Anticipatory risk map

Fault lines in the Marmara region

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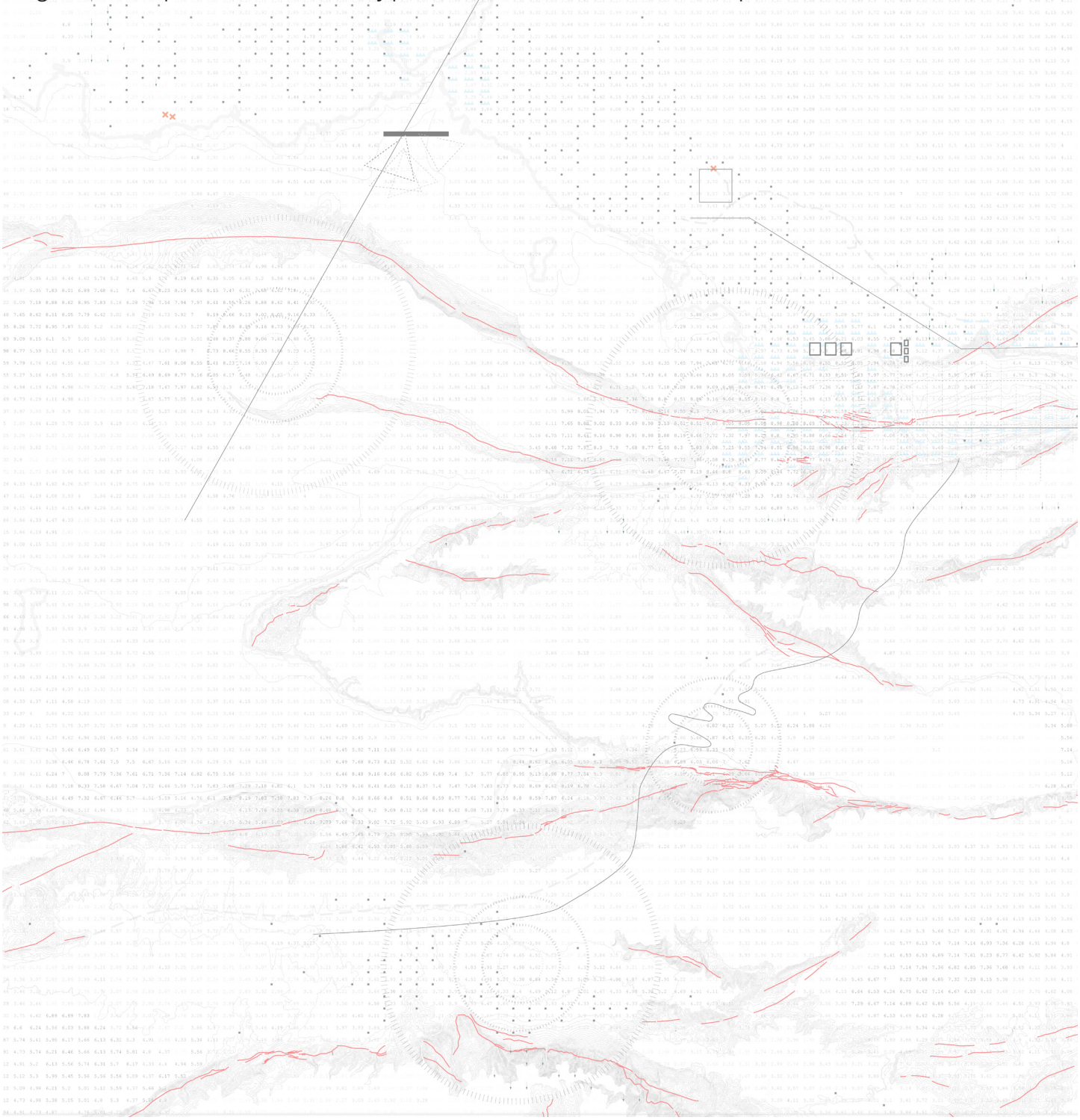
Introduction

As a part of the 'Transient Liquidities along the New Silk Road II' graduation studio organized by the Borders & Territories department, this research aims to address the geophysical and the geomorphological situation arround the Sea of Marmara. Through this research, the group works to gain a better understanding of the assemblage of the soil and ground, as well as its relationship with collective human life, under the constant threat of seismic activity.

