Safety and Security Challenges

Greece scale

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Co-Evolve4BG

Analysis of Threats and Enabling Factors for Sustainable Tourism at Pilot Scale

Safety and Security Challenges

Greece Scale

REGION OF EASTERN MACEDONIA & THRACE

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OVERVIEW

The present document was produced in the framework of **Co-Evolve4BG** project "*Co-evolution of coastal human activities & Med natural systems for sustainable tourism & Blue Growth in the Mediterranean*" in relation to Threats and Enabling Factors for maritime and coastal tourism development on a national scale" Co-funded by ENI CBC Med Program (Grant Agreement A_B.4.4_0075).

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Abstract

This deliverable aims to integrate research and record the Greece territory's safety and security challenges and tailored to its unique characteristics. The risk notion two primary categories are man-made dangers and natural hazards. It is essential to clarify the terms and definitions related to risk and the safety and security challenges. Natural risks refer to the physical dangers that can occur and threaten human lives and infrastructures. Overland floods, Tsunamis, earthquakes, and other perils are the principal hazards that cause the most significant disruption and degradation of people's environment and socio-economic life.

Man-made and Technological risks are related to the industry, transportations, pandemics, political stability, terrorism, war, and other safety issues. Many times, the technological disaster is the secondary effect of the occurrence of a severe natural catastrophe.

In both categories of notions of risk, the losses, except for human lives, represent billions of Euros spent to prevent, mitigate, or eliminate risks.

I. Introduction-Risk Notion

Contemporary humans all over the world are daily confronted with threats, disasters and dangerous phenomena which affect the human environment which he has created and in which he lives, often causing his death or injury, the disturbance of his socio-economic background, but also other adverse effects on the natural environment and therefore on planet earth itself, as a single ecological system. The natural environment and therefore the human societies created within it have always been affected by natural disasters, which are the result of the occurrence of a natural phenomenon (catastrophe) to such an extent that it can significantly and measurably change the existing structure of the environment, at the level of soil morphology, landscape, and the physical functionality of the ecosystems. It can also affect the existing flora and fauna of a defined area, as well as most importantly, adversely affect people's lives, causing infrastructure losses, mainly in the coastal area where most of the activities occurred, which lead to economic losses that ultimately lead to deterioration in people's living standards. The inability of humans to cope with natural and human-made disasters has been recorded since ancient times (as human-made disasters for the bygone years reference is made mainly to wars and pandemics). In addition, it should be noted that history has many recorded events and connections to natural disasters (Atlantis as a mythological reference) and human-made catastrophes (extinction of the Mayan pandemic) that led to the end of the entire civilizations. Thus, modern societies in all countries and internationally have set themselves the primary objective of protecting people from perils and natural disasters or to mitigating their resulting effects.

Disasters do not simply mean the effects of natural phenomena or the consequences of human error that cause them to occur. They are much more a consequence of the human environment, since destructive is only attributed to those phenomena that have a direct or indirect influence on the natural or structured human space and the interactions that shape it. Thus, although disasters are confused and identified with the phenomena that simultaneously trigger them, disasters occur because of the unique vulnerabilities of each society in time and space, combined with its reduced capacity to mitigate or avoid the possible and possible consequences of such an event and to ultimately recover (O 'Keefe *et al.* 1976; Dandoulaki, 2011).

Greece, particularly, has experienced a whole range of extreme, adverse natural events. Among these, seismic disasters, floods, and wildfires exhibited short recurrence intervals and high potential impacts on human sufferings and economic damage. Therefore, these hazard cases are at the top of the agenda of Greek state policies concerning risk management. Concerning these hazards and risks, the Greek government and administration have developed a worth-examining organization and policy-making effort.

I.1. Terms and Definitions of Risk notion

I.1.1. National Definitions concerning Disasters and Risks

1. Hazard:

A potentially catastrophic event, phenomenon, or human activity that could result in loss of life or injury, property damage, social and economic disturbance, or environmental degradation.

2. Vulnerability:

conditions determined by physical, social, economic, and environmental factors or processes, which increase a society's vulnerability to the effects of risk.

3. Susceptibility:

the factors that create the conditions for the development of disaster risk.

4. Resilience:

the ability of a system or society, potentially exposed to potential dangers, to resist or adapt to maintain an acceptable level of functioning and cohesion.

5. Disaster:

serious disruption of the functioning of society, which results in significant human, material, and environmental losses, which exceed the capacity of the affected community to cope with it, with its means and resources.

6. Early Warning:

the provision of early warning and adequate information through competent bodies enables the launch of specific actions to avoid or reduce the impact of risk and prepare for effective response.

7. Coordination:

the organization, prioritization, and monitoring of the required actions, as well as ensuring interoperability, implementation of the rules of operational activities, and cooperation between the stakeholders to achieve a common goal.

8. Prevention:

the set of actions and measures to avoid the potential effects of hazards and minimize natural, technological disasters and other threats.

9. Preparedness:

the set of actions and measures taken in advance to ensure an effective response to disasters.

10. Response:

includes actions, during or immediately after the disaster, to protect people's life and health, meet their immediate lifesaving needs and provide relief and support to mitigate the effects of the disaster.

11. Short-term Relief:

includes actions after a disaster to restore or improve living conditions in the first hours and days after its occurrence.

12. Disaster Management Cycle:

the set of regular and management decisions and operational activities at all stages and phases of the disaster cycle, *i.e.*, prevention, preparedness, response, and recovery.

13. Organized preventive evacuation of citizens (Evacuation):

includes all actions for the preventive evacuation of citizens at risk due to their stay near an area threatened by a catastrophic phenomenon.

14. First Responders:

those who, on a case-by-case basis and locally responsible, is the first to deal with the catastrophic event.

15. Civil Protection Experts:

the specialist scientist or officer certified in fields related to disaster management and response and the calculation of critical factors, such as risk assessment, general risks, vulnerability, and exposure to risk.

16. Emergency:

the sudden and unpredictable threatening situation that requires immediate action to minimize its adverse consequences.

17. National Hazard Mitigation Policy:

an action plan that sets out the final and intermediate targets for disaster risk reduction and the respective evaluation indicators and timelines at the national level. It includes all the necessary actions, procedures, and programs related to all phases of the disaster

cycle and the prevention, preparedness, response, rehabilitation, and feedback of the planning at the local and national level to reduce the risk and strengthen the resilience.

18. Risk:

The potential human, material, or environmental losses over a specified period, which are the result of a combination of hazards, vulnerabilities and deficiencies or appropriate measures to reduce the potential adverse effects.

I.1.2. International definitions concerning disasters and risks

The term disaster, as defined by the United Nations (UN) Secretariat for International Strategy for Disaster Reduction (UNISDR), is the "serious disruption of the functioning of a community or society, which includes extensive human, material, economic and environmental damage, and its consequences, which exceed the capacity of the affected community or society to deal with them using its resources" (UNISDR, 2009).

Hazard is defined as a dangerous phenomenon, substance, any human activity, or situation that can cause loss of life, injury, health effects, property damage, loss of goods and services, social and economic disruption and environmental damage. The threats raised under the Hyogo Framework for Action 2005-2015 as defined by the UN are "naturally occurring threats and related environmental and technological threats and hazards" (ISDR, 2005). Such threatening phenomena come from several geological, meteorological, hydrological, marine, biological, and technological sources which combine. Disaster occurs when vulnerable populations are exposed to these threats.

The present study follows the categorization of threats/risks as reported by the UN, where it is pointed out that:

- Physical threat: "is the natural process or phenomenon that can cause loss of life, injury or other health effects, property damage, loss of goods and services, social and economic disruption and an environmental disaster" (UNISDR, 2009).
- Technological threat: "is the threat arising from technological or industrial conditions, including accidents, hazardous processes, infrastructure failures or specific human activities that may result in loss of life, injury, disease or other health effects, material damage, social and economic upheaval or environmental damage" (UNISDR, 2009).

I.2. Increase of Threats and Vulnerability

The leading cause of the observed increase in threats is climate change and the consequent degradation of the environment, which have caused an increase in the occurrence of natural phenomena. Disaster management experts have observed a significant correlation between the loss of natural sites (*e.g.*, wetlands, forests, hydrological networks, coastal area) and the abnormal fluctuations of the average

global temperature, initially due to the industrial revolution that continues today with the overexploitation of natural resources. These fluctuations, among other things, cause dynamic changes in many significant physical hazards, the occurrence of which is observed at increased frequency and intensity (Coppola 2007). Similar upward trends are observed in technological disasters, although in recent years, they seem to be stabilizing.

Modern societies present an ever-increasing vulnerability that is the result of several factors. According to the most relevant literature, overpopulation combined with environmental degradation and climate change is the leading cause of increasing vulnerability. The upward trend in world population of around 3 billion in the 1960s (The World Bank, 2015) has now more than doubled to over 7 billion. According to the population growth calculation models, it is estimated that in 2050 it will undoubtedly exceed 9 billion, and respectively in the year 2100, it will exceed 10 billion (United Nations, 2011).

The ever-increasing vulnerability of the population is not only due to its increase but to uncontrolled urbanization. Many rapidly growing megacities (more than 10 million) are located in disaster-prone locations. Usually, coastal cities of high seismic risk, exposed to strong winds and sudden floods (Krass, 2003).

I.3. Recorded Trends

The recorded disasters and their study reflect the trends that are emerging. These trends are observed worldwide and prove that:

The Total Number of Individuals Exposed to Risks and Affected by Disasters is increasing. The people constructed (Table 1) their settlements in places where they could meet their basic needs regarding food, water, their ability to protect and defend themselves, and the ease of doing business with other sites. The potential risks were simply a “necessary evil” or element that could be managed (albeit with some acceptable losses), so they were not considered when selecting and creating cities. Urbanization combined with overpopulation is primarily responsible for land use in these areas, from rural to urban. It is predicted that more than 75% of the world’s population, around 2000 live in areas at risk of at least one natural threat. As a result, as these areas periodically experience major disasters, it follows that the number of people affected by disasters each year is getting higher (UNDP, 2004).

The Number of Disaster Victims is declining, in contrast to the recorded increase in human exposure to natural phenomena (Fig. 1), which is inferred from the increase in the number of disasters, the use of new technologies brought by advances in science and technology in disaster management has allowed their effects to be mitigated. The visible statistical results are that while the number of disasters is three times higher than in 1970 onwards, the number of casualties has been reduced by about half (Coppola, 2007). One of the main reasons for the inverse relationship between disasters and losses is that better organized and scientifically sound campaigns inform and

prepare the population to cope with disasters. In addition, another cause is the improvement of the response time before an impending catastrophe through early forecasting and warning—for example, Pacific Tsunami Warning Center (PTWC), operated by the United States NOAA in Ewa Beach, Hawaii.

Table 1. Top-10 Country-Natural disasters by number of deaths in 2007 (Padli *et al.* 2009)

Type of disaster	Country	Number of death
Cyclone Sidr, November	Bangladesh	4,234
Flood, July-August	Bangladesh	1,110
Flood, July-September	India	1,103
Flood, August	Korea, Dem P Rep	610
Flood, June-July	China, P Rep	535
Earthquake, August	Peru	519
Heat wave, July	Hungary	500
Cyclone Yemyin, June	Pakistan	242
Flood and landslides, June	Pakistan	230
Flood, July	India	225

Source: EM-DAT: The OFDA/CRED International Disaster Database.

