Safety and Security Challenges

Tunisian scale

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Co-Evolve4BG

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

Safety and Security challenges

Tunisian scale

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OVERVIEW

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REVIEW

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Abstract

This report aims to identify the different threats to the morphological stability of the Tunisian coastal zones. It is developed through the review of existing data at national and regional scales. The document is structured as follows: Section 1 provides an overview of the present and the future possible trends of Climate, Sea Temperature and Sea Level at the Tunisian level considering Climate Change. Section 2 highlights the morphological characteristics of the Tunisian coastal zones. Section 3 focuses on reporting the trend of evolution of the Tunisian costal zones considering the foreseen relative Sea Level Rise scenarios and the present erosion trend.

I. Introduction – Risk Notion

Security threats can seriously affect the tourism sector which, if it focuses only on a single product such as the seaside resort, becomes more vulnerable and not very resilient in the face of crises. Today, the security factor has become decisive in the choice of touristic destination. Indeed, according to Moscatello and Armelle (2013) security is an imperative for the tourism sector, because it is the second most important expectation in hotel sector after cleanliness.

Tunisian touristic marketing product relies on hotel infrastructure installed along the Tunisian coasts. Despite its precious heritage and landscape, Tunisia is still marketed as a purely seaside destination, the closest to Europe. If it is dominated by a one-design product, therefore Tour Operators (TOs) can substitute Tunisia by any seaside destination. To this end, Tunisia, which started the "Arab Spring", has suffered the full brunt of the harmful consequences of the climate of insecurity which accompanied its social revolution of January 14th, 2011, as opposite to Marrakech (Morocco) which has resisted to the 2005 attack consequences. In addition, the lack of attractive touristic images, the Tunisian touristic cities have not been able to overcome the security crisis.

Risk is a danger to which an individual or property is exposed in certain circumstances. Under the term "tourism risks", all the facts and processes likely to compromise tourism will include here:

Visitors' goods, health, or life: Natural disasters (floods, earthquakes, tsunamis, storm swells and tides), some dangerous diseases (AIDS, malaria, yellow fever, SARS and Covid-19) but also various forms of aggression, even physical attacks on tourists. These facts and processes, whether real or imagined, strongly compromise touristic activity. Indeed, safety is a visitor's fundamental requirement and a necessary condition for his movement.

Touristic infrastructure quality or existence: Natural disasters, international wars, civil wars, urban growth, pollution when they cause the degradation, or even the destruction of tourist infrastructures and facilities.

Every touristic risk has a double facet: it is both a concrete, measurable fact (number of occurrences of such an accident) and a perceived fact constructed by the observer. Often, there is discordance between these two risk facets. Today, for example, developed societies show great fear of climatic, tectonic, or geo-morphological paroxysms. In general, however, these phenomena are more extraordinary in their brutality, brevity, or intensity than in the number of their victims.

In this sense, it has a very clear deterrent effect on a part of the clientele. On the contrary, the repetitive natures of traffic accidents (which kill more tourists) are now perceived as an accepted inevitability: they have become ordinary accidents or risks.

II. Natural risks

Every year, the media report their statistics of major tourist accidents caused by climatic paroxysms (*e.g.,* heavy rains and their hydro-morphological consequences, avalanches, storms, violent winds, and tropical cyclones) and seismic or volcanic events.

Touristic location characteristics tend to increase the risks associated with the physical environment. Indeed, touristic activities are most often located in places that are particularly subject to natural hazards, such as water immediate proximity (river, lake, or sea). They are thus exposed to becoming the first victims of the slightest floods or storms.

Similarly, to enjoy a large panoramic view, visitors are happy to occupy widely open sites and steep hillsides, which also concentrate all kinds of risks. In addition, tourism-related sports activities, whether climbing, skiing, or boating, often take the holidaymaker to dangerous places.

Besides, it should also be pointed out that touristic locations often impose restrictive conditions for the construction or operation of reception facilities, for example, a series of seaside hotel installations on a coastal strip which is not spared from risks. In what follows, the different natural risks to which coastal areas are exposed will be presented. These risks may be due to floods (torrential rains and dam breaks), earthquakes or marine floods (tsunamis and swells).

II.1. Overland floods

II.1.1. Floods history in Tunisia

Tunisia is a Mediterranean country whose development is closely linked to meteorological and climatic risks. Extreme events such as major floods and droughts periodically expose the population to significant human and material losses (Harzallah*et al.* 2018). In Tunisia, rainfall is characterized by its great irregularity in time and space, as well as by its often torrential and very violent nature, especially during the intermediate seasons. During major rainfall events, the rivers are often dry and become diluvian, and since at least the 1950s, these rivers have been dammed and developed (Chouari*et al.* 2016).

Table 1 summarizes the main historical floods reported in medieval and modern times. Thereafter and since the 19th and 20th centuries, Tunisia has had several observed periods of devastating floods, such as those of 1902, 1931, 1932, 1958, 1959, 1962, 1964, 1965, 1969, 1973, 1982, 1990 and 2003 (Frigui and Touzi, 2009). These devastating events caused socio-economic damage.

Table 1. Main historical floods in medieval and modern periods in Tunisia (Fehri, 2014)

Year	City or region	Event Magnitude and damage
861	Kairouan	Destruction of the Kairouan bridge
921	Kairouan and its valley Rakkada	Destroyed constructions, damaged properties
953	Kairouan	-
988	Mansoura	-
1020	Ifriqiya	-
1325	Gabes and its surroundings	-
1612	Several regions of the country including Djerba	Major loss of life and material damage in Djerba
1726	Region of Tozeur	Destruction of several residences
1861	North-West of the country	Damage mainly affecting cereal crops

Table 2 summarizes the events observed since 1900. As mentioned in the previous table, these events are of devastating proportions. For example, the September 1969 flood had a devastating effect especially in the country center, affecting 300,000 people, with 500 deaths, 7,000 destroyed homes and damage estimated at 12% of the Gross National Product.

The heavy rainfall of March 1973 caused an exceptional flood in North Tunisia, with a return period greater than one hundred years. Runoff was estimated at 1 billion m^3 in Medjerda (Fehri, 2014). The exceptional rainy episodes of January 1990 were concentrated in Meknessy and Sidi Bouzid regions (central Tunisia). They were less intense in the eastern and southern parts of the country (Khanfiret *al.* 1998). October 1982 flood caused more than 70 victims in Sfax and its suburbs, a large Tunisian city located in the center-east of Tunisia. The economic losses were estimated at about 47 million dinars (Daoud, 2013). More than 700 houses were destroyed and 8,000 others damaged. Streets, roads, bridges, railways, power lines and telecommunication equipment were also affected.

The consequence of the heavy rainfall of January and February 2003 was a spectacular flood which occurred along Medjerda and its main tributaries. Despite several retention infrastructures along this river, more than one billion m^3 of water flowed into the sea which is almost its total annual contribution (Le Temps, 2018).

Recently, floods of January 2012 in the Northern part of the country or those of September 2009 and September 2013 in Sfax and September 2016 in the Tunisian Sahel, still mark the collective memory.

Table 2. Main floods recorded in Tunisia from 1900 (Fehri, 2014)

Year	Main cities, regions affected		Magnitude of the event/damage
1902	Most parts of the country		
November 1931	Northeast of the country and Southern part of the Sahel		Significantly material damage, to road infrastructure
1932	Central Tunisia		Overflow at SabkhetKelibia and RN1 cut-off at Sidi Bouali
1958	East coast from Moknine to Sfax	Moknine	830 disaster-stricken families
		Mahdia	124 disaster-stricken families
		El Jem and KsourEssef	50 disaster-stricken families
		Sfax	280 disaster-stricken families
1959	Sahel, Kairouan, Gabes		4,000 homeless and material damage estimated at more than 2 million dinars
November 1962	Region of Gabes, region of the oases especially Tozeur and Nafta		50 dead and 7000 homeless
Autumn 1969	The whole country, in particular Central Tunisia		300,000 people affected and more than 542 dead; material damage estimated at the time at between 30 and 35 million dinars
March 1973	North of the country, the Medjerda catchment area		100 dead and huge material damage
March 1979	Medenine region		Destruction of 890 dwellings, collapse of 57 cave dwellings, losses of 7600 sheep and goats
October 1982	Sfax city		Nearly 1000 homes completely destroyed, and 8 500 homes destroyed
January 1990	Central and Southern Tunisia		60 dead, loss of 7,800 head of cattle in Sidi Bouzid alone, severe material damage estimated at over 90 million Tunisian dinars, 58% of surface wells damaged and 14,000 homes destroyed
September 1995	Tataouine		20 dead and material damage estimated at over 6 million Tunisian dinars
May 2000	Jendouba valley		1,170 people affected and material damage estimated at more than 3 million Tunisian dinars
January -February 2003	Northern part of the country: middle and low Medjerda and the Great Tunis		4 dead and 2,500 homeless people and material damage
September 2003	The Great Tunis		Crops 85% damaged and material damage
October 2007	The Great Tunis, Sabbalet Ben Ammar		16 dead and important material damage
September 2009	Rdayef		17 dead et 8 injured and material damage
September 2011	The North of the country especially Zaghouan and the lower Medjerda valley		3 dead, huge losses in the agricultural sector which are estimated at around 30 million Tunisian Dinars and road infrastructure under severe strain especially in the government of Zaghouan

II.1.2. Status of flood risk management

For the management of flood risks in Tunisia, hydrometric measurement networks are installed, and they are composed of:

- A rainfall network of 850 stations spread throughout Tunisia.
- A pluviographic network of 70 stations, 40 of which are digital.
- A hydrometric network of 60 stations, 40 of which are digital: measurements taken are water level, discharge, solid materials, wet surfaces and 60 low water level and salinity measurement points (Chouari*et al.* 2016).

In addition, dam construction is one of the important preventive measures against floods. Several Tunisian cities are equipped either with a ring canal such as that of Sfax (Fig.1), flood protection structures and river redevelopment (Fig.2). However, early warning systems should be installed, which will make it possible, based on weather forecasts, recorded rainfall or rising water levels upstream, to provide communities with an early warning of impending floods and to also trigger protocols to mitigate the impacts of floods. The rainfall and hydrometric network should be further strengthened and modernized.

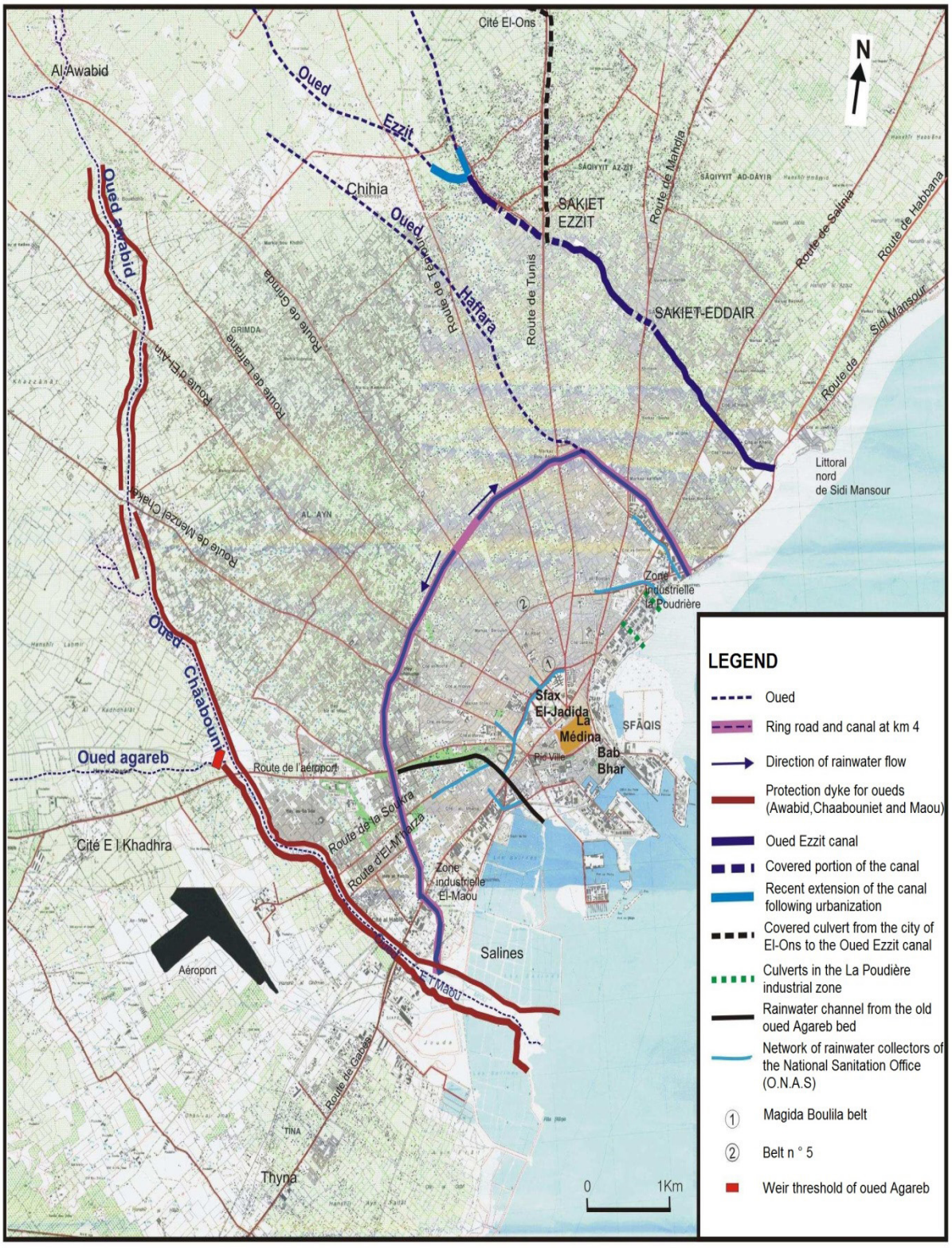

Figure 1. Flood protection system for Sfax - Tunisia (Daoud, 2013)

II.1.3. Terrestrial flood and urbanization

Since the last century, most of Tunisia's large cities, particularly coastal ones, have experienced significant population growth and unbridled urban growth. The area most affected by this phenomenon is the Great Tunis (governorates of Tunis, Ariana, Ben Arous and Manouba located around Tunis City). According to the Great Tunis Urban Planning Agency, the urban area has multiplied by about nine in 55 years: it has grown from 3,387 ha in 1957 to about 28,000 ha in 2012 (Fehri, 2014).

These changes, introduced by human occupation, have extended the urban fabric to the detriment of natural flows. They have led to changes in the functioning of the hydrographic networks. The densification of urban fabric has led to soil sealing, diversion and damming of rivers. These modifications have had undeniable repercussions on hydrological and hydraulic processes.

Soil sealing has been caused by the extension of urban roads, pavements, car parks, dense constructions, shopping and leisure malls and mega-projects (*e.g.,* financial ports, marinas, and shopping malls). In addition to this controlled densification, all kinds of anarchic constructions have occupied the public and hydraulic domains. The flows are then disrupted by more and more obstacles. This phenomenon has led to major changes, not only hydrological (*e.g.,* an increase in the volume of water runoff) but also hydraulic (*e.g.,* the roughness and length of the hydraulic paths have decreased), which led to a reduction in concentration time resulting in increased flow velocities.

An example cited in Fehri (2011) is the basin drained by El Ghrich and El Greb river (small catchment area of 26.4 km2 the North of Tunis city) which was only 5.7% urbanized in 1950 but reached 70.5% urbanization in 2007 (Fig.2).