Looking at the configuration of the land it becomes paramount that the fault lines are analyzed, as these form the land not only in the spatial, but also in their effect of the social sense. This research will work towards a better understanding of the land through mapping, taking these different factors into account; providing insight into the spatial relations as they present themselves in the landscape.



Specification of the theme

The North Anatolian fault line and its zone of influence play a substantial role in the collective human life in the area around the Sea of Marmara.[1] This fault line runs through the entirety of Turkey, from east to west, and breaks off into many shorter subsidiaries as shown in figure 1. Due to their inscription on the landscape and the superposition of different layers, these fault lines have sizeable effects on the collective human life in these territories[2], both physical and metaphysical.

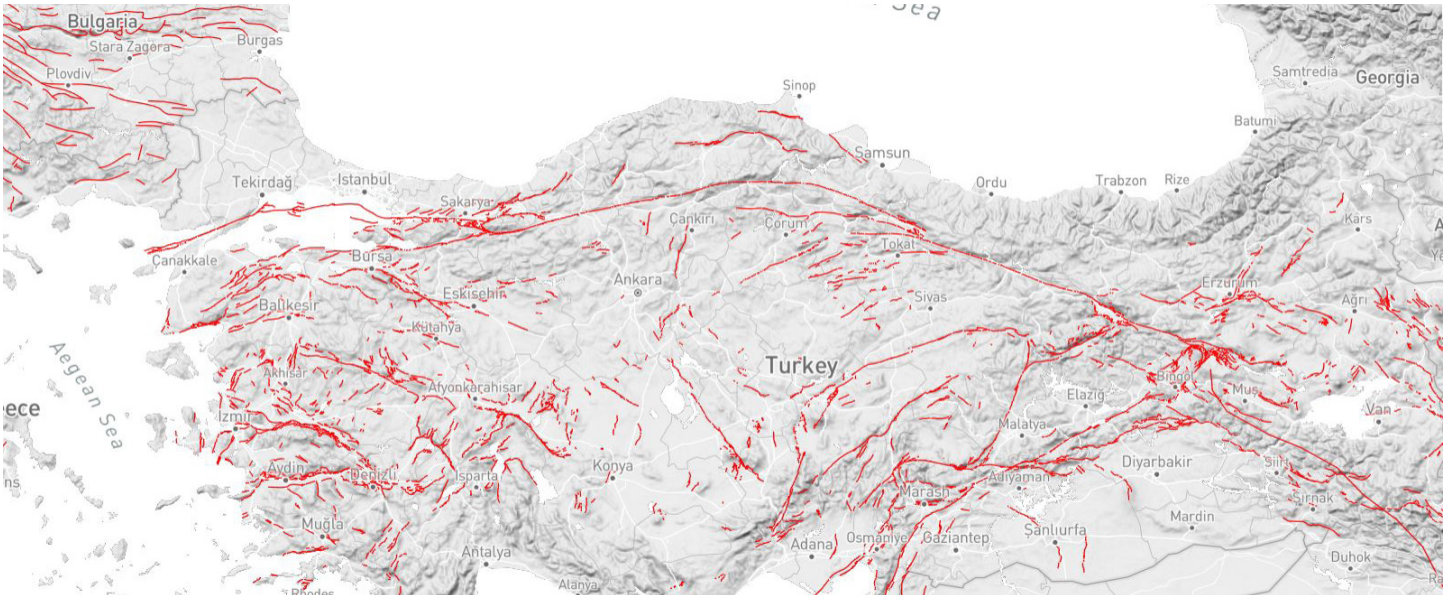


Figure 1: North Anatolian Fault line and its subsidiaries, as it runs through Turkey[3]

These effects traditionally come with many risks to human life, due to both the magnitude of these layers as well as the earthquakes they cause. Defined by Blaikie et all (1994)[4] risks equal hazards plus vulnerability. To define these risks to collective human life, it becomes increasingly important to research both these hazards as well as the implied vulnerabilities in the territory.