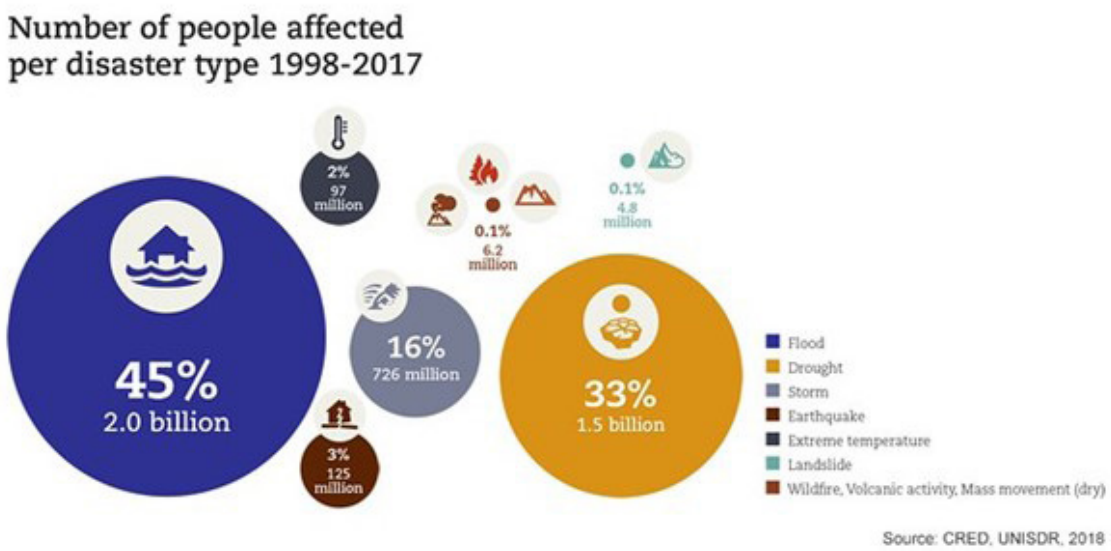

Figure 1. Number of people affected by each corresponding type of disaster in the period 1998-2017 (CRED, 2014; UNISDR, 2009)

Furthermore, nowadays, there is a more significant concern for protecting people against dangers (Fig. 2). An example of this concern is the construction of shelters to protect the population. Finally, after a disaster, the creation of response and rescue mechanisms is mentioned as secondary practices, all simultaneously with emergency plans and evacuation of residential areas.

Disasters are getting more and more costly. The cost of disasters does not leave countries indifferent to the world, because the economic damage caused by any disaster is constantly increasing, whereas before 1975 it rarely exceeded one billion dollars, while today, more and more disasters far exceed this amount. Globally, it has been recorded that since 1990 and almost every year, the total cost of disasters tends to exceed $ 50 billion / year (Birkmann *et al.* 2011, CRED, 2014).

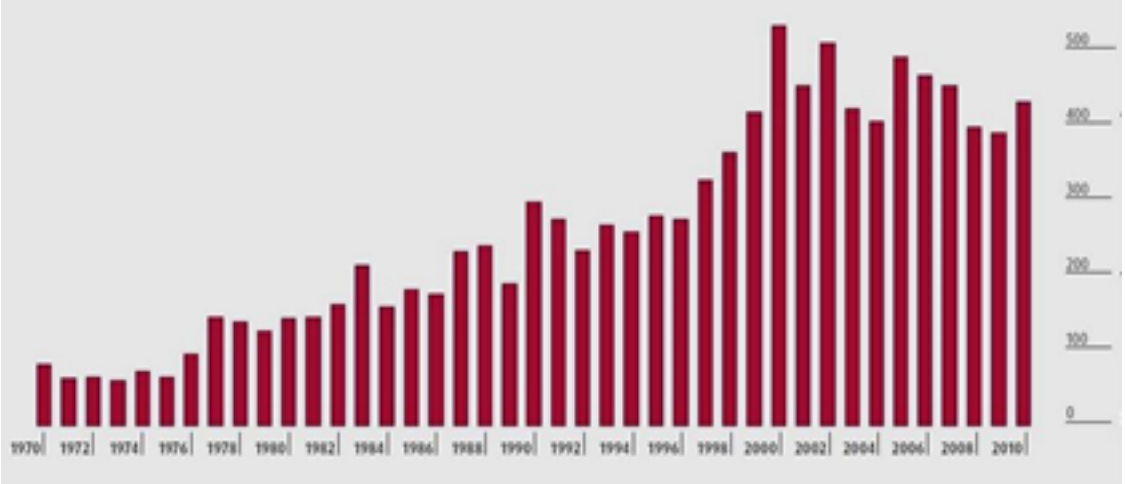

Figure 2. Total number of recorded natural disasters from 1970 to 2010 (Birkmann *et al.* 2011; CRED, 2014).

I.4. Vulnerability and Disasters

An inverse relationship is recorded between the level of development of a country and the victims of disasters, which occur all over the world. About 95% of their victims come from the least developed countries (Van Westen *et al.* 2013). This is because, in less developed economies, governments cannot afford to build disaster-resistant housing for their citizens, while at the same time relocating settlements, which are home to the poorest people or even those below the poverty line, in areas of high risks, such as coasts affected by hurricanes and gravity waves, or in areas adjacent to hazardous industrial installations. We conclude that the number of disaster victims worldwide is related to the income class of the affected people. Extreme droughts, earthquakes, floods, and windstorms are the most common causes of death. Therefore, the lower/more inferior income groups are much more vulnerable to risks, on the one hand, because they lack mechanisms to resist and mitigate the risks. On the other hand, they do not have the financial resources to build new homes and modern and sustainable infrastructure (Paidakaki, 2011).

The ever-increasing vulnerability of the population is due to its increase, but other factors cause this recorded increase. A key reason is an intense rate of urbanization (Fig. 3; United Nations) and, more specifically, uncontrolled urbanization, especially in areas where they have high-risk characteristics and harm, increasing the vulnerability of people to any risk and potential threats. Many rapidly growing megacities (over 10 cm) are in disaster-prone locations. Usually, coastal cities of high seismic risk, exposed to strong winds and flash floods (Krass, 2003), creating complex parameters and being essentially a challenge for disaster design and management experts.

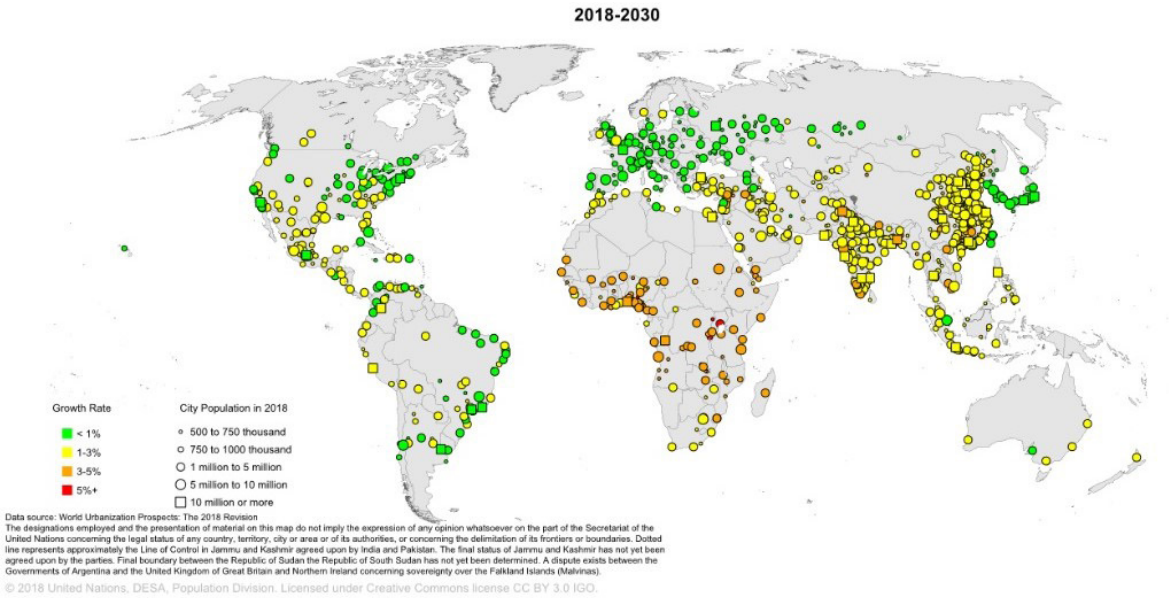

Figure 3. Estimation of the world population for 2018-2030, distributed in the largest cities - urbanization phenomenon (United Nations, 2011).

I.5. Risk Assessment

The risk assessment process aims to create zones/areas where the probability of disasters of all types is considered high. In addition, possible secondary phenomena must be assessed, which will occur due to the primary disasters.

One form of the conceptual approach to risk is summarized by UNISDR, followed by the terms of the UN equation with their definitions (UNISDR, 2009):

Risk = hazard * Vulnerability * Exposure

Risk = The combination of the probability of an event and its negative consequences.

Hazard = dangerous phenomenon, substance, human activity, or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Vulnerability = The characteristics and circumstances of a community, system, or asset make it susceptible to a hazard's damaging effects.

Exposure = People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.

The frequency of their occurrence determines hazards and the intensity they present during them. Intensity refers to the magnitude of the severity of a phenomenon during its occurrence and development (*e.g.*, wind intensity in Beaufort climates), and frequency refers to the number of recurrences of the phenomenon within a predetermined time range (*e.g.*, one year). A primary role for analyzing disasters is played by determining the location of the phenomenon's onset, which plays an essential role in the occurrence of the phenomenon and its course of development.

The term "elements at risk" refers to the population, real estate, and movable property, services, and in general to any other tangible and intangible property that is exposed to disasters in a clearly defined geographical area. The choice of method by which these vulnerable elements are categorized expresses our perception of the disaster threat and its approach. The interaction of risk with the factors exposed to it during one's actions at the same time determines the magnitude of the potential vulnerability they present, often in the form of an estimate, since it has been observed that the exposure is generally superior to factors that they cannot be calculated before the disaster (*e.g.*, the behavior of materials after years). For there to be interaction, it is of course necessary that these two elements coexist in the same space (Van Westen *et al.* 2013).

Finally, vulnerability is determined by "the characteristics and conditions of a community, system or assets that make them vulnerable to the harmful effects of risk" (UNISDR, 2009). Vulnerability is the common component of physical, social, economic, and environmental vulnerability. Therefore, its analysis requires a multifaceted approach, both qualitative and quantitative, the use of indicators, *etc.* (Van Westen *et al.* 2013).

II. Natural risks

Natural disasters are caused by natural phenomena that occur after rapid or slow events. That may be of geophysical origin (earthquakes, landslides, gravitational waves, and volcanic activity), hydrological (avalanches and floods), climatological (extreme temperatures, droughts, and fires), meteorological phenomena (hurricanes and storms), or biological events as pandemics/epidemics of diseases, such as Covid-19 and Ebola virus or animal epidemics (IFRC, 2014).

Natural phenomena that cause natural disasters are described by elements that characterize quantities such as the intensity of the phenomenon, the speed of the event expression, its duration, and the extent of the affected area. For example, a tsunami is a relatively small, usually short-lived, and rapidly occurring phenomenon, in contrast to drought, which often occurs over a long period as it develops slowly. In addition, it is no exception that threats are interconnected. The occurrence of a natural phenomenon is at the same time the trigger for the occurrence of another new event such as a gravity wave after an earthquake or a flood caused by a hurricane (UNISDR, 2009).