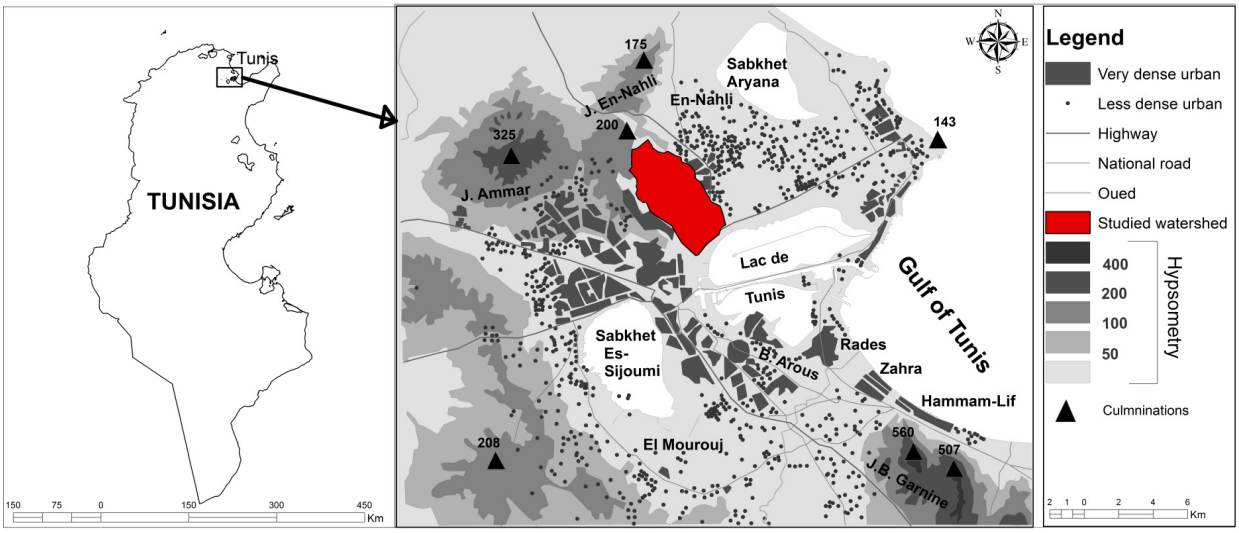

Figure 2. El Ghrich et El Greb river localisation (Fehri and Zahar, 2016)

This urbanization also concerns the growth of touristic areas since the 1970s. Commercial tourism is the dominant model, characterized by hotels with high occupancy rates (hotels in the main touristic destinations in this region have an average occupancy rate of over 60%). In addition, the rate of illegal construction remains high throughout the Mediterranean basin and this phenomenon should be remediated. On the other hand, flood risk levels should be undertaken to limit the construction of infrastructures which can strongly alter landscapes and potentially influence the response of an area to heavy rainfall.

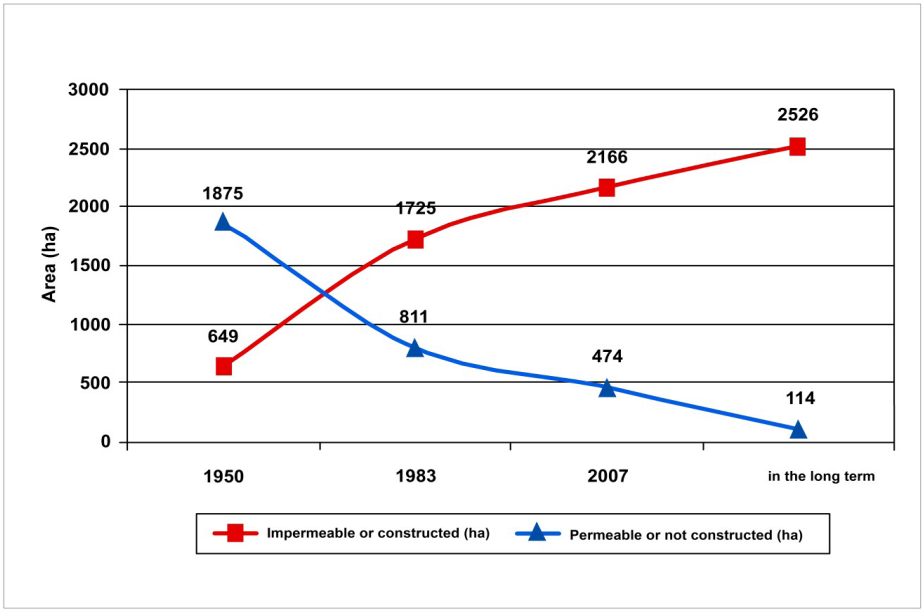

Figure 3. Evolution of urbanized areas in El Ghrich and El Greb catchment–Tunisia (Harzallah*et al.* 2018)

II.1.4. Impact of flood on Tourism

Faced with floods, tourists are particularly vulnerable because of difficulties in informing them about risks and alerting them in the case of an event. In addition, floods can have a significant impact on heritage, accommodation, and tourism infrastructure.

For example, following the latest flood in Cap Bon (the north-easternend of Tunisia) on September 22nd, 2018, the damage amounted to tens of millions of Tunisian Dinars. They are considered the most devastating floods in the history of Tunisia. The area of Nabeul-Hammamet (Fig.4) is the delta of many rivers. Touristic complexes are often located between two rivers. During this flood, several houses and even hotels were isolated. The beaches and the sea have been flooded, polluted by solid waste of all kinds carried by rivers which have returned to their natural course, carrying away everything in their path (*e.g.,* cars, animals, and garbage). They have had serious consequences on tourism. Indeed, the General Federation of Hoteliers has estimated at 12 million dinars the consequences of these bad weather conditions that have

affected the Cap Bon. Tourism and handicrafts have suffered enormous damage: 29 units were affected, with 6 units including one in Korba and two in Nabeul forced to close. Other hotel units were damaged but were able to reopen their doors a week later. For example, an hotelier in Nabeul (Fig. 4) announced that his hotel has been submerged by rising waters of up to two meters, which had led to cancellations of reservations.

Figure 4. Flood of hotel in Nabeul (Tunisia), September 22nd, 2018 (Le Temps, 2018)

II.1.5. Current and Future Threats

The floodable zones of Medjerda lower valley have been mapped by IRD team (formerly OROSTOM) at 1/100,000th (Claude *et al.* 1977). Then, the flood maps at 1:50000 scale were drawn up by teams from the Equipment and Major Hydraulic Structures Department (EGTH). In the Master Plan for Territorial Development (1998), a single map was identified, which represents flood and potential flood areas. According to the assessment of floodable areas in Tunisia resulting from this master plan: floodable areas represent an area equivalent to 11538 km^2, of which 11,000 km^2 are agricultural areas and include 140 towns and many industrial zones. Medjerda valley in eastern Tunisia and the Kairouan region are the most affected and a quarter of the country's population is threatened by this risk (MEAT, 1998). Figure 5 shows the location of potentially floodable areas and cities in Tunisia, established by the Tunisian Ministry of Equipment and Territorial Development (MEAT, 1998). Hammamet touristic area is included. However, according to this map, touristic areas of the Center and the South do not seem to be concerned by floods. A study is currently underway by MEAT to update this flood map in Tunisia. This study could show whether a more detailed assessment would be necessary. This study should lead to the proposal of a national strategy to fight future floods, especially in the most vulnerable regions.

Another document (GFDRR, 2020) lists the urban floodable areas and shows that flood urban risks are high, according to the modelling carried out. This modelling predicts that urban floods with the potential to cause damage and threaten lives have a 10% risk of occurrence. Fig. 6 shows that the northern coastal areas have a high risk of urban flood. For Cap Bon, the risk is moderate and for the rest of Tunisia the risk is low, except for Mahdia where the risk is very low.

In addition, Tunisia is subject to irregular climate conditions and is characterized by great aridity. Climate projections indicate a rise in temperatures, a change in rainfall patterns and in the frequency of extremes, a rise in sea level and an intensification of desertification. These changes will undoubtedly increase the environmental and socio-economic vulnerabilities of Tunisia (Harzallah*et al.* 2018).

In a global and comprehensive vision, the interdependence of urban and tourist areas should be considered in order to better assess the vulnerability of the whole country to floods.

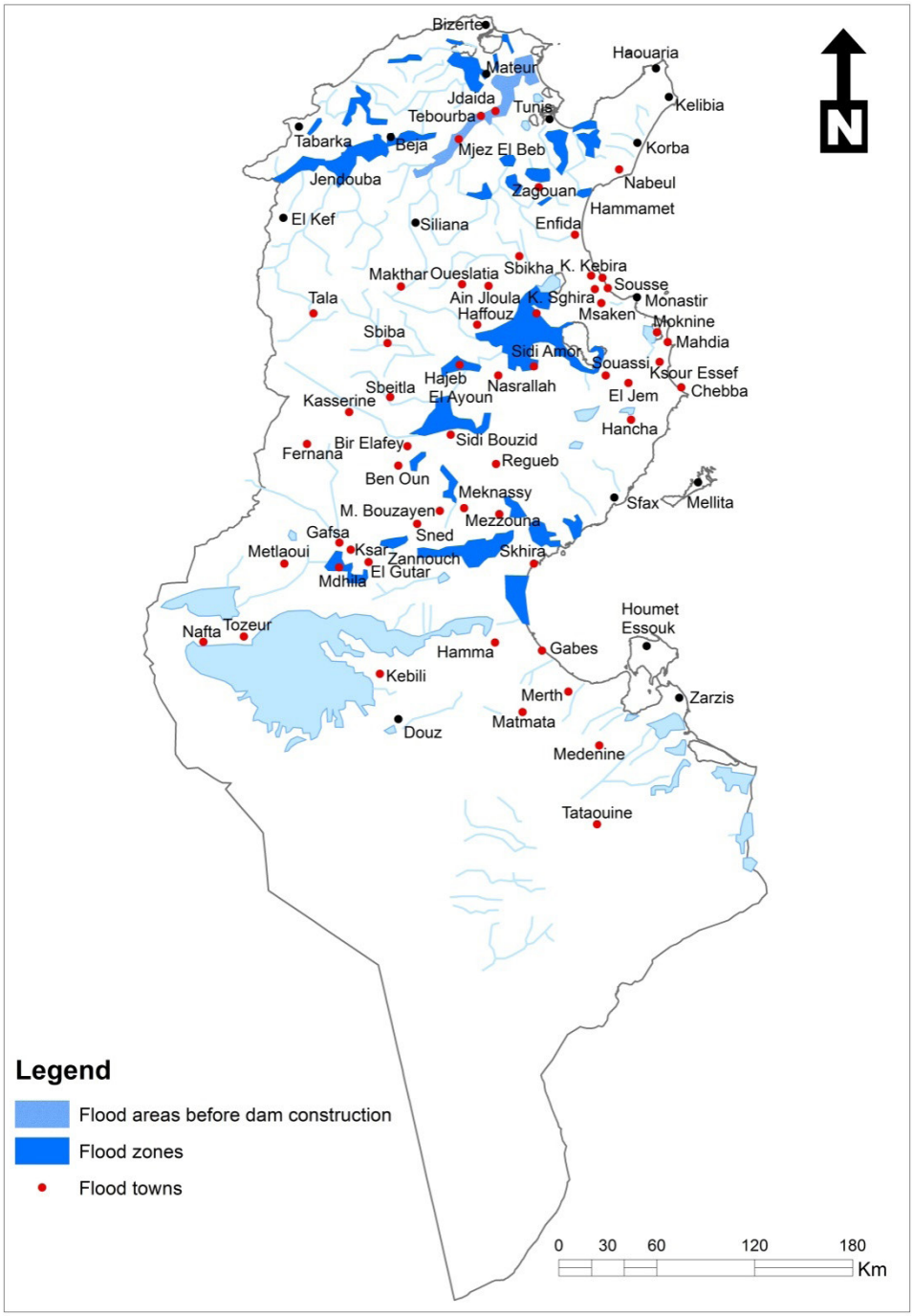

Figure 5. Floodable and potentially floodable areas in Tunisia (MEAT, 1998)

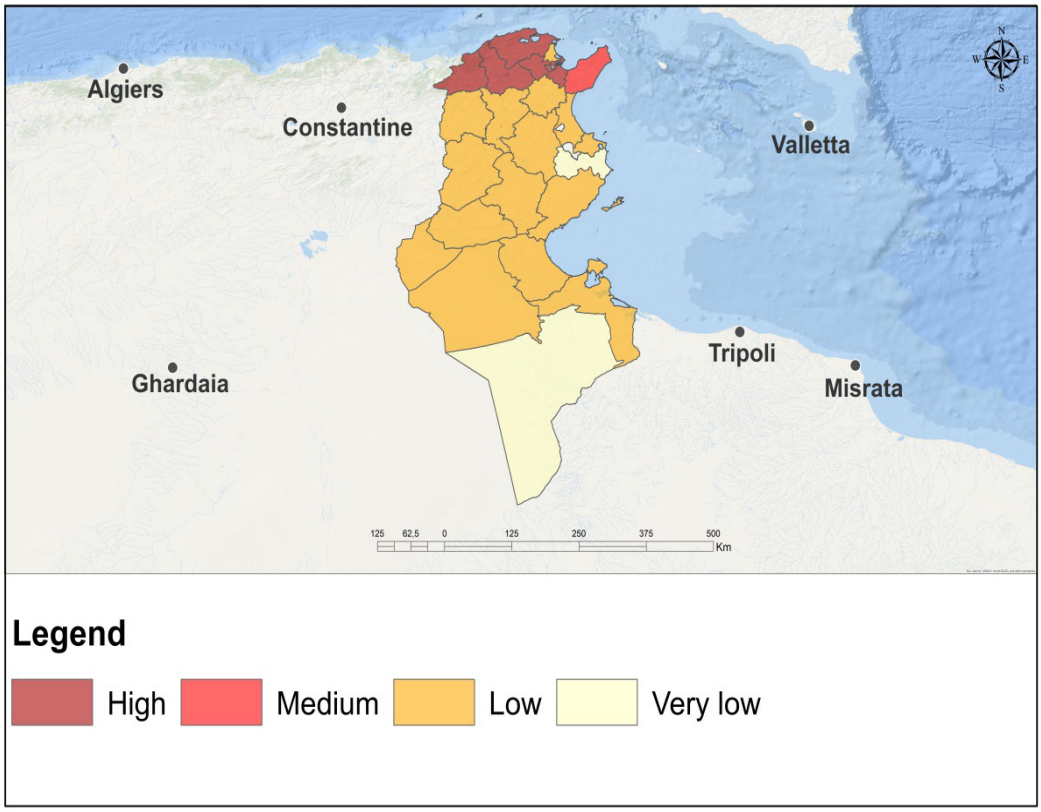

Figure 6. Urban flood risk in Tunisia (GFDRR, 2020)

II.1.6. Risks of dam breaks

Water storage structures such as dams can present a risk of failure and cause significant damage to property and people. The main causes are (CFBR, 2020):

- Technical problems such as a malfunction of the flood gates, a defect in design or construction or materials, the age of the structure and the nature of the foundations.
- Natural causes such as exceptional floods of higher intensity than that used for spillways dimensioning, the construction phase which is a sensitive period for flood risks because the spillways are not yet operational, landslides and earthquakes.
- Human causes such as poorly performed preliminary studies, insufficient execution controls, operating errors, lack of monitoring and maintenance, or malicious acts.