To be able to truly understand the effect of the North Anatolian Fault on human life, a research question was posed before starting the mapping: "Considering the fault line as a crucial characteristic of the landscape, how can we understand the effect of disruptions on collective human life?" In researching this, the goal is for more clarity to be created in regard to the prognosis that this fault line indeed has a large effect on the collective human life in these territories, but also regarding how collective human life responds to this.

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1 Erdik, M., Demircioglu, M., Sesetyan, K., Durukal, E., & Siyahi, B. (2004, August). *Earthquake hazard in Marmara region, Turkey* [Paper No:270]. 13th World Conference on Earthquake Engineering.

2 Kundak, S., & Türkoğlu, H. (Eds.). (2005, August). *Assessment of Seismic Risk in Istanbul*. 45th European Congress of the European Regional Science Association.

3 Temblor, Inc. (2014). *Earthquake Likelihood*. Temblor. Retrieved September 30, 2022, from https://app.temblor.net/risk/custom-location/WzQwLjg4OTc4OTA0MDY5MTk5NCwyOC45NzIxODE0MjExOTg3MTJd

4 Blaikie, P., T. Cannon, I. Davis, and B. Wisner (1994), *At Risk: Natural Hazards, People's Vulnerability, and Disasters*. London: Routledge.

Collective human life

Despite their locations so close to the fault line and its implied risks, regions such as Istanbul and Izmit are preferred by many as their home. After experiencing the earthquake of 17 August 1999, which cost more than 17.000 people their lives as well as leaving half a million people homeless, Izmit was quick to rebuild in precisely the same locations that were affected before[5]. To find out why people continue to return to these risk-prone areas, further investigation of the collective human life itself is needed. Where the settlements are located along the North Anatolian Fault and the size of these settlements, are an important first step in regard to answering the research question. While these are key elements that are being analyzed, there is an understanding that many factors contribute to the choice of relocating or rebuilding a city in the same area, factors which this research considered general knowledge, and was not included in the mapping exercise. Such factors are economic, politic, strategic and historic.

Mapping disruptions

The second step in answering the research question is mapping the different disruptions along the North Anatolian Fault. In mapping these disruptions throughout the region a better understanding of the how and why in regards to the continuous return to the region in to be gained. Different types of disruptions can be defined, but for this research the main focus was put on earthquakes and their consequential disruptions.

5 EQE International. (2000, August). Izmit, Turkey Earthquake of August 17, 1999 (M7.4). In *Preventionweb*. Retrieved October 15, 2022, from https://www.preventionweb.net/files/2745_IzmitTurkey1999.pdf

Anticipatory risk map

When attempting to map disruptions, creating an anticipatory risk map proves to be the most compendious. This type of map is one that is often found in different capacities, of which the most common uses are found in urban planning and project development; by charting risks, an accurate assessment and preliminary investment of the region can be made. In this map and research, the product is similar to the ones in these fields, but the goal is different; instead of focusing on the risk assessment altogether, the aim is to organize and define the individual risks and their affected areas. Through layering these disruptions on top of each other, a new understanding of the land and the manner of inhabitation is gained, highlighting the resilience of collective human settlements.

Layering the map

The map itself is built up by first tracing the North Anatolian Fault, after which the land is mapped through an earthquake intensity scale populating the region with numbers; the higher the number, the higher the intensity of a projected earthquake. This is the primary layering in anticipating risk.

The secondary layer in anticipating risk is the layer of potential effects of the earthquakes; this is the secondary layer, as this is hypothesized from historical reports on the region. Projected unto the map using a coordinate system, this layer shows tsunamis and collapses, as well as settlements along the North Anatolian Fault line.

However, through the method of layering the disruptions alone the understanding of the map would be minimal. As such a tertiary level of analysis was introduced to the research: the mapping of spatial narratives. This layer shows how and why certain settlements are affected, and what the influence of the primary and secondary layering is in the map.

