ANALYSIS ON GLOBAL SCALE OF CORRELATION BETWEEN RAISE OF THE TEMPERATURE CAUSED BY CLIMATE CHANGES AND VARIOUS TYPES OF NATURAL DISASTER

Autors: Marco Pasini (*), Marco Colombo (*), Fabiano Rinaldi (*), Luigi Passariello (**)

*CRSLaghi: Lake reserch and studes center
**INGV: National Institute di Geophisics and Volcanology, public scientific centre of research of Italian Ministry of Research
*** Ma.Pa.COM: ICT Company committed to the development of high added value solutions based on 4.0 and 5.0 technologies

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Abstract
The study was aimed at studying the relationships between the increase in temperatures due to climate change and the occurrence of natural disasters. The study was carried out with worldwide data to understand how temerature changes, caused from climate changes, influenced Wildfire, Volcanic activity, Mass movement (dry), Landslide, Flood, Extreme weather, extreme temperature, Drought, All natural disasters.

INTRODUCTION
Disasters – from earthquakes and storms to floods and droughts – kill approximately 40,000 to 50,000 people per year. This is the average over the last few decades. While that's a relativelysmall fraction of all deaths globally, disasters can have much larger impacts on specific populations. Single extreme events can kill tens to hundreds of thousands of people. In the 20th century, more than a million deaths per year were not uncommon. Disasters have other large impacts, too. Millions of people are displaced – some left homeless – by them each year. And the economic costs of extreme events can be severe, and hard to recover from. This is particularly true in lower-income countries.We are not defenceless against disasters: deaths from disasters have fallen significantly over the last century as a result of early warning systems, better infrastructure, more productive agriculture, and coordinated responses. As climate change increases the risks of more extreme events, making societies even more resilient will be crucial to prevent our recent progress from reversing. To do so, we need to understand how disaster events are changing, who is most vulnerable, and what can be done to protect them. As a consequence of changing climate, the frequency of natural hazards such as floods, bushfires and intense tropical cyclones has been increasing. While climate change is a phenomenon which is evolving gradually over the long term, extreme natural disaster events are already present. Hence, the adaptation and mitigation of these events are already well recognised (IPCC, 2014). While many governments are seeking remedies, public concern is also becoming a force in the development of adaptation and mitigation measures. Over the past several decades the literature in various disciplines (see, Ford et al., 2011) has provided insights into how the public's short-term behavioural and investment decisions change such as evidenced in farming practices (e.g. Niles et al., 2015; Wheeler et al., 2013). Nevertheless, there is a lack of research addressing climate change and natural hazard effects on the public's long-term investment decisions, particularly where governments have attempted to mitigate their adverse impacts. In this study, we aim at bridging the gaps in the literature by comparing public's long-term investment decision making invoked by climate change and extreme disasters as it relates to property market behaviour.While climate change in terms of rising greenhouse gas (GHG) emissions is a steadily increasing

phenomenon, the frequency of natural hazards attributed to changing climate has also been increasingly globally (Energy and Climate Intelligence Unit, 2017; van Aalts, 2006) and is negatively influencing the value of natural capital and the capacity for sustainable development (Rajapaksa et al., 2017a; Managi and Guan, 2017). The reduction of GHG emissions has been identified as the key remedy by governments and agreement has been reached by them on policies to affect these reductions (Intergovernmental Panel on Climate Change (IPCC, 2014). Indeed, most governments already have implemented mitigation and adaptation policies (Ford et al., 2011). However, public responses to climate change are less clear cut (e.g., Ray et al., 2017) and in general minimal in their effect. However, the experiencing of the increased frequency of climatic hazards (often aggravated by climate change) is shown to heighten the public's climate change risk perceptions and increase their propensity to embrace adaptation measures (Islam et al., 2016; Capstic et al., 2015). Where the public's response has been significant, they have moved away from vulnerable areas where property market values would be affected. For example, after the Tohoku earthquake, despite the action taken by the Japanese government to reduce the impact of radiation, residents are still avoiding certain areas (Munro and Managi, 2017). A reduction in the value of properties damaged by disasters is now a common phenomenon (see Ortega and Taşpınar, 2018; Rajapaksa et al., 2017b). Therefore, disaster-prone areas often request policy action (Rey-Valette et al., 2018). The objective of present work is to explore and analyse climate change and its relation to natural disasters (occurrence and economic impact).For this analysis, global temperature rise is used as an indicator of climate change.