A dam break causes a flood downstream preceded by a major submersion wave, the consequences of which will have an impact on:

- Population: *e.g.,* drowning, injuries, and movement difficulties.
- Properties: destruction of buildings, damage to homes, structures, hydraulics, civil engineering, livestock, and crops.
- Environment: such as destruction of fauna and flora, erosion, pollution, waste and sludge.
- Tourism: such as the fact that it influences tourist businesses and travel difficulties.

According to (CFBR, 2020), break risk remains minor, particularly in the last forty years or so (Fig. 7). It is less than 0.38% since 2000's.

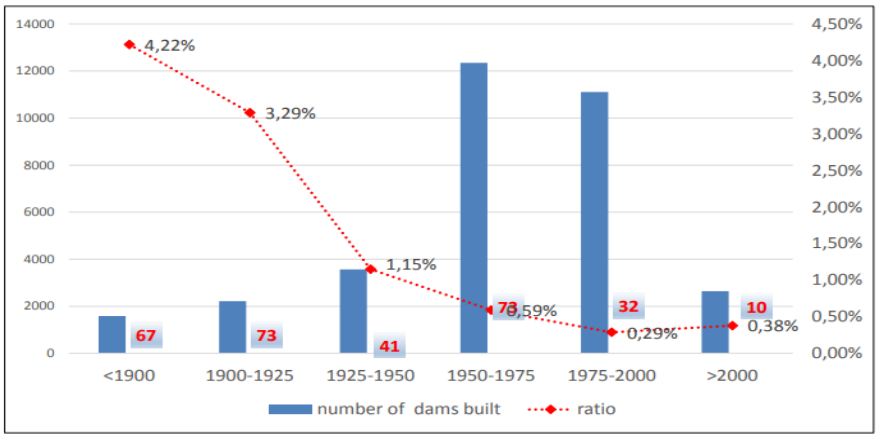

Figure 7. Breakdown of dams around the world by year of construction (CFBR, 2020)

According to the Ministry of Agriculture (ONAGRI, 2020), Tunisia has 34 dams in service and several hundreds of dams and hill lakes (Figs.8 and 9).

In Tunisia, there have never been any breaks. Indeed, the oldest dam was built in 1929. In addition, they have heights between 15 and 75m for most of them, so that the risk of failure is less than 1% (CFBR, 2020; Fig.10). However, some of these dams could cause floods that will reach the coast in case of failure, such as the case of Sidi Salem dam (36° 35′ 27″ N, 9° 23′ 23′ 51″ E, Beja and Tunis) for which floods will reach the coast of Tunis.

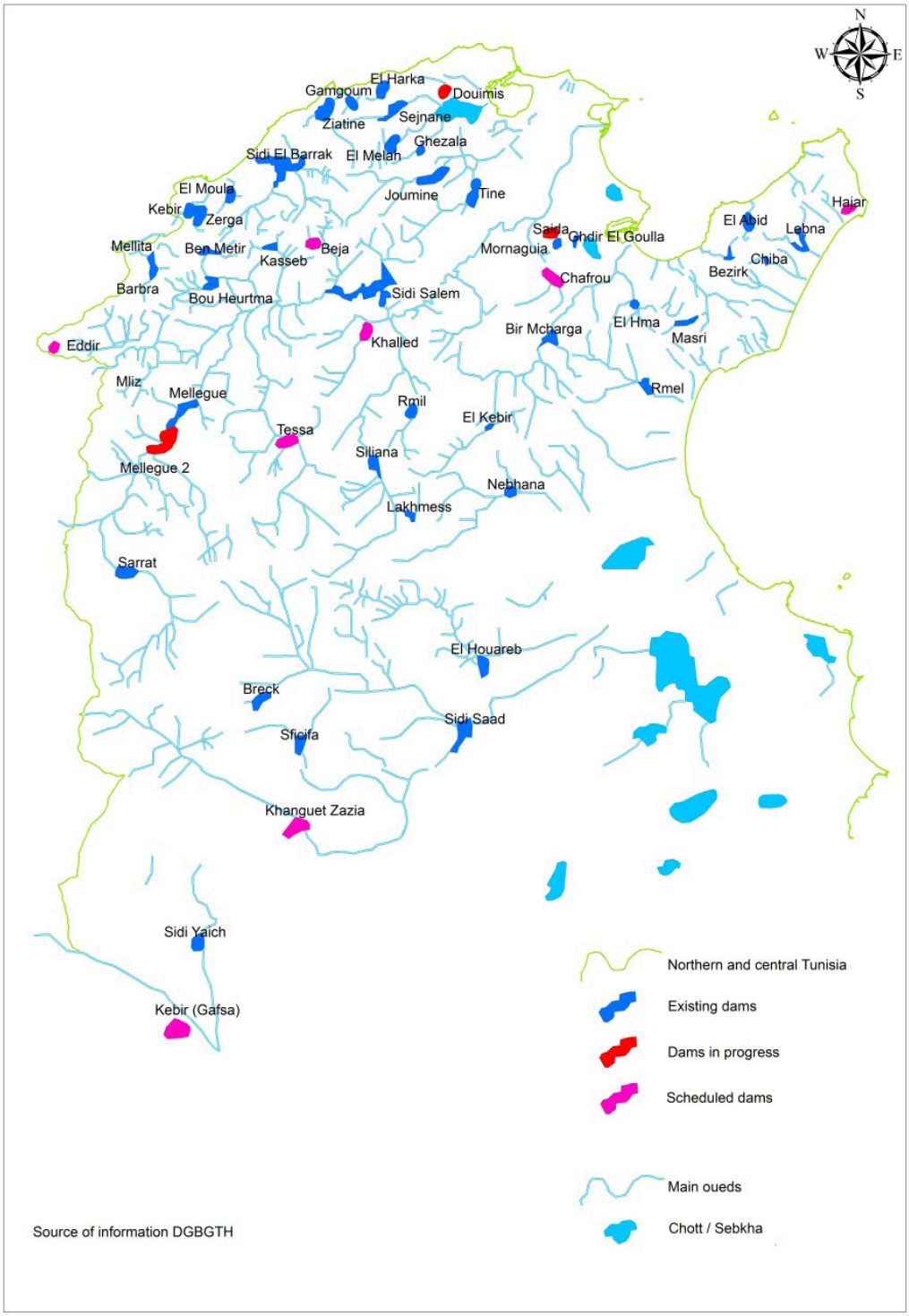

Figure 8. Map of existing current and planned dams (DGGBTH, 2020)

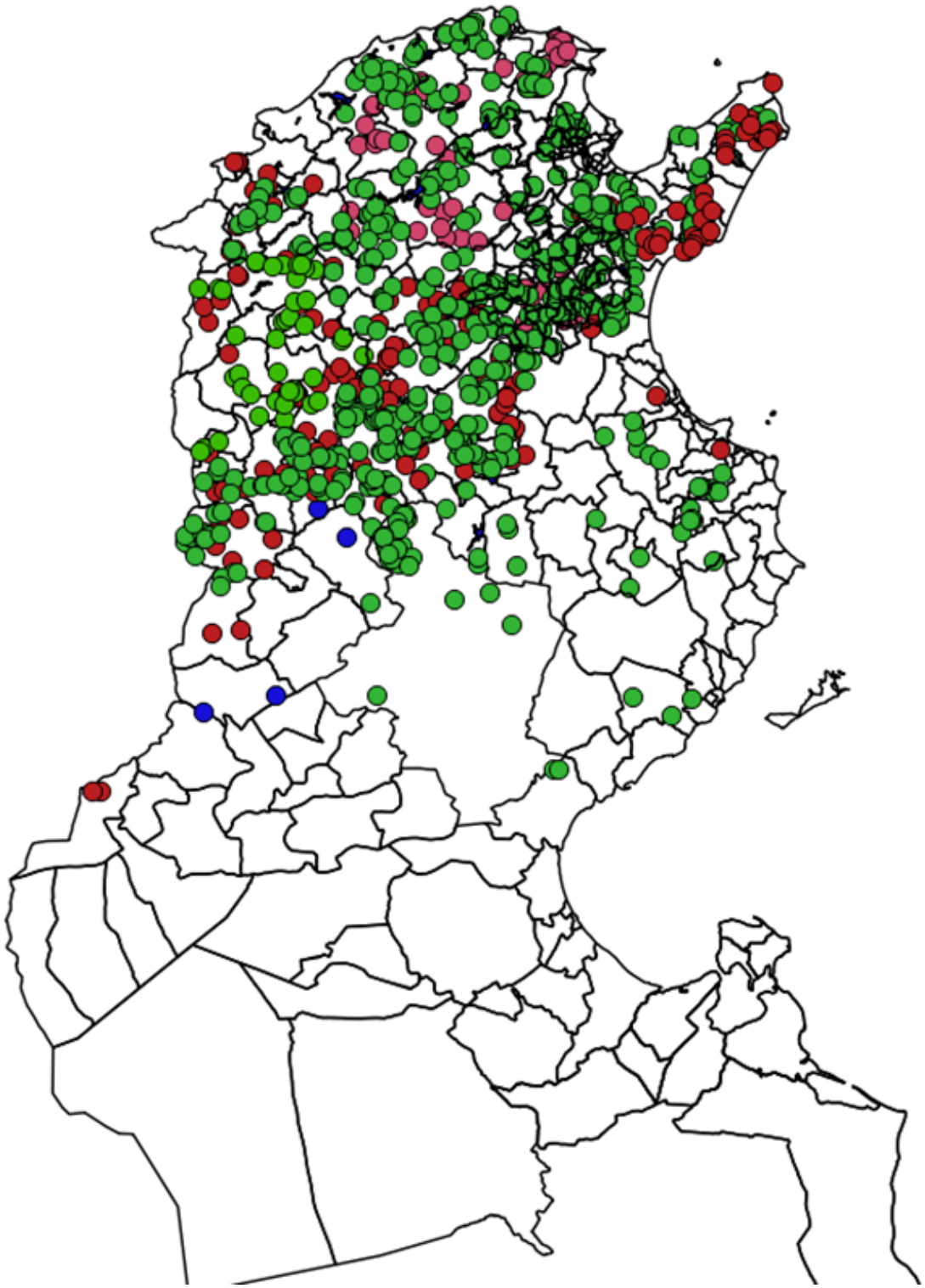

Figure 9. Map of dams and hill lakes (MARHPM, 2002)

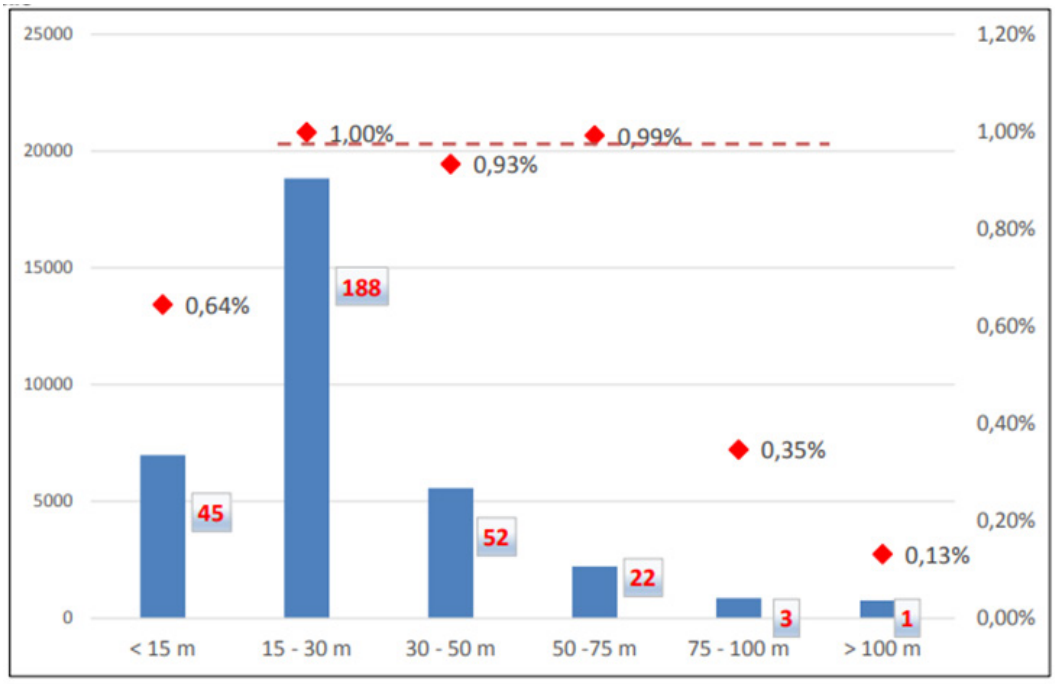

Figure 10. Dam breaks in the world according to dyke height (CFBR, 2020)

II.2. Earthquake risk

Among the potential natural hazards for coastal areas are also earthquakes. Earthquakes present a direct risk, but also an indirect risk through the tsunamis that they might generate.

II.2.1. Earthquakes in Europe and the Mediterranean

The Mediterranean is in an active geodynamic context. The collision zone of the Africa and Europe plates corresponds to a region subject to frequent seismicity. To identify the seismic sources, Terrier (2007)proposed zoning (France, Italy, Tunisia, Algeria, Morocco and Spain) based on tectonic, bathymetric and seismological data (Fig.11). Each zone is characterized by a fracture mechanism, earthquake maximum magnitude evaluation (MW) and surface fracture estimation (release, length, and area of the fractured fault plane). The choice of distant tsunami-genic events will be based on the results of this zoning.

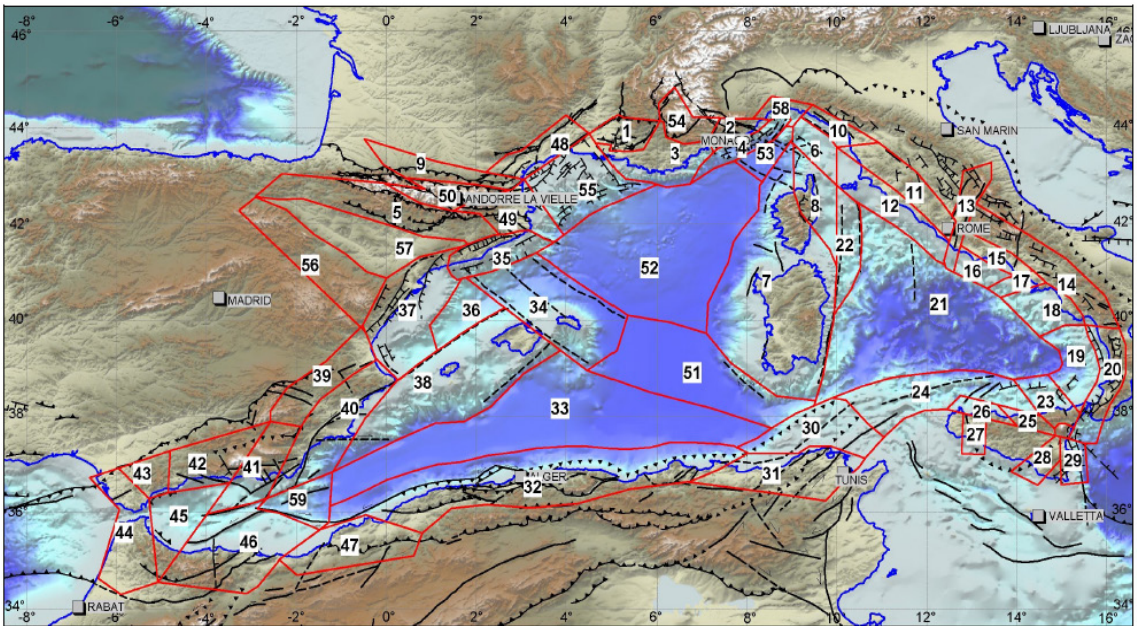

Figure 11. Seismic zoning map of the Mediterranean Sea (Terrier, 2007)

The past geological complexity seems to continue today as evidenced by the diversity of deformation regimes in this region, including for example compressional structures such as the Dinarides or the Maghreb, extension in the heart of the Apennines and detachment in the Western Alps.

