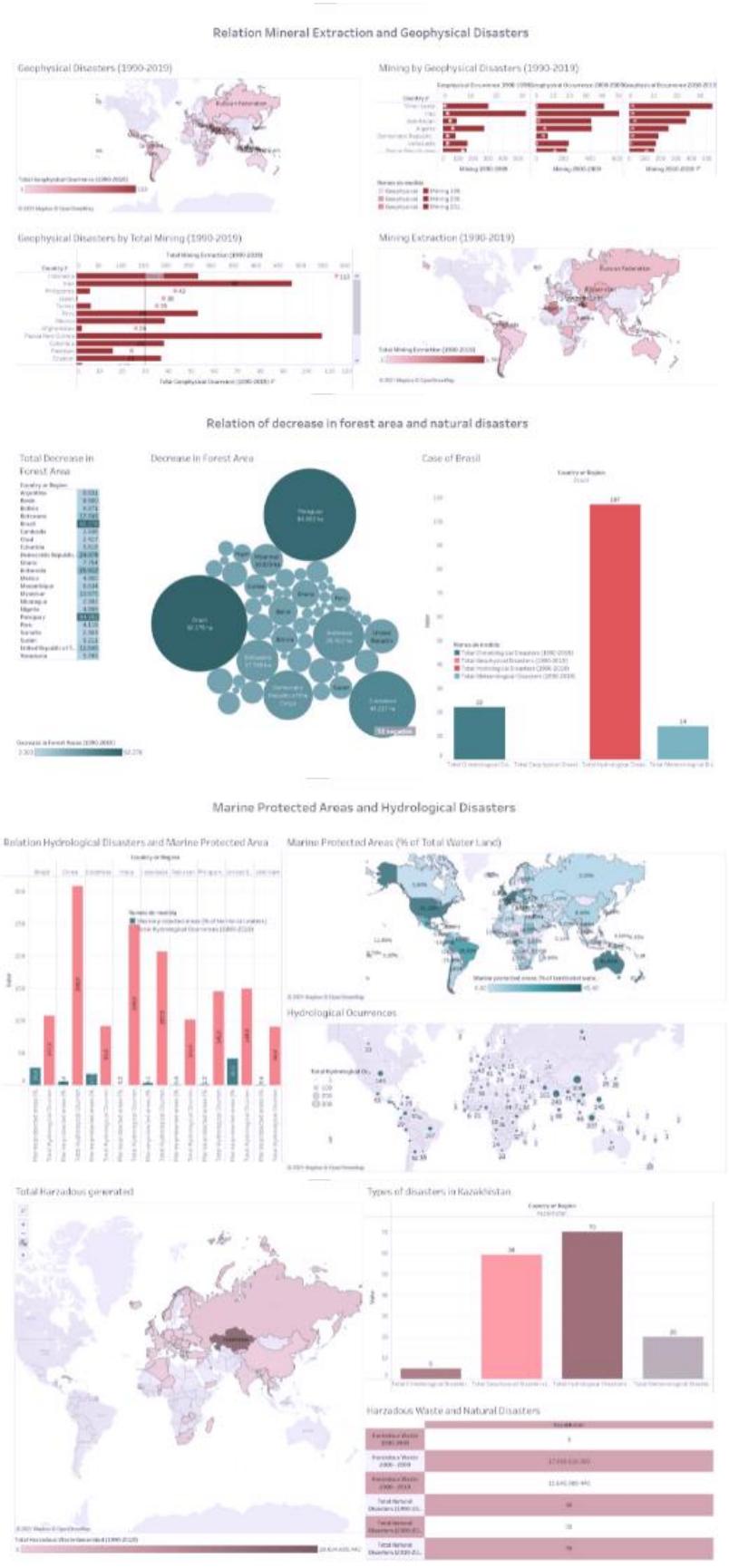
Climatological Disasters and Gases Emition