DISSERTATION CONTRIBUTION

The contribution provided with this research activity concerns an investigating example at a global level of the relationships between climate change on the one hand and the occurrence on the other hand of various types of natural disasters, including the economic damage connected to them.

MATERIALS AND MODELS

The source of the global temperature data is obtained by Berkeley Earth. Natural diasaster data is taken from https://ourworldindata.org/natural-disasters (data published by EMDAT (2019): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium) consisting ina complete collection of data, charts, and research on natural disasters and their costs.

DISCUSSION AND RESULTS

The global temperature dataset has monthly granularity. It can be resampled annually to reduce the number of entries, without losing the average temperature information.

In climate science, temperature anomaly represents temperature pattern accurately than absolute temperature. It is a measure of the departure from baseline temperature. Basically, it indicates how much warmer or cooler it is than the baseline. The baseline used here is the average temperature over the 30 year period 1951-1980 (base period used by NASA).

The temperature anomaly values are stored in a new column in the dataframe and the absolute temperature values are dropped.

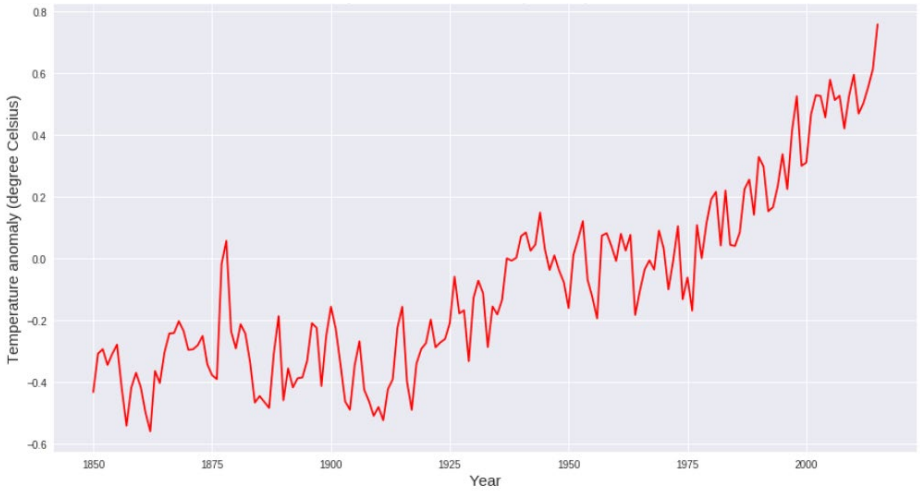

Figure 1- The Warning Earth – Global Anomalies temperatures (annual) for 1850-2015

Plotting the temperature anomaly over the years, clearly indicates the warming of Earth. The warming is more pronounced from about 1920 onwards. In 2015, the Earth is 0.76 degree Celsius warmer than the normal. The result above confirms the scientific consensus that the Earth is warming. Let's explore the natural disaster data and analyse how the occurrence of various types of natural disasters has changed over the years. The 'Entity' column contains 10 types of natural disaster entries and their summation, 'All natural disasters'. For further analysis it is suitable to rearrange the data according to the disaster categories. Global warming doesn't affect the probability of impact by asteroids, meteroites, etc. on Earth. So, the 'Impact' entity can be removed from the dataframe. There are several 'NaN' values which could mean missing values or unreported disaster occurrences. For our analysis, we'll replace them with 0, which means no disaster occurrence and it would also benefit plotting the data.