The EU and, more specifically, the DRMKC - Disaster Risk Management Knowledge Centre has introduced a risk index used at a country level and named INFORM. First was introduced in 2012 and now has released its 4th edition.

INFORM's concept and methodology are based on a multi-layered and structured model which, by measuring 54 different indicators, results in a composite indicator valid at the country level. The INFORM Risk model adopts the three aspects of vulnerability reflected in the UNISDR definition. The Greece risk profile is illustrated in the Figure 4 and the analysis of each one of the indicators in Figure 5.

A flood is a condition in which normally dry areas are covered by volumes of water for a specified duration. The flood volumes of water come from rainfall (Fig. 6), river overflow, the inflow of the sea into coastal areas, or the breaking of a dam. Likewise, a brief definition of the concept of a flood, as given in European Directive 2007/60/EC, entitled "Risk Assessment and Management" Flood "is defined as follows: Flooding is the temporary covering by water of a part of the land which, under normal conditions, is not covered with water. This term must include floods from rivers, streams, floods from the sea to coastal areas and can exclude floods from sewer systems".

Flood types are classified into the following categories, depending on the origin of floodwater; floods are called rivers, tidal (sea), or lake floods. Depending on the flood's time of creation and passage begins in slow and sudden or immediate response (flash floods). Depending on the main reference area, they are called urban or outdoor. The unique relief patterns, the large and complex coastline, and the plenty of islands in Greece guide numerous small-sized abrupt hydrological basins. Most of the streams have temporary flow, characterized by non-permanent surface runoff, often raised percolation (due to the dominance of karstic formations, covering 40% of the Greek region), and flash floods. On the other hand, a short number of medium-scale watersheds (of the range of few hundreds to few thousands of km^2) with constant flow rivers.

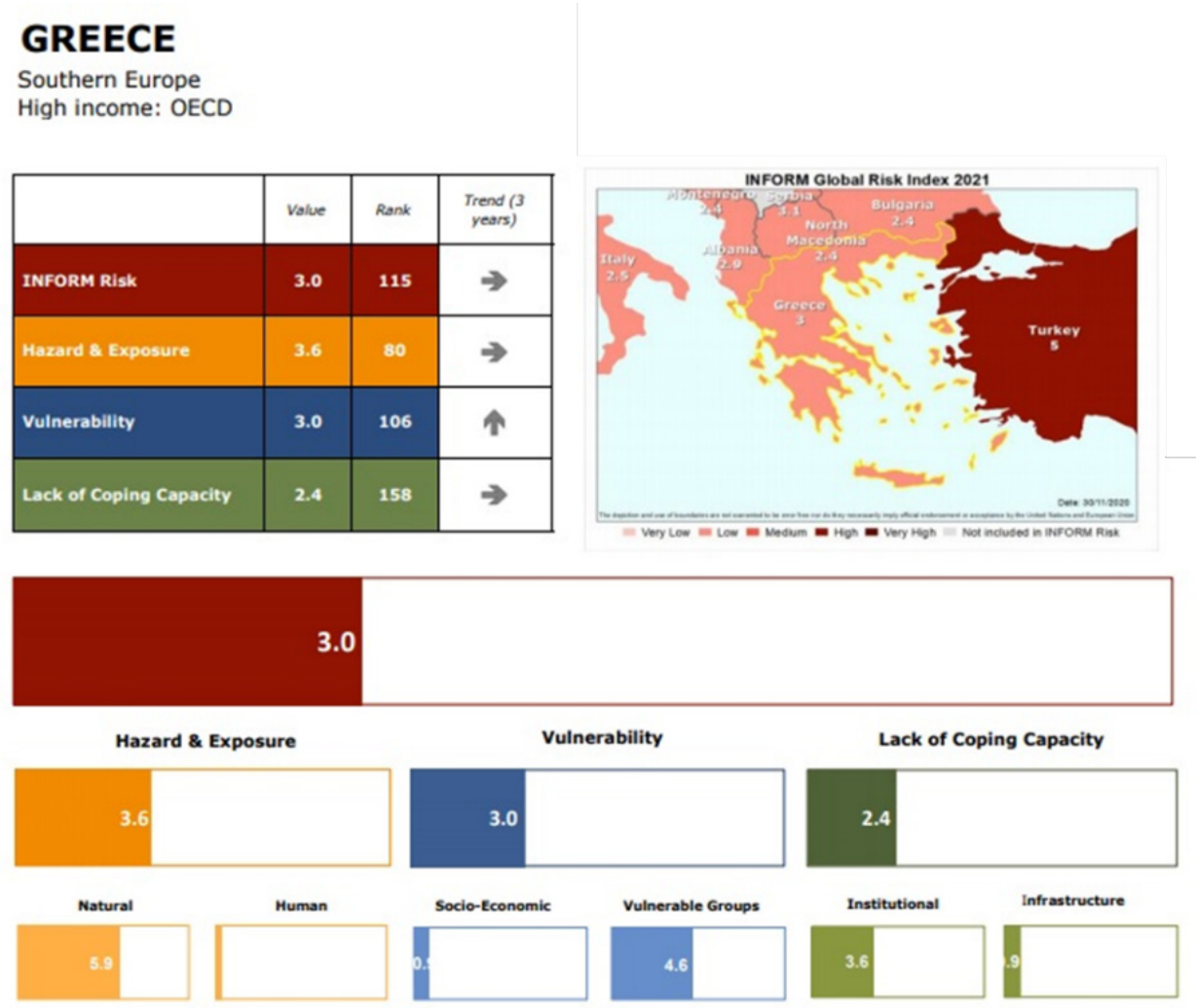

Figure 4. INFORM Risk Index Greece Risk Profile
(source: https://drmkc.jrc.ec.europa.eu/)

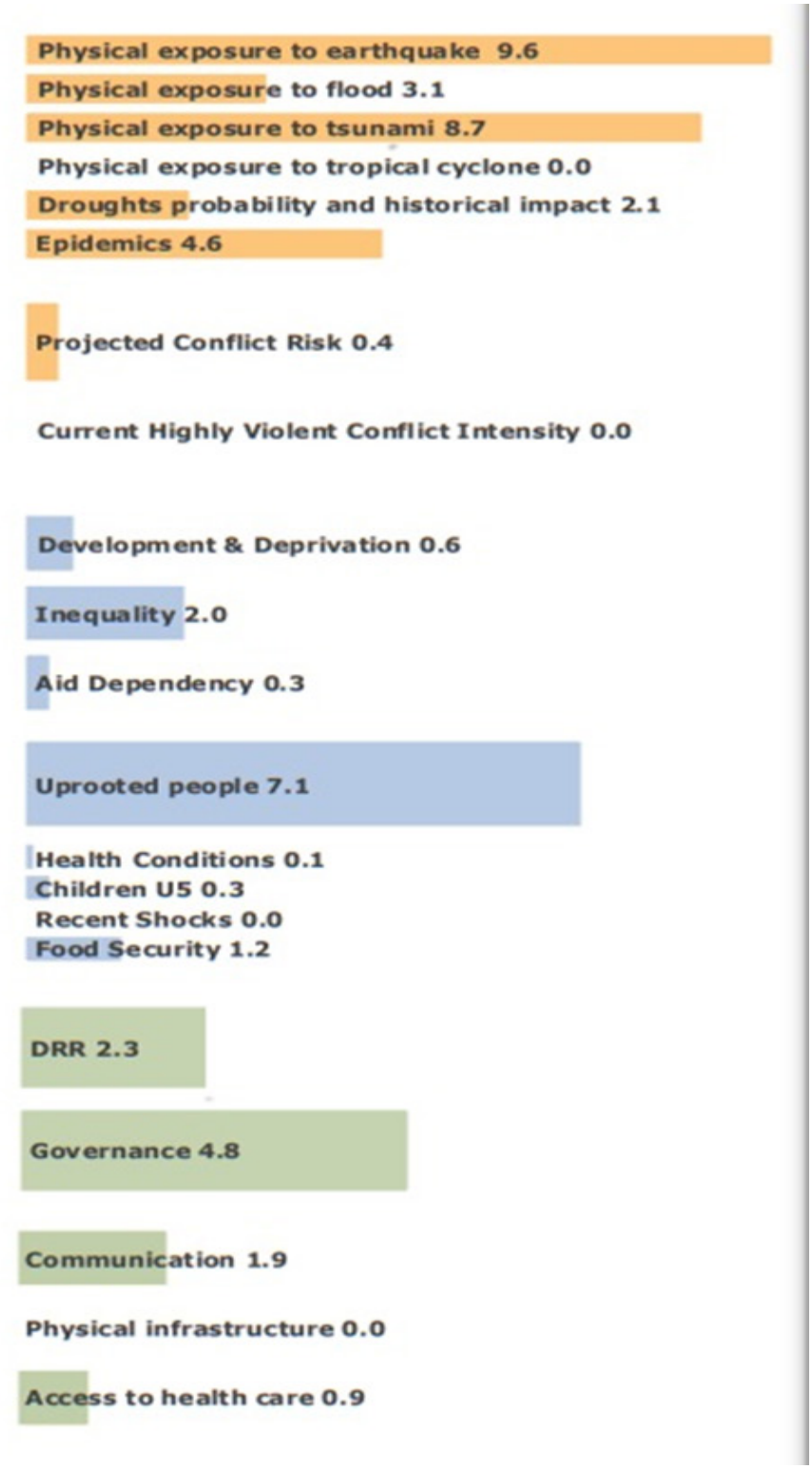

Figure 5. INFORM Risk Index Greece risk profile analysis (https://drmkc.jrc.ec.europa.eu/)

Most of them lie in the W and N parts of the country. Significantly, the principal rivers in Macedonia and Thrace (Evros, Strymon, Nestos, Axios) are transboundary. In contrast, most of the rest big rivers (Acheloos, Aliakmon, Peneios, Arachthos, Aheron, Louros) are found from the Pindos Mountain range and extend beyond the Greek territory except one (Aoos, which flows toward Albania). A record of the 20 largest rivers (according to basin area) in Greece is given in Table 2. The type of rainfall regime and physiographic and morphological features of the basins give rise to notable variations in the runoff and flood reproduction mechanisms. So, in some basins, the mean annual equivalent runoff (*i.e.*, runoff quantity per area) exceeds 1,000 mm (a very great value, usually found only in tropical regions), while this amount is one order in some other cases magnitude lower or even less (Koutsoyiannis *et al.* 2008).