Moreover, the existence of rigid blocks (Adriatic plate, Corso-Sardinian block, and Iberian block) independent of the two great tectonic plates and the presence of regional geodynamic phenomena contribute to the significant modification of the deformation field related to the convergence of Africa towards Eurasia. Apart from the fact that in this plate boundary zone extensional and compressive deformation regime coexists, the speed of movement of the plates is not uniform. This is whatNocquet (2002) shows from the analysis of geodetic and seism-tectonic data (Figs.12 and 13)

The current convergence of the African and European plates is manifested by a particularly high seismic activity in the South of the Western Mediterranean (Maghreb and Betic ranges, Sicily, and Calabria). In the North, from the Pyrenees to the Tuscan margin, earthquakes are less numerous but, occasionally, they can reach magnitudes greater than 6.5 (*i.e.*, capable of creating surface fault ruptures).

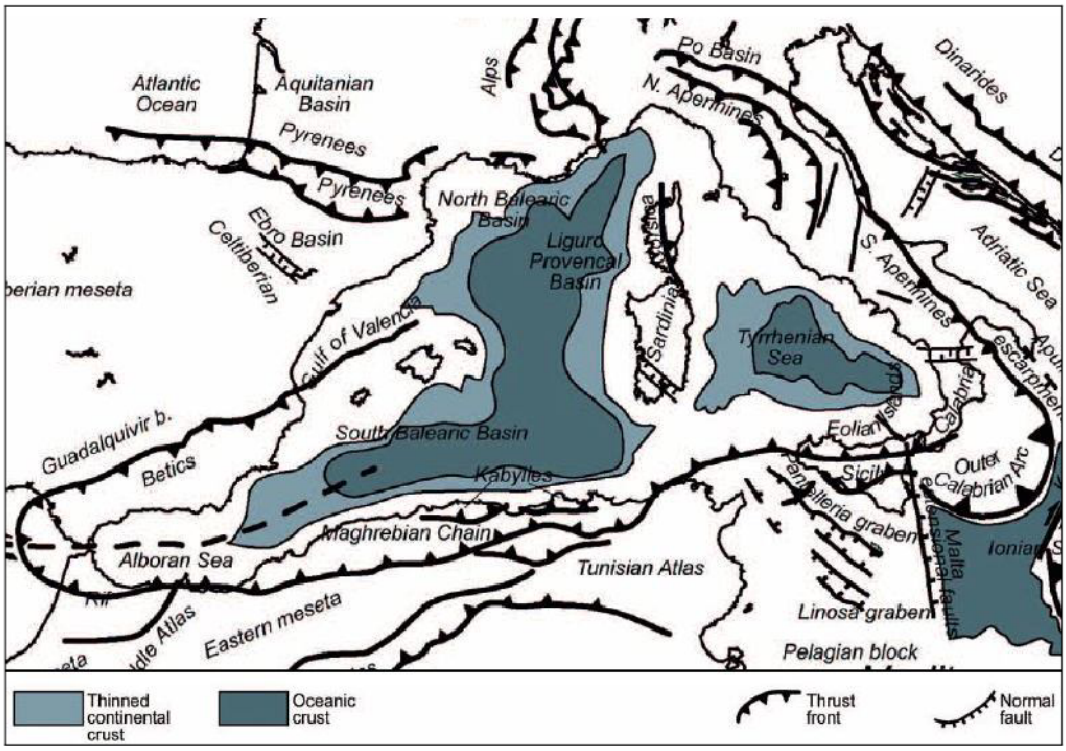

Figure 12. Tectonic scheme of the Western Mediterranean (Nocquet, 2002)

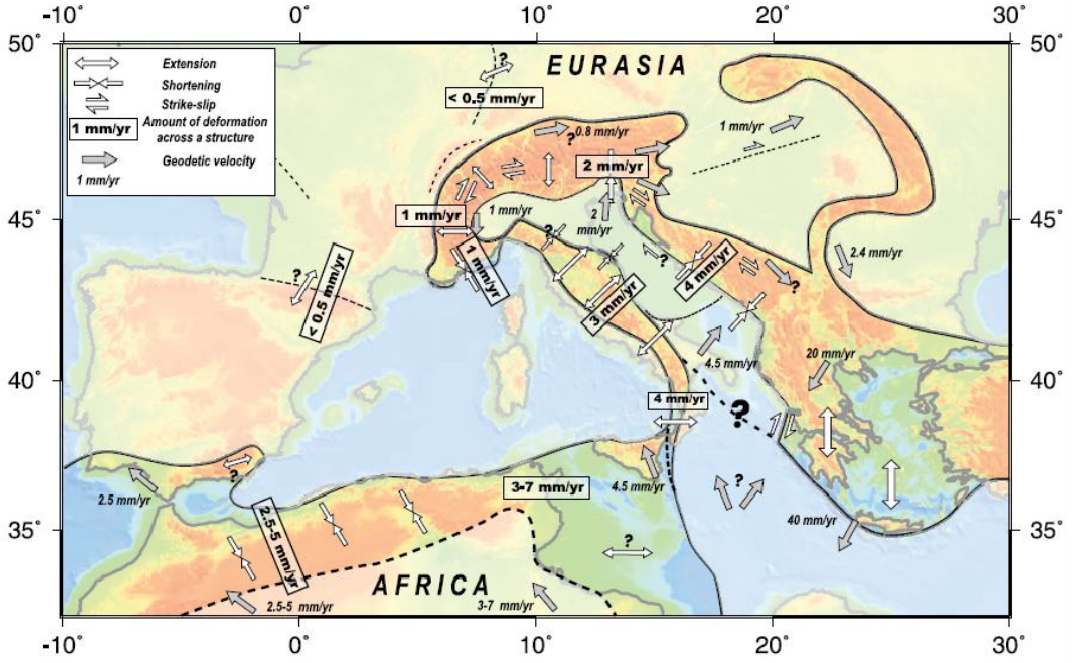

Figure 13. Kinematic synthesis in Western and Central Mediterranean Europe(Nocquet, 2002)

II.2.2. Earthquakes in Tunisia

According to the recorded history, the magnitudes of earthquakes in Tunisia can exceed 5. To have a more precise idea of the seismic activities in Tunisia, Fig.14presents the earthquakes recorded with a magnitude greater than 5 over the last seventy years. Fig. 15 presents the most recent earthquakes that occurred near the Tunisian coasts.

Fig. 16 presents the earthquake map of Tunisia (Ben Ayed and Zargouni, 1990). According to this map, the magnitude of land earthquakes near the Tunisian coasts do not exceed MW=5 according to the Richter scale.

However, it was essential to consider not only the seismic sources close to the Tunisian coasts, but also those located on the more distant shores of the Western Mediterranean.

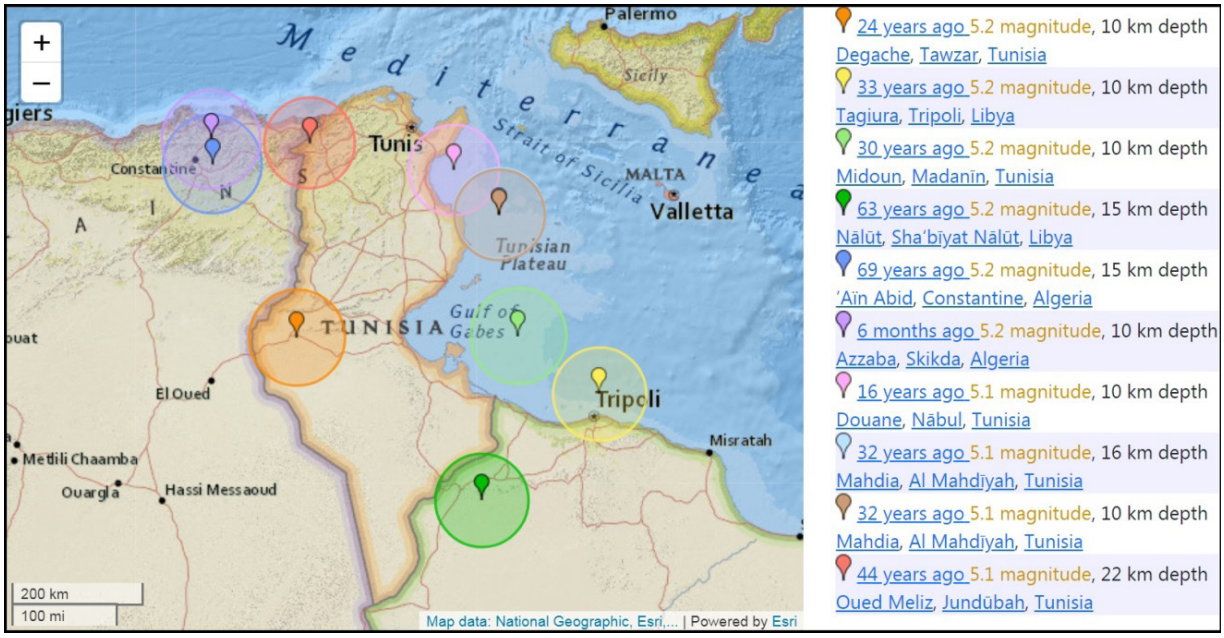

Figure 14. Location of earthquakes with a magnitude greater than 5[1]

1 Earthquaketrack. Retrieved from https://earthquaketrack.com/p/tunisia/biggest, 2021.

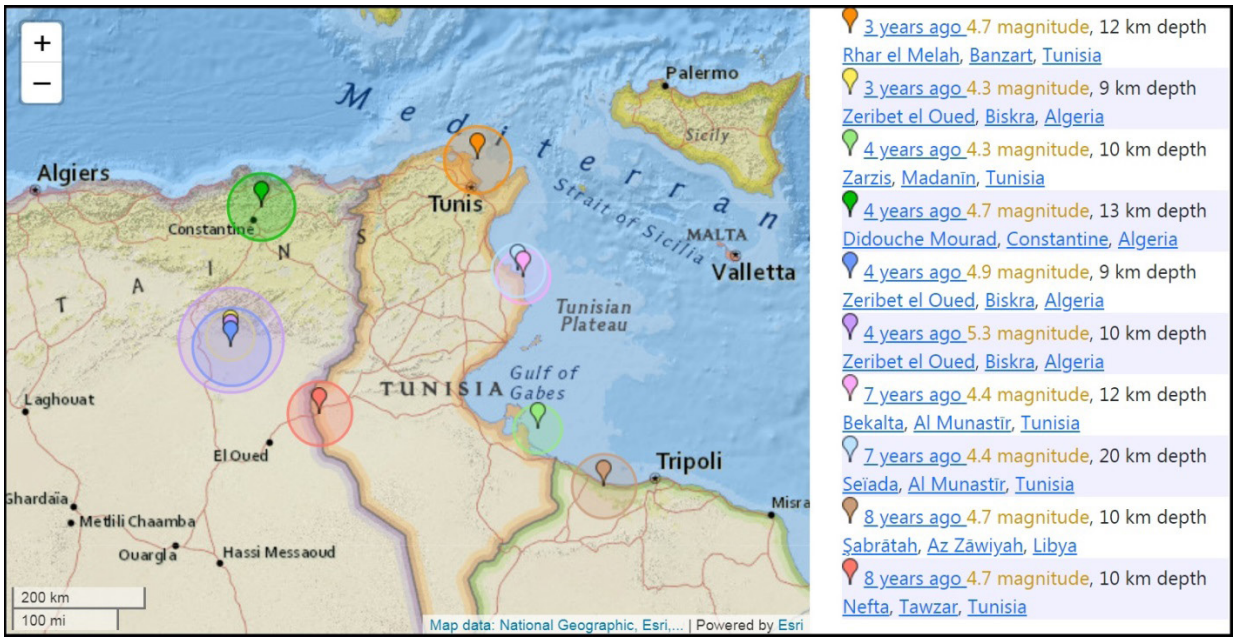

Figure 15. Location of the most recent earthquakes that occurred near Tunisian coasts[1]

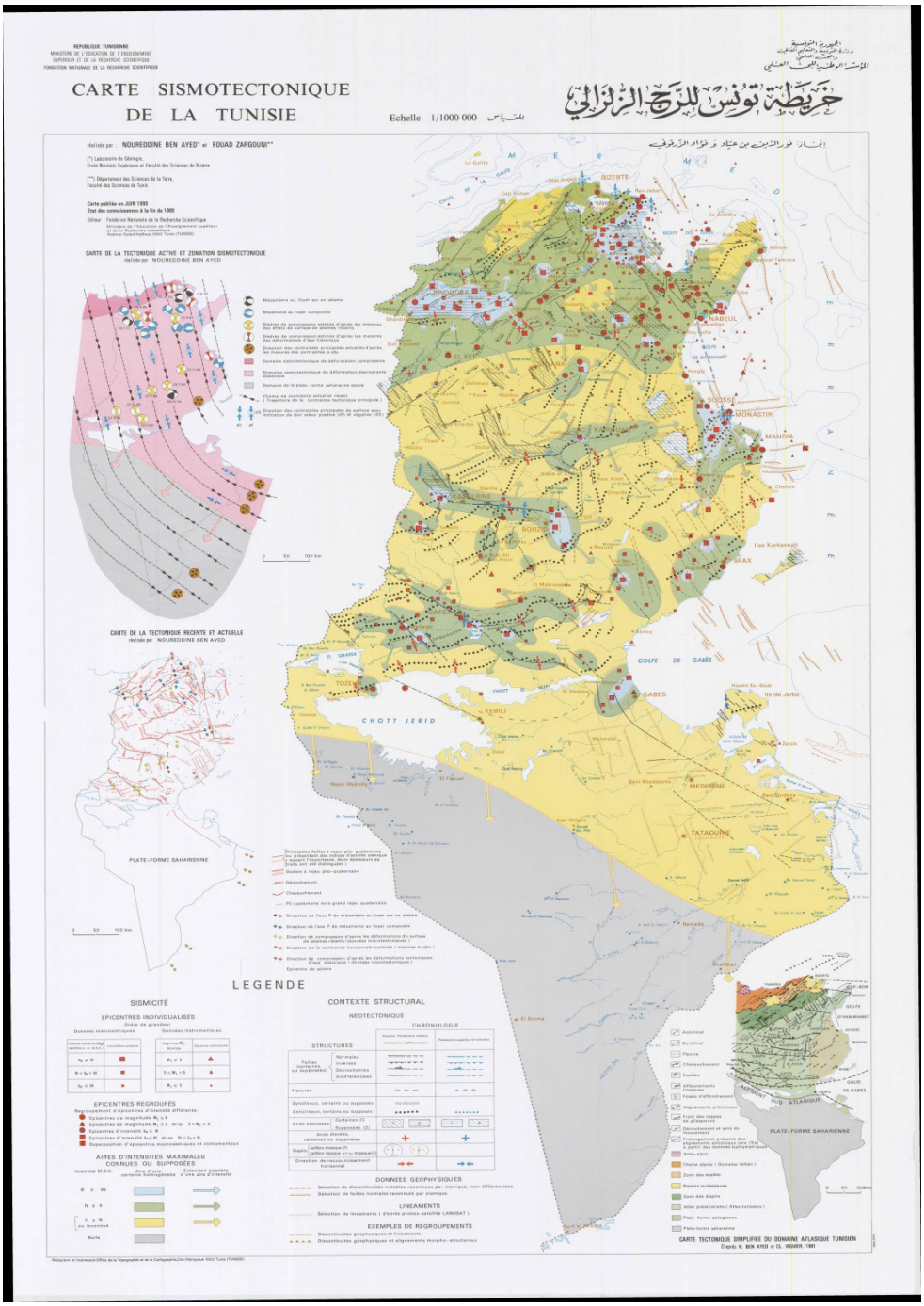

Figure 16. Tunisia earthquake map (Ben Ayed and Zargouni, 1990)

II.3. Tsunami risks

II.3.1. Tsunami history in the Mediterranean Sea

The tsunamis that have occurred in the Euro-Mediterranean region are mainly known thanks to many documentary sources spanning over a long period of time, such as stories and chronicles, descriptions by travelers, reports by authorities and eyewitness accounts.