Mapping spatial narratives

Through the mapping of spatial narratives, this research aims to show how a place relates to the people living there with a temporal constraint; over the course of history, this relation has changed and synthesized. Using a deconstructionist approach, the research intends to construct an alternative form, a charged map. The research provides an alternative view of the landscape emphasizing the process of mapmaking. Precedence study of previous earthquakes analyses the spatial consequences and subsequent regeneration of space such as the Izmit earthquake in 1999. This generates valuable information for future events.

Different infrastructural projects run through the fault region. Pipelines, mines, power plants, bridges, water dams, cities, airports and harbors are all located within the critical zone. The research maps the spatial consequences of natural catastrophes through the sequential framing of consequences. The interconnectedness of the landscape is reflected through the narratives, infrastructural dependence becomes visible through remote locations of energy and resource extraction, critical transport lines and habitat destruction.

Mapping in detail

The map is constructed through different layers. The first layer traces the North Anatolian Fault line orienting the geological structure in coordinates. Next, the morphology of the fault line is further enhanced through the visualization of both bathymetrical and topographical contour lines. The area is further mapped through an earthquake intensity scale populating the region with numbers; the higher the number, the higher the intensity of a projected earthquake. This is the primary layering in anticipating risk, and provides a first inscription into the landscape.

Another layer in anticipating risk is the layer of potential effects of the earthquakes; as this is hypothesized from historical reports on the region. Projected onto the map using a coordinate system, this layer shows tsunamis and collapses, as well as settlements along the North Anatolian Fault line. A tertiary level of analysis was introduced to the research: the mapping of spatial narratives. This layer shows how and why certain settlements are affected, and what the influence of the primary and secondary layering is in the map.

Reflections on mapping

Timeline

The collective map has had a lot of different angles over the course of the past couple of weeks. In the beginning it was hard to encapsulate the precise topics of research, which led the group down many different paths all at once.

From the beginning this group was quite quick to decide on an extremely data driven approach, something that proved to come with its own hardships later on. In this, an important first iteration was made in recognizing the earthquakes as a major authority in the region. As an initial approach to the map, the group proposed that the usual illustration of the map (figure 2) be erased, and instead, replace it with a grid. This process of deterritorialization and reterritorialization[6] was used to highlight the understanding that the seismic activity that takes place at the bottom of Marmara Sea, has an equally devastating effect as an earthquake that took place in the vicinity of a major city, on dryland. On top of this grid, we overlayed data from previous earthquakes, calculated using a logarithmic formula that translated the Richter magnitude scale into a single number, pinned in its geographical accurate point using the longitude and latitude system.

As shown in figure 2 the logarithmic scale that's mostly used to measure earthquakes was flattened, exhibiting only the prevalent earthquake locales during only a few years, starting from the 60s.

This tactic proved to be too limiting in its analysis, and the team found that more depth of the information was needed before useful results could be extracted.