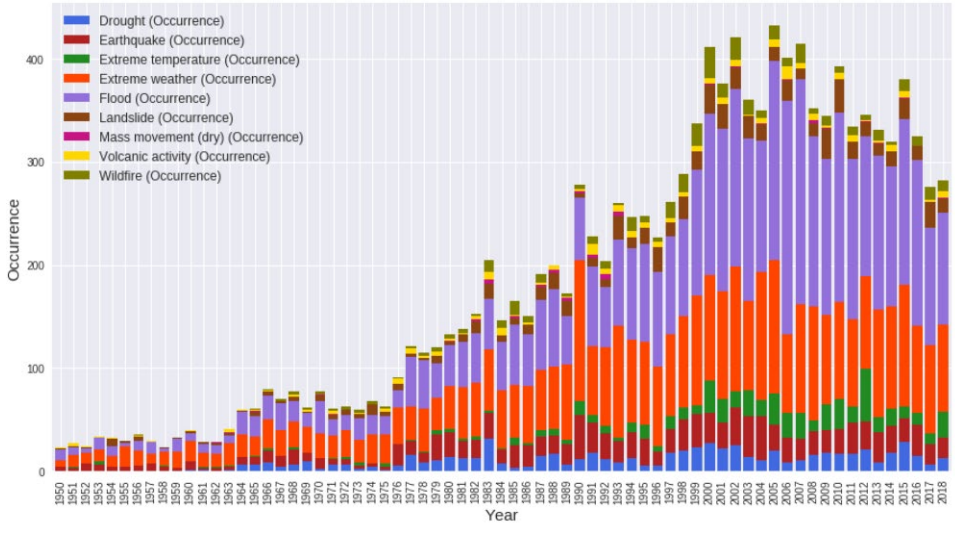

Figure 2. Global occurance of natural disaster

The bar plot above with individual stacks for each disaster category shows that the occurrence of floods has significantly increased over the years relative to other disasters. The next highest increase in occurrence is that of extreme weather followed by earthquakes. The plot also shows that there has been a steady increase in the number of total natural disasters globally. This is more evident from the plot below.

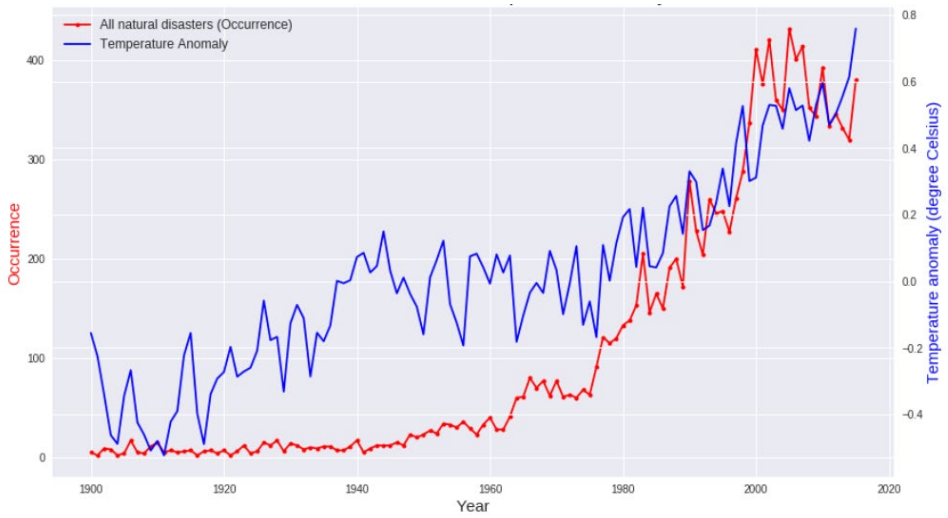

Figure 3, Natural disaster occurences and temperature anomaly between 1900-2015

The above plot indicates a positive correlation between temperature anomaly and the occurrence of natural disasters. Especially after around 1940 when it starts becoming warmer than the normal, natural disasters also start rising globally.Let's also investigate the economic damage caused by natural disasters.