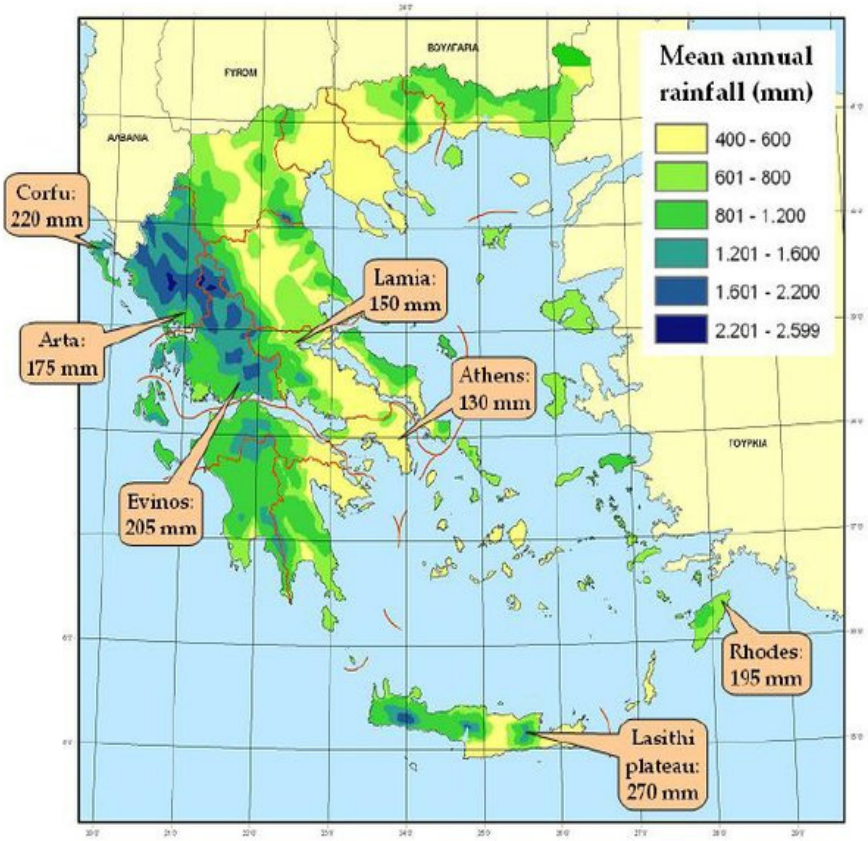

Figure 6. Geographical distribution of mean annual rainfall in Greece and estimates of 24-hour rainfall depth for 50-year return period at characteristic locations (Koutsoyiannis *et al.* 2008)

Coastal flood is defined as the temporary seawater coverage of a part of the land not covered by water under normal conditions. Winds created by thunderstorms or strong depressions can generate waves that penetrate the ground and cause significant flooding. The extent of the coastal flood is a function of the height of the water that enters and is regulated by the topography of coastal areas exposed to floods. Due to

climate change and rising sea levels, the severity and the regularity of floods are increasing. More specifically, the coastal ones, low-altitude areas, and small islands are at greater risk for floods than others. Floods are particularly adverse in degraded coastal areas and more generally in areas prone to natural disasters.

Coastal floods are a natural occurrence. However, human influence in the coastal environment can worsen coastal floods. Extraction of water from groundwater reservoirs in the coastal zone can affect the elevation of the land, thereby increasing the risk of flooding. Possible protection projects along the coast, such as sea walls, change the natural processes of the beach, which often lead to erosion in nearby coastal areas, which also increases the risk of flooding. Coastal floods can occur from various causes, including storm surge or meteorological tides created by storms such as hurricanes and tropical cyclones, sea-level rise due to climate change, and tsunamis.

The coastal zone (the defined area at 100 km from the coast and with an altitude of 100 meters) hosts a significant and growing percentage of the world population and financial activities. Over 50% of the world's population and 65% of cities with over five million people are in the coastal zone. Except for the critical number of people at risk of coastal flooding (Fig. 7), these coastal urban centers provide a substantial percentage of the world's Gross Domestic Product. Their lives, houses, industries, and infrastructures in cities, such as roads, railways, and industrial facilities, are affected by coastal floods with tremendous possible social and economic costs. The recent earthquakes and tsunamis in Indonesia in 2004 and Japan in March 2011 clearly show the destruction that floods can cause in the coastal area. Indirect financial costs can arise if sandy beaches of economic interest are damaged, thus, leading to the loss of tourism in regions that depend on the attractiveness of these beaches.

In Greece, flood phenomena are caused by intense rainstorms generated by the entrance of depressions, probably accompanied by cold fronts, typically approaching from the west. Convectional weather types (characterized by a hard higher air mass that creates dynamic variability) are also accountable for several intense storms and flash floods, particularly in the summer period (Mamassis and Koutsoyiannis, 1996). Snowmelt-driven floods are rare in Greece.

Although the western regions are stormy, extreme floods are also common in Eastern Greece and the Aegean Islands. This reveals that, as we move from the west to the drier hydroclimatic regions of the east, the rainfall severity of storms remains high.

Coastal floods can lead to a wide variety of environmental effects at different spatial and temporal levels. Floods can destroy coastal habitats such as coastal wetlands and Estuaries Rivers and can erode dune systems. Besides, these Coastal structures are the natural means to protect the coast against the waves of storms. The continuous coastal floods and the rise of its level may reduce this natural protection, allowing the waves to penetrate greater distances inland, worsening erosion and pushing forward coastal floods. After flooding, the extended penetration of seawater can also cause the salinization of agriculturally fertile soils, thus leading to lost productivity for long periods.

Coastal freshwater, including lakes, lagoons, and coastal aquifers freshwater, can also be affected by saltwater intrusion. This saltwater can destroy these water systems as habitats for organisms, freshwater, and drinking water sources for peoples (http://floods.ypeka.gr).

Table 2. List of 20 most significant rivers in Greece (Koutsoyiannis *et al.* 2008)

	River	Basin area (km^2)		Length (km)		Mean annual runoff	
		In Greece	Total	In Greece	Total	Volume (hm^3)	Depth (mm)
1	Peneios (Thessaly)	9500		205		2558	269
2	Aliaknon	8813		314		2724	309
3	Strymon	5990	16787	118	430	4063	242
4	Acheloos	4812		240		4383	911
5	Alpheios	3570		110		2100	588
6	Evros	3344	52788	204	639	12065	229
7	Nestos	2429	6130	130	192	3140	512
8	Aoos	2154		70	260	2200	1021
9	Arachthos	2000		128		2280	1140
10	Boeoticos Kephisos	1956		98		286	146
11	Kalamas	1900		115		1900	1000
12	Spercheios	1830		80		693	379
13	Evrotas	1738		80		760	437
14	Axios	1636	22250	76	350	3024	136
15	Filiouris	1486				154	104
16	Loudias	1251		60		95	76
17	Evinos	1163		92		917	788
18	Gallikos	1055		70		54	51
19	Peneios (Heleia)	1026		72		427	416
20	Mornos	974		58		404	415

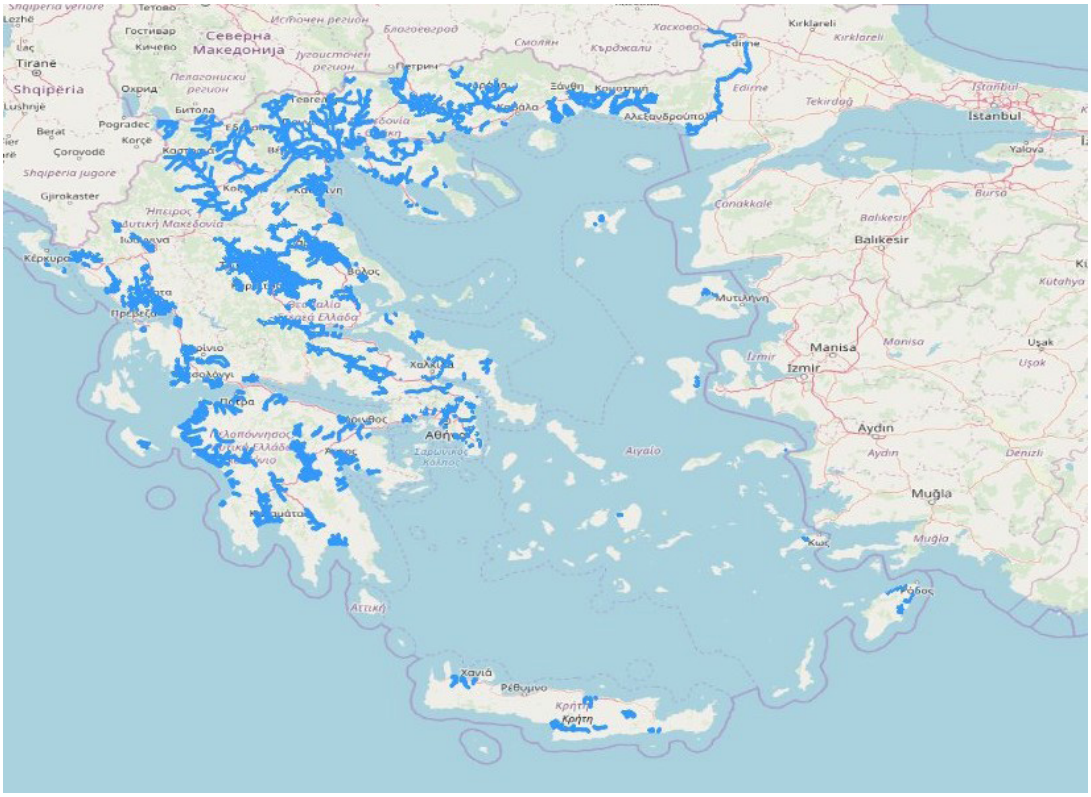

Figure 7. Flood Zone from Inland Waters recovery period T = 50 years (http://floods.ypeka.gr/)

II.1. Earthquake Risk

From a geodynamics perspective, Greece and its neighboring areas compose the most active area of the eastern Mediterranean and Europe. The main geotectonic features entail (a) Continental concentration, including the subduction of the oceanic part of the North African plate under the European plate (Fig. 8), connected with solid crustal shortening and an uplift rate of a few mm/yr. adjacent to the Hellenic Arc due to accumulation of sediments of the African plate under the overriding Aegean plate; (b) extensive, high-rate expansion in the back-arc area due to the rollback of the subducting African slab; (c) meaningful right-lateral strike-slip movement along the North Aegean trough (NAT), and the Cephalonia-Lefkada Transform Zone (CTFZ), which is due to the offset within the oceanic-continental convergence in the west and the westward distribution of the Anatolian plate in the east.

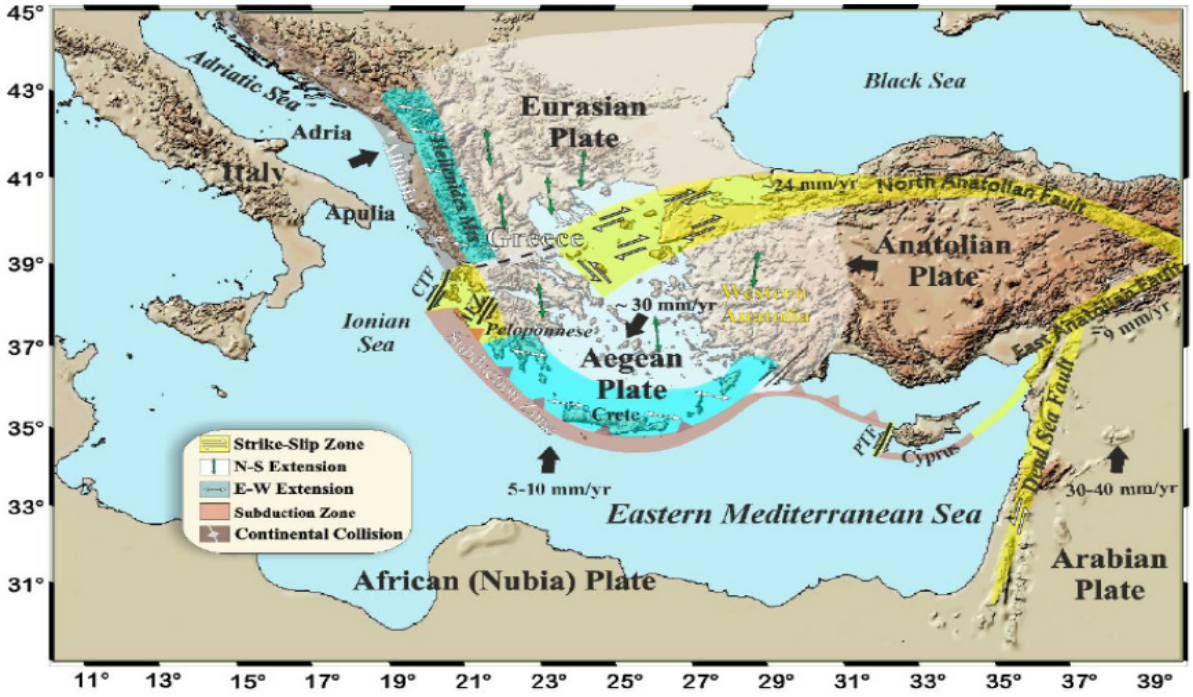

Figure 8. A sketch of the significant kinematic boundaries within the eastern Mediterranean, with the rates of motion relative to Eurasia. CTF: Cephalonia Transform Fault zone; AFZ: Achaia Fault zone; PTF: Pafos Transform Fault zone (Figure modified from Papazachos *et al.* 1998).