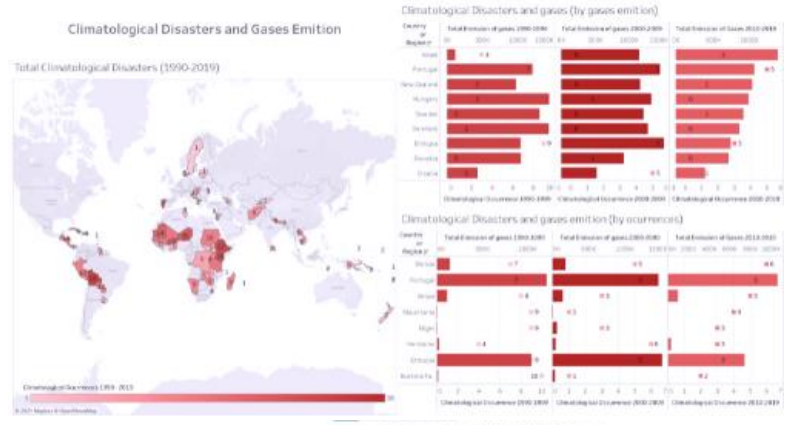


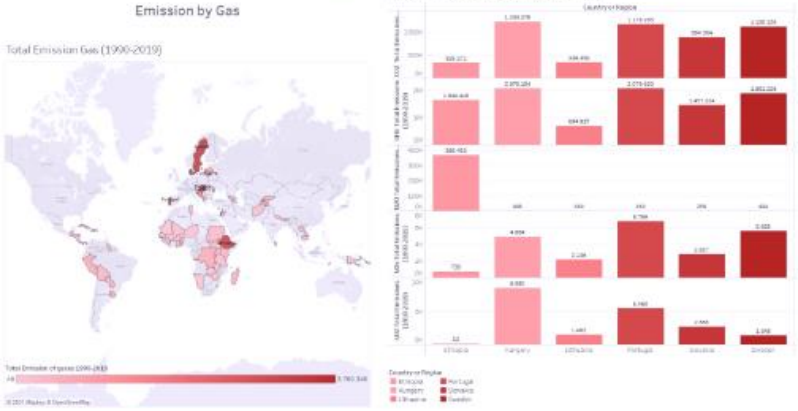




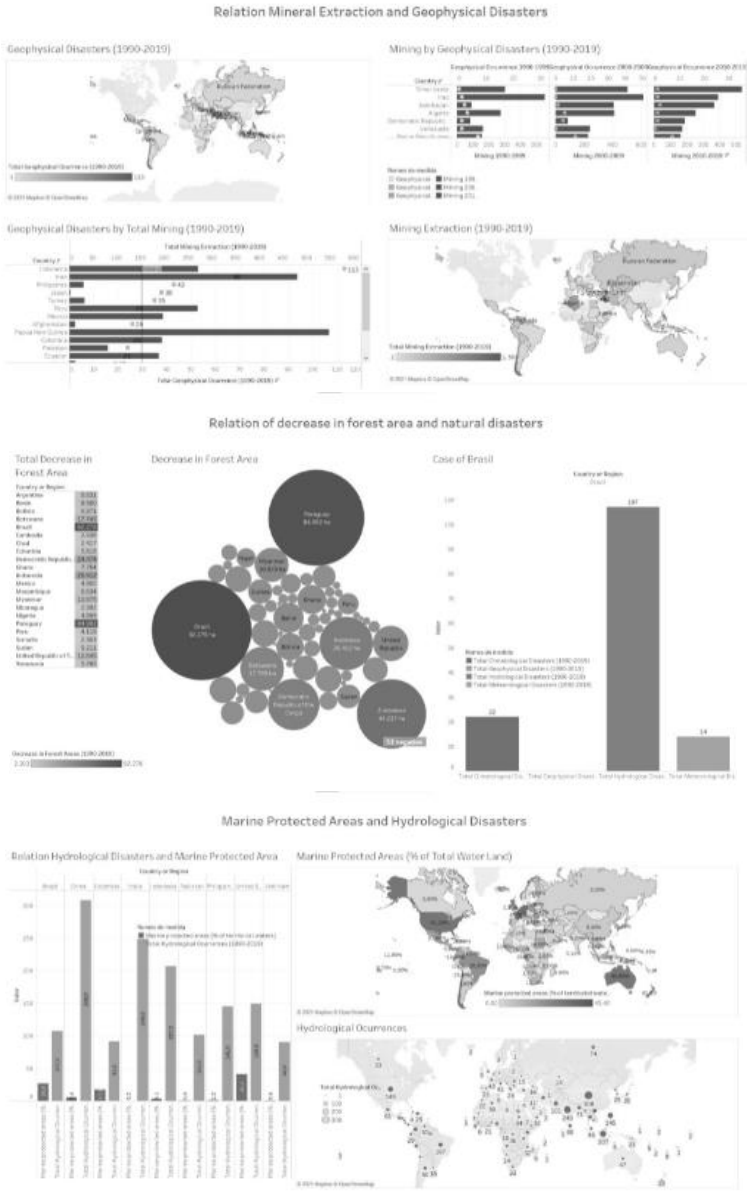
Tritanopia - blue blind

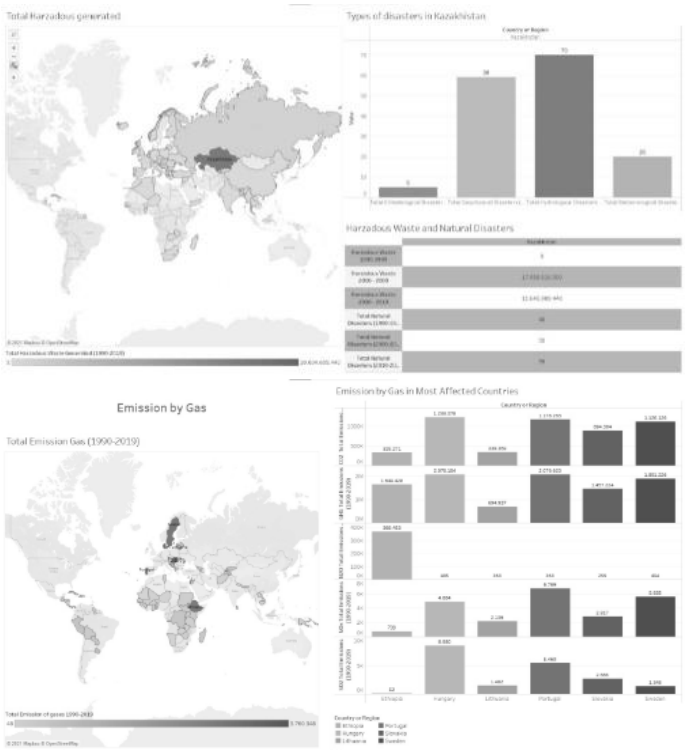



Climatological Disasters and Gases Emition
Total Climatological Disasters (1990-2019)