Entity	All natural disasters	Drought	Earthquake	Extreme temperature	Extreme weather	Flood	Impact	Landslide	Mass movement (dry)	Vol act
Year										
1900	30000000.0	NaN	NaN	NaN	30000000.0	NaN	NaN	NaN	NaN	Na
1901	0.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
1902	0.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
1903	480000000.0	NaN	NaN	NaN	NaN	480000000.0	NaN	NaN	NaN	Na
1904	0.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na

Remove the irrelevant columns, rename the other columns and handle the missing values.

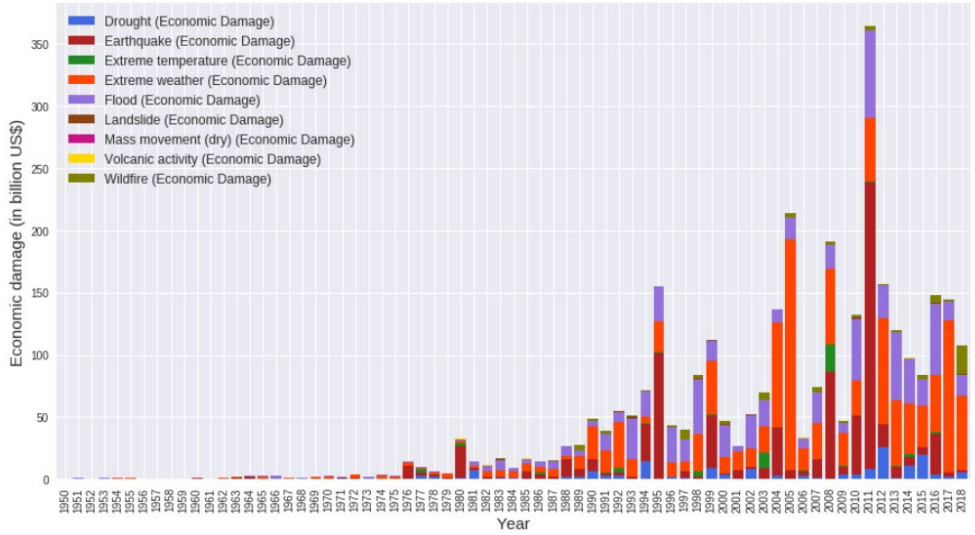

Figure 4, Economical damage from natural disaster tyoe between 1900-2018

Economic damage is highly variable as it depends on several factors such as the disaster type, disaster location, severity of the disaster, disaster management efforts, etc.However, one key trend that stands out from the plot is that the total economic damage from all the disasters is generally increasing over the years. The main reason is the increase in disaster occurrences (correlated with global temperature rise), although all disasters don't contribute equally to the economic damage. Another reason for higher economic damage could be the overall increase in economic growth which leads to more infrastructure, land use, etc.Combine the three main dataframes (global_temp_df, nat_disaster_df and econ_dmg_df) and create a correlation table to measure the correlation between each entity.

A value of 1.0 implies perfect positive correlation, -1.0 implies perfect negative correlation and 0 means no correlation between the two entities. Let's see how temperature anomaly compares to everything.

A better way to visualise all the information in the correlation table is through a correlation heatmap.