6 Deleuze, G. & Guattari, F. (1977). *Anti-Oedipus: Capitalism and Schizophrenia.* Viking Penguin.

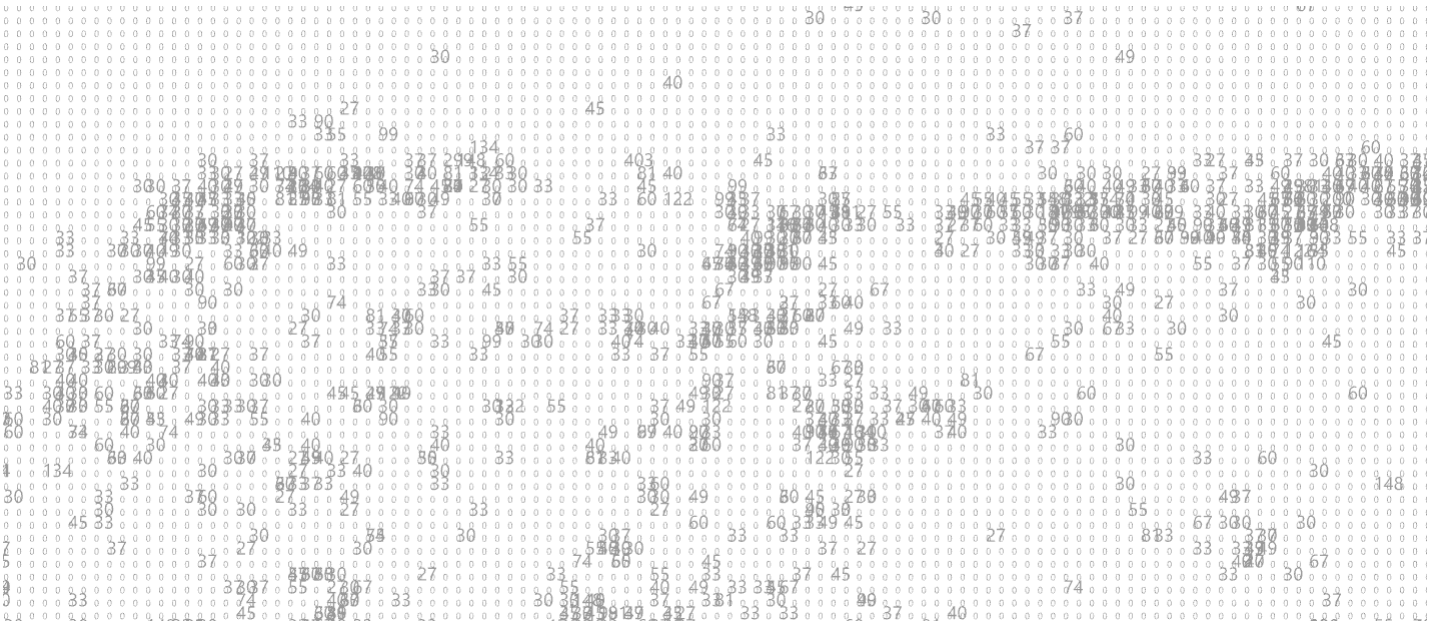

Figure 2: First iteration of group mapping

As such, the team collected more data on different intriguing sites in the region, including archeological sites, draught areas, mining sites, and the more intense earthquakes. However, a clear enough frame was not decided upon before starting, resulting in an overload of information on different fronts, as shown in figure 3, which did not necessarily answer any research questions the team could have had at this point.