Climatological Disasters and gases (by gases emition)
Climatological Disasters and gases emition (by ocurrences)

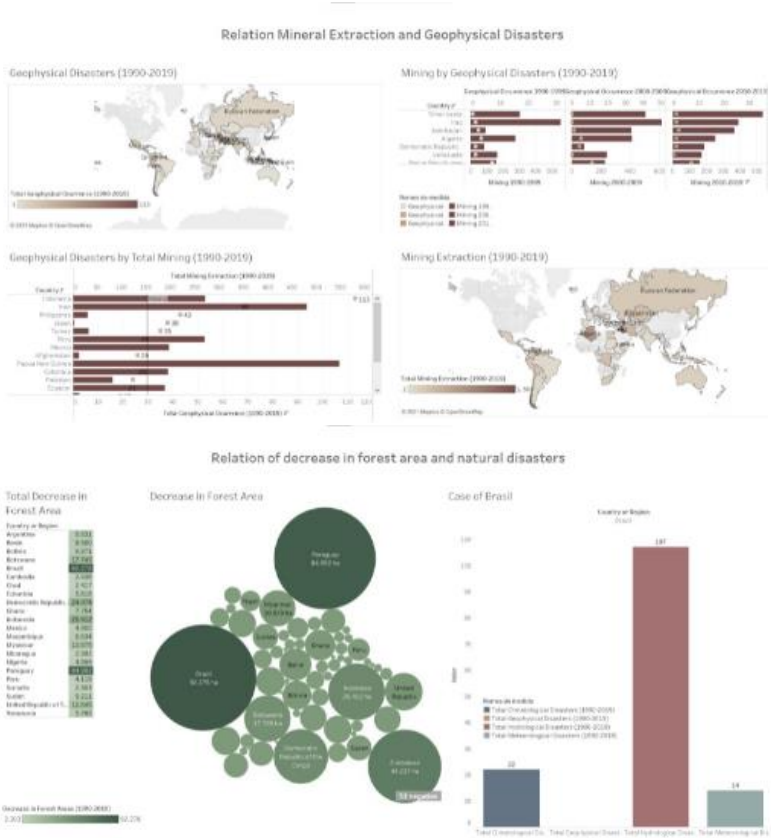

Emission by Gas
Total Emission Gas (1990-2019)
Emission by Gas in Most Affected Countries