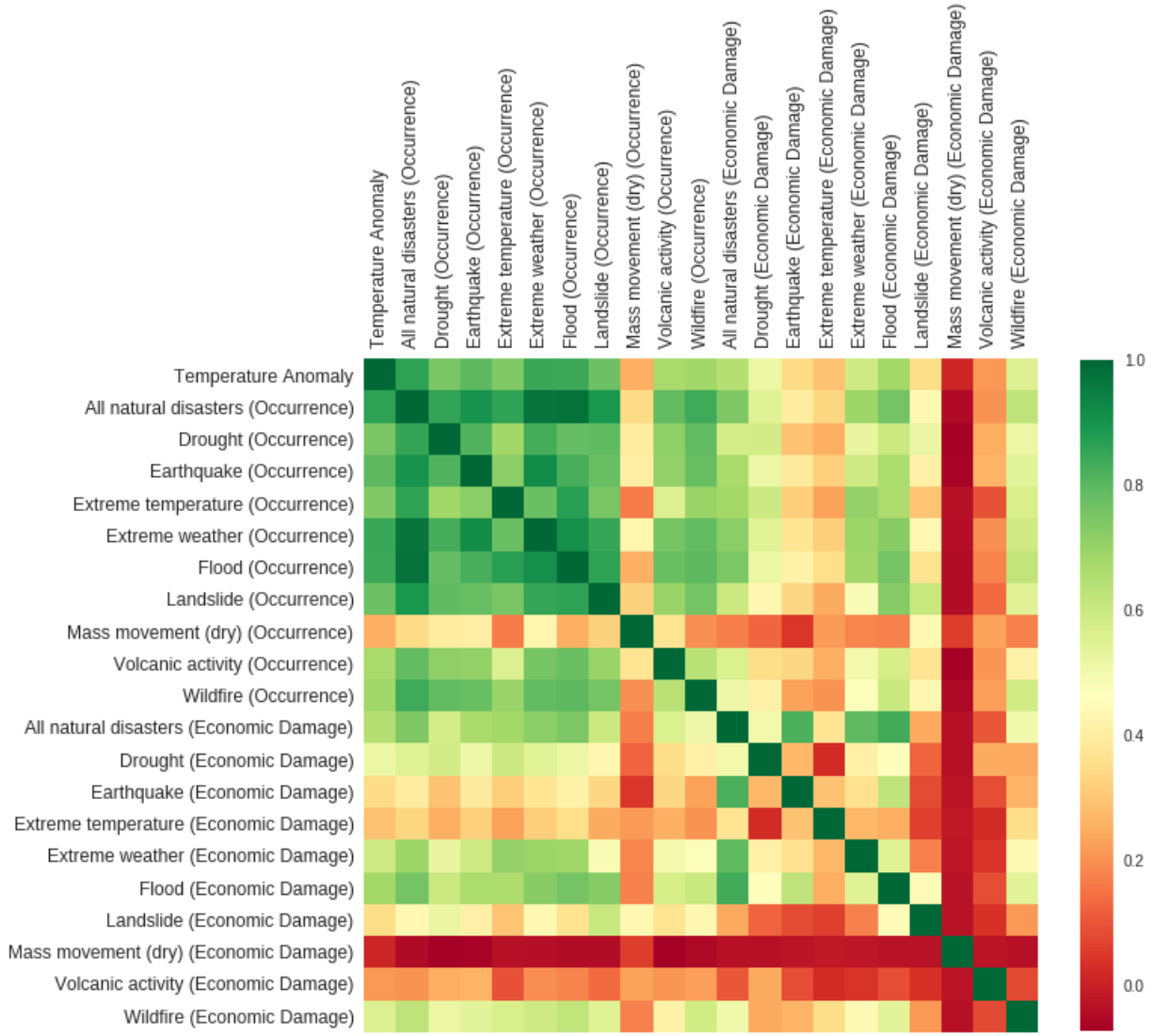

Figure 5. Ccorrelation heatmap

CONCLUSIONS AND FUTURE WORKS

The heatmap and the correlation values confirm that global temperature rise has a strong positive correlation with all types of natural disaster occurrences, except mass movement (dry) and vulcanic activities, We noted also that global temperature has a relatively lower correlation with economic damage.

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