The fault length and rupture character data can be used to evaluate the peak anticipated magnitude and average co-seismic displacement, using relevant empirical relations. This type of information is beneficial in planning land use and designing infrastructures and critical facilities close to or across active faults (Fig.9).

Greece presents high seismic vulnerability as it is one of the most seismically active regions in Europe. The analysis of physical risks and current socio-economic conditions shows a perilous ongoing situation. Vulnerability is a concept that refers to a set of general or considerable conditions formed of physical and socio-political factors that negatively affect an individual, household or society capability to mitigate, prepare and respond to an earthquake emergency. The range of physical damage and social disruption in periods of crises is the measure of the society and nation's resilience (Kassaras *et al.* 2020).

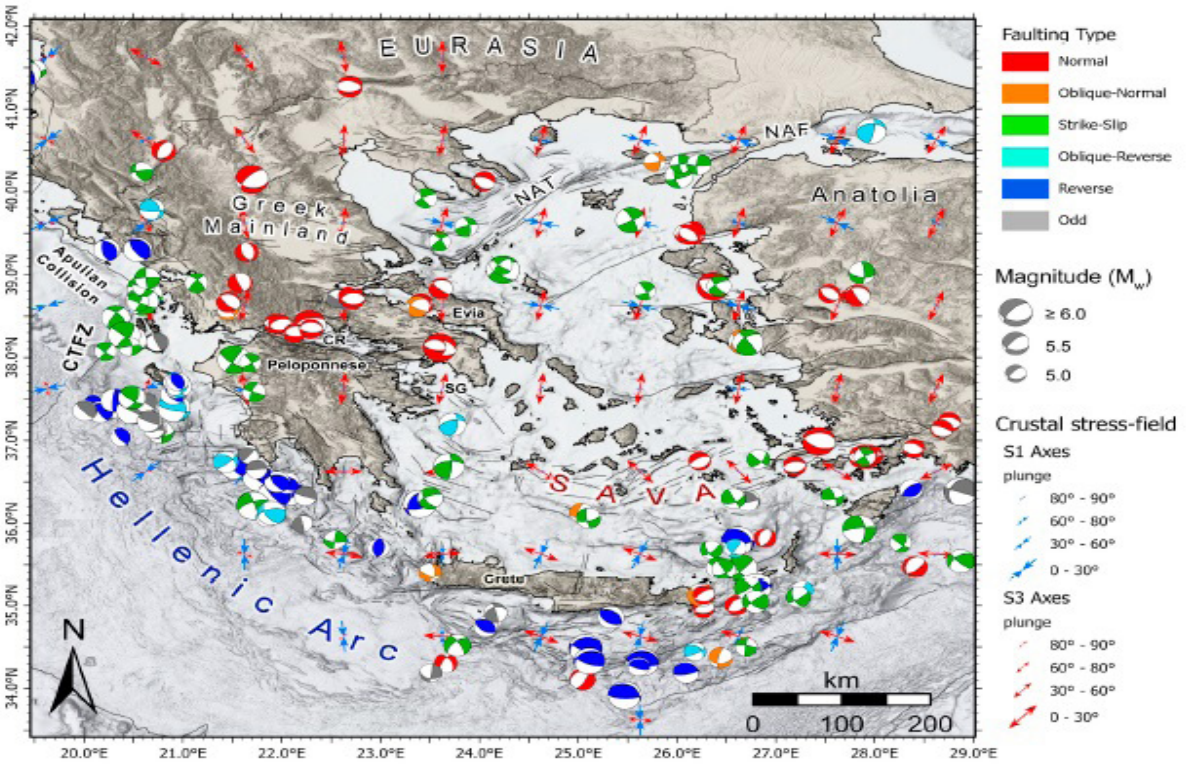

Figure 9. Summary map showing the main seismotectonic features of the Greek region. Blue and red arrows indicate the trend and plunge of the significant (S1) and minor (S3) principal stress axes. CTFZ: Cephalonia Transform Fault Zone, NAT: North Aegean Trough, NAF: North Anatolian Fault, CR: Corinth Rift, SG: Saronikos Gulf, SAVA: South Aegean Active Volcanic Arc. (Kassaras et al. 2020)

Regarding the physical vulnerability aspect, Greece's status presents significant vulnerability as about 80% have been constructed before 1985 without or with a reduced earthquake-resistant design (ERD; Pomonis *et al.* 2012). These have been verified as quite susceptible and in need of strengthening measures that are lacking. The pre-seismic investigation appears problematic, and although the central government ordered a fast-track inspection of all public buildings following the disastrous 1999 Athens earthquake, barely 15% of them have been examined today. Furthermore, 50% of schools and hospitals were built before the present-day building code. At the same time, an urgent issue exists for the industrial buildings, whereby mandatory inspections are not performed and are often inappropriate for use or are operated without a license.

Another vital aspect of the issue at hand is the distribution of incorrect information by the mass media, which has to do with social vulnerability, often amplifying the seismic phenomenon, thus producing a cloud of chaotic perspectives, raising stress and insecurity. Awareness of the population is dependent mainly on the earthquake monitoring potential. The public information about earthquake activities has been

improved in Greece, combining a permanent seismological system and two accelerometric networks. As a result, news of the public is quick and trustworthy, achieved within the electronic media in a few minutes after the appearance of earthquakes (*e.g.*, http://www.geophysics.geol.uoa.gr).

In Greece, the outbreak of an earthquake hazard has shown to be a catalytic factor for changes – short-term though- in the socio-cultural mentalities of the stricken community. Seismic disasters reverse prevalent convictions among the stricken community, particularly those choosing the constant loss of land. Earthquake disasters lead to solidarity and social cohesion and remind that primary needs and necessities for safety, shelter, health, and food are not fulfilled and secured forever, even though the human society stands vis-a-vis natural surroundings.

II.2. Tsunami Risks

Tsunamis are violent waves triggered by other natural hazards, such as earthquakes, underwater or coastal landslides and volcanic activity. These hazards can create a severe disturbance in the water mass, giving it high energy, ending in enormous waves (Witter *et al.* 2003).

Nevertheless, the main cause of tsunamis in the world is earthquakes. Their violence is directly related to the characteristics of the earthquake, which are the length, magnitude, focal depth, and direction of the surface rupture of the activated fault. Larger tsunamis are related to the geodynamic process of subduction zones along convergent plate boundaries (Ambraseys and Synolakis, 2010). The characteristics of the central waves of tsunamis are like those of waves generated by the wind, but the speed at which they can move is remarkably high, reaching up to hundreds of km/h (Bryant, 2014). Tsunamis can sustain their kinetic energy over lengthy distances, allowing them to spread in any direction and potentially affect any coastal area. In addition, the height of the waves at the beginning of their development is significantly higher than that of regular waves and can reach, in extreme circumstances, tens of meters.

Two principal features of a tsunami wave, describing its risk potential, are the run-up and the inundation zone. The run-up displays the maximum vertical distance among the mean sea level and the highest spot to which the flood zone spreads inland and indicates a short-term sea-level rise affected by a tsunami. In other words, run-up describes the maximum elevation at which the inundation flows can end. Inundation zone is designated as the maximum horizontal intrusion of flood flows in the coastal area (Papadopoulos, 2014). Both characters are positively associated with the magnitude of the earthquake and reveal the intensity of the tsunami. In addition to components, as mentioned earlier, flow depth and velocity are critical factors affecting potential damage to the building (Kelsey *et al.* 2002).

In Greece, the responsible organization for monitoring, recording, and protecting against tsunami risk is the Hellenic National Tsunami Warning Centre (HL-NTWC). The HL-NTWC belongs to the Institute of Geodynamics of the National Observatory of

Athens (NOA-IG), the head earthquake analysis and monitoring Centre in Greece. The tsunami warning services are offered nationally and at the international level. The HL-NTWC is one out of four accredited Tsunami Service Providers (TSPs) operating in the region of the North-Eastern Atlantic, the Mediterranean, and connected seas Tsunami Warning System (NEAMTWS). The HL-NTWC offers tsunami investigation, knowledge and training, develops monitoring systems and other infrastructures, provides 24/7 tsunami warning services for the Eastern Mediterranean and Greece, and actively participates in international inspections, communications and exercises.

The recent history of HL-NTWC goes back to the 1990s but only to 2010. The state authoritatively established it while it declared operational in August 2012.

Tsunami Warning Centre (HL-NTWC) is the Hellenic Unified Seismic Network (HUSN). NOA-IG coordinates HUSN, which incorporates more than 150 seismic stations (Fig. 10) contributed by the NOA-IG's national Hellenic Seismic Network (HL) and other local seismic networks run by university laboratories (http//bbnet.gein.noa.gr/HL/). Moreover, seismic stations established in Greece and bordering countries that belong to interconnected, collaborative associate networks, such as GEOFON (GE), MEDNET (MN), INGV (IV), KOERI (KO), and Cyprus (CQ), are also involved in a near real-time acquisition and storage.