Monochromacy – Achromatopsia



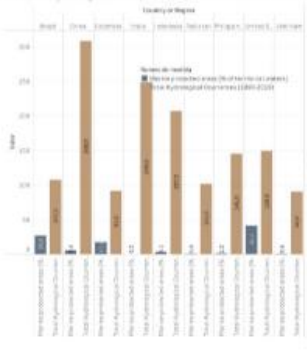


Monochromacy- Blue Cone



Marine Protected Areas and Hydrological Disasters

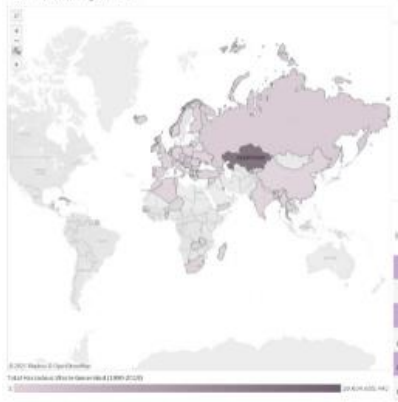
Relation Hydrological Disasters and Marine Protected Area



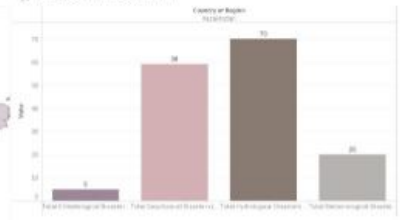
Marine Protected Areas (% of Total Water Land)

Hydrological Ocurrences

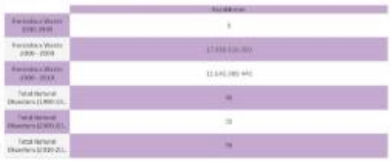
Total Harzadous generated



Types of disasters in Kazakhstan

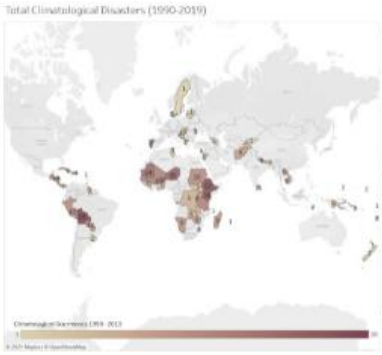


Harzadous Waste and Natural Disasters

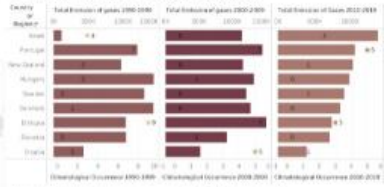


Climatological Disasters and Gases Emition

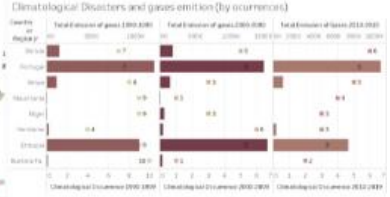
Total Climatological Disasters (1990-2019)



Climatological Disasters and gases (by gases emition)

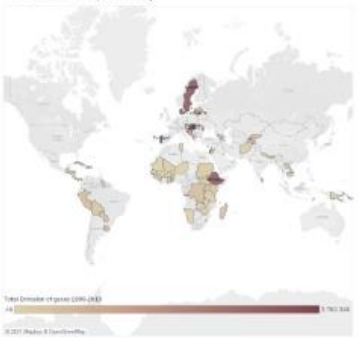


Climatological Disasters and gases emition (by ocurrences)



Emission by Gas

Total Emission Gas (1990-2019)



Emission by Gas in Most Affected Countries