These documentary sources have provided a good basis for the publication of a variety of tsunami data compilations, such as descriptive and/or parametric data from tsunami catalogs and books. In modern times, descriptive catalogs of tsunamis have been published by several authors, includingBaptista (2011),Altinok (2011),Maramai (2014) andDiakogianni (2015).

Fig. 17presents the map of tsunami generators map in the Mediterranean and areas at high risk of tsunamis. Based on this map, the Mediterranean can be divided into Eastern and Western basins.

Tsunami in the Eastern Mediterranean Basin: From the historiographical analysis and dating of the pieces, it appears that Kourion was most likely struck by a local earthquake without a tsunami around AD 370 (Guidoboni, 1994). In Southeast Cyprus, a destructive tsunami of intensity 7 (Fokaefs, 2007) was reported in association with a very large earthquake of magnitude 7.6 (Guidoboni, 2005), causing a tsunami that was reported on the Syrian coasts.

On September 10th, 1953, two strong earthquakes in south-western Cyprus also caused local tsunamis with an intensity of 5 and 3 respectively (Fokaefs, 2007). The Tyrrhenian Sea has also been the source of tsunamis in history. In Tuscany, a tsunami of intensity 4 occurred on March 5th, 1823. In Lipari Islands, tsunamis of intensity 3 or 4 produced by landslides in the volcano Stromboli have been historically documented on July 3rd, 1916, May 22nd, 1919, September 11th, 1930, and August 20th, 1944 (Maramai, 2014). The best studied case is the one that took place on December 30th, 2002, during an eruptive episode in Stromboli (Tinti, 2005).

Another tsunami-generating zone is that of eastern Sicily and Messina Strait. An extreme event occurred in Tyrrhenian Calabria on February 6th, 1783 (Tinti, 2005) since a huge landslide caused by an earthquake (Bozzano, 2011) triggered a tsunami of intensity 6. Flood heights of 6-9m were observed and more than 1,500 lives were lost. In north-eastern Sicily, the devastating earthquake of January 11th, 1693, which killed about 70,000 people, triggered a tsunami of intensity 7.

Tsunami in the Western Mediterranean Basin: In the Western Mediterranean basin, tsunamis have been reported (Fig. 18) in northern Algeria following strong earthquakes on January 2nd, 1365, May 6th, 1773, August 21st-22nd, 1856, September 9th, 1954, and October 10th, 1980. These tsunamis were of an estimated intensity of up to 4 (Papadopoulos, 2005). Soloviev (2000) has suggested that most of these earthquakes in northern Algeria triggered landslides. However, in 2003 a small tsunami of magnitude 6.8 occurred in Boumerdès. The origin of this tsunami is due to the earthquake in the city of Zemmouri, Algeria (Yiga, 2003; Meghraoui, 2004).

In Ligurian Sea and on French Riviera, an underwater seismic slope that occurred on October 16th, 1979, during the construction of the new Nice airport produced a destructive tsunami wave 3m high which was observed up to Antibes, about 15 km west of Nice. The earthquakes of July 20th, 1564, and February 23rd, 1887 (Eva, 1997; Larroque, 2012) triggered tsunamis flooding the city of Nice in Antibes and Genoa in Cannes, respectively.

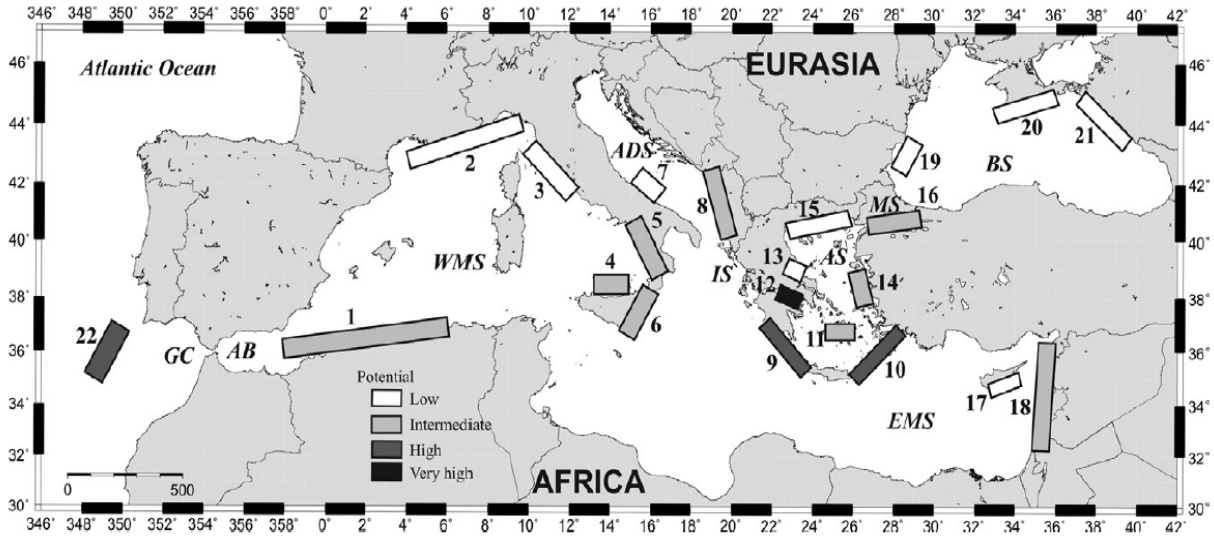

Figure 17. Tsunami-generating areas defined from documentary sources and their classification in relation to tsunami potential (Papadopoulos, 2016)

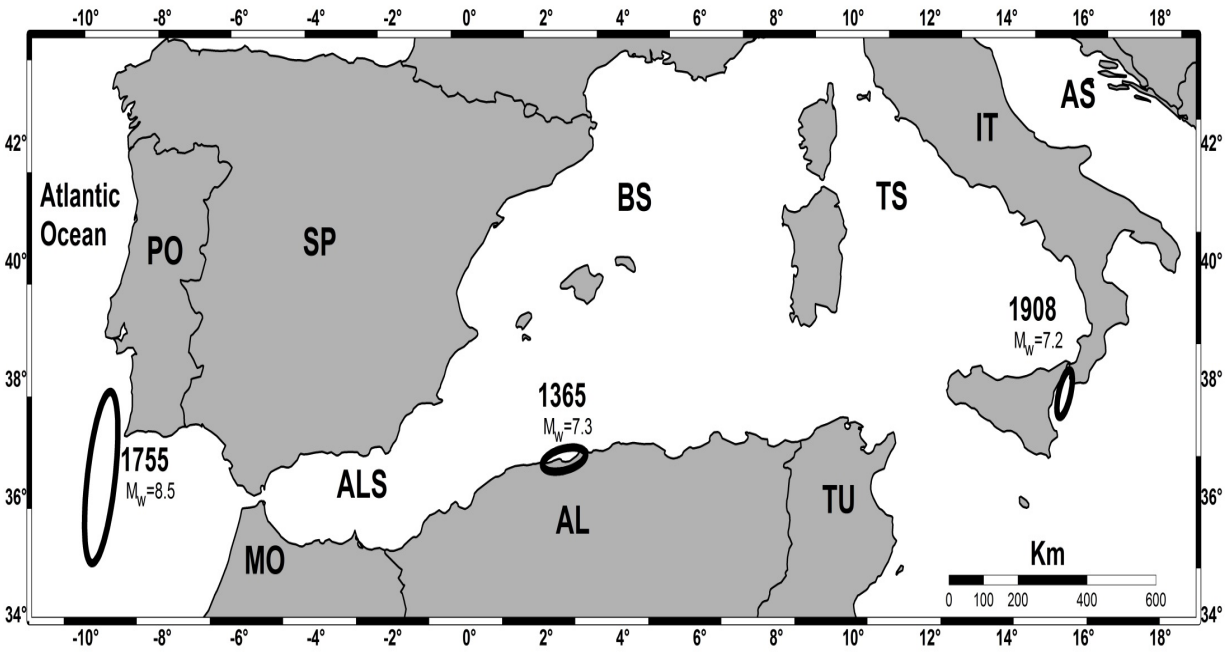

Figure 18. Breaking zones of strong tsunamis in the Western Mediterranean (Papadopoulos, 2016)

II.3.2. Tsunami Impact

In the Mediterranean region, several efforts have been made in recent years to assess the tsunami risks based on scenarios. One of the first efforts was published by Tinti (2005)who developed simple scenarios of mega-tsunamis generated by earthquakes in four seismic zones in the western, central, and eastern sectors of the Mediterranean basin.

Numerical simulations of these mega-tsunamis have shown that both local and remote coastal areas are at risk, with the local area being hit within about 15 minutes of the tsunami occurring. Within about an hour, the tsunamis cross the basin and strike the remote coasts opposite the source, namely France and Liguria (Italy) for the Algerian source, Greece, Tunisia and Libya for the Eastern Sicilian source and Italy and North Africa for the Hellenic sources. However, historically, only the last known case has occurred.

Although the impact of tsunamis, which are known to occur in the Mediterranean region, has been described in many documentary sources, few systematic studies have so far been carried out to understand what precisely the main types of impacts are, the level of impacts and their distribution in space and time.

For example, an inventory has been created containing descriptions of the impact of each tsunami (Papadopoulos, 2016). To guarantee the high reliability of the information used, the study identified 114 events that had some impact on the built environment and/or on human communities, and/or on the natural environment regardless of the impact extent and type.

The main impacts are Death (casualties) (D), damage to ships (VD), damage to buildings and other man-made structures (SD), impact on land (LI) and impact on the environment (EI).

Land impact refers to soil erosion and other geo-morphological changes caused by tsunamis, destruction of cultivated land by tsunami inundation and simple inundation of land. On the other hand, they considered that the environmental impact may include various effects such as fish and shellfish left behind after the tsunami, changes in sea color, death of animals, replacement of rocks from the open sea to land and deposition of tsunami sediments.

The term “impact” used thus far is quite general, expressing the full range of the extent of the impact, from low to high. That is why they have classified the tsunami impacts into four levels. Level 1 corresponds to the impact lowest level, while Level 4 corresponds to the impact highest level. For example, the statement “one person was killed” is translated as level 1 impact type D (D1), while the statement “more than 20 people died” is translated as D4. Fig. 20 shows the maximum level of impact per tsunami, regardless of the type of impact.

Following the same geographical distribution with the distribution of tsunami intensity (Fig.20), the maximum impact is concentrated in eastern Mediterranean basin, mainly

along Hellenic arc and secondarily in southern Italy and in the Levantine Sea, on the most eastern shore of the Mediterranean. However, it should not be underestimated that past tsunamis have also had some impact in south-western Iberia, the Strait of Dover, and Western Norway.

Statistics by type and level of impact are shown in Fig. 20 to Fig. 23. As expected, most events that have had some impacts, whatever the type and level of impact are concentrated in the Eastern Mediterranean basin and in the Hellenic Arc area.

Impact on structures was reported in 40 events (Fig. 20). 34 fatal tsunamis were reported (Fig. 21), while events impacting land and the environment numbered 28 (Fig. 22) and 27 (Fig. 23), respectively.

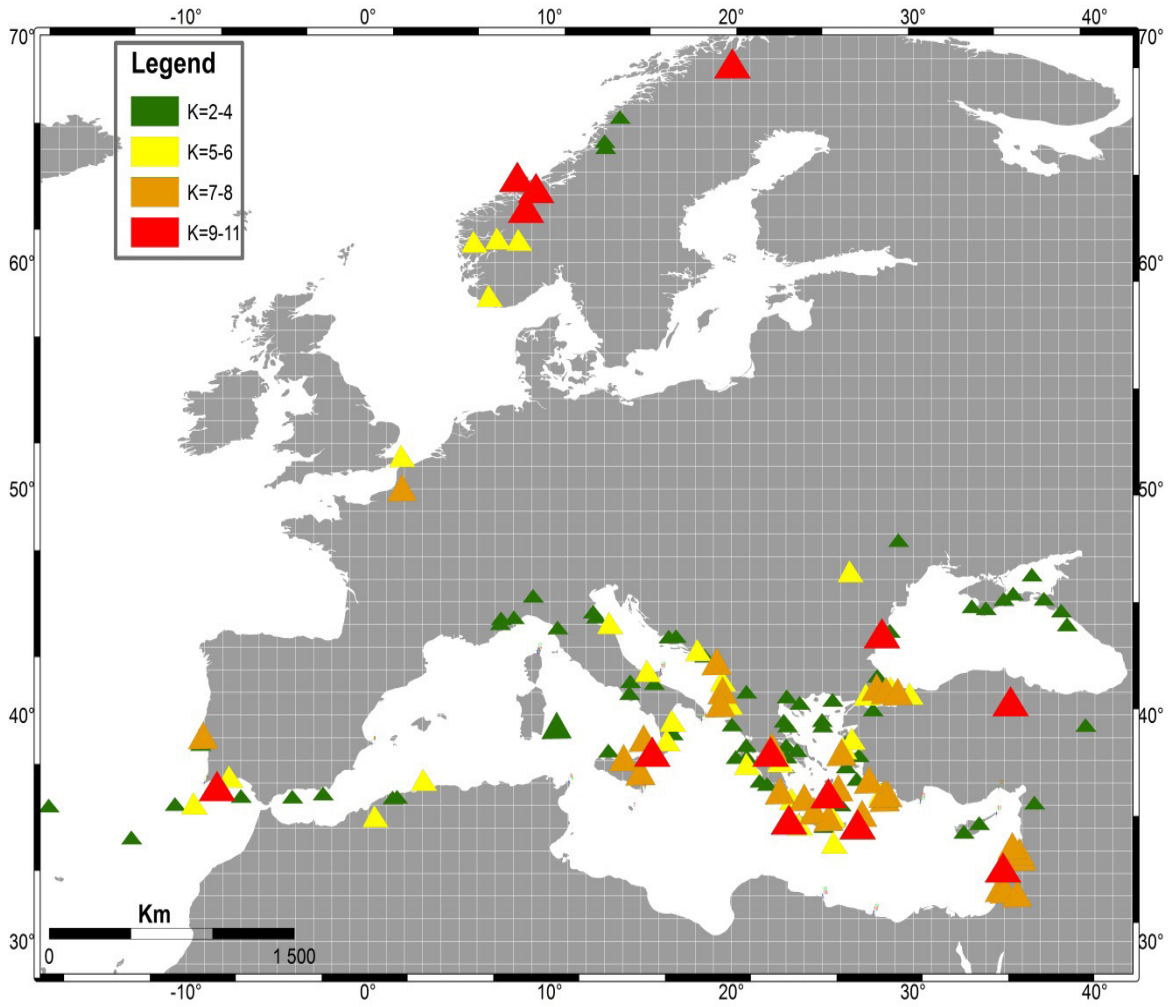

Figure 19. Geographical distribution of the tsunami origins,K is the maximum intensity on the 12-point scale (Papadopoulos, 2016)