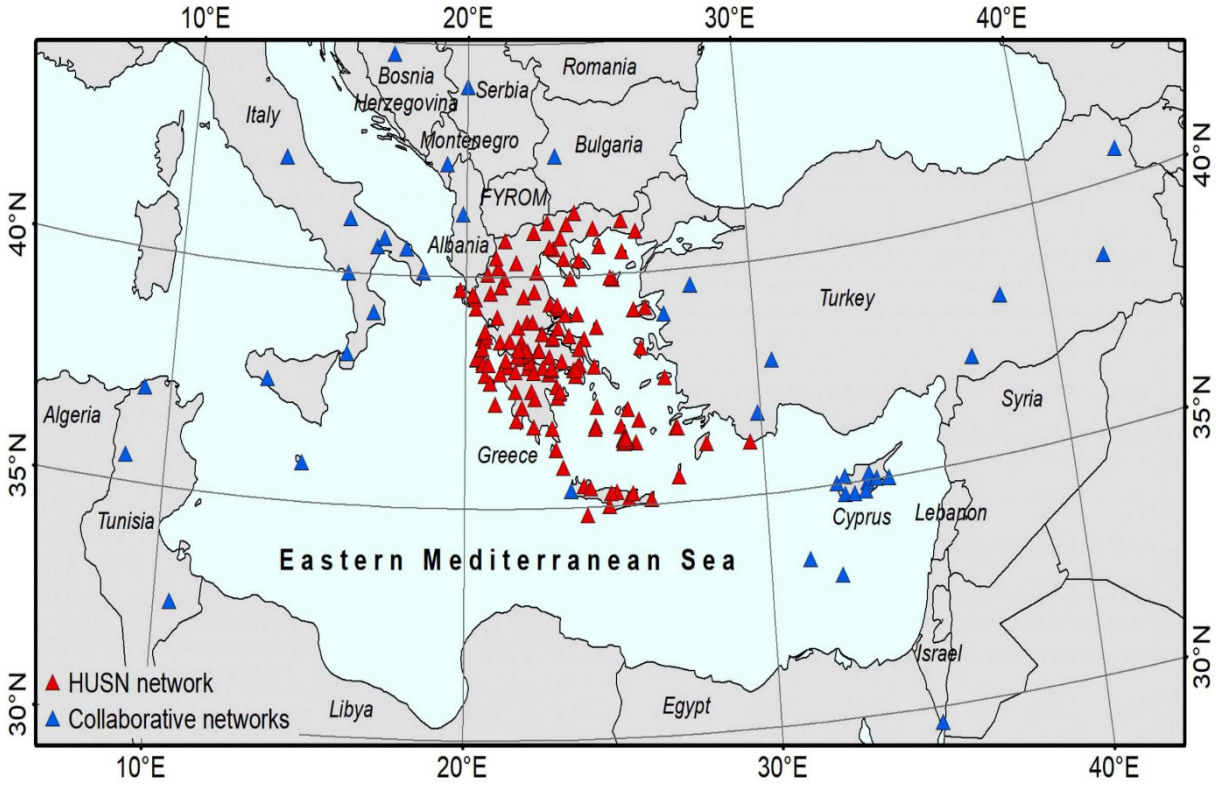

Figure 10. Map showing seismic stations being available online at NOA-IG (http://hl-ntwc.gein.noa.gr/)

For the monitor of the sea-level changes, the HL-NTWC is supported essentially by its tide-gauge network developed since 2013 and is fast growing in support of many national and international projects. The real-time tide-gauge network of NOA recently composed 18 real-time stations (Fig. 11) equipped with radar and pressure type sensors with a very high frequency of sampling rate, which is suitable for recording tsunami waves and holding tsunami operations.

Vicinity to a tectonic plate boundary, particularly in subduction zones and submarine active significant fault zones, defines these coastal areas as prone to tsunamis and increases the risk (Batzakis *et al.* 2020). Consequently, in Greece, these areas are under the monitoring of the potential threat of a tsunami wave, which could have devastating impacts both to the coastal and beach ecosystem and the coastline infrastructures.

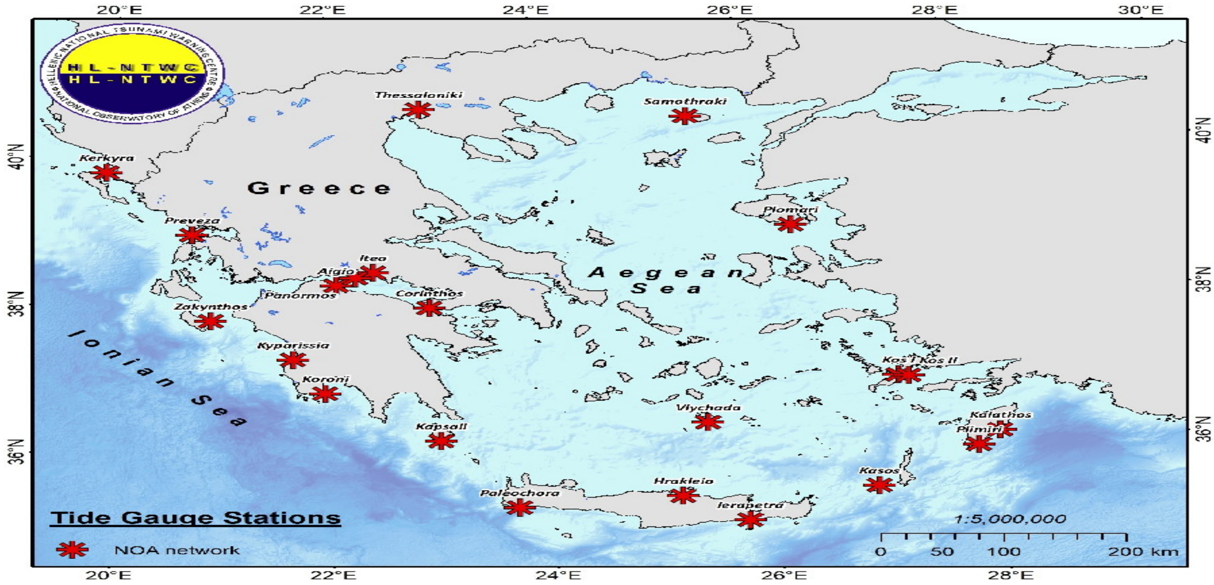

Figure 11. Map showing Tide-gauge stations being available online at NOA-IG

II.3. Other Risks of Marine Flood of Greece Coasts

Coastal communities in Greece are increasingly exposed to risks from several factors contributing to coastal floods (Fig. 12). Extreme hydrometeorological events are highly affected by climate variability, which, in succession with accelerated urbanization and poor governance, adds stress to coastal urban zones. Physical processes and phenomena such as sea-level rise, storm surges, heavy precipitation, shoreline erosion stand for the appearance of coastal flooding but additionally, human activity negatively influences the evolution of flood risk. Knowing only the development of physical hazards will not lead to efficient flood protection. Realizing the vulnerability of coastal regions is a core element by considering governance and socio-economic, cultural, historical,

and political variety, which have a strong influence on the actions taken to subdue risks, hazards, and subsequent catastrophes. However, technical measures play and will have an important part of current and future solutions, the transition from flood defense to flood risk management appears necessary, and concepts such as participation, dialogue, coordination, will of the state will, transparency and volunteerism start to play a major role in mitigating flood risk.

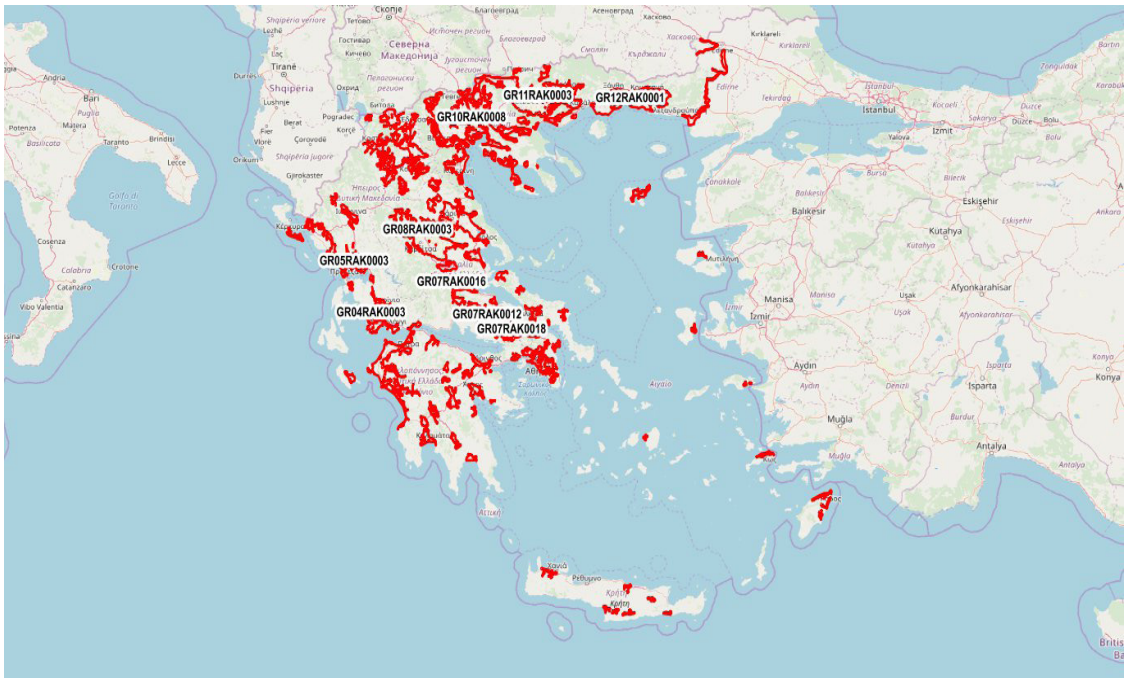

Figure 12. Potentially High Flood Risk Zones in Greece (http://floods.ypeka.gr/)

However, flash floods, pluvial and fluvial types of floods are only part of the problem. Several coastal places in Greece are exposed to strong winds with great fetches resulting in extreme violent overtopping of coastal infrastructures like port facilities. Due to the development of large waves that eventually cause serious damage, especially in coastal areas. Usually, coast cities suffer by successive severe damages of the windward wave breakwater, and an increasingly significant repair cost concerns the City and Port Authority. In addition, large quantities of sea water enter the coastal area (Commercial, residential, beach or Parking), which overflow the surface of the port as well as the wider areas of the coastline, causing a delay in the loading and unloading services, damage to port facilities and ship loading, traffic difficulties and damage to seaside shops and restaurants, deterioration of beach facilities and degradation of the aesthetic of the coastal landscape. The negative effect of wave energy is also the erosion of the recreational beaches, which strongly affects the contribution of tourism to the local and national economy, rousing the interest of authorities to find effective solutions at national, regional, and even local levels.

II.4. Conclusion

Greece's coastline is extremely extensive and exceeding 18,000 km, which is the longest in the whole of Europe. In Greece, the coastal zone is of paramount importance. Of the total 13 regions of the country, 12 are coastal. Most of the big urban centers of the country are in the coastal zone, as well as 80% of the industrial activities, 90% of tourism and recreation, most of fisheries and aquaculture, 35% of agricultural land, which is often of high productivity, and an essential part of the infrastructure (harbors, airports, roads, electricity network, telecommunications, *etc.*) (Lioutas and Tsimopoulou, 2010).

Twelve of the 13 administrative regions (prefectures) of Greece are classified as coastal (only one administrative region is landlocked). The vitality of the coastal zone for Greece can be highlighted after recording what is in the coastal zone, namely:

a) the country's largest urban centres (Athens, Thessaloniki, Patras, Heraklion, Kavala, Volos),

b) 80% of national industrial activity,

c) 90% of tourism and recreation activities,

d) 35% of the country's farmland (usually highly productive),

e) the country's fisheries and aquaculture, and

f) an essential part of the country's infrastructure (ports, airports, roads, power, and telecommunication networks, *etc.*). The value-added generated in the coastal zone includes:

- the operation of 20 ports, handling an annual total of over 1 million tons of cargo.
- a total fishery production of 96,000 tons.
- a total fishing fleet of 19,000 vessels (representing 20% of the EU-25 total).
- a total aquaculture production worth €258,000 (or 10% of the EU-25 total); and
- most hotel beds in the tourism sector. During the tourist season (summer), it is not unusual for some Greek islands to increase 2- to 10-fold due to the influx of domestic and foreign tourists.