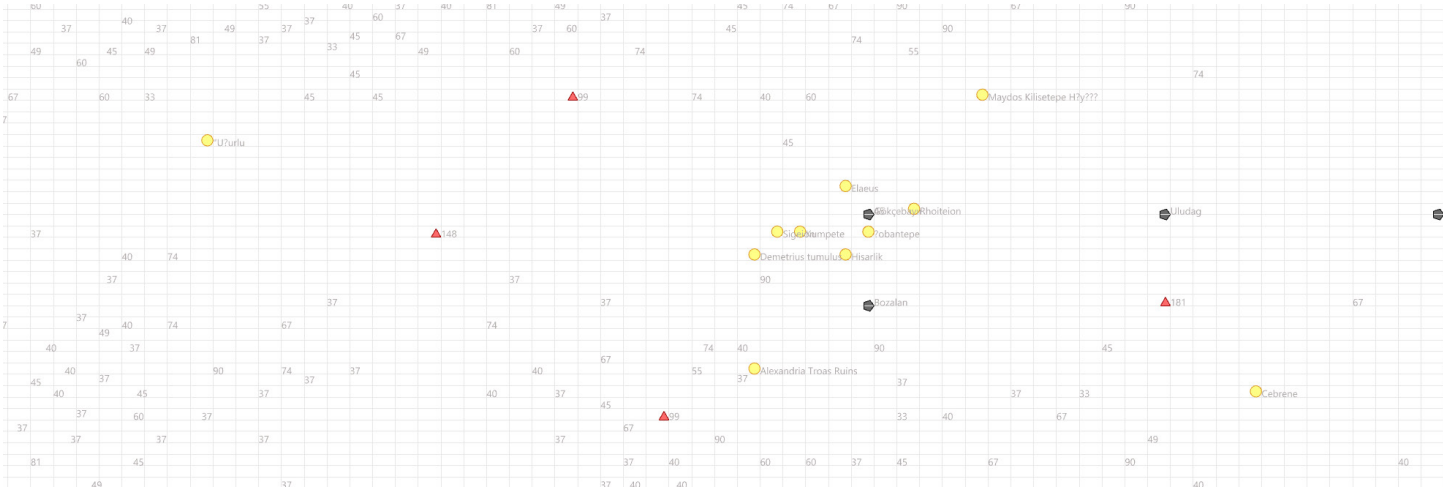

Figure 3: Second iteration of group mapping

After the second iteration of the map, it became increasingly clear that it was important to frame the research by forming a research question and themes to be able to further develop the map. To be able to do this, the team decided to work with experimental tactics for a week; the topic became very theoretical and extremely centered on the idea of disruptions in relation to time. By including the dimension of time, the 2D representations became too planar, so the group attempted at creating a 3D visualization that would convey also the dynamic character of the disruption.

To be able to do this, the group decided to experiment with different manners of representation as well. As shown in figure 4, this proved to be very experimental and barely showed the information that needed to be displayed, and what it showed required too many additional lengthy explanations.

This moment in development of the map also coincided with the first time feedback on our research was given, and it became abundantly clear that the intended direction of research was not defined clearly enough yet.

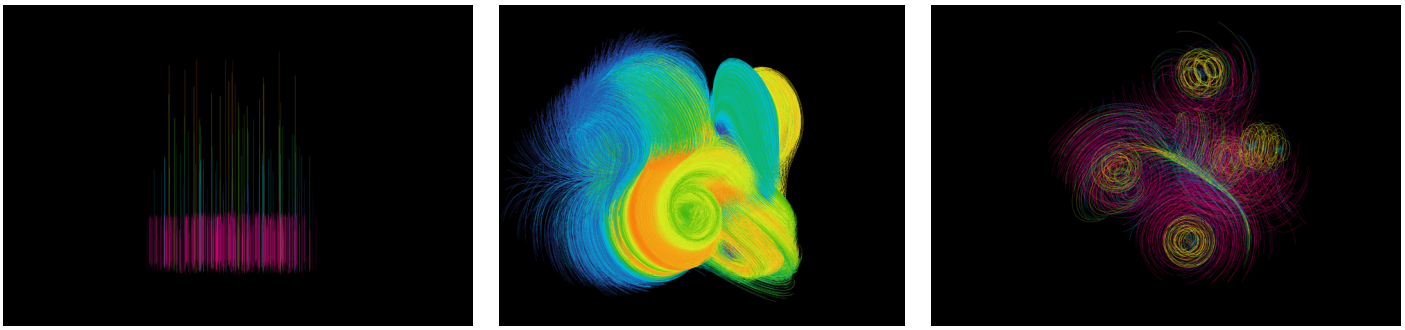

Figure 4: Theoretical mapping; interpolated data collected, interpolated data with time plotted, wind simulation interpolation

A major overhaul of the entire structure was done in the third iteration of the map, and this is also the iteration that has been continuously developed until the P1. More authority was given to the fault line, and a research question and structure as mentioned earlier in the research plan was developed. This was done by drawing the thickness of the fault line, defined by the topography lines. By doing this, the height and depth of the fault became more readable and so did the space it occupies on land. Additionally, the base map became, rather than a system of lantitude longitude a translation of a heat map that would predict that susceptibility of earthqakes in each area. The darker and higher the number the more prone to a stronger earthqakes. Both means of expressions were adopted so that the risk can be understood when you view the entire map at a distance, or you step closer to it.