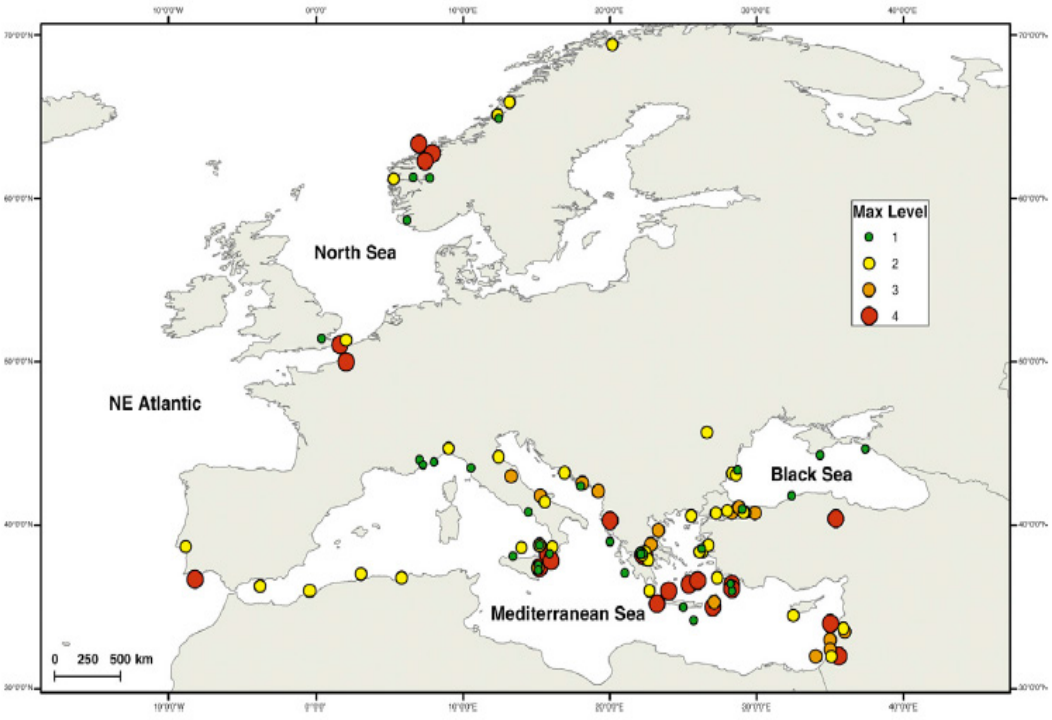

Figure 20. Distribution of the maximum impact level per tsunami (Papadopoulos, 2016)

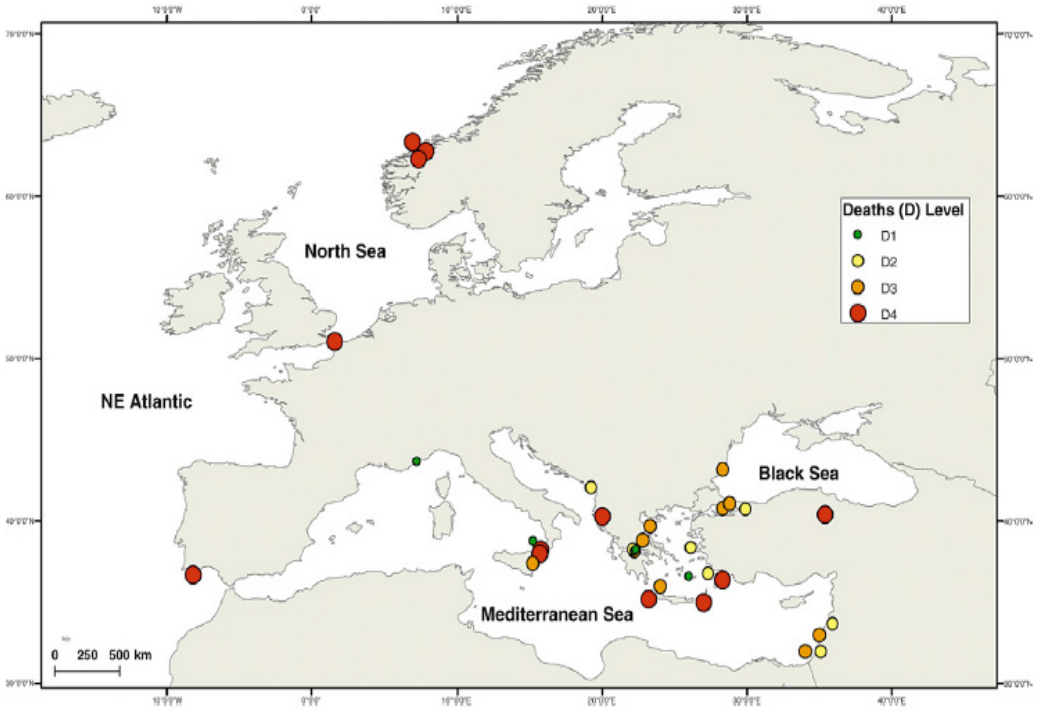

Figure 21. Distribution of the deadly tsunamis (Papadopoulos, 2016)

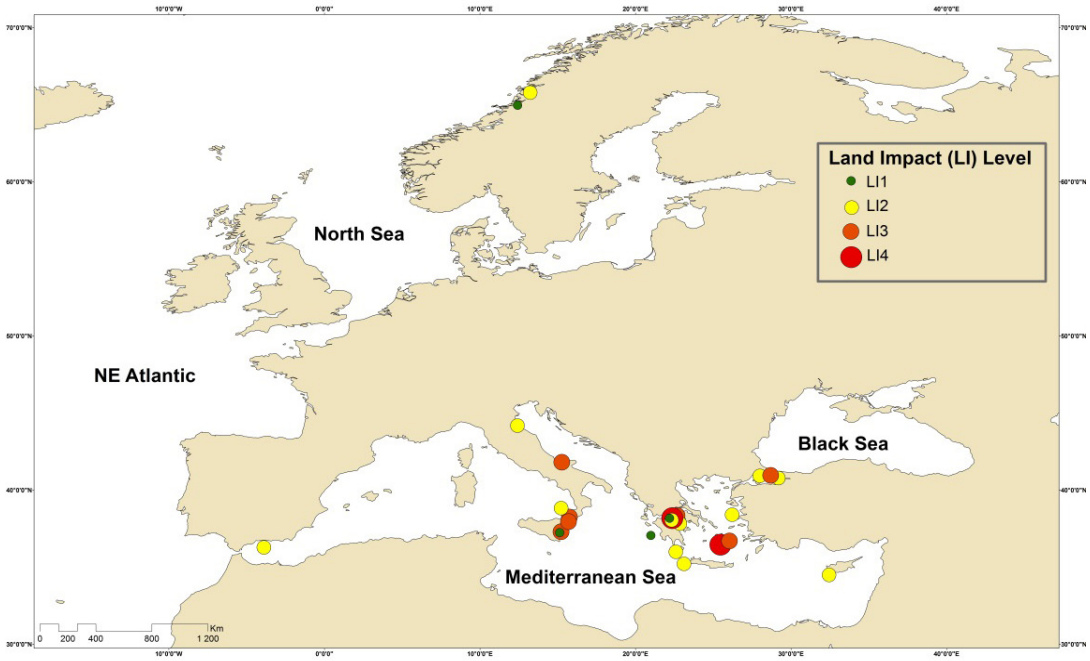

Figure 22. Distribution of the tsunami impact on land (Papadopoulos, 2016)

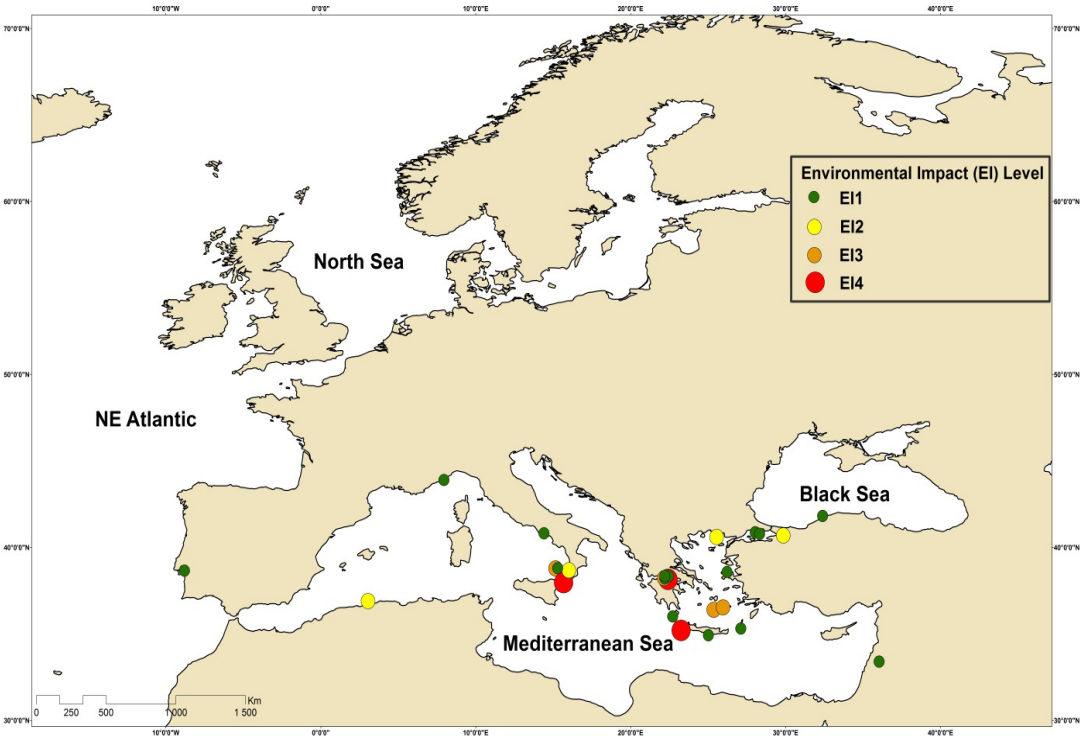

Figure 23. Distribution of the tsunamis environmental impact (Papadopoulos, 2016)

II.3.3. Tsunami risk on Tunisian coasts

In Tunisia, very few studies on tsunami impacts on Tunisian coasts have been carried out. Among these very rare studies, recently, a team of researchers from the National School of Engineers of Tunis (ENIT) conducted a study for the Tunisian Electricity and Gas Company (STEG) on these impacts (STEG, 2015).

This study was based on numerical simulations of wave propagation generated by earthquakes. Seismic sources close to Tunisian coasts were exploited, but also those located on the more distant shores of the Western Mediterranean. The simulations were based on scenarios covering “rare” (MAX scenarios) and “common” (MED scenarios) events. The results of each of these simulations are detailed in the report of STEG (2015). The results provided a first vision of the exposure of the Tunisian Mediterranean coasts to the risks of flooding by Tsunamis.

The results indicate that the highest wave amplitudes are generated by distant earthquakes produced off the Maghreb. They do not exceed 1.0m for the northern coasts of Tunisia (from Tabarka to Ghar El Melh), with an arrival time of about an hour after the earthquake, as shown by the results at the ports of Bizerte and Sidi Boussaid (Fig. 24). On the other hand, the eastern and southern coastal areas of Tunisia (from Tunis to Gabes) are not vulnerable to tsunamis. Indeed, in these areas, the amplitudes of the highest waves do not exceed 0.2 m, as shown by the results at the ports of Monastir and Skhira (Fig. 24).

These results are later confirmed by the study of Papadopoulos (2016)to conclude that all Tunisian coasts, from north to south, do not present a serious risk of flooding by Tsunamis since its amplitude does not exceed 1 meter.

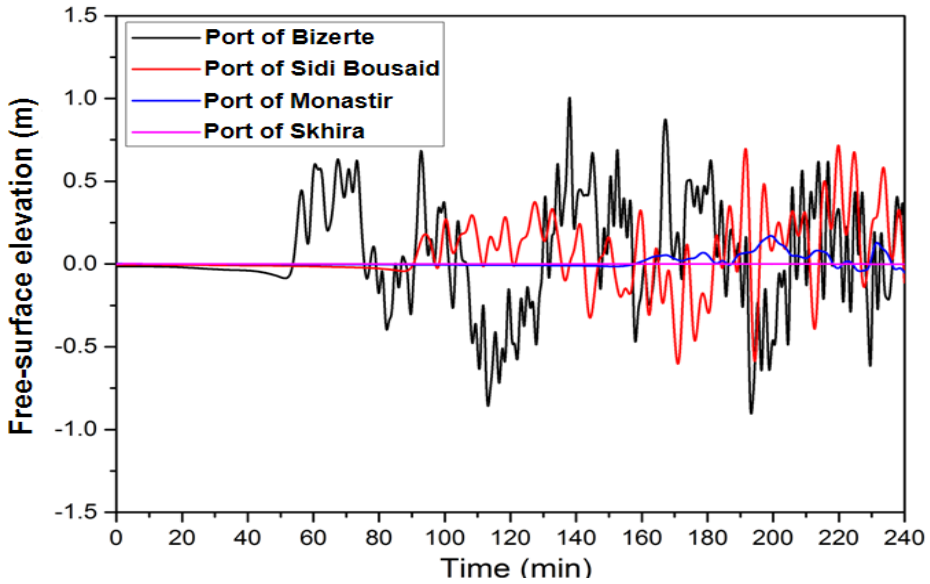

Figure 24. Simulation results for water body evolution due to a tsunami near the Tunisian coasts (STEG, 2015)

II.4. Other risks of marine floods of Tunisian coasts

Apart from the estimation of flood risks due to land runoff as well as the tsunami hazard, the coastal zone is threatened by other risks of marine floods. These include the risk of floods resulting from tides, storm swells, seiches, overhang generated by climatic conditions (atmospheric pressure and wind) and rise in mean sea level due to climate change. To predict these last risks, a detailed study was carried out by the Portuguese Engineering Office (HP, 1995).

II.4.1. Sea level rise due to seiches and overhang

Let us recall that seiche can manifest themselves inside ports by standing or nearly standing waves, often of modest vertical amplitude but with quite high periods of about several minutes. This phenomenon is rarely studied during hydraulic collection and recording campaigns or during the sizing phase (or resizing phase) of Tunisian ports and it is difficult to separate its contribution from that of the wind in which the influence of atmospheric pressure is also included (HP, 1995). The effect of seiches is weak and is generally masked by the other causes of sea surface level variation such as tide and wind.

Overhangs generally refer to the rise in mean sea level due to the shear generated by surface winds. At a five-year return period, the study of HP (1995) shows that the maximum overhang reaches 0.4m on the northern coasts of Tunisia and reaches 1.1m on the eastern coasts.

II.4.2. Sea level rise due to tide

The tide is an important phenomenon that controls coastal zone dynamics. It is a periodic oscillatory movement of sea surface (ebb and flow), associated with tidal wave passage caused by the combined effects of the gravitational forces of the Moon and the Sun.

A high tide is the highest level reached by the sea during a tidal cycle, whereas the lowest level is called low water. The period and amplitude of the tide vary in time and space depending on the relative positions of the disturbing stars with respect to the earth. Generally, the impact of the Moon is more important since it is closer to Earth than the Sun.