Furthermore, beaches are the heart of the economy for many countries, especially in the Mediterranean Sea. Coastal erosion of beaches and low-lying coastlines is in serious concern of many nations, threatening the countries' economies, other sectors as the natural environment, industrial capability, transportations, and cultural heritage. This erosion results from a combination of anthropogenic and physical factors, which

are many in numbers and complex in calculations, such as variations in wave energy, tidal currents, wind action, the nature and origin of sediments, and sea level rise.

Tourism is the “heavy” industry for the Greek economy and the central pillar for tourism development is the unique natural environment and primarily the coastal zone with beaches. Moreover, natural ecosystems are considered a fundamental element to modern human wellbeing, public goods such as clean air, water, soil, and fisheries are also included. Thus, the preservation and sustainable use of biodiversity is of paramount importance for Greece, including for decision-makers and the public. For the following years, a significant challenge is how Greece could achieve sustainable management of ecosystems and green growth, preserving and protecting the fragile coastal and marine ecosystems with the rich biodiversity to be at risk, in balance with an eco-friendly touristic product.

III. Anthropogenic risks

Anthropogenic risks are defined as technological and man-made disasters. Technological – man-made disasters occur within or near the boundaries of human residential areas. The cause of immediate provocation is human beings. However, they can arise indirectly because of a natural disaster. Such situations are generally recorded accidents with loss of life or injury, pollution, and environmental degradation (IFRC, 2014).

A general categorization is:

Social Disasters:

They come from threats by human intent and are related to human nature and socio-economic phenomena in general. These catastrophes are wars, crime as a phenomenon, terrorism in all its forms, and social unrest. Particularly severe are the disasters in which weapons of mass destruction are used partially or extensively, as they cause extensive damage to private and public property during their use and a vast number of deaths and injuries. The worst and most common form of social catastrophe is the various types of war that typically cause innumerable economic and social damage and the natural environment (use of atomic bombs, chemical-biological weapons). At the same time, the number of casualties in human lives can amount to tens of millions of human lives.

Technological Disasters:

Technological catastrophes result from human negligence or error and are an inevitable result of technological development, innovation, and development. The disasters caused are usually components of transport, industry, and construction.

Transport: related to accidents that are connected to the movement of people and the transportation of goods. According to the World Health Organization and the World Road, Safety Report released in February 2020, up to 1.35 million people are killed in road accidents. Between 30 and 50 million are seriously or slightly injured (World Health Organization, 2020).

Industry: industrial disasters, as they are called, occur in the context of accidents at work or due to negligence. The use of hazardous materials such as explosives, flammable materials, corrosive substances, poisonous or radioactive products, and various other toxic substances and substances remain widespread and necessary throughout the industry, agriculture, medicine, in research areas, as well as in the general production of consumer products (Haddow *et al.* 2011).

Construction: construction disasters are related to all types of human installation and construction, the failure of which may be responsible for possible mechanical / construction weaknesses, poor design, miscalculations, and poor execution of technical plans (Haddow *et al.* 2011).

Socio-Natural Disasters:

According to the UN Disaster Reduction Strategy, man-made disasters include phenomena where the human factor contributes to multiplying the occurrence or amplifying natural disasters. This category is associated with specific effects of hydrometeorological and geophysical threats, at an increased frequency than expected, due to the impact of human activity. Examples are the overexploitation and degradation of rural land, the deforestation of forest areas estimated to lead to severe droughts shortly, which intense floods and eventually extensive landslides will follow. The effects of socio-natural threats can be mitigated through rational land management and environmental resource management (UNISDR, 2009). Socio-natural disasters as climate change continue unabated and its effects, affecting an increasing number of people, will be the main threat to humans in the future. Phenomena such as wars, migration, and extreme poverty will require the most intense and active involvement of EDs worldwide in their management and mitigation.

III.1. Political and War Risks

The effect of political stability and political associations in and among states is hugely influential in defining the image of destinations in tourist-generating regions and the natural and perceived safety of tourists (Hall, 2000). Besides, the media through books, magazines, newspapers, and satellites has a substantial influence on images of destinations, especially as media selects detailed descriptions and analysis of places, events, and pictures which would have the highest impact on producing stereotypical images of a tourist destination in tourist –generating regions. Wars, coups and political strikes or protests raise problematic concerns in tourism development and visitor attraction.

Political instability is a complicated and multidimensional term (Fig. 13) with different meanings and understandings (Gupta, 1990; Sanders, 1981; Andriole and Hopple, 1984). The need to evaluate and analyze the many interrelationships of political instability and the tourism industry is required, regarding the delicate essence of the tourism industry, the ever-increasing competition, and the small profit margins.

“Political instability is defined as the condition of a state in which a government has been overthrown or is controlled by factions following a coup, or in which the basic functional requirements for control and maintenance of social order are unstable and periodically disrupted” (Cook, 1990 cited in Sonmez, 1998). Numerous varied dimensions of political instability can be recognized within international tourism, such as global and civil wars, coups, terrorism, riots, political and social unrest, and strikes.

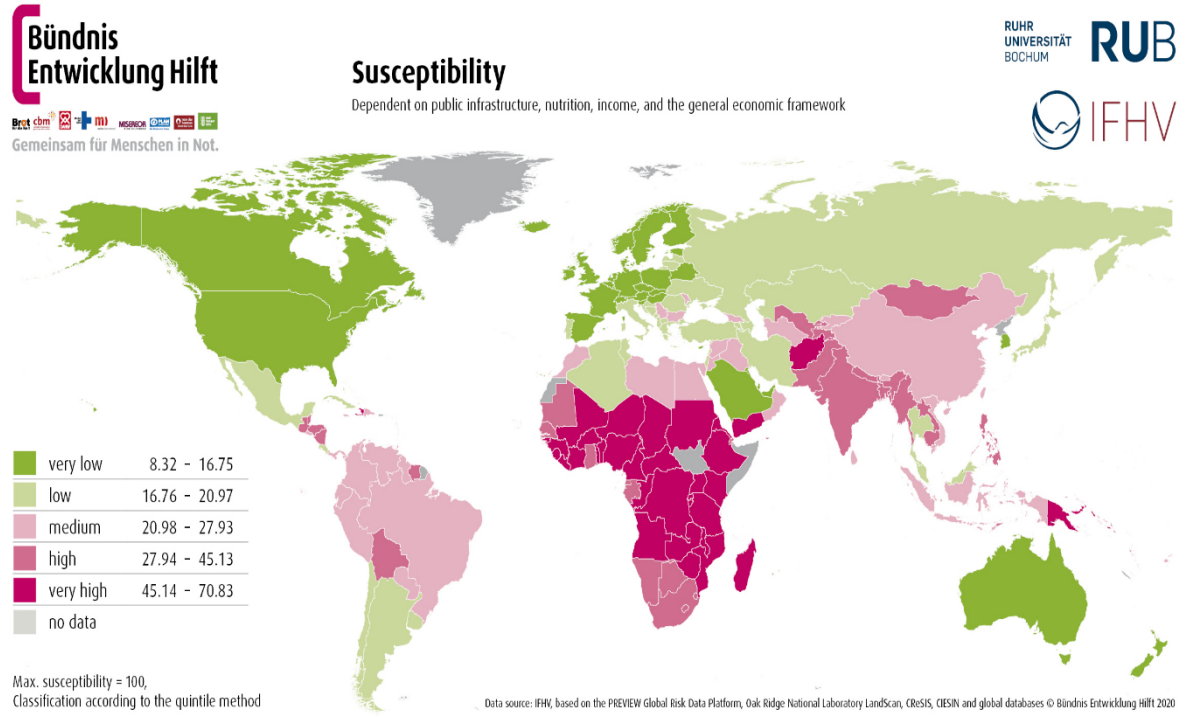

Figure 13. World Risk Index 2020 by the Institute for International Law of Peace and Armed Conflict (IFHV) of the Ruhr-University Bochum.

Political instability, civil crisis, and war can extend the risk perception at a destination (Lepp and Gison 2003). Political instability creates negative advertising, which results in the inevitable reduction in tourist arrivals. The risk perception can affect tourist decision-making, and destinations can be seriously impaired, with substantial adverse economic results as tourists change their vacation destinations or countries, which may take years to overcome.

Political stability is of ultimate value to any investment, but it is of specific weight to tourism because of its nature offering peace, leisure, fun, and comfort. These can only be favorably marketed under stable political conditions. Tourist arrivals are a barometer not only of a nation's monetary relationship with other currencies, but also of a nation's cautious view (Cothran and Cothran, 1998).

Mass media plays an important role in formation and expression where specific destination images are portrayed to attract and reduce potential visitors (Hall and O'Sullivan, 1996). Tourism can also be used as a tool for political and ideological purposes, in the face of the industry's betterment of a politically troubled nation. On the other hand, tourism can be shaped by a political objective, but the manipulation of tourism can only harm it.

Tourism has been defined as a changeable industry, highly sensitive to the smallest scary situation - whether real or imagined. The tourist is good at seeking comfort. The

tourist avoids risky or troubled areas, whether natural or perceived. War, political uncertainty/instability would easily destroy the tourism industry of affected places or even possibly affected countries/regions. A full-fledged war will have a negative impact long after the conflict, as the social infrastructure that supports tourism would have been severely damaged. The tourism value chain would be broken and might take a long time to re-establish. On the psycho-social front, tourist confidence in dreaded destinations takes a long time to rebuild, if ever. Overall, the war would readily destroy the tourism of any goal, as potential visitors would stay far away, with the consequent collapse of the affected country's tourism industry.

III.2. Tourism and Terrorism

Tourism has always been one of the two service pillars holding Greek financial status. Profits from tourist activity and travel added to international transport, mainly maritime, represent up to 10% of GDP and investment around two-thirds of the trade deficit each year. Even though current accounts heavily dependent on services are often victims of their natural volatility, as they are often subjected to impacts caused by often unforeseen external disorders, the structure of the Greek economic system offers no other perspective than reliance on travel and transportation profits to finance the trade deficit and substantial interest payments.

National income and its growth rate can affect how well a country can sustain a terrorist coup and, at the same time, remove any adverse consequences for the economy. This occurs because such hits regularly impose a disadvantageous influence on international economic transactions and consequently production and economic action. Such outcomes are not anticipated to be evenly harmful to all economies that suffer terrorist attacks but instead be determined by their level of development. Developed economies like the US, for instance, can trigger more and better mechanisms by financial or fiscal policy and use them to decrease or even eliminate the outcomes of a terrorist attack. The same applies to the money market of such countries that can recover following a terrorist hit and regain the investors' trust. By contrast, the developing economies are much more vulnerable because their production potential is usually focused on a short number of areas like tourism. Therefore, a terrorist attack on any of these sectors is expected to have a severe impact on the economy, rarely resulting in disproportionate negative results on the country's GDP. For this reason, even though Greece cannot be accurately considered a developing country, the cost to its tourism industry because of a terrorist attack would be significant given its weight in the country's economy.

Terrorism appears significant in determining tourist arrivals in Greece. It seems that the variable measuring casualties resulting from terrorist attacks in Europe are marginally more beneficial. The fact remains that in all cases, the level of responsiveness of the rate of arrivals to terrorist activity appears somewhat limited, an opinion which seems in harmony with other results recorded in the literature relating to this question which argue in favor of the temporary impact of terrorist attacks on the flow of tourists to a particular destination (Fig. 14).