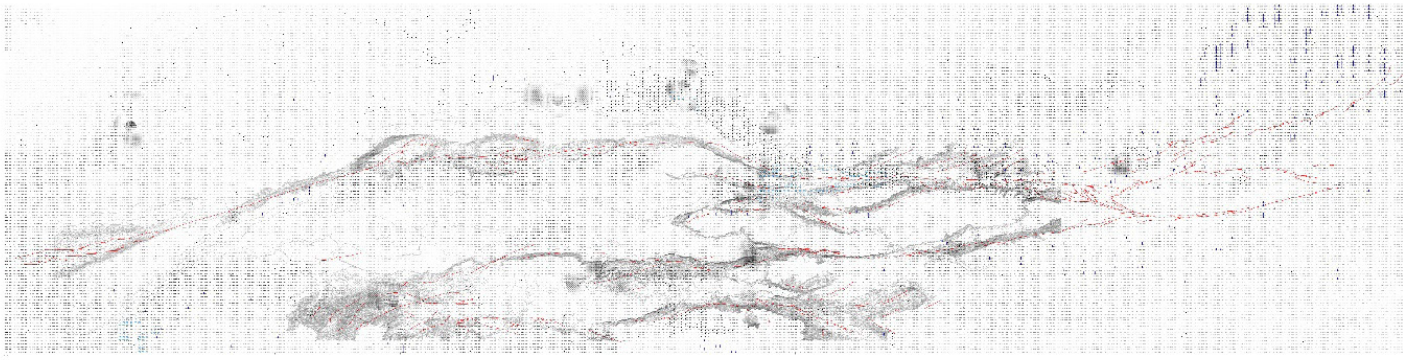

Figure 5: Third iteration of group mapping

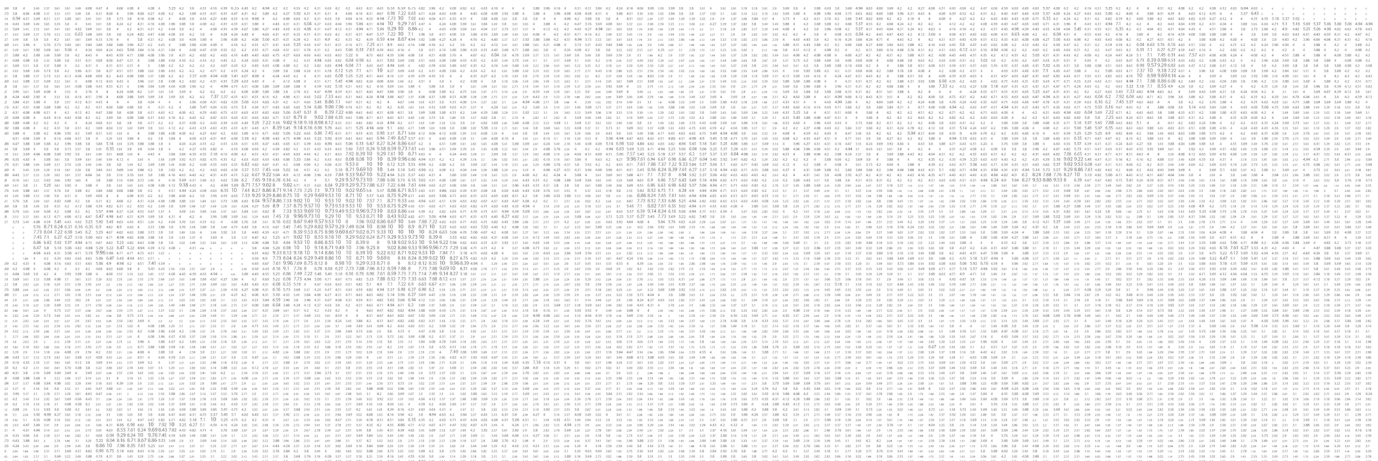

Figure 6: Highlight of danger

Lastly, in order to explain the effect of the disruption of the earthqake on human life, the group decided to include the narratives.

The narratives are a series of icons that populat the map, imagining the different outcomes of variousy loacted disasters. The location of the earthqakes that we previsioned was based on the recent seismic event that took place in the Aegean Sea, in 2019 and destroyed a number of buildings in Izmit, 40 km away from the epicenter. By studying the sediment map of the area we chose to imagine these narratives in location with a very similat karst landscape and young sediments as the one that can be found und er Izmit.

As and example, the narrative below follows and earthqake, that took place in the sea, causing some oil tanks to fail and produce an oil spill that pollutes both land and water. At the same time, as a conseqence, a smaller seisimc activity took place some kilometers East, affecting tunnels.