Along Tunisian coasts, the dominant tide is of semi-diurnal type, *i.e.*, it presents two periods of low water and two periods of high water in 24 h, linked to the moon and/or the sun (of M2 type and of lesser importance of S2 type). All measurements of the water surface levels confirm the predominance of the M2 wave. The other main harmonics are, in decreasing order: S2, K2, N2, K1 and O1.

In the Mediterranean, the dominant M2 tide is characterized by an amphidromic point (minimum elevation and high speed) located in the Strait of Sicily between Cap Bon (in Tunisia) and Sicily (in Italy). The tidal wave crosses the strait near the Tunisian coasts

while attenuating and then goes southward and enters the Gulf of Gabes while being amplified by a strong resonance (Sammari, *et al.* 2006). The tide seems to turn and enter the Gulf of Gabes. This is induced by the shallow regions that force the tide to be directed towards the interior of the Gulf (Fig.25).

In Tunisia, the tidal range is low (does not exceed 0.4 m) and this at the level of all the Northern and Eastern Tunisian coasts. Nevertheless, tidal range increases in the Gulf of Gabes, which is characterized by the highest tides of Tunisia and the Mediterranean Sea. A maximum tidal range of 2m has been recorded in Gabes in fast waters, which is mainly due to the low slope of the continental shelf and its shallow depth. In contrast, in still waters, this tidal range reaches only 0.3m (Sammari*et al.* 2006).

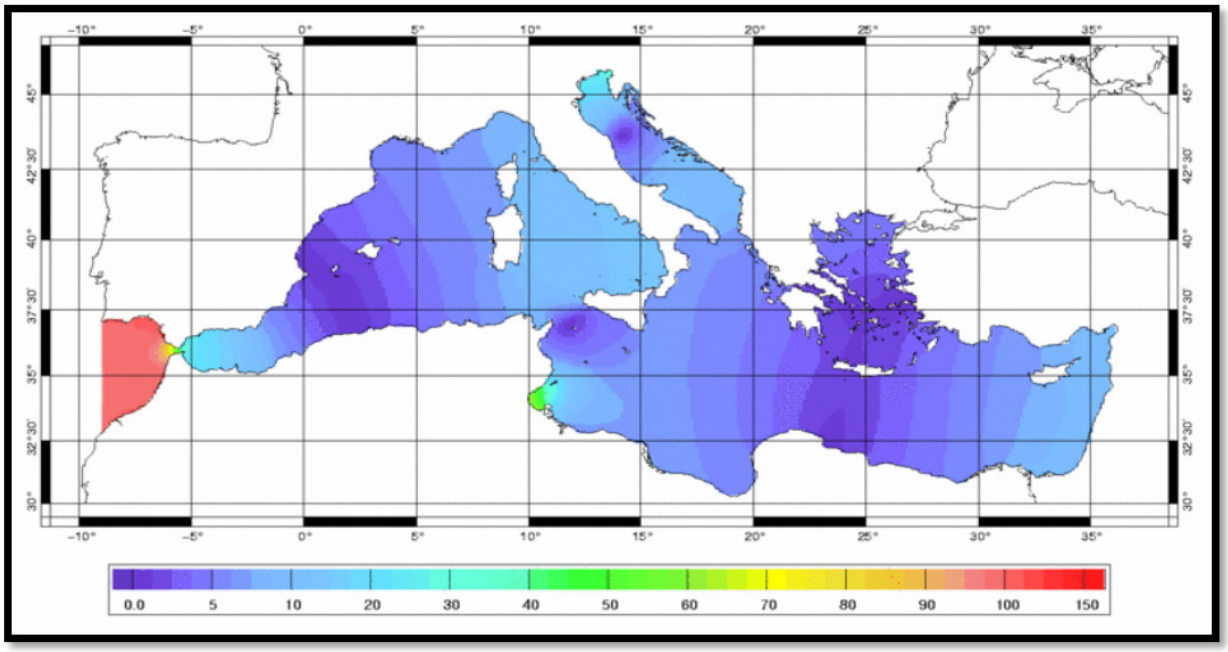

Figure 25. Amplitude of the dominant tide type M2 in Mediterranean Sea (Molines, 1991)

II.4.3. Sea level rise due to storm swells

Swell comes from the propagation of waves generated on distant sea surfaces by sufficiently strong winds and must be differentiated from the “sea wind” which comes from a local wind source. It is therefore a particular case of waves. Swell, coming from the sea, can reflect when it encounters obstacles, refracts when it encounters environments of different speeds and diffracts when it bypasses an obstacle. In all these phenomena, swell period remains constant; however, its amplitude can vary. In case of exceptionally strong winds, storm swells may be generated. According to a study carried out by HP (1995), dominant swells have the following characteristics:

- The ten-year swell (return period of 10 years) reaches 6.3 meters of significant height off the eastern coasts of Tunisia and 10 meters for the northern coasts.
- The 50-year swell (return period of 50 years) would be 8.3m of significant height off the eastern coasts of Tunisia and 13.2m for the northern coasts.
- However, flood risk induced by these swells is generally low at coastal levels because of the shallow depths of these areas and the waves breaking.

II.5. Conclusion

A review of the main potential sources of land and sea flooding along the Tunisian coastline was presented, which can pose a hazard to coastal areas, particularly tourist areas in Tunisia. This bibliographical synthesis clearly shows that coastal touristic areas in Tunisia are not threatened by land floods and that the risk of marine flooding is very low, with a sea surface elevation not exceeding 1m (Fig. 26).

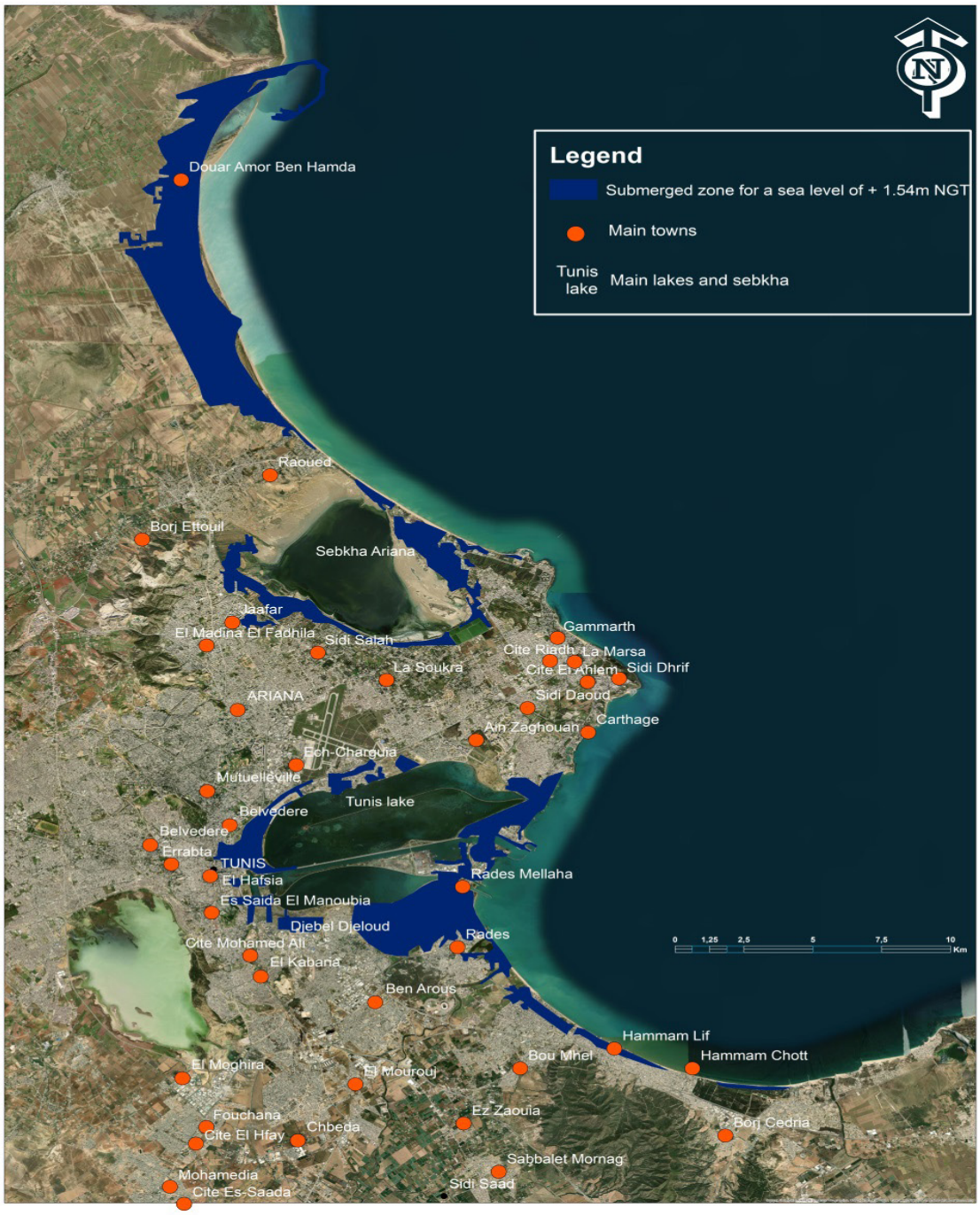

Figure 26.Marine submersion hazard in the current situation for a storm with 50-year return period[2]

2 Egis BCEOM International. Retrieved from https://www.Egis BCEOM International / IAU-IDF / BRGM 2011

III. Anthropogenic risks

The main anthropogenic risks linked to human activities for coastal tourismconcern the political risks and civil or international wars, the risks of terrorism as well as the various health risks.

III.1. Political and war risks

Political stability is an essential prerequisite for attracting international visitors to a given state and thus for tourism development. On the one hand, it is crucial to ensure the normal functioning of territorial sphere actors and the maintenance in a destination of the commercial sphere actors. On the other hand, its absence constitutes a serious brake for potential visitors. Indeed, violent protests, civil or international wars and terrorist actions discourage potential visitors or lead them to cancel a reservation when they occur suddenly.

The destabilization of a state by civil or international war is a serious threat to tourism development, as it weighs heavily on the volume of visitor arrivals while forcing tourism operators to withdraw, causing the possible destruction of tourism resources, and discouraging potential investors.

In general, wars or civil unrest limited to conflict have only a temporary impact on the duration of visitor flows. As soon as hostilities begin, following a ban on access to the territory (except for journalists and diplomats), the cessation of activities of tourist operators or the fears of the visitors themselves, the number of tourists quickly dries up and becomes derisory. International tourism statistics do not adequately reflect the extent of the phenomenon because, except for the diplomatic corps, they record most travelers, including journalists or emergency aid teams.

For Northern Ireland, Stephen (1994) found a systematic decline in the number of foreign visitors following the bloodiest episodes of the civil war, especially when media coverage was significant. In most cases, a rapid resumption of inflows is observed at the end of the conflict. In Cyprus, for example, tourist flows, after having fallen sharply following the intervention of the Turkish army in the northern part of the island (1974), quickly returned to their initial level (Andronicou, 1979). The North of the island, placed under Turkish authority, has, however, experienced a slowdown in its tourist development. Because the Greek authorities, in power in the South of the island, have banned European tour operators from transporting tourists directly to the Turkish side.

Although often temporary, the impact of wars on tourism has a significant spatial scope, far beyond the combat zone. The second Gulf War (1990-1991) which led to the invasion of Iraq by an international coalition led by the United States, thus caused a decrease in arrivals not only in the Middle East as a whole, but also in North Africa (Egypt, Tunisia, and Morocco) and even in some East Asian destinations. Indeed, in the main emitting regions, some potential visitors considered it dangerous to make long-distance air travel because of the risk of terrorist attacks.

Similarly, tourism in India and the Maldives (Indian Ocean) suffered from the civil war in Sri Lanka and associated terrorism. Because of the Arab Spring, which began from Tunisia in December 2010, touristic destinations in North Africa and the Middle East have seen a significant decline in their entries. The situation worsened for Syria and its neighbors (notably Turkey) after the outbreak of the civil war in Syria.

Armed conflicts can also have a long-term impact on tourism, keeping flows at a very modest level, well beyond their resolution. This is particularly the case when a war seriously deteriorates the image of a territory, especially in a country that has not yet established itself on the international tourism scene or where tourism development is in its infancy. South Korea, for example, has long suffered from the deplorable brand image it enjoyed in Europe and the United States following the Korean War. This is due to the television series about the war, the massive destruction following the war, but also to the political instability between North and South Korea since the end of the war. This negative image was reinforced in the early 1980's, following the downing of a Korean Airlines Boeing 747. Therefore, the 1988 Summer Olympic Games organization in Seoul was a key issue for South Korea. The aim was to erase the bad image of the State by showing that it could offer all the security guarantees and warmly welcome hundreds of thousands of visitors.

Having a poor brand image is more dramatic when competition is strong: with the multiplication of destinations and the improvement of tourism marketing techniques, the possibilities of substitution of destinations have increased considerably. The thwarted tourism history of Kashmir provides a good illustration of this. For three decades (1950–1980), the Indian government strongly encouraged the development of tourism in this state located in the far North of the Union, notably by financing the construction of large luxury hotels on Lake Srinagar. However, conflicts between Muslims and non-Muslims over the secession of Kashmir led to a sharp decline in tourist arrivals. This decrease in turn benefited other Himalayan regions that could organize trekking and adventure tourism, especially Nepal.

Wars are also a major risk factor for tourism resources and associated infrastructure. In Lebanon, for example, the long years of civil war and conflict with neighboring countries have seriously damaged the local tourism industry. Similarly, a significant part of the tourism infrastructure and resources of the former Yugoslavia was destroyed during the wars in Croatia and Bosnia-Herzegovina.

III.2. Tourism and terrorism

The relationship between tourism and terrorism is today a major issue in the development of tourism. In fact, while the number of terrorist attacks has decreased over the last ten years, the number of victims per attack has continued to grow, as has the proportion of attacks with a strong tourist impact. This has resulted in a very sharp increase in the terrorist risk perceived by potential visitors. This perceived risk is precisely an important factor in the choice of a destination or the decision to cancel a trip. For example,

according to Richter and Waugh (1986), 11.8 million Americans changed their travel plans abroad in 1986 following the US Air Force raids on Libya and terrorist attacks on certain European airports.

Terrorist attacks are acts of violence that affect civilian or military populations - with the aim of creating a climate of insecurity and achieving certain objectives. When analyzing their involvement in tourism, a distinction must be made between attacks that use tourists as deliberate targets and those that do not. Table 3recalls some recent attacks in the world, with dates and places.

Table 3. Places and dates of terrorist attacks in tourist countries

Date	Attack
11/04/2002	Ghriba Synagogue in Djerba (Tunisia): 16 killed including 12 tourists
16/10/2002	Nightclub in Kuta (Bali, Indonesia): 191 killed mostly Australian tourists
28/11/2002	Hotel near Mombasa (Kenya): 15 killed including 3 tourists
28/11/2002	Firing of two missiles, from Mombasa (Kenya), against a charter of the airline Arkia with 261 passengers on board. Missed target
16/05/2003	Five simultaneous attacks against restaurants and hotels frequented by foreigners in Casablanca, Morocco: 44 dead, mostly Moroccans, including 12 suicide bombers
05/08/2003	J.W. Marriot Hotel in Jakarta (Indonesia): 14 dead

Terrorist attacks that are not specifically aimed at tourists can nevertheless have an impact on the tourist activity because they often have the effect of calling international traffic into question. The September 11th, 2001, attacks in the United States, for example, provide a good illustration of this. In the current state of things, there is still not enough hindsight to rigorously assess its impact on tourism.