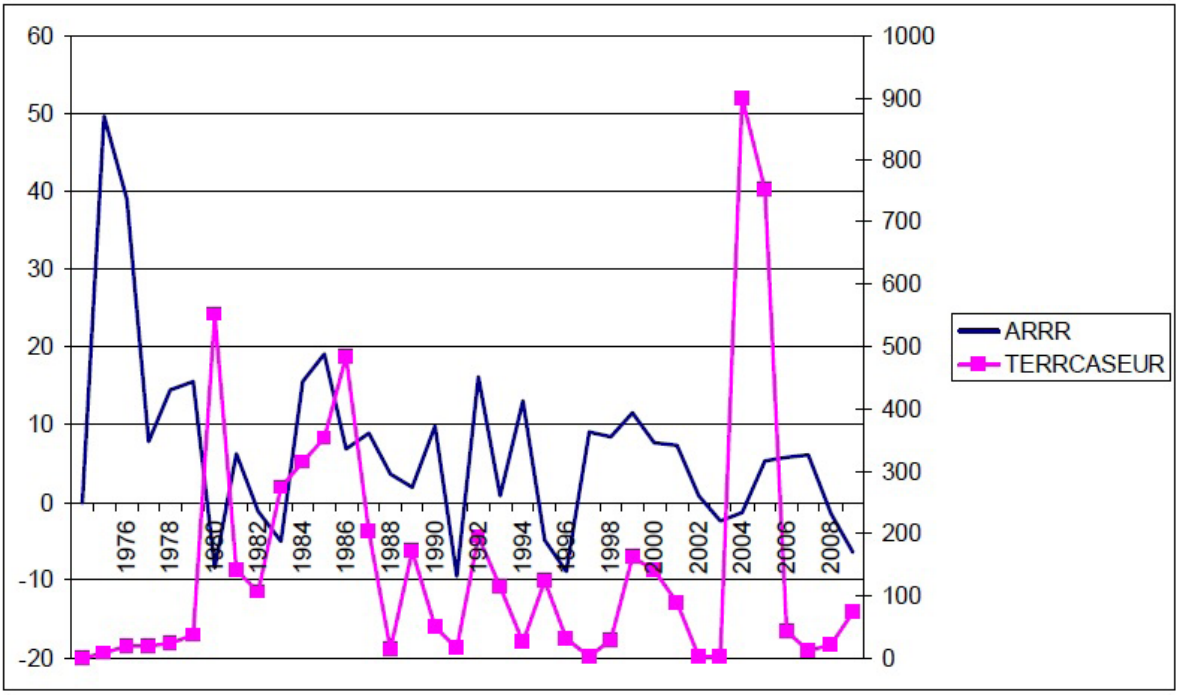

Figure 14. Rate of travel arrivals in Greece and terrorist casualties in Europe

III.3. Health Risks

In the past century, most tourist travels were within the moderate world. A tourist was rarely exposed to specific health risks different from those he might face in his country. The situation has changed with the increasing travel to the tropical, sub-Saharan, or equatorial world. Nowadays, tourists traveling to new destinations, which they previously avoided, are exposed to a wide variety of health risks, leading to the emergence in temperate countries of infections previously encountered or controlled for a long time.

Tourists' health risks are not restricted to international travel to tropical destinations. They also involve several risks encountered in the temperate world, especially those related to swimming or certain dangerous sports practices. In this context, it is rather remarkable that travel medicine has become a medical specialty. It was formalized in 1991 to create the "International Society of Travel Medicine," which has established numerous international conferences. This new medical discipline aims to protect the traveler's health and subdue the outcomes of illnesses and accidents abroad. Far from being limited to tropical, infectious, or parasitic diseases, it is also interested in sports accidents among the young, falls among the elderly, and traffic accidents.

The issue of health risks should not be ignored in any way in view of tourism growth. Indeed, the reporting and magnification by the media of tourists offering symptoms of cholera or malaria following an exotic journey can significantly damage the reputation of a tourist destination, even a popular one.

A consultation before the departure for a forthcoming journey is needed, focusing on a personalized healthcare plan, based on international scientific protocols and epidemiological studies. Travelers need to obtain basic information about the current hygiene conditions and climatic differentiation in the area they schedule to visit. Additionally, there are many health risks upon arrival at the destination. The planned visit to a healthcare professional is necessary, especially for travelers with chronic illnesses or those taking medication, while vaccination is considered crucial for some destination countries. Healthcare professionals should be able to notify travelers and evaluate their needs. According to research studies on the risks specific to the notions and attitudes of travelers, only a few of them are well informed throughout a trip. While most studies indicate that travelers have some pre-travel medical meetings, not all of them follow the required vaccinations and medications.

It is a remarkable fact that there is an urgent need to provide healthcare services to travelers worldwide. According to the World Health Organization (WHO), people who plan to travel need to contact a physician specializing in travel medicine at least four to six weeks before departure. Unfortunately, most travelers do not consider the possibility of consulting a medical service before leaving for an international trip (https://www.ncbi.nlm.nih.gov).

In 2019, 34 million tourists visited Greece from various countries producing €18.2 billion international tourist receipts. These were historical record figures for the Greek tourism industry. In addition, 2020 looked even more eminent till the pandemic outbreak in mid-March in Greece. The fatal infectious disease (Covid-19) hit the Asian countries first and then reached Europe and the rest of the world. Almost all countries forbade international travel. The Greek tourism market collapsed, as did the entire world's tourism markets, particularly in Europe (Papanikos, 2020).

Table 3 presents the current history of international Greek tourism in terms of profits and arrivals. As a percentage of GDP, global tourism receipts raised their GDP share from 5 percent in 2005 to almost 10 percent in 2019. Both GDP and tourism receipts are displayed in nominal terms. Thus, measurements over time can be made only using the percentage of tourism receipts to GDP.

Research has shown that the Covid-19 pandemic had a minimal (5 percent) impact on Greece tourism in the first quarter of 2020. Table 4 illustrates three overall reduction scenarios of 90%, 75% and 60%. The estimates are shown in Table 4. Three scenarios are reported assuming (a) a reduction of 90 percent, which implies that only 10 percent of tourism receipts will be made relative to 2019; (b) a reduction of 75 percent and (c) a reduction of 60 percent. The last is the best-case scenario.

Table 3. International Tourist Arrivals and Receipts, 2005-2019

Year	Int'l Tourism Receipts Billion €	Int'l Tourism Arrivals Millions of Tourists	Spending per Tourist Arrival €	GDP Billion €	Tourism Receipt as a % of GDP
2005	10.73	14.39	746	199.2	5.39%
2006	11.36	15.23	746	217.9	5.21%
2007	11.32	16.17	700	232.7	4.86%
2008	11.64	15.94	730	242.0	4.81%
2009	10.40	14.91	697	237.5	4.38%
2010	9.61	15.01	640	226.0	4.25%
2011	10.50	16.43	639	207.0	5.07%
2012	10.44	16.95	616	191.2	5.46%
2013	12.15	20.11	604	180.7	6.73%
2014	13.39	24.27	552	178.7	7.50%
2015	14.13	26.11	541	177.3	7.97%
2016	13.21	28.07	470	176.5	7.48%
2017	14.63	30.16	485	180.2	8.12%
2018	16.09	33.07	486	184.7	8.71%
2019	18.18	34.00	535	187.5	9.70%

Data Source: GDP (AMECO). International Tourism Receipts (Bank of Greece).

Alternatively, one could consider scenarios where the 90 percent reduction rate is reduced for the rest of 2020, but the critical question is when the lockdown will end. This is a situation of uncertainty and not one of risk.

The economic influence of any pandemic is difficult to calculate, including the number of people who contract the virus and die. The review of literature shows that the outcomes (positive and negative) can be immediate due to lockdown, medium due to time needed to adjust to a pre-pandemic state, and long-run through its effect on human capital, which might last more than one generation as this has been confirmed by the empirical verification of the fetal origins' hypothesis. Based on the head indicators of pre-bookings, this study has found that the impact of the 2020 pandemic on international Greek tourism arrivals was tremendous. The effect on GDP is anticipated to be unusual for a non-war period.

Even the economic crisis that hit the Greek economy hard cannot be compared to the impact of Covid-19 on the Greek economy. The reduction in tourist arrivals is expected to have an effect of between 9 and 14% of GDP. And this is the 2020 impact. Unless uncertainty and risk are reduced (measured by zero cases in the past 14 days), the impact of tourism will continue to put enormous pressure on economic resources. Government interventions by spending public money to support household and small business proprietors‟ income cannot be sustained for an extended period.

Table 4. The Pandemic Impact on Greek Tourism: A Scenario Analysis

	2019 Actual (€M)	Coef. A	2020 Scenario A (worst case)	Coef. B	2020 Scenario B (average)	Coef. C	2020 Scenario C (optimistic)
Q1	747	0.95	709	0.95	709	0.95	709
Q2	4667	0.1	467	0.25	1167	0.4	1867
Q3	10693	0.1	1069	0.25	2673	0.4	4277
Q4	2072	0.1	207	0.25	518	0.4	829
Total (Year)	18179		2452		5067		7682
% of 2019			13.5%		27.9%		42.3%
% Reduction			86.5%		72.1%		57.7%
GDP Impact	29086		3924		8108		12291
% of GDP Impact	16%		2.1%		4.3%		6.6%

III.4. Other Risks

Other risks involve the risk of traffic accidents. According to WHO (1996), the leading cause of death among travelers is transport accidents. According to the World Health Organization and the World Road Safety Report released in February 2020, more than 1.35 million people are killed in road accidents. Between 30 and 50 million are seriously or slightly injured (World Health Organization 2020). Bad road conditions or absence of a road network, unruled traffic, careless drivers, old vehicles, frequently punctured road, corrugated iron, *etc.*, are all factors that certainly cause these accidents. In addition, since the health coverage of tropical countries is different from that of developed countries, one should not expect the arrival of resuscitation services or firefighters.

Nowadays, most tourist guides dedicate at least a few lines to inform tourists about the risks of theft, fraud, violence, harassment to which they may be exposed. These risks, which are very present in certain countries or regions, are generally linked to the precariousness of certain sections of the host population, particularly in urban areas. In addition, there are many travel magazines, books, and leaflets that provide the necessary information. The modern way to inform a potential traveler is via social media, YouTube channels and particular blogs, where a lot of specific and detailed information is provided.

Finally, health risks can also result from the open hostility of locals towards visitors, especially when they are assimilated to former settlers. However, visitors should be aware that these risks can be catalyzed by themselves, for example, when they visibly display their wealth (materials, currencies, jewelry, *etc.*), when they do not respect local cultural codes, beliefs, religions, or when they adopt an openly provocative or insulting attitude.

IV. Conclusions

This deliverable is based on desk research, academic studies, and bibliographical references, which investigate and analyze Greece-wide safety and security challenges. In the Greek context, we have identified the main natural and man-made/technological hazards affecting the level of safety and security within the framework of the specific challenges Greece faces, from the perspective of economic services and tourism.

The results of this deliverable indicated that the main impacts of the current safety and security challenges regarding tourism in Greece are crucial and of paramount importance for the financial situation of Greece. Tourism remains the “heavy industry” of the country and every adverse impact can distract the national development for many years. Above all, the Covid-19 pandemic has shown the vulnerability of Greece in terms of economic indicators and the need to develop a national growth plan where the exception of tourism and other areas will be economic pillars.

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