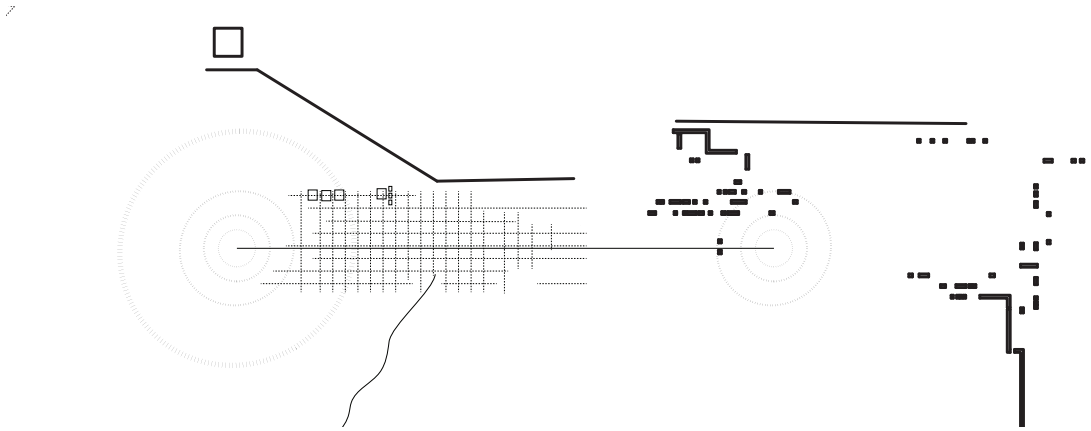

Figure 7: Example of a narrative

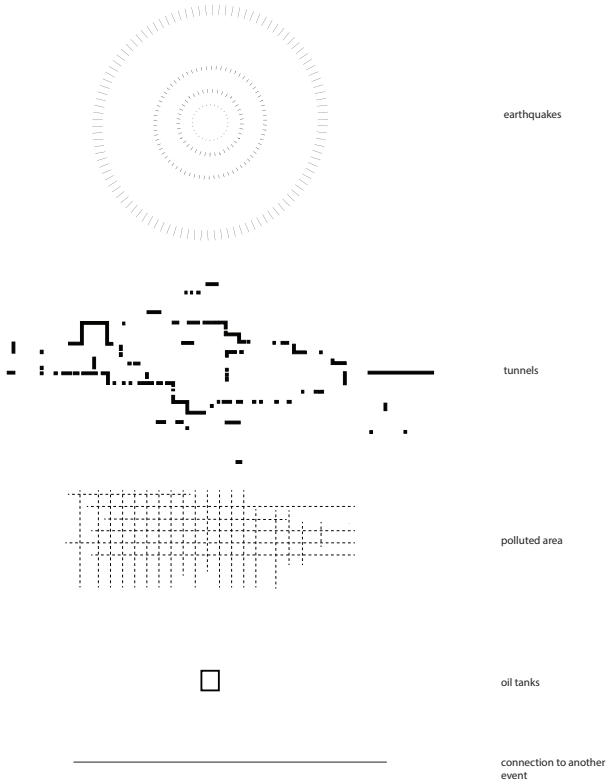

Figure 8: Legend

Reflections

In our collective mapping there were a number of defining moments in the structure of our research. An important one was the early decision for a data driven map; the choice for purely data driven can't be compared to other choices, as we wouldn't have the time, but we do believe it was important that such a choice was made early in the process. Since we already had problems framing our research, this is something that could have only added to the confusion and extraneous information collection. Around halfway through the development of the map, we let go of the data driven approach, and went with a more theoretical and experimental approach, which showed to be too much for us to handle in the time allotted.

Another defining moment was the specification of the faultline and the earthquakes as important factors in the region. Quite early in the process we let go of the idea of researching the soil itself, simply because the region was so interesting in a geophysical manner. In hindsight this is something that could have helped us in gaining a better understanding of the faultline itself, the earthquakes, and even the settlements on the land.

The third, and perhaps most important one, is the moment that we defined our research question and themes completely. This created a structure for us with which we were able to gain a better grasp of all of the research we had found up until that point, helping us organize our thoughts. The map does not fully answer the question we posed, it rather raises more questions and invites the viewer to project other narratives on it. We do not see this as a failure in completing the task, but rather a different approach.

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