At most, the following facts can be observed based on the WTO statistics:

- Globally: Between 2000 and 2001, the number of international tourist arrivals was reduced by 0.5% and international tourism receipts fell by 5.6% (in constant dollar prices). A recovery was then observed between 2001 and 2002 of 2.7% for arrivals and 1.6% for receipts (in dollars at constant prices).
- At the regional level: Between 2000 and 2001, international tourist arrivals fell significantly in North America (-7.5%), South America (-5.0%), Northern Europe (-4.7%) and South Asia (-4.5%). In the other regions, arrivals have slightly decreased (*e.g.,* -2.6% in Western Europe and -1.3% in the Middle East) or remained stable (*e.g.,* -0.1% in Eastern Mediterranean Europe) and even increased

(+4.8% in North Africa and +8.7 in Southeast Asia). The following year was marked by very contrasting trends, ranging from a significant decline (-13.6% in South America, -5.1% in the Caribbean and -3.3% in North America) to strong growth (+12% in Central Africa and +12.2% in Northeast Asia).

- On a national scale: The table below highlights the diversity of the evolution profiles, in close relation with the weight of the US market in the volume of tourist arrivals (Mexico, Dominican Republic, Jamaica, United Kingdom and Australia) or with the spontaneous association that visitors make between a destination and Islamist terrorism (Egypt).

Table 4. Evolution rate of tourist entries between 1999 and 2002

Destination	ATI in 1999 (x 1000)	Evolution relative to 1999-2000 (%)	Evolution relative to 2000-2001 (%)	Evolution relative to 2001-2002 (%)
United States	48,491	4.9	-11.9	-6.7
Canada	19,465	4.9	0.3	1.9
Mexico	19,043	8.4	-4	-0.7
Dominican Republic	2,649	12.4	-3	-2.5
Jamaica	1,323	6	-3.5	-0.8
Brazil	5,107	4	-10.2	-20.7
United Kingdom	25,396	-0.8	-9.4	5.9
France	73,042	3.4	-2.6	2.4
Spain	46,776	3	4.6	3.3
Italy	36,516	12.8	-3.9	0.6
Turkey	6,893	39.1	12.5	18.5
Egypt	4,489	14	-14.8	12.6
South Africa	6,026	-0.4	-1.5	10.9
Thailand	8,651	9.9	5.8	7.3
Malaysia	7,931	28.9	25	4
Australia	6,026	-0.4	-1.5	-0.3

For terrorist movements, tourists, or the facilities they use offer at least four opportunities. From an operational point of view, first, they are easy targets because, unlike diplomatic representations, the headquarters of transnational firms or the residential areas where expatriates live, they do not enjoy special surveillance. Moreover, large tourist concentrations are generally cosmopolitan places that provide camouflage and security for terrorists (*e.g.,* freedom of movement and transactions in foreign currency without attracting attention). At the media level, acts of violence against tourists are widely covered by the written press, radio, and television. They therefore have great repercussions, both in the countries of origin of the visitors and on the international scale.

Moreover, violent acts against tourists can enjoy a certain legitimacy among the population of the receiving areas. Indeed, through their behavior and the values they convey, tourists are sometimes criticized or condemned. Finally, by attacking tourist targets, terrorist movements are likely to affect the economy of the receiving countries, especially where tourism receipts weigh significantly on national wealth. In Tunisia, tourism sector is very sensitive to security incidents. The crisis in the tourist sector has started since the attacks ofSeptember 11th,2001, in the USA andApril 21st,2002 in Djerba. This last attack was the cause of the loss of the German clientele which constituted the first market for Tunisia until these dates.

Tunisia after the revolution of January 14th, 2011, has suffered from the consequence of the insecurity climate. The political assassinations and the terrorist attacks, which followed this event strongly, undermined the tourism activity (Fig. 27).The TOs are influenced by the increase in their insurance rates and by the media.

The crisis has become stifling following the attacks on the Museum of Bardo and Sousse in 2015 which killed dozens of people, most of whom were tourists of different nationalities. The event has been interpreted by some media as a disaster that heralds the end of tourist activity in Tunisia.

These media and the consular reports of issuing countries in Europe have influenced TOs insurance rates for and subsequently their intention to book for the Tunisia destination. Moreover, the perception of Tunisia as a country of seaside tourism less secure than before has influenced bookings downwards. The weakening of its image means that it can be replaced by any destination, especially among its direct competitors in the Mediterranean basin. Faced with this situation, the curve of tourist arrivals and overnight stays has not stopped dropping in recent years, justifying the vulnerability of the seaside tourism sector in Tunisia and the extent of its crisis (The World Bank, 2020).

Despite all the security measures taken by the Tunisian authorities (Fig.28), TOs and tourist customers do not seem to be tolerant towards Tunisia as a destination, following the second attack which targeted tourists in their place of stay in Sousse. Arrivals and overnight stays have since recorded a significant drop, so that the Tunisia destination is experiencing a greater crisis in attendance.

Even if there is a recovery in 2017 in terms of tourist arrivals (7,052,813 in 2017, against 5,724,021 in 2016), there is a slight increase in foreign currency inflows to state budget (Table 5; The World Bank, 2020).

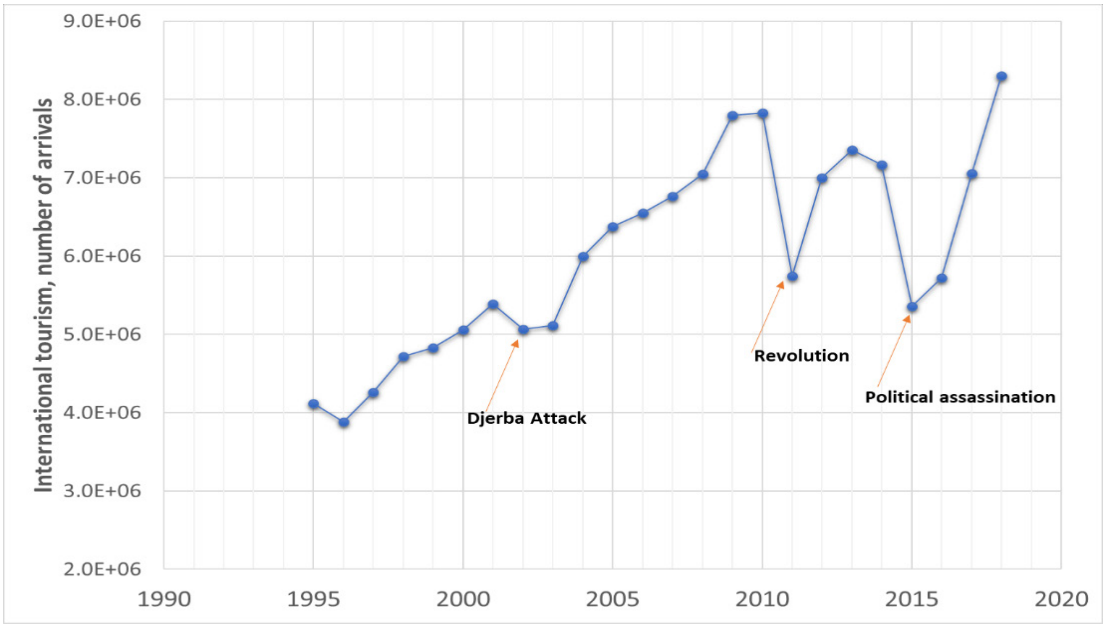

Figure 27. Sensitivity of tourist entrances to socio-political and security events

Finally, Tunisian tourism, which is already suffering from a structural crisis since the early 1990s, is further weakened by the security incidents that occurred in the country following its revolution of January 14th, 2011 (Fig. 29). Tunisian destination therefore becomes more vulnerable compared to its direct competitors in Mediterranean basin, namely Morocco, Egypt, and Turkey, if it offers a one-design product, mass beach tourism.

Figure 28. The permanent presence of the Police to ensure security in the face of empty beaches

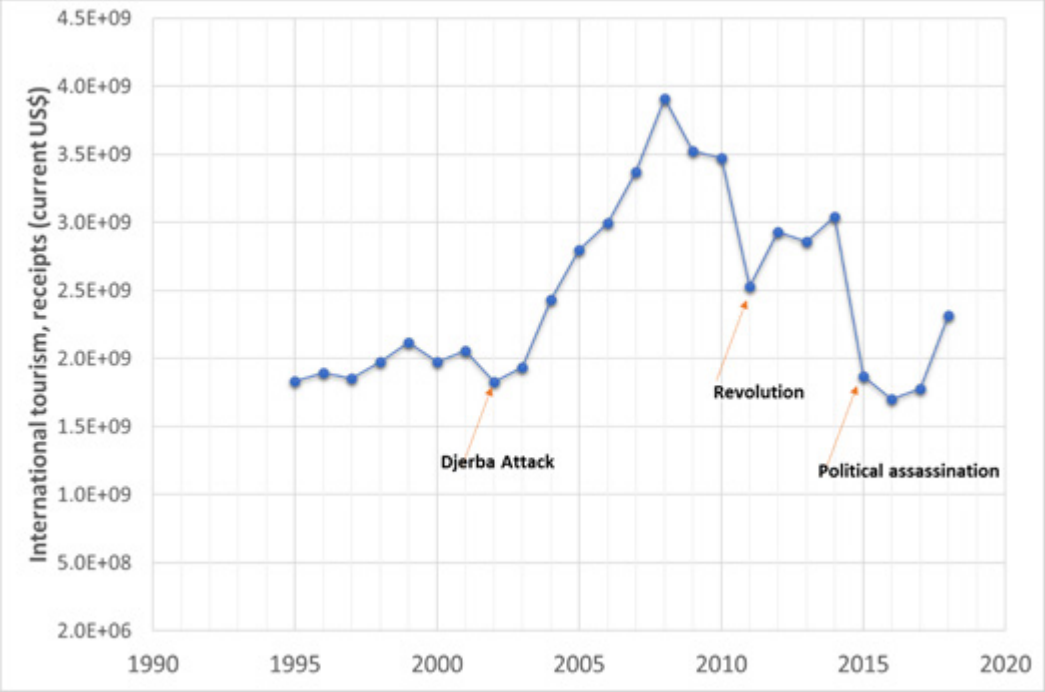

Figure 29. Evolution of tourism revenues in Tunisia

III.3. Health risks

Until World War II, most tourist travel was within the temperate world: visitors were rarely exposed to specific health risks, different from those they might encounter in their home countries. Things changed with the increase in travel to the tropical or equatorial world.

Today, tourists travelling to these new destinations are exposed to a very wide range of health risks, leading to the appearance in temperate countries of previously unknown or long-uncontrolled diseases.

Tourist health risks are not limited to international travel to tropical destinations. They also include certain risks encountered in the temperate world, particularly those related to swimming (drowning but also infectious diseases) or certain demanding sports practices.

In this context, it is hardly surprising that travel medicine has become a specialty. It was formalized in 1991 with the creation of the "International Society of Travel Medicine", which has already organized several international conferences. The aim of this new medical discipline is to preserve the health of the traveler and to reduce the consequences 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 in no way be neglected from a perspective of tourism development. Indeed, the reporting and magnification by the media of tourists offering symptoms of cholera or malaria following an exotic stay can strongly tarnish the image of a tourist's home, even a traditional one. In September 1994, following reports of a few cases of pneumonic plague in India, the largest British TO at the time cancelled all its vacation trips to the Indian subcontinent for a fortnight.

The SARS (Severe Acute Respiratory Syndrome) epidemic, recorded in several states in the spring of 2003, provides another illustration of the discrepancy between actual and perceived risks. The epidemic, which started in China at the end of 2002, broke out worldwide in 2003, causing more than 8,000 cases and nearly 800 deaths. Thanks to unprecedented international mobilization, motivated by the global alert triggered on March 12th, 2003, by the WHO, the epidemic was contained by isolation and quarantine measures. Similarly, the causative agent of SARS, a previously unknown coronavirus, was rapidly identified.

Despite the relatively modest number of people who died because of the epidemic, despite the limited number of infections on board aircraft (5 cases out of nearly 8,500), and despite the major role played by local transmission (in hospitals or homes) in the spread of the epidemic, SARS had a major impact on international tourist flows, particularly to and within East Asia. The figures recorded by the IATA (International Air Transport Association) are indicative of the crisis. In just a few weeks, traffic to Hong Kong fell by 60% and 40% of flights to this destination were cancelled.

For several countries, the SARS epidemic proved to be much more serious than the 2nd war in Iraq as it had a direct and immediate impact on tourism, aviation, hotels, and other tourism-related activities. Indeed, as the WTO points out that the sustained media coverage of SARS epidemic led to a veritable wave of paranoia and some Asian destinations, which were not affected such as India, Indonesia, Malaysia, Cambodia, Philippines, and Thailand, suffered almost as much as the countries where SARS cases were reported.

Recently, since the beginning of the year 2020, we have been witnessing the spread of a dangerous and dreadful new virus called "Covid-19".General confinement and even curfews have been decreed in several countries around the world to stop its spread. The impact of Covid-19 on world tourism is apparent to its full extent, while the UNWTO estimates the cost of the pandemic. A clearer picturehas been provided now of the heavy toll of losses caused by Covid-19 on international tourism according to the WTO figures. They show that for the period up to May, the cost was already three times higher than the cost of the global economic crisis of 2009.

III.4. Other risks

Other risks include the risk of traffic accidents. According to WHO (OMS, 1996), the leading cause of death among travelers is transport accidents.

Poor road conditions, anarchic traffic, unconscious drivers, dilapidated vehicles, frequently punctured asphalt, and corrugated iron are among the factors that obviously favor these accidents. In addition, the health coverage of tropical countries is different from that of developed countries, so do not expect the arrival of resuscitation services or fire-fighters for first aid.

On the other hand, most tourist guides today devote at least a few lines to theft risk, fraud, violence and harassment to which tourists 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.

However, they can also result from the open animosity of natives towards foreigners, especially when the latter are assimilated to former settlers. Finally, it is important to be aware that these risks can be catalyzed by the visitors themselves. For example, when they visibly display their wealth (*e.g.,* materials, currency, and jewelry), when they do not respect local cultural codes, or when they adopt an openly provocative attitude.

IV. Conclusions

In conclusion of this bibliography, in Tunisia, there has never been a dam failure. Indeed, the oldest dam was built in 1929. Regarding the Tsunami, studies have shown that the highest amplitudes of waves are generated by distant earthquakes produced off the Maghreb. They do not exceed 1m for the northern coasts of Tunisia (from Tabarka to Ghar El Melh), with an arrival time of about one hour after the earthquake. The coastal areas of eastern and southern Tunisia (from Tunis to Gabes) are not vulnerable to tsunamis. Indeed, in these areas, the amplitudes of the highest waves do not exceed 0.2 m.

Also, an inventory of the main potential sources of terrestrial land marine flooding along the Tunisian coastline was presented, which can constitute a danger for the coastal zones and particularly for tourist zones in Tunisia. This synthesis clearly shows that the coastal tourist areas in Tunisia are not threatened by land flooding, and that the risk of marine flooding is very low, with a rise in the sea surface not exceeding 1m.

Finally, for the tourism part, despite all the security measures taken by the Tunisian authorities, the tourist clientele does not seem tolerant towards the Tunisia destination, following the second attack which targeted tourists during their stay in Sousse.Since then, arrivals and overnight stays have recorded a significant drop, so that the Tunisia destination has experienced a greater crisis in attendance.

However, the situation has started to improve in recent years, following the strengthening of security in Tunisia and particularly in tourist areas.

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